A multistage mixed methods evaluation of the implementation and impact of a reconfiguration of acute medicine in Ireland's hospitals

A dissertation submitted to the University of Dublin for the
Degree of Doctor of Philosophy

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August 2020

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Declaration

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Summary

The National Acute Medicine Programme (NAMP) was introduced in Ireland in 2010 to provide a framework for the delivery of acute medical services and to address deficits in the care of acutely ill medical patients presenting as emergencies to Irish hospitals (Royal College of Physicians of Ireland et al., 2010). Central to the programme was the development of Acute Medical Units (AMUs) in all major hospitals, and similar functioning, but smaller Acute Medical Assessment Units (AMAUs) in smaller hospitals[1]. This thesis describes the mixed methods evaluation undertaken to assess the degree to which the Programme has been implemented, whether it has had a significant impact, and the factors that have influenced both of these.

The first stage of the evaluation was the conceptualisation of the programme's theories. Eliciting a programme's theory is recognised as a crucial first step in evaluating a complex intervention such as this, as it serves as a basis for formulating and prioritising evaluation questions, designing evaluation research and interpreting the finings (Rossi et al., 2004). This was done using an iterative process of documentary review, key informant interviews and in-person meetings with the NAMP management. The output was a logic model depicting the Programme's desired outcomes, components, and mechanisms of change.

The second stage was to measure programme implementation. There were two different implementation outcomes assessed. Firstly, the alignment of the organisational structures, processes and resources implemented at the AMAUs with the model of care, and secondly, the extent to which the units were being utilised.

The first implementation outcome was examined by mapping a comprehensive survey of the AMAUs, conducted by the NAMP management team in 2018, to the model of care. The survey found that many of the core components and contingences which were described in the model of care as being 'critical' to the success of the Programme have not been fully implemented. Critically, none the units are operational 24/7. The survey also found significant heterogeneity across the hospitals in terms of what has been implemented. Some hospitals had considerably greater fidelity to the model with many core aspects implemented and operational; though no hospitals had all elements in place. Other hospitals had poorer levels of implementation, lacking many of the critical success factors including adequate assessment space, continuous consultant presence, ambulatory care

[1] A note on terminology: a fully functioning AMU consists of the AMAU with an associated Short stay ward (SSW) for patients whose length of hospital stay is not expected to be greater than 48 hours. For consistency, units in the Irish setting are referred to throughout the thesis as AMAUs.

pathways established, and priority access to essential services such as same day diagnostics and urgent diagnostic with 72 hours. A key deficit, common to all hospitals, was access to urgent outpatient medical appointments necessary to reduce the necessity to admit patients overnight. Another key finding was the absence of structured processes in place to identify and manage the frail elderly presenting as an emergency with medical conditions to hospital.

The second measurement of programme implementation was a comprehensive utilisation study of the units. This was a retrospective study of all emergency hospitalisations for medicine among adults aged 16 years and over, to acute public hospitals between 2009 and 2017, using Hospital In-Patient Enquiry (HIPE) data. The study found a rapid rise in AMAU activity in 2012 and 2013, accompanied by a decline in those admitted in-house from the ED. AMAU activity reached a plateau in mid 2014, while ED-admissions increased to pre-2012 numbers. A greater number of emergency hospitalisations for condition continue to be admitted in-house from a non-AMAU source than are assessed in an AMAU. The study found that the AMAUs assess a significant number of patients with ambulatory care sensitive medical conditions. In 2017, over 50% of the episodes streamed through an AMAU belonged to one of the 18 medical condition assessed - 10% of episodes alone had a primary diagnosis of chest pain non-specific. Once there, the majority of patients were discharged directly, though this was highly age and condition specific. Some conditions, regardless of age, had high same day discharge rates (e.g., migraine, deep vein thrombosis, vertigo and chest pain non-specific all had discharge-direct rates above 65% in each age category). The study also found significant variation across the hospitals in terms of the proportion of their emergency medical hospitalisations that were streamed to their AMAU, and the trajectory of the patients assessed in them. This is likely due to different internal processes, pathways and resources in place at units to safely ambulate patients home, or patients with lower acuity being streamed to the units. Within hospitals there were stark differences in the utilisation of their AMAU month-on-month, with utilisation lower in the winter months, which is likely indicative of 'boarding' in these units during the winter month affecting their ability to accept patients.

The third stage of the evaluation assessed programme impact. Owing to data constraints programme impact was limited to a measurement of just one outcome - the change in overnight emergency hospitalisation rates for medical conditions and ambulatory care sensitive medical conditions, and the bed days used by them. The analysis found that in the pre-intervention period there was a reduction in these rates, most likely because of sustained bed closures during this period. Though it is likely that there were early gains made in those hospitals opening and operating AMAUs during this period. The monthly age-sex standardised rate and the age-specific rates of overnight emergency hospitalisations for medical conditions remained unchanged between 2012 and 2017. Therefore, there is no evidence to support the hypothesis that the significant increase in activity in the AMAUs from 2012 onwards led to a decrease in the national rate of overnight emergency hospitalisations for medical conditions, or the bed days used by them. There was evidence to suggest that the increased activity in the units from 2012 onwards led to a sizeable reduction in overnight emergency hospitalisations for chest pain non-specific, with a substantial reduction observed across all age categories. The modelled age-sex standarised rate of overnight emergency hospitalisations for chest pain non-specific reduced by approximately 40% between January 2013 and December 2017, after several years of no change in the hospitalisation rate for this condition. There was evidence of a very modest monthly reduction in emergency rates of hospitalisation for migraine/acute headache and for syncope. An incidental finding of the analysis was the dramatic rise in overnight emergency hospitalisations for UTI/pyelonephritis, with the age-sex standardised rate increasing from 190/100,000 population in 2009 to 328/100,000 in 2017, and the rate of bed days used from 1,987/100,000 population into 3,395/100,000.

The final stage of the evaluation was a study of the factors that enabled or impeded the implementation of the Programme, especially as it pertained to the AMAUs. This was a qualitative study using semi-structured interviews with programme management and clinical staff working in the AMAUs. Sites were purposively sampled based on rates of utilisation of their units in 2017, with three 'high' and three' low utilisation sites. The study found that the staff working in the units faced many challenges in establishing and growing the AMAU. The most commonly voiced was the influence that limited bed capacity in-house was having on the ability of their unit to function as per the model of care. Staff spoke of units being regularly used to 'board' medically admitted patients who were awaiting an in-patient bed in-house. Other barriers included overworked staff with limited opportunity, capability and support to implement change; a lack of funding to implement the model; insufficient staffing, especially medical staffing; a resistance to a new way of working from medical consultants, and friction between departments and key interfaces driven by differing visions for the delivery of acute medical care, and finally, a striking imbalance between the incentives and disincentives to implementing the new model. From a programmatic perspective, one of the major barriers to implementation was the lack of joined up coherent strategic leadership at the different levels of management across the health system. Enablers of implementation at the hospitals included strong clinical leadership; good multi-disciplinary relationships within the AMAU and with key departments such as radiology and laboratory services; and supportive hospital management.

Acknowledgements

I would like to gratefully acknowledge my supervisory team at TCD, UCC and the Nuffield Trust, for their guidance, expertise, and generosity during the undertaking of the PhD. I would like to thank my colleagues at the Centre for Health Policy and Management, Trinity College Dublin, for their advice and friendship over the years. I am also grateful to those leading the Masters in Implementation Science at the School of Medicine, TCD, who introduced me to the unknown world of implementation theories, models and frameworks.

This PhD was funded by the Clinical Strategy and Programmes Division of the HSE, and I would like to acknowledge their support and interest in the research. This work was made possible by the Health Research Board via funding for the SPHeRE programme, and I am grateful for the opportunity to have taken part in such an innovative PhD programme. A special mention needs to go to my peers on that programme for their support and influence.

The engagement of the National Acute Medicine Programme team, who were keenly interested to improve the Programme, was critical and highly appreciated. They were instrumental in identifying the research questions that needed to be answered. They provided me with their time and knowledge, and access to information that was essential to progress the evaluation. I would also like to thank the clinical staff in the Acute Medical Assessment Units and the Emergency Departments at the hospitals who gave me their valuable time to interview for the thesis. The Health Intelligence team, HSE, and Open App were highly influential in the early days of this work when I was gaining an understanding of the HIPE data system. This research was contingent on the availability of high quality hospital administrative data. To that end, I would like to thank the HIPE coders at the hospitals, whose work this thesis is built upon. A special thank you goes to the HIPE team at the Healthcare Pricing Office whose attention to detail and responsiveness to my queries was greatly appreciated. I would like to mention the influence of Mel McIntyre, the founder of Open App who sadly passed away in 2017.

Many wonderful colleagues have inspired me over the years. Debra Rowett, Aine Heaney and Judith Mackson were instrumental during my years at NPS MedicineWise, Sydney, as were Professors Avorn, Choudhry, and Fischer during my time at the Division of Pharmacoepidemiology, Harvard Medical School and Alosa Health, Boston. Lastly, I would like to acknowledge the unwavering support, guidance, fun and friendship of my friends and family.

Dedication

This work is dedicated to the memory of my dad, Jerome Hurley.

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Chapter 1. Introduction

1.1 Background

Ireland, as with other jurisdictions, has seen a significant reduction in its stock of acute hospitals beds over its recent past, with a 13% reduction between 2007 and 2012 alone; since then the numbers have remained relatively stable (Appendix 1.1). In the OECD *Health at a Glance* report, published in 2019, Ireland was ranked in the lower third of countries in terms of hospital beds per capita (3.0 beds per 100,000 population in 2017), compared with an OECD-36 average of 4.7/100,000 population (OECD, 2019). In 2017, occupancy rates for acute beds in Ireland were at 94.5%, the highest of all OECD-28 countries reporting the metric (OECD-28 average = 75.2%). This represents a full 10 percentage point increase from that reported in 2000, the comparison year used in that report. Importantly, this reduction and stagnation in acute beds coincided with a time of significant growth in the Irish population. Between 2009 and 2017 - the period examined in this thesis - Ireland's adult population (i.e., aged 16 years and over) increased by 5.1% from 3.54m to 3.72m. This increase was most pronounced in the older age categories, as the younger population (16-44 years) declined by 5.9% between 2009 and 2017 from 2.04m to 1.92m, likely due to emigration during the economic recession. The numbers in the other three age categories used in this thesis, increased consistently year-on-year between 2009 and 2017. The 45-64 years age category increased by 15.1% from 1.00m to 1.15m, the 65-84 years age category by 30.4% from 444,928 to 580,184, and the oldest age category (≥ 85 years) by 29.1% from 53,974 to 69,693 (Appendix 1.2). Importantly bed closures during this period were not accompanied by an increase in the capacity of services in the community, including primary care, to provide healthcare. On the contrary, the economic recession experienced during this period led to severe cuts to these services (Nolan, 2014).

Acute medical units

In other jurisdictions, this reduced supply in hospital beds, along with continued growth in demand for emergency services, has been identified as resulting in patients waiting longer in overcrowded emergency departments (EDs) in other jurisdictions (Pallin et al., 2013, Ham, 2015, O'Cathain et al., 2014a, Pinkney et al., 2016, Karakusevic, 2016), and often receiving suboptimal care on trolleys (Carter et al., 2014, Hoot and Aronsky, 2008). In view of this increased demand and reduced capacity, hospitals are attempting to introduce innovative ways to make better use of existing bed stock, by implementing interventions to reduce avoidable admissions, length of stay and delayed discharges (Ewbank et al., 2017). The development of the discipline of acute medicine and the introduction of Acute Medical Units (AMUs) is seen as one such approach to achieve these goals (Mason et al., 2014). Acute medicine is the part of general (internal) medicine concerned with the immediate and early specialist management of adult patients suffering from a wide range of medical conditions who present to, or from within, hospitals requiring urgent or emergency care. In very simple terms, acute medicine is the care process for unwell adults (usually age 16 years and above) who attend hospital with a medical (non-surgical) condition.

This model of acute care delivery has been adopted in the UK, Australia and New Zealand (ACI Acute Care Taskforce Medical Assessment Unit Working Group, 2014, Internal Medicine Society of Australia and New Zealand, 2006), and more recently in the Netherlands (van Galen et al., 2017), with the introduction of Acute Medical Units (AMUs). An AMU is defined as '... *a dedicated facility within a hospital that acts as the focus for acute medical care for patients who have presented as medical emergencies to hospital or who have developed an acute medical illness while in hospital'* (Royal College of Physicians, 2007). Somewhat confusingly, these units are also referred to as Acute Medical Assessment Units (AMAUs), Medical Assessment Units (MAUs), Acute Assessment Units (AAUs), Medical Assessment and Planning Units (MAPUs), and Admission and Planning Units (APUs).

The majority of medical patients presenting to hospitals as emergencies in the UK are now assessed and treated in AMUs, either directly, or after triage in an emergency department (Reid et al., 2017), and these units are considered essential for improving the quality of care for patients presenting to hospitals with complex medical conditions (Schipper, 2017, Holland et al., 2017). While there is wide variation in how these units are designed and operated, it is recommended that they are co-located on the same floor as other acute and emergency services, and are staffed by acute medicine physicians or specialist consultants with an interest in acute medicine. It is expected that the presence of a senior decision maker should expedite the clinical decision making process and improves patient care by facilitating timely review of each patient as they arrive in the unit (McNeill et al., 2009).

1.2 Ireland's National Acute Medicine Programme

The National Acute Medicine Programme (NAMP) was established in 2009[2] as part of a suite of National Clinical Programmes introduced that year. These programmes were

[2] The Programme team was established in 2009, the model of care published in 2010, and the widescale opening of units occurred in 2012 and 2013. There were units operational prior to 2009, and additionally some units opened between 2009 and 2012.

developed as collaboration between the Health Service Executive (the service responsible for the delivery of healthcare in Ireland) and the medical colleges and associations. They were tasked with the challenge of improving access and quality of services, while reducing costs, and were designed with specific quality, access and efficiency objectives. These programmes were clinician led, as there was a strong conviction that the path to reform was to meaningfully engage clinicians in leadership of clinical improvements. The programmes empowered clinicians to lead within the health system and to act as advocates for improvements in patient care, with the weight of their peers behind them. This support from clinical leaders was essential in driving the programmes forward. Political engagement was also crucial to ensure the success of the programmes, and the same clinical leaders took on this role, meeting with local and national politicians, and engaging with media to gain public support for change in the system.

The National Acute Medicine Programme (NAMP) was once such Clinical Programme, and was a collaborative between the Royal College of Physicians of Ireland (RCPI), the Irish Association of Directors of Nursing and Midwifery (IADNAM), the Therapy Professions Committee (TPC), the Irish College of General Practitioners (ICGP) and the Irish Health Service Executive (HSE). The Programme was highly ambitious and sought to drive through widescale change in acute medicine in Ireland's hospitals. It provided a framework for the delivery of acute medicine services to address deficits in the care of acutely ill medical patients presenting as emergencies to Irish hospitals (Royal College of Physicians of Ireland et al., 2010). Its aim was to develop acute medicine services so that all medical patients would receive the highest quality of acute medical care and be assessed and managed in an effective and efficient manner. This model of care was a framework for how acute medical services should be delivered in Irish hospitals. It identified four medical patient pathways to signify the journey of medical patients presenting to hospital and recommended specific practice changes in each pathway. The four patient pathways were: an ambulatory care pathway, a medical short stay pathway, a pathway for routine specialist in-patient care and a pathway for the frail and older patient with complex needs after discharge[3]:

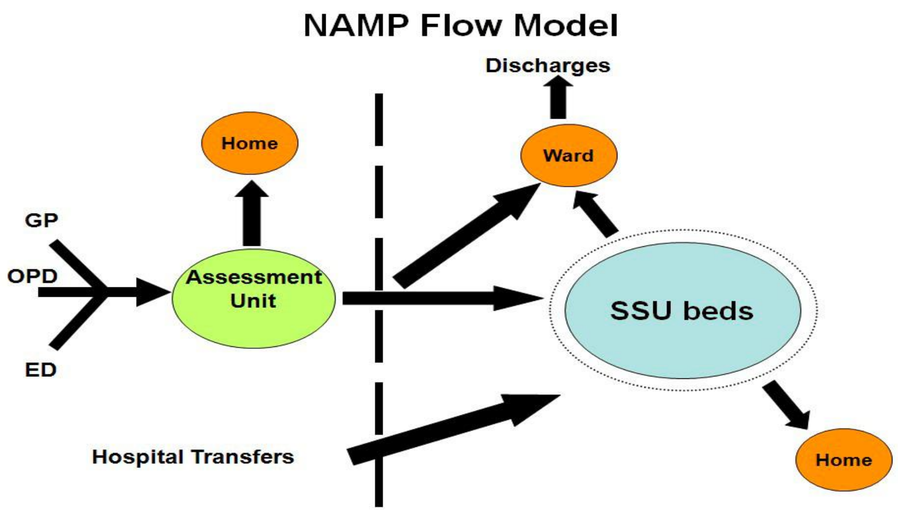
Central to the Programme was the development of AMUs in all major hospitals, and similar functioning, but smaller AMAUs in smaller hospitals. A full description of the history behind the decision to introduce Acute Medical Assessment Units is provided in Appendix 1.3. As part of the Programme, hospitals were categorised into model type depending on the nature of the services that could be safely provided. Model 1 hospitals are small community

[3] These four pathways are described in detail in Chapter 3, Table 3.1.

or county hospitals and do not have an AMAU. Model 2 hospitals are smaller hospitals that accept differentiated patients. Model 3 hospitals are larger hospitals that accept undifferentiated and model 4 hospitals are larger teaching hospitals that admit undifferentiated medical patients and accept tertiary referrals. A comprehensive description of the units to be established per hospital model is provided in Appendix 3.3

As with the UK model, the purpose of these units was to facilitate the streaming of medical patients either directly from GPs or from ED at triage (Figure 1.1), into a designated assessment area to be assessed and diagnosed by a senior decision maker (a consultant physician or a registrar/specialist registrar) within a 1 hour target, and the decision made within a 6 hour target to discharge home, admit to an adjacent Short stay ward (up to a 48 hour stay), or admit to an in-patient ward (Royal College of Physicians of Ireland et al., 2010, O'Reilly et al., 2015).

Figure 1.1 Flow diagram of the AMAU



Source: Royal College of Physicians of Ireland and Health Service Executive, 2012b.

The recommendations on the structure function, staffing and processes of these units were clearly laid out in the model of care, and are described in detail in Appendix 3.3.

The Programme expected to improve outcomes for medical patients presenting as an emergency to hospital. It expected that medical patients would be managed more efficiently and effectively in a timely manner in a more appropriate setting (i.e. in the AMAU with access to senior decisions makers), rather than in a chaotic emergency department (ED). Patients would received standardised care and be managed in accordance with evidence-based protocols developed by the NAMP team and other National Clinical

Programmes. This would result in higher quality care, improved quality of life, and patients more satisfied with the care they received in hospital.

From a service perspective, the Programme expected to reduce overnight admissions to hospital for those medical conditions deemed 'potentially avoidable'. It aimed to do this by increasing same day discharges of patients from the AMAU, who would otherwise have been admitted to an in-patient bed had they remained on the conventional route. The Programme also expected to reduce the length of stay of <u>all</u> medical patients admitted to hospital, and do so without increasing re-admissions. This was to be achieved by efficiencies introduced throughout the entire hospital stay of medical patients. This would result in a positive impact on hospitals, and result in less overcrowding in emergency departments.

While hospitals were not mandated to adopt this new framework, they were actively encouraged to do so. In 2010, when the model of care was published, there were eight acute public hospitals with an existing AMAU. Implementation started over the course of 2012 and 2013, with the last unit opening in 2014. At time of writing (October 2019), 29 acute public hospitals in Ireland had an AMAU, which represents over 88% of acute hospitals. Of the nine model 4 hospitals, seven operate the NAMP model of care[4]. The remaining model 4 hospital operates a different model for acute medicine whereby medical patients requiring admission from the ED to go to a co-located medical unit with a 5-day length of stay. This hospital has published several published articles on the outcomes of their unit (Byrne et al., 2010) (Rooney et al., 2008) (Moloney et al., 2007). Of the seventeen model 3 hospitals; fifteen have an AMAU; as do seven of the eight model 2 hospitals.

1.3 Literature on Acute Medical Units internationally

1.3.1 Evidence on the effectiveness of the units in improving patient outcomes

There is mixed evidence on the effect of AMUs in improving patient care. Two recent reviews expanded upon the initial systematic review conducted by Scott *et al.* (2009), and conclude that hospital length of stay, in-hospital mortality and 28-day re-admission rates are reduced when AMUs are introduced into hospitals (Scott et al., 2009, Reid et al., 2016, van Galen et al., 2017). The authors caution however that the studies were of moderate quality; the majority presented aggregate results (unadjusted for potential confounders), and ignored secular trends. A more recent systematic review by NICE assessed whether

[4] An eighth model 4 hospital originally participated in the Programme but closed its AMAU at the end of 2016 as new hospital management did not agree with the model.

admission or assessment through an AMU (compared with direct admission to a general medical ward) decreased hospital admissions, improved patient outcomes and hospital resource usage, and found that there is mixed evidence for the benefit of admission through an AMU (National Institute for Health and Care Excellence, March 2018). With stricter inclusion and exclusion criteria, their review was limited to just three observational studies (Li et al., 2010, Rooney et al., 2008, Coary et al., 2014), which they classed as very low quality. Recognising the continuing growth in the area of acute medicine and the fact that over 90% of hospitals in the UK now have an AMU, the NICE committee felt that ongoing assessment of AMUs was crucial especially in terms of adherence to standards and quality indicators, and called for higher quality research on the impact of AMUs, including measuring improvements in patient flow and reduced length of hospital stay (National Institute for Health and Care Excellence, March 2018).

There are no studies examining the effectiveness of AMUs in reducing potentially avoidable admissions to hospital. Despite the size of the problem of unplanned admissions for healthcare systems, there is still insufficient robust research evidence about the effectiveness of any interventions in the ED (and the wider hospital setting) to avoid/reduce potentially avoidable admissions, and many of the interventions commonly deployed lack an evidence base to support them (O'Cathain et al., 2014b).

1.3.2 Determinants of successful implementation of the units

There is a significant gap in the acute medicine literature concerning the factors influencing the implementation of AMUs. To date there are no published studies which have examined the barriers and enablers to the establishment and embedding of these units. There are similarities however, with the London Quality Standards programme, which aimed to improve the quality of acute and emergency care, as this set out the minimum quality of care that patients with medical illnesses should expect when admitted to hospital. An evaluation of its implementation identified many barriers and enablers to adherence to standards in acute care (Vaughan et al., 2017), and it is likely that many of these will be of relevance to this study, given the similarity of programme objectives.

1.3.3 Evidence of the components of the units related to better outcomes

Studies in the UK and Australasia have shown considerable variation across hospitals in terms of compliance with recommendations on how care should be delivered in AMUs (Ward et al., 2009, McNeill et al., 2011, Reid, 2016). The heterogeneity of the AMU models studied and the fact that most studies have examined a single site make it hard to deduce *which* elements of the AMU are associated with better patient outcomes (van Galen et al., 2017, Reid et al., 2016).

The Society of Acute Medicine in the UK has called for research to describe *what* features of an AMU contribute most to improved patient outcomes (Holland et al., 2017). In response to this, Reid *et al.* (2017) conducted a second systematic review - this time to examine the evidence base on *how best* to deliver care in AMUs (Reid et al., 2017). They found limited evidence and a significant knowledge gap on how best to deliver AMU care. The one component examined, which had consistent evidence of improved patient outcomes, was the presence of a consultant for a sustained period. This has been associated with a reduction in potentially avoidable admissions to hospital (Pinkney et al., 2016), reductions in mortality and 28-day re-admission rates (Bell et al., 2013), and reduced length of hospital stay (McNeill et al., 2009). Hence, consultant presence is deemed a core component of AMUs worldwide (Royal College of Physicians, 2007, Holland et al., 2017, McGovern, 2013, Royal College of Physicians: Designing Services, 2017, ACI Acute Care Taskforce Medical Assessment Unit Working Group, 2014) and the Royal College of Physicians in the UK have published recommendations on how to provide this consultant cover (Royal College of Physicians, 2012).

In contrast to this, the High intensity Specialist Led Acute Care (HiSLAC) study examined the link between increased mortality rates associated with weekend hospital admission (the weekend effect) and sub-optimum staffing levels of specialist consultants. (Aldridge et al., 2016). Their cross sectional study measured the level of intensity of specialist cover on a Sunday in comparison to a Wednesday and examined whether this was associated with an increased risk of mortality, adjusting for individual patient risk factors. They found that while there was a substantial difference between weekend and weekday specialist involvement in the care of patients admitted as emergencies to acute hospitals in England, they were unable to demonstrate an association between variation across hospitals in specialist staffing and mortality. Whilst recognising the methodological and contextual issues that made it difficult to find association, the authors state that this finding suggests the need for caution in attributing the weekend effect mainly to a lack of consultants at weekends.

A more recent study examined whether performance on 'clinical standards' introduced in the NHS was associated with this 'weekend effect' (Meacock and Sutton, 2018). Four priority clinical standards for emergency hospital care were introduced with the aim of reducing deaths associated with the ‘weekend effect’ (i.e. time to first consultant review, access to diagnostics, access to consultant directed interventions, on-going review). Compliance with these standards will be mandatory for all NHS hospitals by 2020 as part of the seven-day services policy.[5] Their retrospective study over a three year period found that Trusts' performances on the clinical standards was not associated with the current magnitude of, or changes in, their weekend effects over the past 3 years, and state that the *'achievement of seven day clinical standards for emergency hospital care may not reduce weekend mortality'*. They state that their findings cast doubt on whether adoption of seven-day clinical standards in the delivery of emergency hospital services will be successful in reducing the weekend effect.

Finally, Vaughan & Mitchell (2013) synthesized the literature on the benefits of a multidisciplinary team (MDT) in the acute medicine setting on patient experience and clinical outcomes. They found that there is a consistent, albeit methodologically flawed, body of evidence that supports MDT working in this setting.

1.4 Thesis motivation and objectives

This thesis was commissioned by the Health Service Executive (HSE), in its capacity as the body responsible for the design and oversight of the National Clinical Programmes. They were interested in knowing whether the Programme was achieving its objectives and having a meaningful impact on admission rates to hospital. Additionally, the Acute Medicine Programme team were interested in deciphering what was driving the heterogeneity they observed across the units, why some sites were finding it more difficult than others to adhere to the principles of the model of care, and what the key threats to the sustainability of the Programme were.

This thesis describes the multistage mixed methods study undertaken to examine these aspects. The mixed methods approach taken in the thesis has a number of advantages, including providing a more holistic and textured picture of a programme and its implementation and having the potential to redress the inherent biases that any single method has (Odendaal et al., 2016). In undertaking evaluations of this sort, it is the extent to which methods align with the questions that the stakeholders are interested in answering that determines the quality of the evaluation. This was the approach taken throughout this thesis. This evaluation was a formative one, with findings regularly fed back to the national programme team, to provide key information that could be used to improve the Programme. It was undertaken with their full support and engagement throughout.

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[5] Ensuring patients admitted as an emergency receive high quality consistent care, whatever day they enter hospital.

The aims of this thesis were to undertake a complex mixed methods evaluation of the implementation of the Programme, its impact on overnight emergency hospitalisation rates, and the factors that influenced both of these. The specific objectives of this thesis were to:

- describe in detail the Programme's theories and desired programme outcomes, and the components and mechanisms of change required to achieve these outcomes
- assess how the Programme has been implemented across acute public hospitals, both in terms of alignment of the organisational structures, processes and resources put in place at each of the hospitals to the model of care, and the utilisation of the AMAUs
- provide an in-depth analysis of trends in acute medicine activity and potentially avoidable medical admissions over the life of the Programme
- examine whether the Programme has had an impact on reducing overnight emergency hospitalisations to hospital for medical conditions, and potentially avoidable medical admissions
- identify the factors that have influenced implementation and operation of this programme and its ability to achieve its outcomes.

As other jurisdictions consider the expansion of AMUs (van Galen et al., 2017), evaluating the recent, large scale, country-wide, implementation of these units provides an excellent opportunity to highlight the factors - contextual and other - which facilitate and impede implementation of these units into the acute setting. Additionally, by identifying key mechanisms and contexts that influence the effectiveness of a large, recently implemented programme, this study will contribute to guiding the future development, implementation and evaluation of similar programmes. Lessons learnt from this evaluation will be shared with others designing and planning similar transformative programmes, particularly in the Irish setting, where there is ongoing reform in the healthcare sector, with a growing emphasis on Integrated Care programmes to join health and social care services, and a move toward universal healthcare in Ireland in the form of Slaintecare (Houses of the Oireachtas, 2017).

1.5 Thesis structure

Each chapter in this thesis describes a discrete stage of the evaluation, and as such can be read as a standalone chapter. However, it is advisable to read consecutively, given the mixed methods nature of the evaluation, where reference is frequently made to prior stages.

Chapter 2 describes the conceptual and methodological approach taken in the evaluation. It provides an overview of implementation science as it pertains to programme evaluation and describes the conceptual approach taken to evaluate the Programme. The mixed methods study design is presented, and a brief description of each stage is provided.

Chapter 3 describes the Acute Medicine Programme, and its theories and assumptions as to how the Programme was expected to achieve its outcomes. Logic modelling is frequently used in programme evaluation and in this case, it describes the Programme components, its expected outcomes and the key assumptions and expectations. This chapter details how the logic model was developed through a combination of documentary review, key informant interviews, and in-person meetings with the NAMP team.

Chapter 4 examines the organisational functions (i.e., structures, processes and resources) put in place at the hospitals to support these units.

Chapter 5 describes the level and quality of the utilisation of the units. This was done for emergency hospitalisations for <u>all</u> medical conditions, and then for ambulatory care sensitive medical conditions.

Chapter 6 examines whether the widescale establishment of the units from 2012 significantly succeeded in changing the trend in the rates of overnight emergency hospitalisations and bed days used by these hospitalisations, for medical conditions and ambulatory care sensitive medical conditions respectively. A national approach was taken and data from all acute hospitals accepting adults aged 16 years and over was included, including those few hospitals that do not participate in the NAMP programme and do not have an AMAU.

Chapter 7 presents the findings of the qualitative study undertaken using semi-structured interviews with the NAMP team and frontline clinical staff to identify the factors that have influenced the implementation of these units, their ability to operate as per the model of care, and their ability to achieve their desired outcomes.

Chapter 8 concludes the thesis an presents the key learnings. The strengths and challenges are presented, and directions for further research are outlined.

Chapter 2. The conceptual and methodological approach taken in the thesis

2.1 Introduction

This chapter presents the conceptual and methodological approach taken in the thesis. The chapter opens with a brief introduction to programme evaluation, followed by the components of programme evaluation specific to this thesis. Firstly the role of programme theory in programme evaluation is introduced. This is followed by a short review of the implementation science literature as it pertains to two aspects of implementation pertinent to the evaluation, namely assessing implementation, and identifying the determinants of successful implementation. Two frameworks which are core to the evaluation are discussed - Proctor's *Conceptual model of implementation research* (Proctor et al., 2009) and the *Consolidated Framework for Implementation Research* (CFIR) (Damschroder et al., 2009).

The latter half of the chapter focuses on the study design used to test the hypotheses presented in the conceptual framework. The study design is described both visually and in terms of the procedures and outputs for each stage; an approach recommended in several texts which describe mixed methods evaluation (Creswell, 2015, O'Cathain et al., 2007). Only a brief description of each stage is provided; a more thorough description of the methodological approach is reserved for the relevant chapter.

2.2 Approaches to programme evaluation

The use of the term real-world evaluation has grown in popularity in recent times to describe evaluations in complex 'real-world' situations, where the evaluator has limited control over the intervention or context, and traditional experimental methods are inappropriate. Even though these evaluations are frequently conducted with budget, time, and data constraints, they must be of an acceptable level of rigor and validity. These constraints frequently limit the design options and the data collection methodologies available to the evaluator. They also mean that decisions have to made in terms of what information is critical to the stakeholders (Bamberger, 2019).

In terms of evaluating complex interventions in real world situations, potential methodologies include quantitative, qualitative, mixed-method, and theory-based approaches. The emergence of mixed methods is a recent and distinct approach to evaluation design. Mixed-method designs involve the planned use of two or more quantitative and qualitative methods of data collection and analysis. Building on the strengths of both quantitative and qualitative approaches, mixed methods can combine more comprehensive coverage with in-depth analysis of individual cases and a holistic understanding of the context within which each project is implemented. Mixed methods designs focus on collecting, analysing and merging both quantitative and qualitative data into one or more studies (Landsverk et al., 2012). The central premise of these designs is that the use of qualitative and quantitative approaches in combination provides a better understanding of research issues than either approach alone. (Landsverk et al., 2012). In implementation research, qualitative methods are typically used to explore and obtain depth of understanding as to the reasons for the success or failure to implement evidence-based practice. Connecting the data occurs when the analysis of one dataset leads to (and thereby connects to) the need for the other dataset, such as when quantitative results lead to the subsequent collection and analysis of qualitative data (i.e. expansion) or when qualitative results are used to build to the subsequent collection and analysis of quantitative data (e.g., development) (Landsverk et al., 2012).

Selecting the appropriate evaluation design depends on several factors including: the purpose of the evaluation, the information the stakeholders require, the evaluation questions to be examined, the constraints that the evaluation will be faced be, and how the findings will be used (or not) (Bamberger, 2019). A comprehensive programme evaluation ideally includes both formative and summative components (Geonnotti, 2013). Both approaches can examine how an intervention was implemented, the barriers and facilitators to implementation, and the effects of the intervention on various outcomes. Formative evaluations focus on engagement with stakeholders when the intervention is being developed and as it is being implemented, to identify when it is not being delivered as planned or not having the intended effects, and to modify the intervention accordingly. A summative evaluation, on the other hand, generally provides feedback to stakeholders at the end of programme implementation. Formative evaluation complements summative evaluation and is essential for trying to understand why a programme works or doesn't, and what other factors (internal and external) are at work during a project's life (Geonnotti, 2013).

Considerable time and effort was devoted in designing this evaluation, which was only agreed upon *after* the programme's theory had been unearthed. See the study design presented in Figure 2.4. The formative aspects of the evaluation included keeping stakeholder informed about the progress of the evaluation and the preliminary findings and hypotheses. The findings of each stage were fed back periodically to the primary stakeholders - NAMP team - via attendance at in-person team meetings and the issuing of reports. The findings were also presented to other relevant stakeholders -HSE, Royal College of Physicians of Ireland and individual hospitals, via reports, in-person presentations, meetings and conference representations. Much of this work was used in the development of an ambulatory care framework for the acute floor (HSE National Acute Medicine Programme, 2018). As a supplement to this framework, each of the 34 acute hospitals were provided with their individual in-depth data for 2017, on the trajectory of emergency medical hospitalisations by clinical condition, and the flow differential between the AMAU and ED-admission pathways for these conditions. The rationale for same was to assist individual hospitals identify conditions rich in potentially avoidable admissions to guide them develop and bolster ambulatory care pathways in their own hospital.

2.2.1 The role of the evaluator: subjectivity and reflexivity

It is recognised that qualitative research values subjectivity and reflexivity, and it is acknowledged that the principal investigator brings her subjectivity, views and perspectives into this research project (Braun and Clarke, 2006). Reflexivity is an essential requirement in qualitative research and involves critical reflection on the role of the researcher in the project and their relation to knowledge (Braun and Clarke, 2013). The principal investigator in this research project was a female; with over 10 years' experience working in the design and evaluation of healthcare programmes, and writing her PhD thesis on this evaluation project. She had a clear interest in the evaluation, given the length of time working on the project with its various inter-connected stages. The principal investigator had a professional working relationship with the National Acute Medicine programme team, which developed over the course of the evaluation. During all communication with relevant participants it was highlighted-that the evaluation was part of a thesis for the fulfilment of an academic qualification, and that it was being undertaken with the full support of the National Acute Medicine programme team and the HSE, who funded this evaluation.

2.3 The role of programme theory in evaluation

The purpose of an evaluation is not just to estimate "how much" change has occurred but also to explain "why" and "how" the changes were produced. As such, this evaluation was informed by the UK's Medical Research Council (MRC) guidance on process evaluation on complex interventions (Moore et al., 2015). This framework recognises that to inform policy and practice, one needs to understand not only *whether* interventions work but *how* they were implemented, their causal mechanisms, and how effects differ from one context to another. It highlights the essential role context plays in programme evaluation, where context is defined as those '*factors which affect implementation, intervention mechanisms* *and outcomes, or the causal mechanisms present within the context which act to sustain the status quo or potentiate effects'*. Programme theory is a central building block of most evaluation designs, and eliciting a programme's theories is a crucial first step in evaluating a complex intervention. Programme theory explains why a programme does what it does and provides the rationale for expecting that doing so will achieve the desired results (Rossi et al., 2004). Evaluators have long recognised the importance of programme theory as a basis for formulating and prioritising evaluation questions, designing research and interpreting findings (Rossi et al., 2004). Theories enable clarity about the components of a programme, the mechanisms through which the programme activities are thought to lead to the intended outcomes, the key outcomes to be assessed, plus the measurement tools, analytical approaches and data collection methods and standards that will be used (Davidoff et al., 2015). The first step in assessing programme theory is to actually articulate it, that is, to produce an explicit description of the conceptions, assumptions, and expectations that constitute the rationale for the way a programme is structured and operated (Rossi et al., 2004). In this evaluation, the Programme's theory was elicited in a iterative manner with the NAMP team, and depicted in a logic model. This is described in detail in Chapter 3.

2.4 The role of implementation evaluation in programme evaluation

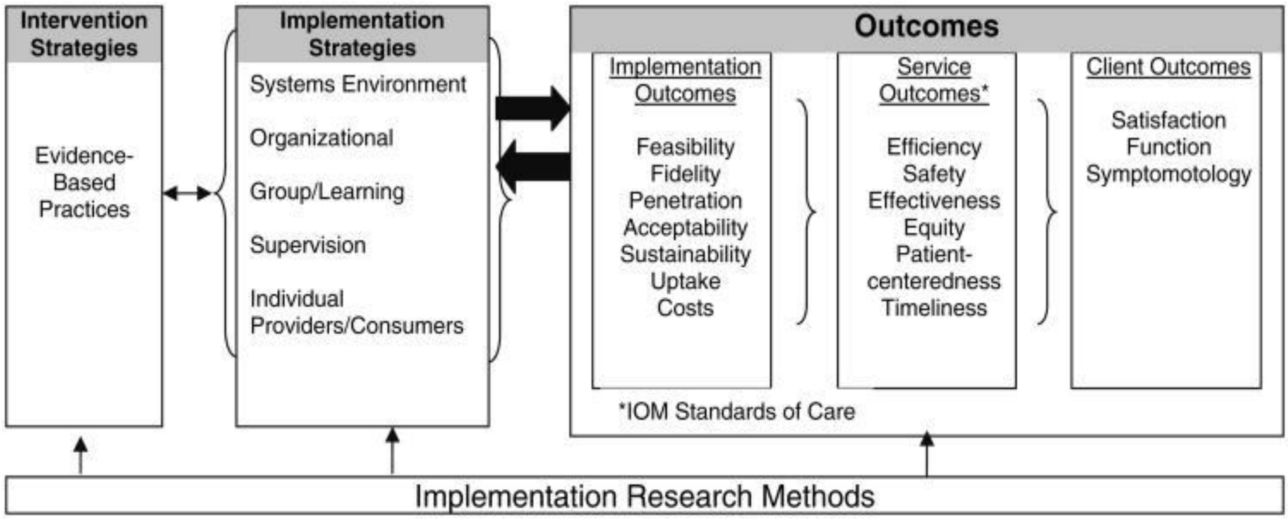
Implementation is the process of putting a decision or plan into effect. Implementation science has been defined in several ways that are consistent with the definition put forward by (Eccles and Mittman, 2006) in the inaugural issue of the journal, *Implementation Scie*nce: "...the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practice into routine practice and, hence, to improve the quality and effectiveness of health services." Hence the goal of implementation science is not to establish the health *impact* of a clinical innovation, but rather to identify the factors that affect its *uptake* into routine use (Bauer and Kirchner, 2020).

The field of implementation science has grown enormously as a result of an increasing awareness of the "science to service gap", i.e., concern about the often limited success of transferring evidence-based practice to ordinary service settings and it deals with the "what," "how," and "who" of implementation (Fixsen et al., 2005). This "science to service gap" is also referred to as the "implementation gap" whereby practices with convincing research support have limited use in routine practice caused by poor implementation. Therefore, programmes or interventions are deemed to be ineffective simply because they have not been implemented as planned (referred to as type III error) (Rossi et al., 2004, Dobson, 1980). Evaluating *how well* a programme has been implemented is therefore essential to understanding and interpreting an impact evaluation. When efforts fail, it is important to know if the failure occurred because the intervention was ineffective in the new setting (intervention failure), or if a good intervention was deployed incorrectly (implementation failure) (The National Implementation Research Network's Active Implementation Hub, 2017). Hence, one of the major roles of an implementation evaluation is to complement an impact evaluation and determine what quality and quantity of services a programme provides; so that this information can be used to interpret the findings on what impact those services have (Rossi et al., 2004). Without understanding the degree to which a programme was implemented as planned, it is difficult to suggest linkages between outcomes and programmes. Knowing what took place is a pre-requisite for explaining or hypothesising why a programme did or did not work. Durlak (2015) contends that 'monitoring implementation and examining how the level of implementation relates to different programme outcomes are now essential aspects of all programme evaluations.' (Durlak, 2015). Implementation science is concerned with measuring how well a programme has been implemented, the barriers and facilitators of successful implementation and the development and application of strategies that overcome these barriers (Bauer and Kirchner, 2020). A discussion of some of these aspects and their application in this study ensues.

2.5 Measuring implementation outcomes

An implementation framework that introduces the concept of implementation outcomes and their importance in programme evaluation is Proctor's Conceptual model of Implementation Research (Proctor et al., 2009, Proctor et al., 2011). Proctor draws attention to the fact that an intervention or treatment will not be effective if it is not implemented well, and stresses that implementation outcomes serve as necessary preconditions for attaining subsequent desired changes in clinical or service outcomes. Implementation outcomes serve as indicators of the implementation success and they are key intermediate outcomes in relation to service system or clinical outcomes in treatment effectiveness and quality of care research. Proctor categorizes three types of outcomes: implementation outcomes, service outcomes and client outcomes (Figure 2.1).

Figure 2.1 Proctor's Conceptual Model of Implementation Research



Implementation outcomes are distinct from these other two outcome categories. They are the effects of deliberate and purposive actions to implement new treatments, practices, and services. The implementation outcomes identified by Proctor are: acceptability, adoption, appropriateness, costs, feasibility, fidelity, penetration and sustainability (Table 2.1).

Table 2.1 Implementation outcomes (Proctor et al., 2011)

Outcome	Description	Other terms
Acceptability	The perception among stakeholders that an intervention is agreeable, palatable or satisfactory.	Content; comfort; credibility
Adoption	The initial decision to employ the intervention.	Uptake; utilisation; intention to try
Appropriateness	The perceived fit, relevance or compatibility of the innovation.	Perceived fit; compatibility; suitability; practicability
Feasibility	The extent to which an innovation may be carried out within a given setting.	Actual fit; suitability for everyday use; practicability
Fidelity	The extent to which the intervention was delivered as described.	Delivered as intended; adherence, integrity; quality of delivery
Implementation Cost	The cost impact of the implementation effort; both due to the cost of delivering the treatment, and the complexity of the implementation.	Cost-effectiveness; cost-benefit; marginal cost
Penetration	The integration of the new practice into a service setting and its subsystems	Institutionalisation; spread; service access
Sustainability	The extent to which the innovation is institutionalized within a service's ongoing operations	Maintenance , continuation, durability, incorporation, integration

Measurement of these outcomes is made at either the pre-implementation phase, mid-early implementation, or late in the implementation phase, depending on the individual outcome. Methods of measurement include questionnaires, survey, interviews, and administrative data.

Assessing programme fidelity (i.e., the extent to which the intervention was delivered as described), is deemed a necessary outcome to examine, as it is essential in making sense of unsuccessful outcomes, to determine whether the failure reflect the unsuitability of the model or shortcoming in the implementation process. However, given the complex multi-faceted nature of the Programme and the large degree of heterogeneity across sites, it was felt that measuring fidelity would not be realistic. Instead the implementation outcome assessed was the degree of alignment across site to the model of care, from the perspective of the organisational structures, processes and resources put in place to support the programme. This is an implementation outcome defined by Rossi (2004), which pre-dates Proctor's model. This outcome was assessed by mapping the responses to a comprehensive survey of each of the AMAUs, undertaken by the Programme team, to the model of care. This stage of the evaluation is presented in Chapter 4.

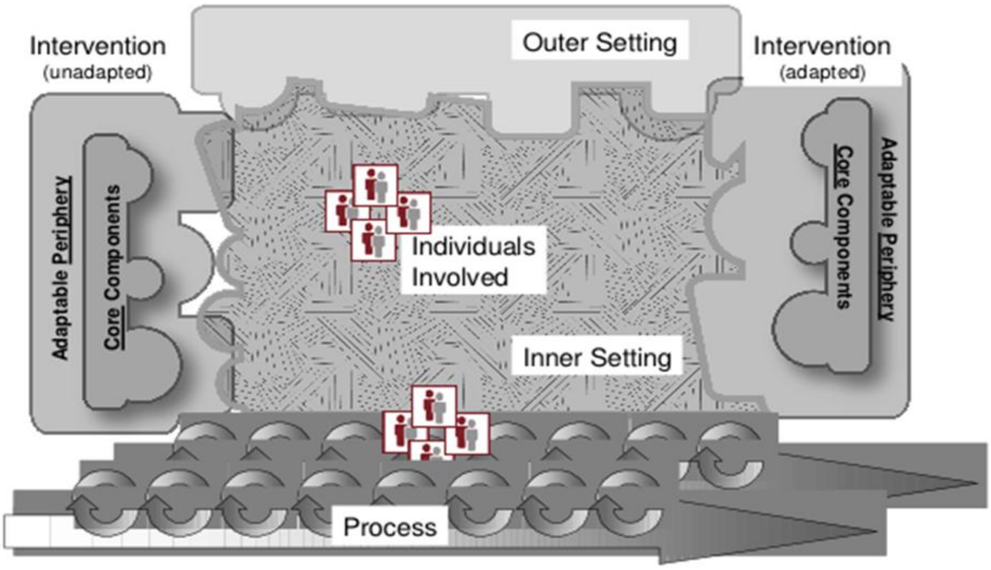
The second implementation outcome assessed was the level of utilisation of the units. This was deemed a more appropriate outcome than programme reach, which would not provide the level of richness required to understand the conditions and characteristics of those assessed in the AMAUs. This outcome was assessed by a comprehensive utilisation study using administrative hospital data, to examine the role the units played in terms of emergency hospitalisations for medical conditions to acute public hospitals between 2009 and 2017. This stage is presented in Chapter 5.

2.6 Identifying factors influencing implementation

There are a wealth of frameworks identifying the factors than can facilitate or impede the implementation and routinisation of an intervention into practice (Durlak and DuPre, 2008) (Ogden and Fixsen, 2014). These frameworks typically categorise factors into domains, which include aspects of the intervention itself, the individuals expected to adopt it, the setting into which the innovation is being introduced (the inner context), the wider system (outer context) and the process of implementation itself. Many of the factors are generic and will influence the implementation of any innovation or programme, while others are more related to a specific innovation (Grol et al., 2013).

Damschroder and colleagues (2009) reviewed 19 existing implementation theories and frameworks in order to identify common constructs that affect successful implementation across a wide variety of settings (e.g., healthcare, mental health services, corporations) (Damschroder et al., 2009). Their framework identifies five key domains that influence successful implementation: intervention, outer setting (factors external to the organisation), inner setting, individuals and process. Each of these 'domains' have several constructs upon which the authors offer guidance on how best to select, operationalise, measure and report findings. The resulting *'Consolidated Framework for Implementation Research'* (CFIR) provides a comprehensive taxonomy of constructs that are likely to influence the implementation of complex programmes (Damschroder et al., 2009).

Figure 2.2 Depiction of the domains influencing implementation, as per the Consolidated Framework for Implementation Research



Source: Damschroder et al (2009)

In this evaluation, qualitative interviews were conducted with programme team and clinical staff at six hospitals to identify the factors that influenced the implementation of the Acute Medicine Programme and its outcomes. Questions, which were guided by the CFIR constructs (Appendix 2.1), focused on participants' experience with the units, their perception of how they were working, their compatibility with the hospital system, and the main threats to their sustainability. Hospitals were purposively sampled based on the level of utilisation of the AMAUs identified during Stage 2, with three 'high' and three 'low' implementation sites selected. Sampling cases at either end of the implementation spectrum facilitates the identification of factors that contribute to or hinder implementation. This approach has been taken by Damschroder & Lowery in their study assessing implementation determinants for their propensity to distinguish between sites with high versus low implementation effectiveness (Damschroder and Lowery, 2013).

2.7 Measuring programme impact

Proctor's model (Figure 2.1) differentiates programme outcomes into service outcomes and client outcomes. <u>Service outcomes</u> are the six domains of healthcare quality: efficiency, safety, effectiveness, equity, patient centeredness and timeliness (Institute of Medicine

(IOM), 2001). These are intermediate (proximal) outcomes which are upstream on the trajectory to improved health outcomes and are strongly influenced by implementation processes and strategies (Glasgow et al., 2013). Client outcomes include improvements in symptom, function and satisfaction with the care received.

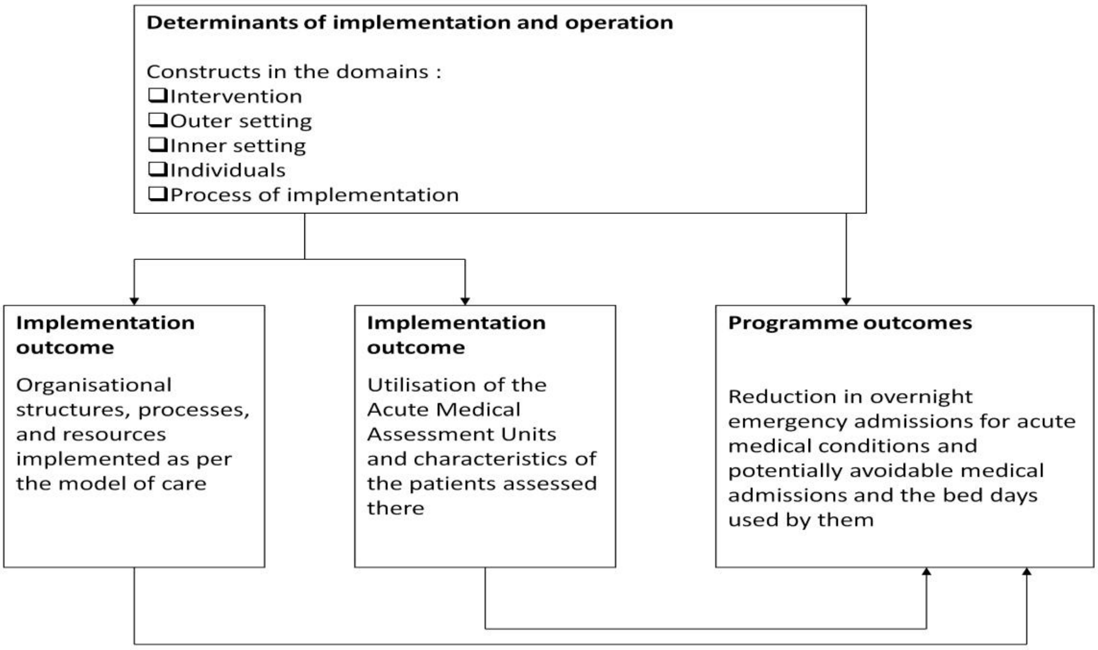
In this evaluation, the expected programme outcomes were documented during the development of the logic model (Chapter 3). Many of the outcomes - especially client outcomes - in terms of improved health outcomes for medical patients, improved quality of life, improved patient satisfaction and a reduction in re-admission rates, could not be measured given a lack of data and the constraints of the data available. An outcome which could be measured was a service level outcome of 'effectiveness'; which was defined as the *'reduction in the rate of overnight emergency hospitalisations (and the bed days used by them) for medical conditions especially those deemed potentially avoidable'*.

2.8 The conceptual approach taken in the thesis

The conceptual framework for this thesis therefore focused on determinants and outcomes of implementation and their relationship to effectiveness. The two frameworks by Proctor and Damschroder were combined to generate hypotheses about the process and outcome of implementation:

- that there were several important 'determinants of implementation' which influenced implementation
- that these determinants also independently affected the Programme's outcomes, and
- that the two implementation outcomes were associated with Programme outcomes

Figure 2.3 Conceptual approach to the evaluation



2.9 Study design

A mixed methods multi-stage evaluation was used to test these hypotheses, namely that that there were several important 'determinants of implementation' which influenced implementation; that these determinants also independently affected the Programme's outcomes, and that the two implementation outcomes were associated with programme effectiveness. Underlying all stages of the study was the Programme theory elicited in Stage 1. This was used to identify (i) the external context which needed to be examined and considered, (ii) the implementation outcomes that could be measured and how, (iii) the factors that need to be explored in the qualitative interviews with clinical staff, and (iv) the Programme outcomes to be measured and how. This study had a sequential design whereby qualitative research was undertaken to explain quantitative findings (Creswell, 2011). This took the form of semi-structured interviews with clinical staff at six hospitals to identify the factors that influenced the Programme's implementation and its ability to operate with fidelity to the model of care. Owing to the extensive time required to conduct all stages of the study, it was not feasible to conduct the interviews after the impact evaluation had been undertaken. Therefore, the information on the effectiveness of the programme on reducing overnight emergency hospitalisations for specific medical conditions was not available at the time of the interviews. Hence the interviews focused on factors influencing the ability of the AMAUs to avoid overnight hospitalisations in general, not for specific conditions.

Figure 2.4 Mixed methods study design

1. Theory conceptualisation (Chapter 3)

Elicit the Programme's theories and depict in a logic model using:
Documentary review
Key informant interviews
Discussions with NAMP programme staff

Output
1. Logic model depicting the Programme's desired outcomes, components and mechanisms of change to guide the entire evaluation.
2. Detailed description of the organisational structures, processes and resources to be implemented at each site for use in the survey design and analysis in Stage 2

Stage 2. Assess alignment of implementation with model of care (Chapter 4)

Work with the NAMP team to design a survey to examine what has been implemented at each of the 29 hospitals, as it pertains to the AMAUs based on the output of Stage 1

Map the findings of the survey to the model of care to provide a detailed description of the organisational structures, processes and resources implemented across sites

Stage 3. Assess utilisation of the units (Chapter 5)

Measure utilisation of the units using secondary administrative data (HIPE data) to gain a comprehensive account of the role the units play in acute medical activity in Irish hospitals.

Purposefully select six sites at either end of the level of utilisation of the AMAUs

Stage 5. Identify the factors influencing the programme's implementation and ability to achieve its outcomes (Chapter 7)

Purposively sample six sites based on their level of implementation (utilisation of the units from Stage 3)
Undertake semi-structured interviews with clinical staff (N=28) and programmme staff (N=7)

Output
Clear description of the factors that have influenced programme implementation in the domains of: the characteristics of the programme, the inner setting, the outer setting, the individuals responsible for implementation and the process of implementation.

Stage 4. Assess programme impact (Chapter 6)

Clarify the expected programme outcomes using the logic model
Create analytical datasets using secondary/administrative data
Estimate programme impact using interrupted time series on the analytical data sets

Output
Estimation of programme impact in reducing overnight emergency admissions for medical conditions, especially those termed potentially avoidable

Chapter 3. The Acute Medicine Programme's theories

3.1 Introduction

The process of deciding on the most important questions for programme evaluators to answer requires an in-depth understanding of the intervention, what it expects to do, and the underlying assumptions as to how it expects to achieve this (Moore et al., 2015). This approach is also recommended by Rossi *et al.* (2004) who state that before evaluators can decide upon core questions, a clear description of the intervention is vital. The UK Medical Research Council guidance on process evaluation recommends depicting the intervention and its causal assumptions in a logic model. A logic model can be used to present both *process and impact theory* and is a replica of what a programme is intended to be which can then be analysed. It can be used for identifying the Programme's functions, activities and outputs to assess fidelity, and to understand how the Programme interacts with the organisation's structures and functions (Rossi et al., 2004, Moore et al., 2015). Following the guidance of Rossi *et al.* (2004), a stepwise approach was taken to eliciting the theories of the Acute Medicine Programme with the aid of NAMP programme team. A logic model depicting same was developed and used throughout the evaluation to guide all subsequent stages.

3.2 Developing the logic model with the Programme team

Design

Active, iterative process of developing the logic model using a combination of documentary review, in-person stakeholder meetings, and key informant interviews.

Methods

1. Document review

A comprehensive reading of the literature in the field was undertaken (Appendix 3.1). The Acute Medicine programme's model of care, which describes the framework for how acute medical care should be delivered in Ireland, was analysed to identify 1) programme components, 2) the expected outcomes, the implicit mechanisms as to how these components were expected to achieve these outcomes. This was done with the assistance and direction of a supervisory team member with experience in this area (McHugh et al., 2016). During this process the model of care was also coded and the organisational structures, processes and resources to be implemented documented for use in the survey of sites in Stage 2.

2. Acute Medicine Programme team meetings

In line with guidance for developing a logic model, an initial face to face meeting was held with the NAMP team (physicians, nurses and allied health professionals with expertise in acute medicine, and programme managers) (n=6), to identify and define expected outcomes, both programme outcomes and implementation outcomes. Importantly, discussions were held on which programme outcomes could be assessed given data constraints.

3. Interviews with Acute Medicine Programme personnel

One-to-one key informant interviews were conducted with the NAMP team, including all programme managers since programme inception (n=7). The purpose of these interviews was two-fold; firstly to understand programme processes and how these were expected to achieve the desired programme outcomes, and secondly to get clear description of the process of planning, designing and implementation of the Programme. The topic guide used in these interviews is presented in Appendix 3.2.

4. Refining the logic model

A first draft of the model was developed in the format recommended by the Kellogg Foundation (2004) with emphasis not only on the outcomes and components but the mechanisms by which it expects to achieve these outcomes (W.K Kellogg Foundation, 2004). This was revised through two face-to-face meetings with the national team.

Findings

The final logic model is presented in Figure 3.1 and described thereafter. It depicts the components of the Acute Medicine Programme as well as envisaged programme and implementation outcomes. Additionally, it provides summary information on the programme's assumptions and expectations, contingencies and interdependencies, as well as key relationship critical to the success of the programme.

Figure 3.1 The logic model developed to inform the evaluation

Situation analysis
Acute medicine patients (especially elderly) were 'over represented' in EDs, resulting in long delays and over-crowding, and large number of patients on trolleys awaiting hospital admission

Programme aims
NAMP aims to safely reduce potentially avoidable admissions to hospital by establishing Acute Medical Assessment Units (AMAUs) in acute hospitals for rapid assessment and management, and shorten the length of stay of medical patients admitted to hospital.

Programme Components
AMAU. Dedicated area with spaces for the rapid assessment and diagnosis of acutely unwell medical patients: -Sufficient capacity for demand -Review of patients within 1 hour senior decision makers (consultant and registrar/specialist registrar) -Dedicated nursing staff with experience in acute medical care provision -Fully resourced multi-disciplinary team -Appropriate equipment -Rapid access to diagnostics -Consistent use of protocols, including safe patient handover -Appropriate governance structure **Four distinct patient pathways were described. Specific practice changes were recommended within each area to improve efficiencies in the delivery of care.** 1. Ambulatory care pathway 2. Medical Short Stay pathway 3. Routine specialist in-patient care 4. Frail / older patients with complex needs **Other** Development of the acute medicine team including Advanced Practice Nursing with new competencies Development of data analytics platform (NQAIS) for hospitals to monitor progress

Implementation Outcomes
Adoption Sites agree to adopt the Programme and implement the Model of Care (with minor adaptations where necessary to suit service needs) **Acceptability** Programme deemed acceptable to clinicians and management and given the required support for implementation as per recommendations **Fidelity** Standard operating procedures and protocols for patient care are drawn up locally and adhered to, and the efficiencies recommended in the four patient pathways are implemented. AMAU structures, resources and processes in situ **Utilisation** The Acute Medical Assessment Units are utilised as described in the Model of Care, e.g., Medical patients (with appropriate acuity) presenting to ED are sent to the units for rapid assessment & management **Sustainability** Hospitals have the necessary staff (and other resources) to implement and maintain the Programme as per Model of Care Programme not negatively impacted by staff turnover

Programme Outcomes
Service Outcomes -Reduction in potentially avoidable hospital admissions, as patients avoid overnight admission to hospital (seen, assessed, managed and discharged same day) -Reduction in length of stay of ALL medical patients admitted to hospital, with no impact on re-admissions, as recommended practice changes are implemented -Reduction in variation in length of stay of medical patients across hospital sites as care standardised -Reduction in ED overcrowding and less patients on trolleys waiting for hospital beds -Cost savings in terms of bed days saved **Patient Outcomes** -Medical patients are managed more efficiently and effectively in a timely manner in appropriate settings -Improved health outcomes for acute medicine patients managed in a standardised manner following protocols -Patients are more satisfied with care they receive in hospital

Assumptions, expectations, contingencies and interdependencies
-Ability of hospitals to establish and operate an AMAU of appropriate size and function -Improvements in flow of medical patients through the hospitals -Availability of alternatives pathways to admission for medical patients -Standardisation of care delivered in the units -Availability of adequate number of skilled staffing to work in these units -Change to the way of working -Expanded access to diagnostics for the units -Enhanced information and communication technology (ICT) -Governance of acute medicine locally -Interdependencies with other National Clinical programmes

Key relationships
- Primary care (GPs) ←→ AMAU - ED ←→AMAU: efficient triaging and streaming of appropriate patients into the unit; no 'boarding' of patients from the ED in the units - AMAU→Short-Stay unit →Specialty wards: efficient patient flow and use of resources - AMAU←→diagnostics - AMAU clinicians←→wider physician groups: cross departmental referral of patients across disciplines (i.e. to specialty care) in & out of the unit - Hospital ←→community: smooth 'egress' to step down facilities, nursing home places, home care packages - Acute medicine hospital team ←→ NAMP National team: sharing expertise & guidance - Acute medicine hospital team ←→Hospital Management: ongoing programme support & endorsement

Programme outcomes

The Programme expected to improve health outcomes for medical patients. This was to be achieved by the standardised manner in which patients were to be managed as a result of adherence to evidence-based protocols developed by the NAMP team and other national clinical care programmes. Medical patients would be managed more efficiently and effectively in a timely manner in a more appropriate setting (i.e. in the AMAU with access to senior decisions makers), rather than in a chaotic emergency department (ED).

The Programme expected to reduce overnight admissions to hospital for those medical conditions deemed 'potentially avoidable'. This would be achieved by increasing same day discharges of patients from the AMAU, who would otherwise have been admitted to an in-patient bed had they remained on the conventional route. It expected to achieve this as a result of the establishment and operation of AMAUs with the continuous presence of a senior decision maker who had access to same day diagnostics and laboratory services and again, and the adoption of ambulatory care pathways created by other national clinical care programmes (e.g. diabetes, COPD, congestive heart failure and epilepsy). Patients would be referred to the AMAU by a GP or from triage or following assessment in the ED. The Programme also expected to reduce the length of stay of <u>all</u> medical patients admitted to hospital, and do so without increasing readmissions. This was to be achieved by efficiencies introduced throughout the entire hospital stay of medical patients. This would result in a positive impact on hospitals, and result in less overcrowding in the Emergency Departments.

Programme's components

As well as the introduction of the Acute Medical Assessment Units (described in detail in Appendix 3.3), the Programme identified four medical patient pathways to identifying the journey of medical patients presenting to hospital (from ambulatory care through to care for complex patients requiring longer hospital stays) and recommended practice changes in each pathway to improve efficiency and quality of care. See Table 3.1.

<u>Pathway 1. Ambulatory care pathway</u>

This describes the ambulatory care pathways that were to be delivered in the AMAU, to facilitate same day discharge by the use of specialty ambulatory care initiatives developed by other clinical care programmes - e.g., diabetes, COPD, heart failure and epilepsy. Ambulatory care is clinical care provided on a day basis that is not provided within the traditional hospital bed base or outpatients service. It includes diagnosis, observation, treatment and rehabilitation, thereby mitigating the need for an overnight stay in hospital.

This was to be facilitated by priority access to diagnostics and access to health and social care professionals, as well as access to rapid access clinics and medical outpatients to follow up patients.

<u>Pathway 2. Medical Short Stay pathway</u>

This describes the pathway for those patients who require at most a 1-2 night stay in hospital. These patients would be managed in an adequate Short stay ward, which were to be developed in model 4 hospitals. Here patients would be seen by a senior decision maker within 12 hours of transfer from the unit, and the unit would have the continuous presence of a senior doctor with twice-daily consultant ward rounds. There was a focus on management plans and case management as well as carefully documented physician handovers in line with local protocols.

<u>Pathway 3. Routine specialist in-patient care</u>

This pathway describes those who are expected to have a longer stay in hospital (between 3-14 days). These patients were to be admitted to specialist medical wards (i.e. cohorted wards) directly from the AMAU or the SSW within 2 days of arrival. These patients were to benefit from direct handover from the AMAU (or the SSW) to the consultant physician in line with local protocols, daily consultant ward rounds, management plans and MDT input.

<u>Pathway 4. Frailer and older patients with complex needs after discharge</u>

The model of care recognised that the management of older, frailer patients is complex and requires a proactive approach to acute care management and discharge planning. It recognised the need for a 'frailty model', which includes identification of frailty and comprehensive management approach led by consultant geriatricians supported by a nursing and a health and social care professional team. This pathway describes the appropriate care and discharge of frail and older patients with complex care needs. It emphasises the need for proactive referral for MDT and proactive liaison of this MDT with community services to safely discharge patients. It encouraged involvement of care of the elderly services if required, earlier in the patient's admission. The Programme highlighted the need for close liaison between geriatricians, psychiatrists of old age, AMAU physicians, consultants in emergency medicine, liaison psychiatrists, GPs and community services to facilitate the adoption of care pathways developed by the relevant clinical programmes. Additionally, specific targeted initiatives were to be developed through this close liaison, to improve the management of the most common acute presenting complaints in older people. It was expected that ED/AMAU staff would have gerontological/ geriatric medicine training.

Table 3.1 The four patient pathways specified by NAMP and the practice changes recommended in each of these pathways

Pathway 1. Ambulatory care pathway	Pathway 2. Medical Short Stay pathway	Pathway 3. Routine specialist in-patient care	Pathway 4. Frailer and older patients with complex needs after discharge
Assess and avoid admission in AMAU Patients receive safe and effective treatment in the Assessment Unit and are discharged on the same day	Short stay ward (1-2 nights) Developed for patients who require in-patient care but are not expected to stay longer than 1 or 2 nights	Efficient processing of patients with length of stay of 3-14 days These patients are admitted directly to specialist medical wards directly from AMAU or SSW	Appropriate care and discharge of complex patients Frail older patients have complex care needs, and their discharge requirements must be identified
Establishment of adequate assessment area (AMAU) operating 12-24 hours/7 days Development of clinical criteria for transfer between ED and AMAU Rapid access and diagnosis Access to senior decision maker within 1 hour Priority access to diagnostics and Health & Social Care Professionals (HSCP) assessment Quick and consistent links with specialist ambulatory care initiatives by other programmes Access to rapid access & outpatient clinics and scheduled follow up Liaison with discharge planner Relationship with community teams GP liaison	Establishment of adequate short-stay unit for larger hospitals Access to senior decision maker within 12 hours of transfer from AMAU Continuous senior doctor supervision (i.e. 7 days a week) Twice daily consult, ward rounds Access to prioritised diagnostics and HSCP assess Carefully documented physician handovers in line with local protocols Documented management plan, inc target date of discharge, further diagnostics, interventions and necessary treatments Proactive case management, and integrated discharge	Care formally handed over from the AMAU team to the consultant physician in line with local protocols Patients to be seen by their consultant physician with 12-16 hours of transfer Daily consultant wards rounds. Daily review of medical patients on a 'board'/ward round with senior doctor Written medical and nursing care plans, inc. active discharge planning with planned dates of discharge Pro-active consideration for MDT assessment and intervention Weekend nurse/HSCP-facilitated admissions and discharge Liaison with carer/ community	Early assessment and identification of patients Proactive approach to identify the complex care needs of these patients when they are discharged Daily 'board' rounds and review Streaming to care of the elderly services where appropriate Proactive referral for MDT support Proactive MDT discharge planning and liaison with funding agencies for referral to community placements and supports Raise organisational awareness of the impact of extended lengths of stay on patient safety and the ability the hospitals to manage capacity and demand

Programme's assumptions, expectations, contingencies and interdependencies

As depicted in Figure 3.1, the model of care identified a wealth of assumptions, expectations, contingencies and interdependencies; many of which were deemed 'critical' to the success of the Programme.

<u>Ability of hospitals to establish and operate an AMAU of appropriate size and function</u>

The Programme expected that hospitals would have the necessary funding and capacity to create a new space to house the AMAU. Depending on the hospitals, this would require significant infrastructural change through the re-purposing of a ward, or a new build entirely. The Programme expected that these units would have sufficient capacity, assessment space, and resources to manage the numbers of patients being referred from GPs and from the ED. These units were also to provide space for ambulatory care, and provide a designated area of for the management of the frail elderly. While ideally these units were to be co-located with the ED (or minor injury unit), this co-location was not mandatory.

The Programme expected these AMAUs to operate a service of sufficient opening hours to meet the needs of the hospital and GPs in the vicinity. In larger model 4 hospitals this was expected to be a 24/7 service. This would require significant staffing levels, especially given that a core component of the units was the presence of a senior decision maker (discussed below). Larger hospitals were to have an affiliated short stay ward (SSW) for the overnight stay of up to 48 hours, of patients admitted from the AMAU. The assessment space and beds in the AMAU and SSW were to be protected and under the governance of the AMAU physicians.

<u>Improvements in flow of medical patients through the hospitals</u>

The model of care stipulated that sites were to agree locally through their acute medicine governance group and the GP liaison committee, on *which* patients were deemed appropriate for the AMAU and *how* patients would access the AMAU. The model expected the majority of patients would be direct referrals from GPs, who had decided the patient required a hospital admission or assessment by a medical specialist (with a smaller proportion referrals from ED). These GP-referred patients (via letter or telephone) would proceed directly to the AMAU after a brief Manchester triage in the ED to determine whether urgent resuscitation was required. Patients attending model 3 and 4 hospitals should access the ED and the AMAU through a common entrance. The Programme stated its expectation that the AMAU was expected to work in parallel with the ED and not replace the ED. Neither was the AMAU to be seen as a replacement for a traditional OPD and should not be available to bypass traditional OPD services or investigations. The AMAU was not to be considered an appropriate location for the assessment of patients with sub-acute presentations or for the management of patients with newly diagnosed chronic diseases.

The Programme recognised that the success of the AMAU was contingent on sufficient patient flow through the units, to the SSW and to in-patient beds. It stipulated that there be smooth egress from the SSW, facilitated by the adherence to a strict 48-hour protocol for the SSW. Patients requiring longer stay in hospital were to be moved to an in-patient bed in-house either directly from the AMAU or from the SSW. This improved patient flow was to be facilitated by improved bed capacity, resulting from the implementation and success of the Integrated Discharge Policy[6], and the introduction of efficiencies across the medical patient pathways to shorten the length of stay of admitted medical patients. This included new ways of working, such as improved discharge planning, daily consultant ward rounds, carefully documented physician handovers in line with local protocols, expansion of nursing and therapy roles, and criteria-led discharge. The model of care stated that it was imperative that physicians, hospital management and all members of the MDT actively facilitate discharge processes on a daily basis. It stated that this was critical to the ability of the AMAU to function, and inefficient discharge processes would threaten a unit's ability to function in a safe and effective manner. Physicians and/or the specialist registrar were expected to perform a daily discharge round on their patients between 8am and 9am to confirm which patients are eligible for discharge the next morning. 'Discharge by 11am' was to be aided by nurse-facilitated discharge. Date of discharge identified during assessment was to be discussed, and agreed with the patient and/or family carer and documented in the patient's notes.

Finally, the Programme recognised that a critical factor in its success was the establishment and effectiveness of a navigational hub, where case managers would stream patients to the most appropriate pathway of care. This 'hub' would serve multiple purposes including enhanced patients streaming within the hospital, and between primary care and the acute hospital. The case manager (CM) would have contact with the on-call physicians for AMAU, the GP and the on-call consultant or specialty physician and nursing services, to direct the patients to appropriate services, with the aim of pre-empting the need for some admissions. The options available to CMs would include the direction of appropriate patients to rapid

[6] See Integrated Care Guidance: A practical guide to discharge and transfer from hospital, published by the Health Service Executive National Integrated Care Advisory Group. Latest version March 2017 available at: https://www.hse.ie/eng/about/who/qid/resourcespublications/nationalintegratedcareguidance.pdf

access outpatient department (OPD) appointments, day care facilities, referral to the AMAU or to the ED (for patients too unstable for the AMAU) or streaming directly to specialty services. Improved communication within the hospital would be facilitated by case managers via the navigational hub. The hub would also facilitate the giving of advice to GPs from acute medicine colleagues to circumvent the need for an emergency presentation at hospital.

Availability of alternatives pathways to admission for medical patients

The Programme identified that a critical success factor was the presence of alternative pathways for medical patients, be it ambulatory care, or the enhanced availability of rapid access clinics and medical outpatient appointments. These alternative options would avoid the AMAU being used as an outpatients department for non-acute patients and free up capacity in the AMAUs to accept new acutely unwell medical patients.

The Programme recognised that to meet the growing demand for acute medical care and the impact of this on hospital capacity, that the focus of urgent and emergency care should shift to an ambulatory model, preserving acute hospital beds for the sickest patients. Ambulatory care pathways for common medical conditions were to be developed in conjunction with other National Clinical programmes. These ambulatory car pathways were to be facilitated by same day and priority access to diagnostics, including expanded service at the weekend.

The Programme also expected the enhanced provision of medical outpatient appointments and rapid access clinics for new patients referred in by GPs to the case manager and to follow up patients assessed in the AMAU. Extra outpatient appointments were to be covered by the medical specialists within their own service. This increased availability of medical outpatient appointments would reduce the need to admit patients, allow a speedier discharge and ensure that the AMAU was not used as a medical outpatients department.

Standardisation of care delivered in the units

The model of care was clear that that all acutely unwell medical patients admitted to the AMAU were to be seen within one hour by a senior decision maker (SDM) - consultant, senior registrar, and registrar - and the decision made to discharge or admit for further care made within 6 hours. A National Early Warning Score (NEWS)[7] was to be taken within a specified time of arrival in the AMAU. These metrics were to be routinely audited.

[7] The National Early Warning Score is a track and trigger scoring system used by healthcare staff when recording a patient's vital signs. Each vital sign is allocated a score based on measured physiological

The Programme emphasised the need for the adoption of evidence-based policies, protocols, care bundles and care pathways (including ambulatory care pathways) for the most common acute medical presentations. These were to be to drawn up by other National Clinical Programmes and implemented in the units, ED and hospital wards. In the absence of nationally agreed protocols, locally developed ones were to be shared nationally. Other policies and protocols to be drawn up included operational policies, protocols on retrieval and transfer of patients between hospital models, and protocols on surge capacity when in-patient capacity reached 85%.

<u>Availability of adequate number of skilled staffing to work in these units</u>

The Programme expected that there would be adequate numbers of skilled staffing in the units in terms of medical, nursing and allied health professionals. This was identified in the model of care as being critical to the success of the Programme. A key assumption was that there would be sufficient senior decision makers (consultants, senior registrars and registrars) to provide continuous senior medical cover in the AMAU. Access to senior decision makers in the AMAU was recognised as essential to expedite the clinical decision making process and improve patient care. This would be achieved by the early review of patients arriving in the unit by a senior doctor with competencies and experience to make a prompt clinical diagnosis, and decide the need for specific investigations and the most appropriate setting for that treatment and ongoing care. This would result in a reduction in potentially avoidable overnight admissions and shorter lengths of hospital stay for medical patients.

The Programme expected that medical specialty teams would change their way of doing their medical on-call and amend rotas locally to facilitate a new way of working. Medics in the AMAUs would be supported by their medical specialist colleagues who would consult into the AMAU and cover the AMAU while on-call for the hospital. This would facilitate the opening hours deemed necessary for the successful operation of the units.

To enhance medical coverage, the Programme recommended the development of acute medicine as a specialty, and the establishment of a cadre of acute medicine physicians (i.e., physicians with acute medicine as their primary specialty and physicians with a 50/50 acute medicine/other specialty interest). To facilitate this, the Royal College of Physicians of Ireland would establish a new acute medicine training curriculum. The Programme expected that AMAUs of model 4 hospitals would be staffed by these acute medicine

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parameters, these scores are added together to give a total early warning score. See: https://www.hse.ie/eng/services/publications/clinical-strategy-and-programmes/news-brochure.pdf physicians and/or acute physicians with a specialty interest during core working hours (8am-8pm), weekdays and for 5 hours per day on weekends and public holidays. In model 2 and model 3 hospitals, the consultant physician covering the AMAU would have the responsibility to be present and make management decisions during core working hours 7 days per week. Across all models, the medical consultant physician on-call for the hospital was to manage the AMAU out of hours (i.e., conduct their on-call duty through the AMAU), thereby facilitating 24-hour AMAUs in the model 4 hospitals and 12-24 hour AMAUs in the smaller hospitals.

The Programme placed emphasis on the role of skilled nursing in the units, and recognised that this would involve large investment in the education, training, development of staff, including the identification and development of competencies for nurses in acute medicine. As part of this, the Programme recommended the development of advanced nurse practitioners specialising in acute medicine. It placed significant emphasis on the expansion of nursing roles, including nurse-led clinics and nurse-facilitated discharge. Each AMAU was to have a Clinical Nurse Manager (CNM) to oversee the unit. Additionally, the case manager role in the navigational hub, a critical success factor for the Programme, was to be a nursing role.

The Programme expected the AMAU would have sufficient access to therapy professionals, with an expansion of these services, including extended hours and weekend service. These health professionals would be shared between the AMAU and the ED, and the two services would not compete for resources. The Programme also expected that therapists would provide outpatient clinics to optimise outcomes and facilitate timely discharge.

<u>Change to the way of working</u>

The Programme called for a change in work practices, whereby nursing and allied health professionals would have expanded roles with a more collaborative approach to managing the patient. Examples of these expanded roles included nurse and therapy led clinics and nurse and therapy facilitated discharge. Also at the team level, there would be much greater emphasis on evidence-based protocols, pathways and care bundles.

For medical specialists, the Programme meant a change in working practice/way of working. They would now be doing their medical on-call for the hospital through the AMAU, with rotas amended accordingly to facilitate the optimal openings hours of the AMAUs. They would also be supporting their AMAU colleagues by providing consultation to their patients in the AMAU. A major change was the expansion of their medical outpatient services to deal with the number of patients requiring follow upon discharged from the AMAU, and the development of rapid access clinics that would accept direct GP referrals.

A further change to the working of medical specialists was the expansion of direct medical specialty referral, which had been introduced in some model 4 hospitals. Instead of patients being admitted under the general medical team on-call, they would be admitted direct to the relevant specialty, especially in the model 4 hospital who were likely to have a greater number of specialists. Patients being admitted from an ED or an AMAU (who were unsuitable for a SSW) would also be handed over directly to the relevant specially.

Further changes recommended in terms of work practices of medical specialists were twice daily ward rounding in the AMAU; daily review of medical in-patients elsewhere via ward rounds before 11am; and weekend rounding on newly admitted patients, patients who were deteriorating and patients identified for discharge.

Expanded access to diagnostics for the units

The Programme placed significant emphasis on the availability of priority access to same day diagnostics for urgent cases in the AMAU. This would result in more patients being assessed, and their management plan agreed within the 6 hour target, leading to a reduction in potentially avoidable admissions and shorter lengths of stay. The Programme also expected hospitals to facilitate 72 hours access for other diagnostic tests to facilitate the development of ambulatory care pathways. The Programme recognised that to facilitate 7 day working of the AMAU, an expanded diagnostic service with longer working hours and weekend service would need to be established in hospitals. Importantly, the Programme stipulated that patients were not to be admitted to hospitals solely to await diagnostics, and this would be facilitated by expanded access to diagnostics in the AMAU, as well as GPs having direct access to diagnostics services (radiology, endoscopy) as per agreed protocols.

Enhanced information and communication technology (ICT)

The Programme recognised the need for improved ICT to support patient care and to facilitate secure and relevant data and information movement within and between services, such as an electronic discharge summary to primary care with a standard format to replace written and transcribed record. Additionally enhanced ICT would facilitate the improved use of data for monitoring implementation, evaluating improvement and auditing key metrics.

Governance of acute medicine locally

The model of care made clear the need for governance of acute medicine in the hospital and stipulated the need for an acute medicine governance group. It also recognised the need for clinical governance across the ED/AMAU interface in terms of clarifying the respective roles, authority and accountability of the emergency medicine and acute medicine staff.

The Programme recognised the pivotal role of GPs in the enhanced delivery of acute medicine in hospital and recommended the establishment of a GP liaison committee within each hospital to support GPs in primary care in the management of medical patients.

Interdependencies with other National Clinical programmes

Finally, the Programme recognised that its success was critically dependent on the development and successful implementation and adherence to protocols, policies, care bundles and care pathways developed by other National Clinical programmes, especially for common medical conditions. This evidence-based way of managing patients would result in improved patients outcomes, shorter length of stay, and a lower likelihood of re-admission.

3.3 Discussion

This Chapter provided a detailed description of the Acute Medicine Programme. It described the process by which the programme's components, theories and assumptions were elicited and depicted in a logic model. The process of developing a logic model helps to define the various elements of a programme, which creates the foundation for measurement and evaluation (The Strategy Unit, 2016). As discussed in Chapter 2, this first stage informed all other stages of the evaluation - the assessment of utilisation of the AMAUs in Chapter 4, the survey to assess fidelity to the model of care in Chapter 5, the measurement of outcomes to assess programme impact in Chapter 6, and the topic guide to interview clinical staff in Chapter 7. Crucially, the work undertaken in eliciting the Programme's theories provided the researcher with a level of knowledge and familiarity with the content area to conduct these various stages.

Upon completion of this chapter, a key reflection was the ambitious nature of this programme. The model of care highlighted the many contingencies that needed to be in place for this new model to work.

- The ability of the AMAUs to deliver high quality acute medical care was dependent on them having sufficient assessment space and efficient patient flow.

- Efficient patient flow through the AMAU to the SSW and/or in-patient beds and from the SSW to in-patient beds in-house was contingent on freed up bed capacity in-house because of the implementation and effectiveness of the Integrated Discharge Programme.
- The ability of the AMAUs to operate optimal hours were dependent on the availability of adequate numbers of skilled nursing and medical staff, and buy-in from the medical specialists to amend rotas and provide cover in the AMAU.
- The ability of AMAUs to provide a comprehensive acute medical assessment service to the hospital was contingent on the continuous presence of a senior decision maker (SDM) to assess the patient within one hour and to make the decision to admit or discharge within 6 hours.
- This decision was contingent on the SDM having access to diagnostics and laboratory testing which was contingent on the radiology department operating an expanded service during the week and the weekends. This was contingent on the availability of staff to operate this service.
- The effectiveness of patient streaming was dependent on the existence and effectiveness of a navigational hub staffed with case managers, who would stream patients to the appropriate point of care and would provide GPs with details of alternative services (e.g., rapid access clinics and medical outpatient appointments). The effectiveness of this hub was contingent on these alternatives actually being available and accessible.
- The ability of the AMAU to avoid overnight admission for potentially avoidable admissions and to shorten the length of stay of those admitted in-house, was contingent on the hospital having well implemented evidence-based protocols/care bundles for common medical conditions (e.g., COPD, asthma, diabetes, CHF, epilepsy), and resourced ambulatory care pathways for ambulatory care sensitive diseases (chest pain non-specific, migraine, deep vein thrombosis, TIA, syncope). These protocols were to be produced by the other National Clinical Programmes established at the same time as the Acute Medicine Programme.

There were many other contingencies for success. These will be examined in Chapter 4, which presents the findings of the survey on fidelity to the model of care.

A second reflection is the extent of change that was required for the Programme to achieve its outcomes. Change was required at <u>all levels</u> of the system, from government level to provide funding for staffing (including new consultant posts) and other resources; from the

Royal Irish College of Physicians to develop and deliver a new curriculum to train acute medicine physicians; from hospital management to provide financial and other support for the Programme when issues arose; from hospital departments - emergency department, general medicine, acute medicine and radiology - to change their ways of internal working and their working relationships with each other; from clinical teams to have a greater emphasis on nursing and therapy-led care, and finally, from medical specialists to change how they would practice medicine in the hospitals.

The next chapter presents the findings of the survey conducted across hospitals to examine the degree to which the Programme has been implemented as planned, in terms of the organisation structures, processes and resources put in place to support the Programme.

Chapter 4. The organisational structures, processes and resources put in place at the hospitals to support the Acute Medicine Programme

4.1 Introduction

Accurate interpretation of a programme's impact depends on knowing *what* components of the Programme have been implemented and how well they are operating. A programme cannot aspire to achieve its intended outcomes if it is not implemented, or implemented without 'fidelity'.

While the model of care provided guidance on the function of the units more so than the form that these units should take, it was not overly prescriptive, recognising that different hospitals would have different needs, resources, and infrastructure. This has led to a very heterogeneous model, and the concept of measuring 'fidelity to the model' is difficult. Hence the approach taken in this stage of the evaluation was to measure the structures, processes and resources in place at the hospitals to support the Programme, and the extent to which these arrangements sufficiently approximate the intended ones. It does so by mapping a comprehensive survey of the organisational structures, processes and resources put in place at the hospitals to support the Programme, to the NAMP model of care.

4.2 Methodology

The Acute Medicine Programme team designed a survey to gain to identify aspects of the Programme that hospitals were finding difficult to implement. The survey focused on the establishment and the operation of the AMAUs, rather than the medical patient care throughout the hospital. Two separate surveys were developed by the NAMP team - one for model 3 and model 4 hospitals, and a separate survey for the model 2 hospitals - reflecting the different nature of the units per hospital model. A list of the questions asked of Model 3/Model 4 hospital is presented in Appendix 4.1. The survey was sent via Survey Monkey in August 2018 to each of the 29 hospitals participating in the Programme, for completion by physicians and clinical nurse managers (CNMs) in the AMAUs. A reminder email was sent 2 weeks later.

The NAMP team facilitated researcher access to the survey results from each of the individual hospitals. As described in Chapter 3, during the development of the logic model, the model of care was coded to identify concepts core as to how the Programme was to achieve its outcomes (see

Table 4.1). The survey questions and responses were mapped to these concepts and components, to provide a comprehensive account of the degree to which the organisational structures, processes and resources aligned to the model of care.

Table 4.1 Concepts to assess fidelity to the model of care

Concept	Components to be examined
1. Changes in acute medicine throughout the hospital	Establishment of an AMAU in line with the guidance provided in the model of care Enhanced streaming of medical patients to the right place via a navigational hub Changes in work practices to enhance efficiencies in the care of medical patients throughout the hospital** Governance of acute medicine in the hospital
2. Best practice in terms of the Acute Medical Assessment Units	Hours of operation, location, and capacity of the units Access and appropriate patients streamed to the units Standardisation of care in the units Alternative pathways to admission for medical patients presenting as an emergency to hospital Discharge planning in the units and throughout the hospital
3. Essential resources: skilled staffing in the unit**	Medical staffing and medical consult to the units Skilled nursing and multidisciplinary teams (MDT) in the units
4. Essential resources: access to diagnostics, equipment, ICT	Access to diagnostics Information and communication technology
5. Acute medical care of the older person within the hospital	Care of the elderly in the AMAU Pathways in place for elderly with complex needs within the hospital Integrated approach to care of the elderly Discharge planning focused on the needs of the elderly
6. Relationships and Communication across key interfaces**	AMAU and the ED AMAU and the SSW and in-patient beds in-house AMAU & general internal medical services within the hospital AMAU/hospital and primary and community care AMAU/ hospital and the patient Programme and other National Clinical Programmes

** Not examined in detail in the survey.

Not all relevant aspects could be assessed, given the complexity of the Programme and the constraints of survey as a research methodology. In Concept 1 - changes in acute medicine throughout the hospital - the survey did not examine in detail whether the efficiencies recommended in the model of care for the different patient pathways had been implemented, including the patient journey from ED presentation to AMAU. Changes in work practices to enhance efficiencies in the care of medical patients, could not be assessed in any depth. Specifically the survey did not examine:

- changes in work practices of medical professionals including the continuous presence of a senior decision maker to review patients in the AMAU, and buy-in from the general medical teams to cover the AMAU out of core working hours while on medical call

- the extent to which medical patients are admitted directly to the appropriate medical specialty team rather than the medical team on-call, especially in larger hospitals
- the role of teams and how they work with each other within the AMAUs and across departments

In Concept 3 - staffing in the units - whether the units had adequate numbers of medical, nursing and therapy staff was not examined. The large number of questions required to get a useful account of staffing in acute medicine would render the survey too long. Additionally, the expansion and enhancement of nurse and therapy roles including weekend admission and discharge, therapy led outpatients appointments to shorten length of stay and facilitate admission avoidance, was not examined.

In Concept 4 - access to diagnostics, equipment, ICT - the enhancement and expansion of diagnostic services, such as longer hours and weekend working, again to facility facilitate 7 day workings of the AMAU were not examined, neither was whether GPs had direct access to diagnostics services (radiology, endoscopy).

Finally much of Concept 6 - relationships and improved communication across key interfaces - could not be examined in any detail in the survey, given its subjective nature. Specifically components that were not examined included:

- relationships and communication across key interfaces such as with the ED, general internal medical services, primary and community care.
- the degree to which the Integrated Discharge Policy has been implemented
- availability and access to services in the community, and information on the number of beds in transitional care, step down facilities and nursing homes.

4.3 Findings

In total, 23 of the 29 hospitals that participate in the Acute Medicine Programme responded to the survey. Seven of the country's nine model 4 hospitals participate in NAMP; of those, only four completed the survey. Of the seventeen model 3 hospitals, fifteen participate in NAMP, and twelve completed the survey, though one respondent did not complete the latter half of the survey and responses to those questions are based on 11 hospitals. Of the eight model 2 hospitals, seven participate in NAMP and all hospitals completed the survey. The findings are presented in a comprehensive table of results (Table 4.2) arranged by the six concepts listed Table 4.1. A synopsis of the main findings follows, while the complete findings are presented in Appendix 4.2.

Table 4.2 Organisational structures, processes and resources put in place at the hospitals

Components	Recommendation assessed in the survey	Model 2	Model 3	Model 4
Concept 1. Changes in acute care throughout the hospital				
1. Establishment of an AMAU	Establishment of an AMAU -i.e. 'dedicated location for the rapid assessment, diagnosis and commencement of appropriate initial treatment and ongoing management of medical patients'	7/7	12/12	4/4
2. Enhanced streaming of medical patients via a navigational hub	Presence of a navigational hub staffed by case managers to stream patients referred by GPs to the most appropriate pathway of care [1]	NA	7/12	0/4
3. Governance of acute medicine in the hospital	Acute medicine governance group	NA	8/12	4/4
	Acute medicine governance group represented on the unscheduled care governance committee.	NA	4/12	4/4
	GP liaison committee with individual GP representatives.	NA	5/12	2/4
Concept 2. Best practice in the Acute Medical Assessment Units				
1. Hours of operation, location, and capacity of the units	Opening hours Model 2=12 hours/5 Model 3=12-24/7 Model 4 =24/7	7* 8-12 hours/5	None 24/7 8 *12/5 3* 8/5 1 *14/7	None 24/7 4 *12/5
	Co-located with ED (injuries unit in model 2 hospitals)	5/7	7/12	1/4
	Separate waiting area	2/7	8/12	3/4
	Assessment capacity/spaces	7*(5-10)	3*(0-4) 8*(5-10) 1*(11-15)	4*(11-15)
	Inappropriate 'boarding' of medically-admitted patients	2/7	9/12	4/4
	Surge capacity protocol	NA	10/12	4/4
	Protocol specifying AMAU as last resort for 'boarding of patients	NA	5/12	3/4
	Affiliated SSW	1/7	3/12	4/4

Components	Recommendation assessed in the survey	Model 2	Model 3	Model 4
	SSW for AMAU not shared with other departments	NA	1/3	3/4
	Adherence to egress protocol for 48-hour LOS in the SSW	NA	1/3	0/4
2. Access and appropriate patients streamed to the units	Streaming from ED	NA	12/12	4/4
	Direct GP-referrals	4/7	8/11	3/4
	Protected time slots for GP referrals	2/7	7/11	2/4
3. Standardisation of care in the units	Seen within one hour by a senior decision maker	4/7	6/12	2/4
	Decision made to admit or discharge made within 6 hours	7/7	11/12	3/4
	Patients' NEWS recorded upon a specified arrival time	7/7	9/12	4/4
	Metrics audited for compliance	5/7	4/12	3/4
	At least one pathway to manage an acute exacerbation of common conditions (COPD, asthma, diabetes, mental health, renal/urology, palliative care)	3/7	8/12	4/4
	Pathways for all of the above	1/7	1/12	0/4
	Pathways for none of the above	4/7	4/12	0/4
4. Alternative pathways to admission for medical patients presenting as an emergency	At least one ambulatory pathway in place for list of 15 ACS conditions	3/7	8/12	4/4
	Extra seats/recliners available for delivery of ambulatory care	3/7	7/12	1/4
	Provision/space protected for review/return patients seen under ambulatory care pathways	3/7	4/12	3/4
	Ambulatory care patients (and other requiring review) reviewed in the AMAU (instead of OPD)	5/7	7/12	4/4
	AMAU access to at least one urgent medical outpatients clinic	NA	8/12	3/4
	Cardiology outpatients	NA	5/12	1/4
	Neurology outpatients	NA	1/12	2/4
	Respiratory outpatients	NA	5/12	3/4
	Oncology outpatients	NA	3/12	1/4
	Renal/urology outpatients	NA	1/12	1/4
	Gastroenterology outpatients	NA	5/12	1/4
	Haematology outpatients	NA	1/12	0/4

Components	Recommendation assessed in the survey	Model 2	Model 3	Model 4
	Endocrinology outpatients	NA	4/12	2/4
	Access to all of the above urgent outpatient clinics	NA	1/12	0/4
	Access to none of the above urgent outpatient clinics	NA	4/12	1/4
5. Discharge planning in the units and throughout the hospital	Patients assessed with regard to estimated length of stay, the need for specialist care and early discharge planning	3/7	9/12	3/4
	Estimated length of stay determined in conjunction with the MDT	NA	9/12	4/4
	Estimated date of discharge discussed with patients	NA	9/12	3/4
	Estimated date of discharge documented in patient notes	NA	7/12	3/4
	Nurse-facilitated discharge	2/7	6/12	0/4
	Criteria led discharge	2/7	3/12	0/4
	Mechanisms in place to facilitate AMAU to communicate with GP to manage patient on discharge[2]	NA	7/12	0/4
	Discharge letter same day to GP and other relevant healthcare providers (ideally electronic)[3]	3/7	6/12	2/4
	Copy of discharge letter provided to patient	2/7	5/12	1/4
Concepts 3 & 4. Essential resources in the units (staffing, diagnostics, ICT)				
1. Staffing and consultation services to the AMAU	Designated consultant acute medicine physician present	4/7	7/12	4/4
	CNM 2 or above work in the AMAU fulltime	4/7[4]	NA	NA
	Cover of the SSW by the AMAU physician	1/1	0/3	4/4
	Out of hours cover of the SSW	1/1 GIM	2/3 GIM 1 /3 AMAU physician on-call	3/4 GIM 1/4 AMAU physician on-call
	Availability of at least one medical specialists to consult into the AMAU	NA	12/12	3/4
	Medical consults in COPD	NA	10/12	3/4
	Medical consults in asthma	NA	9/12	3/4
	Medical consults in diabetes	NA	11/12	3/4
	Medical consults in mental health	NA	6/12	3/4

Components	Recommendation assessed in the survey	Model 2	Model 3	Model 4
	Medical consults in renal	NA	5/12	3/4
	Medical consults in palliative care	NA	8/12	1/4
	Access to consults from all of the above specialists		1/12	0/4
	Access to consults to none of the above specialists		0/12	1/4
	Availability of at least one ANPs/CNS to consult into the AMAU	NA	6/12	4/4
	ANP/CNS consults in COPD	NA	4/12	4/4
	ANP/CNS consults in asthma	NA	3/12	3/4
	ANP/CNS consults in diabetes	NA	3/12	4/4
	ANP/CNS consults in mental health	NA	1/12	3/4
	ANP/CNS consults in renal	NA	1/12	0/4
	ANP/CNS consults in palliative care	NA	2/12	0/4
	Access to consults from all the above ANPs/CNS	NA	0/12	0/4
	Access to consults from none of the above ANPs/CNS	NA	6/12	0/4
2. Access to diagnostics	Same day facilitated/priority access to at least one diagnostic test	7/7	11/12	4/4
	X-ray	7/7	11/12	4/4
	CT	7/7	10/12	4/4
	MRI	0/7	3/12	1/4
	Ultrasound	5/7	10/12	1/4
	Access to all of the above	0/7	0/12	1/4
	Access to none of the above	0/7	1/12	0/4
	Facilitated /priority access to at least one urgent investigation within 72 hours	6/7	10/11	4/4
	ECHO	5/7	7/11	2/4
	Exercise stress test	4/7	9/11	3/4
	Doppler	4/7	9/11	2/4
	Oesophago-gastro-duodenoscopy (OGD)	3/7	4/11	1/4
	Pulmonary function	3/7	5/11	0/4

Components	Recommendation assessed in the survey	Model 2	Model 3	Model 4
	Access to all of the above	1/7	2/11	0/4
	Access to none of the above	1/7	2/11	0/4
	Patients admitted to hospital solely to await diagnostics	4/7	7/11	1/4
3. Enhanced ICT	Ability to capture ambulatory care activity with current ICT	5/7	7/11	1/4
Concept 5. Acute medical care of the older person within the hospital				
1. Care of the elderly in the AMAU/within the hospital	Establishment of an area within the AMAU dedicated to the care of the older adult with frailty.	0/7	4/11	0/4
	One or more acute medicine physicians working in the unit who had a specialist interest in geriatric medicine	4/7	9/11	4/4
2. Identification and assessment of frailty	Process in place to identify frailty[5]	1/7	8/11	2/4
	Use of CGA within the AMAU/SSW	NA	5/11	2/4
	Frailty assessment and response team	1/7	7/11	2/4
3. Pathways in place for elderly with complex needs	Specific pathway in place for the delivery of acute medical care to the older person with frailty	1/7	5/11	0/4
4. Geriatric service	Geriatric service within the hospital	4/7	9/11	4/4
	Referral criteria to geriatric service in place	2/7	3/11	2/4

Notes

1. Two model 4 hospitals initially had navigational hubs, but these had closed. It appears there was a lack of understanding about the concept of what a navigational hub is, especially in model 3 hospitals, as many commented that the navigational hub was a bed bureau under bed management.
2. This question, which set out to examine whether there was a GP liaison assigned to the AMAU to assist with discharge, may have been misinterpreted, as many commented about discharge letter s to GPs.
3. While electronic discharges summaries are preferred the question asked was about communication on discharge, not whether this was electronic. Many commented that these discharge summaries were posted same day or following day.
4. While all model 2 AMAUs had a CNM 2 full time, these CNMs were often covering multiple other areas simultaneously.
5. In terms of whether there was a process in place to identify frailty, those that responded yes to this question were asked to name the tool/method used. However only 3 of all AMAUs that responded positively to this question named the tool/method used (4ATs, VIP tool, Rockwood Clinical frailty score).

The AMAUs have limited assessment space and few have provision to deliver ambulatory care, or care to the frail elderly

The AMAUs are small with limited assessment space. Most units in model 2 and model 3 hospitals have 5-10 assessment spaces (mostly trolleys), while the units in model 4 hospitals are larger, with 11-15 spaces. None of the units have separate ambulatory care units, or separate frailty units, and the majority of units do not have space within their units to separate ambulatory care, and care of the frail elderly, from other care delivered in the AMAU. Few have separate recliners/chairs for the delivery of ambulatory care.

The AMAUs are open fewer hours than stipulated in the model of care

None of the units in any of the hospitals are operating 24/7. None of the units in model 4 hospitals are operational at weekends, and only one model 3 unit does so. The majority of units were operating on a 12 hour, 5 days a week schedule.

Access and streaming to the AMAUs is a major issue

Access and patient streaming to the AMAU is heterogeneous and problematic in many hospitals. The majority of patients are directed to the units after assessment in the ED and not direct from the GP, as outlined in the model of care. Several different approaches are being used to stream patients, with the majority of patients beginning their journey in the ED rather than at the 'front-door'.

Boarding of patients in the AMAU is widescale

Despite the availability of surge capacity protocols in the hospitals - the majority of which listed AMAU as being the last place to 'board' patients - 'boarding' was endemic in the units. This practice of admitted medical patients, who are not admitted on the NAMP pathway, but are occupying space in the AMAU as a consequence of overcrowding in other departments (predominantly the ED), is a clear deviation from the model of care, and significantly impedes the operation of the unit, by reducing assessment space and bed capacity. All four model 4 hospitals answered that this was an issue in their unit; in the model 3 hospitals, nine units had medically admitted patients from the ED occupy some percentage of their trolleys, as had two model 2 units.

Adherence to egress from the SSW after 48 hours is problematic

Only seven of the 23 AMAUs had an affiliated SSW for the admission of patients up to a 48-hour period. In six of these seven, there was a lack of adherence to the 48-hour length of stay protocol in the SSW. This lack of adherence is problematic for AMAUs, as it results in a build-up of patients in the AMAU awaiting admission to the SSW, and therefore manifests in an inability to receive patients from the ED/GP. This additionally results in acute medicine physicians in the AMAU being asked to assess patients in the ED rather than in the AMAU. This was the case in eight model 3 AMAUs, though not common in model 4 AMAUs.

Adherence to clinical standards in the AMAUs is good, but dependent on staffing

The results of the survey infer that adherence to the principles of the model of care in terms of patient management in the AMAU is good. The vast majority of units stated that patients had a NEWS recorded within the specified time and that a decision to admit or discharge the patient was made within six hours. There was less adherence to the standard of review by a senior decision maker within an hour of arrival (12/23 AMAUs), with several hospital commenting that this was space and staff dependent. Several hospitals commented that they did not have sufficient staff to meet the 'review within one hour by a senior decision maker' target as there was no consultant presence in the AMAU unless requested or the workload required it. There was a lack of consistency in the AMAUs about *who* is actually a senior decision maker. In some units, only the medical consultant was recognised as one, while in other units the consultant, senior registrar, registrar were. Advanced nurse practitioners were only recognised in one unit as a senior decision maker. Three out of four model 4 hospitals audited these metrics, half of model 2 and model 3 AMAUs did.

AMAUs have a 'variety' of medical cover

All model 4 units had a designated consultant acute medicine physician who had a primary responsibility to be present and make management decisions during core working hours. Only half of the AMAUs in model 2 and model 3 hospitals did, with medical cover in many units provided by the medical on-call team for the hospital. This represents a major deficit of implementation in the model 2 and model 3 hospitals, where specialist rotas were to be amended locally to provide continuous medical cover for the AMAUs during core working hours 7 days per week.

Access to medical teams to consult into the AMAU is good, but heterogeneous

Nearly all model 3 hospitals had medical specialists who would consult into the AMAU in the disease areas of COPD, diabetes and asthma, and palliative care, while less than half had access to specialist consult for renal patients. One model 4 hospital stated that the medical specialists in their hospital did not review patients in the AMAU, while another hospital had access to all specialties. The other two model 4 hospitals had access to specialist consult in COPD, asthma, diabetes, mental health and renal. Access to a specialist consult from palliative care was only available in one AMAU.

The availability of ANPs and CNSs was more common in model 4 hospitals than model 3 hospitals. All model 4 hospitals had access to consults from ANPs/CNS to assess patients with COPD, asthma, diabetes and mental health, while less than a third of model 3 hospitals had access to these specialist nurses. Across all model 3 and model 4 hospitals there was only one unit that had access to a consult from an ANP/CNS for renal patients.

Access to urgent OPD appointments and rapid access clinics is rare

There was widespread limited access to urgent medical OPD appointments and rapid access clinics for patients assessed in the AMAUs or referred directly from GPs. Access was equally problematic in the model 3 and model 4 hospitals that responded, with several hospitals (4 model 3, one model 4) responding that their AMAU has no access to any urgent medical outpatient appointments whatsoever. Other hospitals had better access. This question was not asked of model 2 hospitals.

Access to OPD for haematology, renal/urology and neurology, was especially problematic. Of the 16 model 3 and 4 AMAUs that responded, the number of AMAUs with an urgent outpatient appointment in these specialties was 1, 2 and 3 respectively. The specialties which offered greatest access to the units in terms of availability of urgent OPD slots were respiratory (8 AMAUs had access), and cardiology, gastroenterology, and endocrinology each of which were available in six AMAUs. This limited access to urgent OPD/rapid access clinics is an example of a critical contingency not being in place to facilitate the work of the AMAU. This deficit is likely to influence the ability of the AMAUs to avoid overnight admissions, and or shorten LOS. Additionally this deficit limits their ability to accept new patients from the ED/GPs as review/follow up patients are seen in the AMAUs rather than in the outpatient setting. All three hospital models were asked about this and in 16/23 units, patients discharged from their AMAU requiring review, or follow up in the case of ambulatory care, were reviewed in AMAU clinic and not in a medical outpatients clinic.

Access to same day diagnostics and urgent diagnostics within 72 hours is heterogeneous and almost absent in some hospitals

Access to same day diagnostics and urgent diagnostics within 72 hours (to facilitate ambulatory care pathways was heterogeneous with some hospitals having more comprehensive cover than others. However, none of the AMAUs that responded had access to all the tests listed.

All AMAUs that responded to the survey had same day access to X-ray, and all bar one had same day access to CT. Ultrasound was available same day in the majority of model 2 and model 3 hospitals. However only two of the four model 4 hospitals had same day/priority access to ultrasound. MRI was the diagnostic test with least same day availability. None of the model 2 hospitals had same day access to MRI; only three of the eleven model 3 hospitals did, and only two of the four model 4 hospitals had same day access/priority access to MRI. Similarly the majority of hospitals had access within a 72 hour period to ECHO, exercise stress test (EST), and Doppler test. Oesophageal-gastro-duodenal tests and pulmonary functions tests were less available in hospitals, with all four model 4 hospitals stating they did not have access to pulmonary function tests within a 72 hour period.

This lack of same day/priority access to diagnostics in many hospitals is another clear example of a critical contingency not being in place to support the Programme. Access to diagnostics was exemplified in the model of care as being critical to the operation of the AMAUs. Without this access to diagnostics, which is necessary to aid clinical decision making, it is unlikely that AMAUs are able to safely avoid over night admissions or safely ambulate patients or shorten length stay of patients admitted for further care. A further repercussion of this lack of access to diagnostics was that patients were admitted to hospital solely to await diagnostics in 13 of the 23 hospitals that responded. This was most pronounced in model 3 hospitals (7/11), model 2 hospitals (4/7) and less so in model 4 hospitals (1/4). The survey did not examine expanded diagnostics service to facilitate longer opening hours of the units and weekend opening.

The availability of pathways and protocols to manage acute exacerbations of common medical conditions is heterogeneous

The survey found significant heterogeneity across and within hospitals in terms of what conditions had pathways in place for the management of acute exacerbations. Pathways were less common in model 2 hospitals; and four model 3 hospitals had no pathway in place for any of the common conditions listed in the survey. All model 4 had at least one pathway. Across all hospitals, COPD was the most common condition with a pathway in place for the management of an acute exacerbation, followed by asthma and diabetes. There were very few hospitals with a pathway in place for the management of exacerbations of renal conditions.

Access to ambulatory care pathways is heterogeneous and absent in some hospitals

While some hospitals had several ambulatory care pathways established, many hospitals had only one or two developed and several had none. This was poorest in model 2 hospitals. Across all hospitals, COPD, transient ischaemic attack (TIA) and venous thromboembolism (VTE) were the most common conditions with an ambulatory care pathway in place. The lack of consistent ambulatory care pathways in situ across the hospitals represents a deficit in the Programme's implementation, given the emphasis the model of care placed on the delivery of ambulatory care in the AMAU. These specialty ambulatory care initiatives were to be developed by other National Clinical Programmes - e.g., diabetes, COPD, heart failure and epilepsy. The survey did not examine whether these pathways were developed and simply not established, or were not developed at all. The units did not have designated space in the units for the delivery of this ambulatory care. Very few had extra recliners/seats and units identified that they did not have the IT infrastructure to capture the volume of ambulatory care delivered in their units.

Structured processes and pathways for the early identification, assessment and management of the frail elderly are lacking.

In many units, despite having acute physicians with a specialist interest in geriatric medicine, there was a distinct lack of structured processes and pathways for the early identification, assessment and management of this complex category of patients. This was especially problematic in model 2 hospitals. Across all respondents (n=23 units), only four units had a dedicated assessment area allocated to the older adult with frailty. Less than half of units had formal structures in place for identifying frail patients. There were no frailty assessment and response teams in any of the model 2 hospitals. In model 4 hospitals, two of the four had a frailty response rapid access team for same day response. Over half of respondents did not have a specific pathway in place for the delivery of acute medical care to the older person with frailty. Less than half of the participants in model 3 and model 4 hospitals stated that they conducted a Comprehensive Geriatric Assessment within their unit or SSW. Care of the elderly in the units and throughout the hospital is an area that requires significant improvement to align practices with the NAMP model of care. However, this was an area of current focus in the units, with several units commenting on pilots that were completed or currently underway in terms of identification and assessment of frailty.

Navigation hubs have either not been established or are not operational as per the model of care

The establishment of a navigation hub was considered to be a ‘critical factor’ in the success of the model of care. This 'hub' would serve multiple purposes including enhanced patient streaming within the hospital, and between primary care and the acute hospital. The case manager would have contact with the on-call physicians for AMAU, the GP and the on-call consultant or specialty physician and nursing services, to direct the patients to appropriate services, with the aim of pre-empting the need for some admissions. None of the four model 4 hospitals had a navigational hub. Two commented that there used to be a navigational hub but it closed down and that its function was replaced by the bed management office, patient flow team and safety flow meetings. Several model 3 hospitals commented that their navigational hub was a bed bureau.

ICT is poor in many hospitals

The lack of ICT to facilitate communication on discharge with the GP, ideally the same day, and ideally electronically, is problematic as this was highlighted in the model of care as being *'imperative to the improvement of acute medicine in the hospitals'*. This is an issue that needs to be addressed in terms of clearly defining this activity and recording it as an entire episode so that active measures to avoid in-patient admission can be incentivised.

4.4 Discussion

This stage of the evaluation set out to measure the organisational structures, processes and resources put in place at the hospital to support the programme. These are the first measures of programme implementation and were conducted by mapping a comprehensive survey of the units conducted by the Acute Medicine Programme team to the model of care. There were several reasons for this approach. Firstly, capitalising on the extensive survey undertaken by the Programme team mitigated the need to burden overworked clicnians with another survey. Secondly, the researcher contributed to the survey to ensure that the questions covered, within reason. The concepts and components identified during the earlier coding process. Thirdly, the researcher had limited resources for this complex evaluation and had to balance the need of conducting structured interviews at each hospital (as conducted by Imison and Vaughan (2018)) with other stages of the evaluation.

Using this secondary data survey data had several limitations however. Firstly, not all hospitals participated in the survey. While all model 2 hospitals with an AMAU and the majority of model 3 hospitals responded, only four of the seven model 4 hospitals did. Secondly, the survey was self-reported and reliant on the respondents' accurate interpretation of the questions and their honest answering. Thirdly, the survey focused on the units, not the efficiencies that were to be introduced throughout the entire acute medical pathway. Even then it was not possible to measure all relevant aspects given the complexity of the operation of an AMAU. Fourthly, there were concepts that were not examined in detail in the survey, including improved communication, changes to ways of working, changes to the journey of medical patients. Crucially, the survey did not examine staffing, given the breadth of this concept. This is a limitation given the critical role staffing plays in the operation and effectiveness of an AMAU.

4.4.1 What did the analysis find?

The majority of the survey questions focused on the establishment and the operation of the AMAUs, rather than the delivery of acute medicine *throughout* the hospital, and respondents to the survey were physicians and clinical nurse managers (CNMs) working in the AMAUs. The survey not did examine the barriers and enablers to implementation. These concepts were explored during the interviews with programme and clinical staff, and the findings are presented in Chapter 7.

Of the 29 hospitals that participate in NAMP, 23 participated in the survey. The survey found that there were gaps in implementation in almost all aspect of the Programme examined. Many of the core components and critical success factors have not been widely implemented across the hospitals. There is also significant heterogeneity across and within hospitals, and hospital models, in terms of what has been implemented and how the Programme is operating. This heterogeneity was most pronounced in terms of capacity, patient streaming, the presence of senior decision makers, access to diagnostics and outpatient appointments, and pathways for the management of acute conditions and ambulatory care conditions.

In terms of unit capacity, there was significant heterogeneity within model 3 hospitals. Some hospitals had only 0-4 assessment spaces, while others had 10-15 spaces. AMAUs in model 4 hospitals were larger than in model 3 hospitals and were similar in size to each other (11-15 spaces). Each model 4 had an affiliated SSW for the admission of patients for up to 48 hours from the AMAU. This was not the case with model 2 or the majority of model 3 hospitals, which just had their assessment unit, and not an affiliated admission space.

Streaming of patients to the AMAU was highly heterogenic, with the majority being streamed from the ED upon assessment by an ED clinician and not at triage or direct from GP as per the model of care. AMAU physicians in model 3 hospitals often assessed patients in the ED rather than the AMAU. This was not the case in model 4 hospitals.

An important deficit of implementation was the limited opening hours of the units, with none operational 24/7. This has significant repercussions for the ability of the units to offer a consistent service to medical patients, and be recognised in the hospital system as the primary place for the management of medical patients. While respondents were not asked directly *what* was influencing their ability to provide a service in line with recommended opening hours, one can surmise from other answers, that this limited service was influenced by a lack of a lack of staffing, a lack of services available to the units and the 'boarding' of medically admitted patients in the AMAUs. The 'boarding' of medical patients in the AMAU and the lack of smooth egress from the SSW to in-patient wards was identified as being highly problematic in many hospitals. This scenario was common, despite the majority of units having clear protocols on egress from the SSW after a 48-hour period and the identification of the AMAU in the surge protocol as the last place to 'board' patients. This 'boarding' of patients in AMAU is high risk and has been shown to increase the length of stay of patients, increase the likelihood of re-admission at both 7 and 30 days, and increase the risk of mortality. It also prevents the normal functioning of the AMAU, and impedes its ability to receive patients from the ED and GP.

A key quality indicator in the AMAU is that patients are assessed by a senior decision maker within an hour of arrival at the AMAU. There was heterogeneity across the AMAUs in terms of who was actually recognised as a senior decision maker (SDM). Some hospitals only recognised a consultant as a SDM. Whether this is because of a lack of these other grades or professionals was not examined in the survey. Compliance with 'best proactive' indicators was an area where there was the least amount of heterogeneity across sites, though some hospitals did comment that they were unable to achieve this 'review within one hour' metric because of a lack of the presence of a consultant.

Access to same day diagnostics is essential to the operation of an AMAU, and its ability to achieve its outcomes of avoiding overnight emergency hospitalisation for 'potentially avoidable admissions'. Access to diagnostics was identified as a major limiting factor in the units operating as per the model of care, and delivering an ambulatory care service. There was also a startling contrast between the hospitals in terms of this access to diagnostics. A minority of hospitals had relatively good access, the majority have access to a few tests, predominantly X-RAY, CT, ECHO, USS, EST and DOPPLER, while very few had same day facilitated/priority access to MRI. The admission to hospital solely for diagnostics, which is clearly at odds with the model of care, was identified as problematic in 13 of the 23 hospitals.

The model of care placed significant emphasis on the enhanced provision of urgent outpatient appointments and rapid access clinics for referrals direct from GP or from the AMAU to circumvent the need for an overnight admission. Access of the AMAUs to these urgent medical outpatient appointments was quite heterogonous. Some hospitals had no access whatsoever to urgent outpatient appointments for any of the specialties listed; including a third of model 3 hospitals. The others had access to some urgent specialty outpatient appointments, and only one hospital across all model 3 and model 4 hospitals had access to all. The survey showed that the majority of patients requiring review after discharge from an AMAU are brought back to a review clinic in the AMAU, not a medical outpatient appointment or a rapid access clinic. This is likely to affect the number of new patients the AMAUs can accept from the ED or GPs.

Other programme components such as the availability of pathways to manage exacerbations of common medical conditions, and ambulatory care pathways to safely avoid overnight admissions were implemented to varying degrees across the hospitals. The survey found significant variation across the hospitals in terms of *what* conditions have pathways in place for the management of acute exacerbations. Pathways were less common in model 2 hospitals; and a third of model 3 hospitals had no pathway in place for any of the common conditions listed in the survey. COPD was the most common condition with a pathway in place for the management of an acute exacerbation, followed by asthma and diabetes. This is likely because of the focus the National Clinical Programme for COPD has placed on the adoption of their evidence-based pathway (care bundle) for the management of COPD exacerbations. There were very few hospitals with a pathway in place for the management of an acute exacerbation of renal conditions. The lack of ambulatory care pathways in place in model 2 hospitals is particularly concerning given that the model of care specifically stated that the growth in activity in model 2 hospitals would be in the domain of ambulatory care.

Consults from medical specialists and ANPs into the AMAUs were available in some hospitals to a wide selection of disciplines. Other hospitals had no access to consults from medical specialists, including a model 4 hospital. ANPs for consult into the AMAU were more common in model 4 than model 3 hospitals.

Very few hospitals had clear processes in place to manage the total journey for frail patients. In the majority of hospitals, there was a lack of structured processes and pathways for the early identification, assessment and management of this complex category of patients. It is clear from the survey that the care of the elderly in the units and throughout the hospital is an area that requires significant improvement to align practices with the model of care.

Finally, the navigational hub, identified as being critical for the success of the Programme was poorly implemented. The navigational hubs that were in place in some hospitals were acting as a bed bureau under the remit of bed management, which differs from what is described in the model of care. The Programme aimed to improve communication between primary, community and acute care via this navigational hub and to facilitate access for GPs to alternative services for their management of their patients (e.g., AMAUs, EDs, outpatient appointments, rapid access clinics, specialist units, and home and community services). It also was tasked with facilitating advice to GPs from medical specialists to circumvent the need for an emergency presentation. It is unlikely that the internally focused navigational hubs, which are concerned with bed management, are meeting this core objective.

4.4.2 How do these findings tie in with the literature?

There are two aspects of the findings of the survey that warrant comparison with the literature. The first is how do these units compare with those in other jurisdictions, and the second is whether units elsewhere have the same challenges and degree of heterogeneity as the units examined in the NAMP survey.

Comparison between the Irish AMAUs and AMUs elsewhere

While a full review of the structure and function of AMUs in other jurisdictions is beyond the scope of this discussion, there are some striking differences between the UK and the Irish AMAUs that warrant noting. The Society for Acute Medicine in the UK undertakes a benchmarking audit of acute medical care each year (Society for Acute Medicine, 2018). This patient-level audit provides a snapshot of the care provided for acutely unwell medical patients in over a 24-hour period. The most recent audit reports on 127 AMUs[8] across the UK (from a total of 225), on data related to operational performance, clinical quality indicators and standards from NHS Improvement. This audit provides a wealth of information that can be used to draw comparison with the Irish AMAUs, especially from the aspect of size and structure, staffing, delivery of ambulatory emergency care, and acute medical care of the frail elderly.

<u>Size and structure</u>
The units in the UK are considerably larger than the Irish units; the median capacity of the units is 39 beds (range 10-93). The proportion of beds in each hospital that are dedicated to the AMU varies significantly, with a median of 7.1% of hospital beds (range 2.4%-24.9%). Almost one in ten units (8.1%) units have a Level 2 high dependency unit (HDU), with a median of 7 beds (range 3-14). Almost half (40%) of hospitals have a separate Short Stay Ward with a median 24 beds (range 6-70).

<u>Staffing</u>
There is significant focus in the UK AMUs on a consultant-led service. At 11am, the median number of consultants in the AMUs was 3 (range 2-3); specialist trainees 1 (range 1-2), core trainee 2 (1-3), and foundation year 2 (1-3). The median time at which the last consultant

[8] Note the terminology - AMUs in the UK; AMAUs in Ireland. Those units in Ireland which have an AMAU and a SSW are called an AMU locally.

left the AMU was 21.00 (earliest 17.00, latest 23.00). In terms of allied health professionals this aspect was not well explored in the NAMP survey. Units in the UK seem to have reasonable access to allied health professionals. Over half of AMUs in the UK audit had advanced nurse practitioners, 22% had physician associates and 40% had access to a social worker. At a snapshot taken at 11am on the day of the Society of Acute Medicine Benchmark Audit (SAMBA), across all 127 units the median number of pharmacists per unit was 2 (range 1-2), physiotherapists 1 (range 1-2), occupational therapists 1 (range 1-2).

Clinical quality indicators

The clinical quality indicators used in this UK are similar to the recommendations in the Acute Medicine Programme.

1. All patients admitted to AMU should have an early warning score measured upon arrival (within 30 minutes).

2. All medical patients should be seen by a competent clinical decision maker within 4 hours* of arrival on AMU/ED who will perform a full assessment and instigate an appropriate management plan. (*In most cases, clinical assessment and initiation of a management plan should be undertaken in much less time, and prioritised in accordance with clinical need.)

3. All acute medical patients should be reviewed by the admitting consultant physician or an appropriate specialty consultant physician within 12 hours of arrival on AMU/ED.

Compliance with the metrics in the 2018 audit in terms of number of patients was 83.1%, 94.1% and 62.8 % respectively.

Interestingly, AMUs in the UK have a much broader definition of who is a competent decision maker: *'the competent clinical decision maker is synonymous with the person performing the first medical assessment (clerking), namely ACP (Advanced Care Practitioner), PA (Physician Associate) or any grade of doctor from Foundation Year 1 to Consultant.*

Delivery of Ambulatory Emergency Care

A key difference between the two jurisdictions is in the delivery of ambulatory care. The majority of patients with ambulatory care sensitive conditions in the UK streamed to an Ambulatory Emergency Care (AEC) unit. The majority of the AMUs that responded to the UK survey had an AEC service as part of acute medicine in their hospital (81%), and the majority of these AEC units were separate from the AMU 96.8%). The median number of trolleys and chairs in these AEC units was 8 (range 1 - 54). The median number of clinic rooms per unit was 3 (range 1 - 9); while a small proportion of units (6%) just had flexible beds on the AMU as their AEC service (just 6% of hospitals). This contrasts greatly with the Irish model, where ambulatory care is still in its naissance and there are no AEC units. The ambulatory care pathways that have been developed and were assessed in the NAMP survey are delivered through the AMAU, and not in a separate unit. The AMAUs are carving out space for the delivery of this service, with few having extra space or additional seats/recliners for this service.

<u>Care of the elderly in hospitals</u>

In contrast again to Irish hospitals, where there are no frailty units, almost half of the UK AMUs surveyed had a frailty unit which they defined as '*a ward with staff trained in ways to look after patients who are frail, with a focus in rapid assessment, treatment and rapid discharge*.' Almost three-quarters of these frailty units were separate from the AMU, the remaining quarter were co-located with the AMU. In the NAMP survey, of the 23 AMAUs that responded to the survey, only 3 had a 'dedicated area' of their AMAU for frail patients. There are no frailty units in Ireland.

Almost a quarter of hospitals in the UK survey had a separate admission process (take) for older patients (Geriatric Medicine). Unfortunately, this was not examined in the Irish survey. While most hospital had a geriatric service in place, fewer had a clear referral process for this service in place, and fewer still had specific pathway in place for the delivery of acute medical care to the older person with frailty.

Challenges of the delivery of acute medicine elsewhere and compliance with quality standards and best practice

The second aspect of the literature that warrants discussion concerns the challenges facing acute medicine in other jurisdictions (particularly in the AMUs), especially their heterogeneity in terms of compliance with standards and best practice. This is obvious from the SAMBA report just discussed. There are two other recent reports from the Nuffield Trust, which can be used to draw parallels between the heterogeneity observed in the Irish AMAUs, and those in England.

The first is the mixed methods evaluation of the implementation of the London Quality Standards (LQS) programme (Vaughan et al., 2017). The LQS programme aimed to improve the quality of acute and emergency care in London's hospitals, and it set out the minimum quality of care that patients with medical illnesses should expect when admitted to hospital (London Health Programmes, 2011). Many of the standards relating to acute medicine are concerned with processes in AMUs and are almost identical to the recommendations set out in the Irish Acute Medicine model of care. For example, the standards mandate timely clinical review by junior, consultant and multidisciplinary (MDT) staff; timely access to key diagnostic, interventional and other allied clinical services; robust monitoring of patients with appropriate responses to clinical deterioration; and extended working to seven days per week.

The authors analysed the performance of the 29 London hospitals against the 21 standards in acute medicine, using self-assessment audits conducted by the hospitals at two separate time points. They found that there were some standards that the majority of hospitals had marked difficulty in implementing, such as review of patients on AMUs by a consultant during twice-daily ward rounds, and consultant involvement for patients considered high risk within one hour. They also found that compliance against most standards improved from the first to the second audit, including those which were difficult for hospitals to implement, such as: extended senior decision-making and leadership day cover on the AMU seven days a week; the involvement of consultants in the assessment of patients considered high risk within one hour, and consultant-led communication to patients.

Importantly, they also examined the level of compliance within each hospital to the individual standards and found that the hospitals presented a varied picture in terms of compliance. While some hospitals seem to have met the standards from the beginning, others showed varying degrees of improvement from the first to the second audit. A small number of hospitals, however, saw little improvement over time. The overall trend that emerged from the analysis was that hospitals with higher levels of resource found it easier to implement the standards. Six of the eight large teaching hospitals in London either had consistently high levels of performance or were performing at a higher level with evidence of improvement. They found that while some of these standards were clearly more difficult to implement than others (due to the level of resource required), that degree of buy-in and belief in the standards was an important determinant of implementation of different standards. The authors discussed at length the barriers and enablers to the implementation of the programmme. This will be discussed in Chapter 7, which presents the findings of the barriers and enablers to the implementation of the Irish Acute Medicine Programme.

The second body of work relevant to comparison of the AMAUs in Ireland and the AMUs in the UK that by (Imison and Vaughan, 2018), which examined the configuration of acute medical services and the staffing of these services in smaller acute hospitals in England. The authors conducted semi-structured interviews with medical directors and/or lead clinicians for acute/emergency medical care across 50 hospitals sites (48 trusts). Their analysis of the configuration of acute medical services showed striking variation in the delivery of acute medical care across the hospitals, with no two hospitals operating the same system. They described a service that had many deficits, including complex and often fragmented pathways resulting in excessive patient handovers, rather than a seamless transfer of care. They found that for many sites, the ED was no longer the primary place for the acute assessment and management of the acutely unwell medical patients as patients were moved rapidly to another place for processing such as the AMU or ambulatory care. They found that that there was a growing emphasis on ambulatory emergency care (AEC) to reduce overnight admissions, but again there was significant heterogeneity across the trusts in how this AEC was delivered. Some sites were using GPs to deliver this care; other sites were solely dependent on junior doctors, while other had ANPs with or without medical cover. They found that medical cover in the AMUs was creating problems for maintaining continuity of care, with patients passed between different medical teams during a single hospital stay. Specialist input early in patient care varied considerably, as did specialist involvement in early patient assessment.

Medical staffing was one of the greatest challenges faced by smaller hospitals sustaining acute medical services. Many hospitals reported having severe staffing issues - especially among junior medical staff - and nearly all hospitals were dependent on locum staff to support senior medical roles. There was a distinct lack of medical generalists (general medicine, acute physicians and geriatricians). There was significant variation across hospitals in terms of the number of medical staff and non-medical staff in advanced roles, and the severity of the staffing issues they faced. The number of acute physicians on the AMU during the day from 1-4, with a tendency for them to cover the AMU Monday to Fridays within working hours. A key problematic area was the provision of medical on-call cover, with a number of specialties withdrawing from the on-call rota, leaving an increasing workload on a reducing number of medical specialists and acute medicine physicians. Their survey described three approaches to the engagement of specialty teams on the AMU - a closed model whereby all patients in the AMAU were under the acute medical team with invited specialist review, an open model where specialists and acute teams managed patients triaged to their teams, and a partial model where the acute medical team had responsibility for the majority of patients with the exception of one or two specialists. The first of these is similar to the Irish model, where specialists consult in to the AMAU but the patients remain under the care of the acute medicine physician.

The take home message from this survey of English hospitals was that acute medical services are systems in flux, with nearly all sites instigating changes in at least one aspect of the service model in the previous year. Sites also envisaged more change in the future, e.g., an expansion of frailty services, an expansion of consultant cover on the wards to seven days a week. Trusts were trying to establish longer term solutions for issues they were facing, such as streamlining medical patient pathways to avoid multiple handoffs, and a more proactive model than the current reactive model for specialist engagement in the management of medical patients. This would require closer collaboration between acute medicine physicians and medical specialists in the AMAU. Many of the suggested solutions presented resonate with the recommendations of the Irish Acute Medicine model of care, which was published in 2010.

4.5 Conclusion

While some aspects of the Programme were better implemented others, there were clear gaps in implementation. Core components and contingencies, which were described in the model of care as being critical to the success of the Programme, have not been implemented. For example, none of the units are operational 24/7; a minority have access to alternative pathways to admissions, such as urgent outpatient appointments; access to essential resources such as medical consultant staffing and ambulatory care pathways is lacking; and there are clear deficits in the flow of medical patients, exacerbated by boarding of the units.

The survey found that there was significant heterogeneity across hospitals in term of what has been implemented, and to what extent. There seems to be a dichotomy between the smaller hospitals (model 2 and model 3 hospitals) which have more of an assessment function, while the larger model 4 hospitals, with their affiliated SSWs have an admission function. Some hospitals had considerably greater fidelity to the model with many core aspects implemented and operational; though none had all elements in situ. Other hospitals had much poorer levels of implementation lacking many of the critical success factors adequate such as assessment space, continuous consultant presence, and priority access to resources such as access to diagnostics.

A major finding of the survey was the lack of structured processes in place to care for the frail elderly in the units, and throughout the hospitals. This was examined from the perspective of identification and assessment of frailty, and the present of speciality pathways to deliver acute medical care to this cohort of patients. This was an area of current focus in the units, with several units commenting on pilots that were completed or currently underway in terms of identification and assessment of frailty.

Chapter 7, which presents the findings of the interviews with programme and clinical staff, will explore in detail why there are so many gaps in implementation and so much heterogeneity across the sites. It will examine the contextual factors at the hospital and community level, as well as nationally which have influenced implementation and are currently influencing the ability of the units to function as per the model of care and to achieve their expected outcomes.

The next chapter presents the second aspect of programme implementation; namely utilisation of the units and the role they play in acute medicine activity in the acute hospitals.

Chapter 5. Utilisation of the Acute Medical Assessment Units

5.1 Introduction

Two critical issues in implementation evaluation are determining whether a programme's actual activities and arrangements sufficiently approximate the intended ones, and ascertaining the extent to which the intended targets actually receive programme services (Rossi et al., 2004). Chapter 4 examined the first of these, and provided an in-depth account of the components that have been implemented in the hospitals, as it pertains to the AMAUs. This chapter focuses on the second aspect of programme implementation; namely the extent to which the 'intended targets' actually received the services. It does so through an in-depth examination of the utilisation of these units and their role in acute medicine activity in Ireland's acute hospitals. Having a clear understanding of the level of utilisation of the units is crucial so that the findings of the impact evaluation in Chapter 6 can be better understood. Without sufficient utilisation of the units, it is unlikely that the Programme will have a meaningful impact on avoiding overnight admission for potentially avoidable conditions, and shortening the length of stay of those admitted.

The Programme has a target that 40% of all emergency hospitalisations for medical conditions are streamed through an AMAU; either directly from a GP, from triage, or from the emergency department upon initial assessment.[9] The remaining 60% of medical patients would be (i) admitted directly through existing pathways, e.g., patients presenting with stroke and acute coronary syndrome or acute myocardial infarction, (ii) admitted to an ICU from an ED, or (iii) admitted directly in-house from the emergency department the outpatients departments directly to the general medical team on call, or specialty services.[10]

The objectives of this chapter were to assess the level of utilisation of the units, the characteristics of the patients assessed in them, and the variation across hospitals in terms of the utilisation of their units.

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[9] This target includes those assessed and discharged directly the same day from an AMAU, which are recognised as in-patient hospital admissions.

[10] The Programme recognised that model 4 hospitals which had multiple medical specialties might opt to develop systems of direct medical specialty referral, whereby patients are admitted directly to a specialty consultant who would be responsible for the entire episode of in-patient care. Direct medical specialty referral patients would be assessed in the ED or the AMAU and ideally be admitted to specialty/cohorted wards, according to locally agreed protocols. The Programme recommended that admitting teams be formed within specialties that admit relatively high volumes of acute medical presentations e.g. respiratory, gastroenterology, cardiology, medicine for the elderly and acute medicine.
Unfortunately it is not possible to ascertain from HIPE data whether this has been established or whether those that are admitted as an emergency are still admitted under the medical team on-call.

This chapter set out to examine:

- the admission pathways of emergency hospitalisations for medical conditions, and for ambulatory care sensitive medical conditions between 2009 and 2017, to measure the proportion that were streamed though the AMAUs
- the characteristics[11] of these hospitalisations for medical conditions in 2017 and whether these (measurable) characteristics differed by admission pathway
- variation within and between hospitals in terms of utilisation of their AMAU in 2017

To provide context, a comprehensive technical appendix accompanies this chapter (Appendix 5.3) which provides a detailed analysis of the age-distribution of overnight emergency hospitalisations for medical conditions and non medical conditions, as well as the bed day used by them between 2009 and 2017.

5.2 Methodology

This was a descriptive, retrospective, study of emergency hospitalisations among adults aged 16 years and over, discharged from all adult acute public hospitals, between January 1 2009 and December 31 2017,

5.2.1 Data source and definitions

The Hospital In-Patient Enquiry (HIPE) scheme was used as the data source. HIPE is a health information system designed to collect demographic, clinical and administrative information on admissions and deaths from acute hospitals nationally, and is the only source of morbidity statistics available nationally for acute hospital services in Ireland. All acute public hospitals in Ireland participate in HIPE. The HIPE scheme collects data on discharged patients (including deaths) in Irish public hospitals. It collates administrative, socio demographic and clinical data on day-case and in-patient admissions from admissions summaries and medical records. HIPE is a discharge dataset, meaning a record is only created on discharge from hospital.

Yearly discharge datasets for all hospital discharges for the preceding year were provided from the Healthcare Pricing Office of the HSE to the researcher. Reports which use these yearly discharge datasets refer to 'discharges' and 'discharge rate', rather than admission and 'admission rate' (Wren et al., 2017). However, to enhance the readability of the thesis

[11] The characteristics chosen for examination were dictated by the data available, e.g., age; principal diagnosis and co-morbidity. There is no data available on HIPE to identify the acuity or severity of hospital admissions; hence an examination of whether those on the different admissions pathways have different acuity/severity was not feasible.

and to avoid misinterpretation, the terms 'hospitalisations' and 'hospitalisation rate' are used instead of 'discharges' and 'discharge rate'.

Hospitals included in the analysis

This thesis is concerned with activity in acute public hospitals accepting adult medical patients only (i.e. those aged 16 years and over); henceforth referred to as adult acute public hospitals. See Appendix 5.1. It does not cover activity in children's, or maternity hospitals as they are outside the remit of the Programme. Neither does it cover any activity in private hospitals, as these do not report activity to HIPE. In total, this covers activity in 37 adult acute public hospitals, including three smaller hospitals whose services were downgraded in 2010 - 2012. Not all of these hospitals participate in the Programme, but they were included in the evaluation to provide a comprehensive analysis of acute medicine activity over the study period.

Patient inclusion criteria

This thesis is concerned with in-patient activity only, not patients admitted to hospital as a day-case. On HIPE, a day case is a patient who is admitted to hospital on an elective basis for care and/or treatment which does not require the use of a hospital bed overnight and who is discharged as scheduled. In-patients can be differentiated into same day in-patients and overnight in-patients. Same day in-patients are patients that are admitted as an in-patient and discharged on the same day, while overnight in-patients stay at least one night in hospital. The majority of these same day in-patient admissions are those that are assessed in the AMAU and discharged directly from there, without admission to a short stay ward to an in-patient bed. This more encompassing definition of an in-patient is broader than that used in some other jurisdictions where an in-patient stay has to have a minimum overnight stay in hospital. The definition here is more in line with the UK definition where admissions to the AMU, the Ambulatory Care Unit and the Clinical Decision Unit are classed as in-patient stays.

Classifying hospitalisations into those for medical and non-medical conditions

Each row of data on HIPE represents a single episode of care – a record of one in-patient stay (or a day-case procedure). This record begins at admission to hospital, as a day or in-patient episode, and ends at discharge from (or death in) that hospital. A consultant specialty code is assigned to each record on the basis of the specialty assignment of the consultant associated with the principal diagnosis. The specialty of the consultant is the specialty in which s/he is formally recognised and contracted to work. The Programme classifies admissions as being medical or non-medical based on the specialty assignment of the consultant associated with the principal diagnosis for that record.[12]

See Table 5.1.

Identifying the admission pathways of hospitalisations for medical conditions

Each record on HIPE has a variable termed 'type of admission', which has six categories: 'elective', 'elective re-admission', 'emergency', 'emergency re-admission', 'maternity' and 'new born'. Those records classed as 'emergency admissions' or 'emergency re-admissions' have a further variable which indicates where the patient was treated prior to being admitted into the hospital as an emergency in-patient or when the patient was treated only in a registered Acute Medical Assessment Unit (AMAU). These emergency admission pathways are: (i) admitted in-house from an emergency department, (ii) admitted in-house from the AMAU, (iii) admitted to the AMAU and discharged home from there without admission to an in-patient bed, or (iv) admitted as an in-patient from a source termed 'Other', (v) Unknown.

HIPE does not contain further information on the source of this emergency admission to the AMAU, i.e. it does not differentiate between streamed to the AMAU from an emergency department, from an Outpatients department, or directly from the GP. Patients streamed from a GP to the AMAU will be either classed as 'admitted from an AMAU' or 'discharged directly from an AMAU', depending on their trajectory once in the AMAU.

Based on this categorisation, emergency hospitalisations for medical conditions can be classified as being either.

- admitted from a non-AMAU source: admitted in-house directly from the emergency department and from Other/Unknown sources, or
- admitted from an AMAU: assessed in the AMAU and admitted either to an associated SSW, or to an in-patient bed, or
- discharged directly from an AMAU: assessed in the AMAU and discharged directly from there without admission to an in-patient bed.[13].

See Figure 5.1.

[12] This method of identifying medical hospitalisations on HIPE has been formally agreed by the Health Service Executive (HSE) and the Acute Medicine Programme, and is the approach taken throughout the thesis.

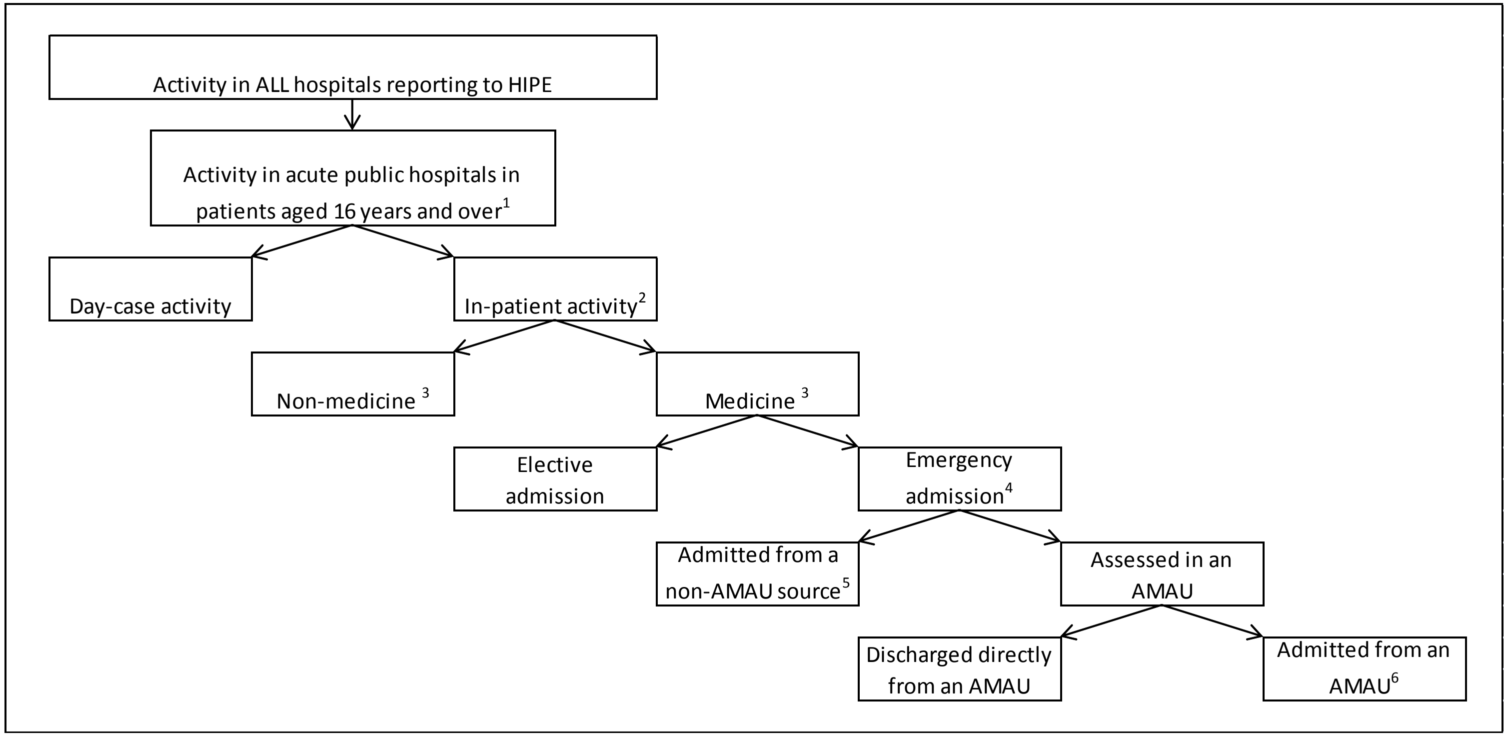
[13] The vast majority of these are same day discharges from an AMAU, given that there is no 24 hour AMAU in operation.

Table 5.1 Indentifying hospitalisations for medical conditions on HIPE

Medicine	Non- medicine			
Cardiology	Anaesthetics	Maxillo-Facial	Paediatric E.D. Medicine	Psychiatry
Clinical (Medical) Genetics	Audiological Medicine	Mental Handicap	Paediatric Endocrinology	Psychogeriatric Medicine
Clinical Immunology	Biochemistry	Microbiology	Paediatric ENT	Public Health Medicine
Dermatology	Breast Surgery	Neonatology	Paediatric Gastro-enterology	Radiology
Diabetes Mellitus	Cardio-Thoracic Surgery	Neuro-Ophthalmic Surgery	Paediatric Haematology	Radiotherapy
Endocrinology	Chemical Pathology	Neuropathology	Paediatric Infectious Diseases	Rehabilitation Psychiatry
Gastro-Enterology	Child/adolescent Psychiatry	Neuroradiology	Paediatric Metabolic Medicine	Renal Transplantation
General Medicine	Clinical Neurophysiology	Neurosurgery	Paediatric Nephrology	Substance Abuse
Genito-Urinary Medicine	Clinical Pharmacology	Nuclear Medicine	Paediatric Neurology	Urology
Geriatric Medicine	Clinical Physiology	Obstetrics	Paediatric Neurosurgery	Vascular Surgery
Haematology	Cytology	Obstetrics/Gynaecology	Paediatric Oncology	Virology
Infectious Diseases	Dental Surgery	Occupational Medicine	Paediatric Orthopaedic Surgery	Vitro-Retinal Surgery
Metabolic Medicine	Emergency Medicine	Old Age Psychiatry	Paediatric Physical Handicap	
Nephrology	Forensic Psychiatry	Ophthalmology	Paediatric Radiology	
Neurology	G.P. Medicine	Oral Surgery	Paediatric Respiratory Medicine	
Oncology	Gastro-Intestinal Surgery	Orthodontics	Paediatric Surgery	
Palliative Medicine	General Pathology	Orthopaedics	Paediatric Urology	
Rehabilitation Medicine	General Surgery	Other	Paediatrics	
Respiratory Medicine	Gynaecology	Otolaryngology (ENT)	Paediatrics Development	
Rheumatology	Hepato-Biliary Surgery	Paediatric Anaesthetics	Pain Relief	
Spinal Paralysis	Histopathology	Paediatric Cardiology	Pathology	
Transfusion Medicine	Immunology	Paediatric Chemical Pathology	Perinatal Paediatrics	
Tropical	Intensive Care	Paediatric Dermatology	Plastic Surgery	

Source: Each row of data in HIPE represents one episode of care – one in-patient stay or a day-case procedure. An episode of care begins at admission to hospital, as a day or in-patient, and ends at discharge from (or death in) that hospital. A specialty code is assigned to the record on the basis of the specialty assignment of the consultant associated with the principal diagnosis. The specialty of the consultant is the specialty in which s/he is formally recognised and contracted to work.

Figure 5.1 Schematic of identifying the admission pathways of hospitalisations for medical conditions



Notes.

1. See Appendix 5.1 for list of adult acute public hospitals included in the thesis.
2. In-patient activity includes same day in-patient admissions (these are predominantly same day discharges from the AMAU).
3. Differentiation of in-patient activity into medicine and non-medicine activity is based on the specialty of the consultant responsible for the principal diagnosis.
4. Each in-patient hospitalisation has a type of admission associated with it: emergency, emergency re-admission, elective, elective re-admission, maternity and new born.
5. Those admissions classed as emergency have a further variable termed 'mode of emergency admission' which describes where the patient was treated prior to being admitted into the hospital as an emergency in-patient or when the patient was treated only in a registered Acute Medical Assessment Unit (AMAU). It has the following categories (i) admitted in-house from an emergency department, (ii) admitted in-house from the AMAU, (iii) admitted to the AMAU and discharged home from there without admission to an in-patient bed, (iv) admitted as an in-patient from a source termed 'Other', or (v) Unknown.
6. Admission from an AMAU is to a short stay ward or an in-patient bed in-house.

Coding medical hospitalisations into clinical conditions

The Clinical Classifications Software (CCS) scheme was used to map the ICD-10-AM codes of those admitted under the remit of medicine (see description above) to a clinical condition. The CCS collapses down the 16,000 ICD-10-AM diagnoses into a more manageable 261 diagnostic categories and 15 major (system) categories that are clinically meaningful.[14]

Coding co-morbidity of hospitalisations for medical conditions

Co-morbidity is a term that describes the presence of one or more additional conditions that co-exist alongside the principal diagnosis. The Charlson Index is routinely used to quantify the impact that certain co-morbidities have on a patient's survival (Sundararajan et al., 2004). The additional diagnoses fields for each medical hospitalisation were examined and a Charlson Index calculated for that episode of care based on these additional diagnoses.

Identifying hospitalisations for potentially avoidable medical admissions

There is an array of indicators used to define this concept of 'avoidability', and there is considerable variation across and within these indicators in terms of the conditions included and the ICD-10-AM codes used to define them. There is also significant debate about this concept of 'avoidability' and how it is dependent on patient-related factors, such as age, other co-morbidities and social setting. Importantly, these indicators ignore the issue of acuity. The current indicators can be divided into three distinct classifications: ambulatory care sensitive conditions (ACSC), potentially preventable hospitalisations, and urgent care sensitive conditions. See Table 5.2.

Ambulatory care sensitive conditions (ACSCs) are defined *as 'those for which hospital admission could be prevented by 'effective management' in primary community and social care'* (Purdy, 2010). These are conditions where the hospitalisation could have potentially been prevented through the provision of appropriate preventive health interventions and early disease management in primary care and community-based care settings. They are a reflection of access to primary healthcare, as well as socio-demographic factors and health behaviours (Glover, 2013). ACSCs consist of a subset of acute and chronic diagnoses considered not to require hospital admission. These diagnoses contain (1) acute exacerbations of chronic conditions that could have potentially been controlled by

[14] The RCSI Clinical Programme in Surgery collaborated with Health Intelligence Unit of the HSE to generate a translation table for converting ICD-10/ICD-10-AM (versions 6 & 8) to the appropriate CCS category. This coding was made available to the researcher by the Health Intelligence Unit, HSE, to facilitate this work.

adequate treatment before the ED visit, (2) acute conditions that could have been managed in a primary care setting and (3) infectious diseases that occur despite effective immunisation. (Frick et al., 2017).

At present, different sets of ACSCs are used in different situations. The most common ACSC set used by the NHS is based on a set of 36 categories of conditions initially derived to measure access to primary care in the United States (Purdy et al., 2009). These were then refined for use in Australia (Purdy, 2010). Other jurisdictions have developed their own definitions of ACSC, again with different conditions and differing diagnostic codes. Frick et al, recently examined five different current definitions of ambulatory care sensitive conditions and found that the prevalence of ACSC in patients ranged from 19.1% to 36.6% depending on the definition used (Frick et al., 2017).

The potentially preventable hospitalisations indicator was recently developed (2017) as a health system performance indicator of accessibility and effectiveness by the Australian Commission on Safety and Quality in Health Care and Australian Institute of Health and Welfare (AIHW) in Australia. A potentially preventable hospitalisation is an '*admission to hospital for a condition where the hospitalisation could potentially have been prevented through the provision of appropriate individualised preventive health interventions and early disease management, usually delivered in primary care and community-based care settings (including by general practitioners, medical specialists, dentists, nurses and allied health professionals)*' (Falster, 2017).

The urgent care-sensitive condition indicator was developed by a research category in the UK in 2010, using a combination of Delphi methods with expert input on 70 potential indicators used as good measures of system performance (O'Cathain et al., 2014a, Coleman and Nicholl, 2010). The conditions in the resulting indicator consist of '*acute exacerbations of urgent conditions which a care system should treat and manage close to home and without the need for hospital admission in as many cases as possible*'.

The commonality across these indicators is that they are used to assess performance of an entire health system and predominantly the effectiveness of primary care. The conditions included in these indicators are those that should be:

- prevented by a focus on prevention (e.g., COPD, diabetes, pneumonia, influenza),
- better managed in primary care to reduce the likelihood of an acute exacerbation warranting an emergency presentation (e.g., COPD, asthma, CHF, diabetes) and

- treated more effectively in primary care when an acute illness arises (e.g., UTI, pneumonia, lower respiratory infection (other)).

Importantly, these indicators have not been used to assess the effectiveness of AMAUs in avoiding overnight admissions to hospital for potentially avoidable medical conditions once an emergency presentation is made at hospital. No indicator currently exists to facilitate measurement of the AMAU's ability to reduce the likelihood of an overnight hospitalisation for a potentially avoidable medical admission. None of the indicators reviewed here can be used in their entirety to evaluate the Programme from this perspective, given that many of these indicators contain non-medical conditions whose admission to hospital falls outside the remit of the Programme.

The decision was taken to consult with the NAMP team to identify conditions where overnight admission to hospital could *potentially* be avoided by prompt assessment in the AMAU or whose length of hospital stay should be shorter as a result of the care they received there. This process started with the list of ACSC medical conditions defined by Purdy *et al.* (2009) and other medical conditions were added if they existed in another ACSC definition, or another indicator; or where ambulatory care pathways were in place as part of the Programme (Table 5.3). The final list of 18 medical conditions is provided in Table 5.4. These conditions can be categorised into acute conditions: cardiac dysrhythmia, chest pain non-specific, deep vein thrombosis, lower respiratory infection other, migraine or acute headache, pneumonia or influenza, syncope, transient ischaemic attack, urinary tract infection or pyelonephritis and vertigo; and chronic conditions: angina, asthma, chronic obstructive pulmonary disease (COPD) or bronchiectasis, congestive heart failure, convulsions or epilepsy, diabetes complications, hypertension and iron deficiency anaemia.

While there is considerable overlap between the indicators in terms of the ICD-10-AM codes used to identify these conditions, there are also discrepancies. When deciding upon the list of ICD-10-AM codes to be used to identify hospitalisations for these conditions on HIPE, the indicator that had the more exhaustive codes for that condition was chosen.[15]

[15] The condition which had the most discrepancies across the indicators in terms of the codes was that of pneumonia. Not all lists include J18.9 'pneumonia unspecified, organism' and choose only some of those listed under J18 (J18.0-bronchopneumonia, unspecified organism; J18.1-lobar pneumonia, unspecified organism; J18.2 -hypostatic pneumonia, unspecified organism; J18.8-other pneumonia, unspecified organism; J18.9 pneumonia, unspecified organism). The vast majority of overnight admissions to hospital for pneumonia however in Ireland are coded as J18.9 - pneumonia, unspecified organism. This is clear from the table in Appendix 5.4 which provides a thorough assessment of the breakdown in numbers of overnight admission each year between 2009 and 2017 per individual ICD-10-AM code. The decision was therefore taken to use the coding from Freund et al. (2013) which has a more inclusive definition of pneumonia.

These conditions were identified based on the principal diagnosis only, and were not limited to those episodes where the consultant responsible for this diagnosis belonged to one of the medical specialties listed in Table 5.1, i.e. the methodology used to identify hospitalisations for medical conditions. The rationale for this was to provide a measure of total activity in these conditions. The majority of these episodes were admitted under medical consultants. Appendix 5.2 provides a more detailed description of each individual ICD-10-AM code used.

Table 5.2 Indicators used in the assessment of potentially avoidable admissions

1. Ambulatory care sensitive conditions (Purdy et al., 2009)		
Acute Conditions	Chronic Conditions	Other and vaccine preventable
Cellulitis	Angina	Influenza*
Dehydration	Asthma	Pneumonia*
Dental conditions	COPD	Tuberculosis
Ear, nose and throat infections	CHF	
Gangrene*	Convulsions & Epilepsy	
Gastroenteritis	Diabetes complications*	
Nutritional deficiencies	Hypertension	
Pelvic inflammatory disease	Iron deficiency anaemia	
Perforated/bleeding ulcer		
Urinary tract infection/pyelonephritis		
2. Potentially preventable hospitalisations (Falster, 2017)		
Acute Conditions	Chronic Conditions	Other and vaccine preventable
Cellulitis	Angina	Pneumonia and influenza (vp)
Dental conditions	Asthma	Other vp conditions
Ear nose and throat infections	COPD	
Gangrene	CHF	
Pelvic inflammatory disease	Diabetes complications	
Perforated and bleeding ulcer	Hypertension	
Urinary tract infection/pyelonephritis	Iron deficiency anaemia	
Convulsions & epilepsy	Bronchiectasis	
Eclampsia		
Pneumonia (not vaccine preventable)		
3. Urgent care-sensitive conditions (O'Cathain et al., 2014a)		
COPD	Pyrexial child under 6y	
Acute mental health crisis	Blocked tubes & catheters	
Non-specific chest pain	Hypoglycaemia	
Falls over 74 years	Urinary tract infection	
Non-specific abdominal pain	Angina	
Deep vein thrombosis	Epileptic fit	
Cellulitis	Minor head injuries	

Notes. *ACSCs are primarily classified on the basis of principal diagnosis, but five conditions are also defined in terms of secondary diagnoses.
VP: vaccine preventable.

Table 5.3 Other conditions included and the rationale for their inclusion

Other conditions	Rationale for inclusion
Bronchiectasis	Included in the Australian definition for preventable hospitalisations[1] (combine with COPD)
Cardiac dysrhythmia	Pathways in place in *some* hospitals as part of the AM programme
Chest pain non-specific	Pathways in place in *some* hospitals as part of the AM programme. Also included in the urgent care-sensitive conditions indicator[2].
Deep vein thrombosis	Pathways in place in *some* hospitals as part of the AM programme. Also included in the urgent care-sensitive conditions indicator[2].
Lower respiratory infection other	Included in ACSC list used by Carey et al[3]
Syncope	Pathways in place in *some* hospitals as part of the AM programme
Vertigo	Pathways in place in *some* hospitals as part of the AM programme
Transient Ischaemic attack	Pathways in place in *some* hospitals as part of the AM programme
Migraine/acute headache	Pathways in place in *some* hospitals as part of the AM programme. Also included in ACSC list used by Freund et al.[4]
Urinary tract infection	Included in ACSC list used by Carey et al in combination with pyelonephritis[3]

1. Falster, M., Jorm, L., A guide to the potentially preventable hospitalisations indicator in Australia. 2017, Centre for Big Data Research in Health, University of New South Wales in consultation with Australian Commission on Safety and Quality in Health Care and Australian Institute of Health and Welfare. Sydney.
2. O'Cathain, A., et al., A system-wide approach to explaining variation in potentially avoidable emergency admissions: national ecological study. BMJ Quality & Safety, 2014. 23(1). p. 47-55.
3. Carey, I., et al., An evaluation of the effectiveness of annual health checks and quality of healthcare for adults with intellectual disability. An observational study using a primary care database. Health Serv Deliv Res, 2017. 5(25). (Carey, 2017)
4. Freund, T., et al., Strategies for reducing potentially avoidable hospitalisations for ambulatory care-sensitive conditions. Ann Fam Med, 2013. 11(4). p. 363-70. (Freund et al., 2013)

Table 5.4 Final list of ambulatory care sensitive medical conditions used in the analysis

Potentially avoidable admission (coding source)	ICD-10-AM codes
Acute Conditions	
Cardiac dysrhythmia[1]	I47; I48; I49.1; I49.2; I49.3; I49.4; I49.5; I49.8; I49.9; R00
Chest pain non-specific[2]	R07.2; R07.3; R07.4
Deep vein thrombosis[2]	I80; I81; I82
Lower respiratory infection other[1]	J20; J21; J22
Migraine/acute headache[3]	G43; G44.0; G44.1; G44.3; G44.4; G44.8; R51
Pneumonia & influenza[3]	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18
Syncope[1]	R55
Transient ischaemic attack[1]	G45.0; G45.1; G45.2; G45.4; G45.8; G45.9
UTI/ pyelonephritis[5]	N10; N11; N12; N13.6; N39.0
Vertigo[1]	H81; H83; R42
Chronic Conditions	
Angina[5]	I20, I24.0, I24.8, I24.9
Asthma[5]	J45; J46
COPD[2] & bronchiectasis[1]	J40-J44 ; J47
Congestive heart failure[5]	I11.0; I50; J81
Convulsions & epilepsy[4]	G40; G41; R56
Diabetes complications[5]	E10.0–E10.8; E11.0–E11.8; E12.0-E12.8; E13.0–E13.8; E14.0–E14.8
Hypertension[5]	I10; I11.9
Iron deficiency anaemia[5]	D50.1; D50.8; D50.9

1. Clinical Classification Scheme (CCS) - code provided by NQAIS-Health Atlas and the Health Intelligence Category, Health Service Executive.
2. O'Cathain, A., et al., A system-wide approach to explaining variation in potentially avoidable emergency admissions: national ecological study. BMJ Quality & Safety, 2014. 23(1). p. 47-55.
3. Freund, T., et al., Strategies for reducing potentially avoidable hospitalisations for ambulatory care-sensitive conditions. Ann Fam Med, 2013. 11(4). p. 363-70.
4. Falster, M., Jorm, L., A guide to the potentially preventable hospitalisations indicator in Australia. 2017, Centre for Big Data Research in Health, University of New South Wales in consultation with Australian Commission on Safety and Quality in Health Care and Australian Institute of Health and Welfare. Sydney.
5. Carey, I., et al., An evaluation of the effectiveness of annual health checks and quality of healthcare for adults with intellectual disability. An observational study using a primary care database. Health Serv Deliv Res, 2017. 5(25).

5.2.2 Data constraints

There were several data constraints that greatly influenced how utilisation in this chapter and programme impact in Chapter 6 were measured.

Absence of a complete account of emergency presentations to hospital

There is currently no database in Ireland that contains clinical information on emergency presentations to hospital. The emergency department data, which is collected at individual hospitals and collated by the Health Service Executive (HSE), is patient experience time (PET) data. It is time stamp data, which provides details on the time of presentation to the ED, the time of discharge from the ED, and is used to assess ED activity and performance. It provides information on conversion from presentation to in-patient admission, and data on the number discharged without admission, but there is no data on the principal diagnosis, or similar clinical information. This means that there is no measure of the volume of medical presentations to hospital over the study period and no measure of the patients discharged home from the emergency departments without admission. HIPE includes information on admissions only; it contains no information on those discharged without admission. This limitation has several consequences for how the analyses were undertaken, and readers need to be cognisant of this when interpreting the findings.

Firstly, when trying to quantify the level of utilisation of the AMAUs, there was no information on the proportion of emergency medical presentations to hospitals that were streamed into an AMAU and therefore 'exposed' to the intervention. This added a layer of complexity to the analysis, which as a consequent had to be assessed from the perspective of 'admitted episodes', rather the proportion of medical presentations that were streamed to an AMAU.

Secondly, when considering the findings of the impact assessment in Chapter 6 which aimed to estimate programme effectiveness in reducing overnight rate of emergency hospitalisations for medical conditions, especially those deemed potentially avoidable, it must be taken into consideration, that if the overall <u>rate</u> at which patients presented to hospital as an emergency with these conditions increased substantially during the post-intervention period (2013-2017) compared with the pre-intervention period (2009-20111), this will have biased downwards any programme impact.

Thirdly, it was not possible to compare the trajectory of those patients with a medical condition who are managed in an AMAU to those managed in an ED. Specifically, it is not possible to assess whether those managed in the AMAU are less likely to be admitted overnight than those managed in an ED. To paraphrase, it is not feasible to examine whether those patients that are admitted and discharged the same day from the AMAU would have been admitted as an in-patient had they remained in the ED. This limitation forced us to look ecologically over time at whether there was a reduction *overall* in the rate of overnight emergency admissions for medical conditions specifically those deemed potentially avoidable, regardless of admission pathway. This analysis, which may be defined as an 'intention-to-treat' analysis, is likely to have biased downwards any effect of the AMAUs in reducing overnight admissions.

Absence of acuity and severity information on HIPE

HIPE is an administrative dataset, and therefore lacks information on the acuity of the presenting complaint or severity of the condition. Consequently, it is not possible to compare the acuity of patients admitted from an ED, to those assessed in the AMAU. Patients may have the same principal diagnosis but quite different levels of acuity or disease severity, and any analysis that attempted to directly compare these two categories would be confounded despite best attempts. Ideally, patients streamed through the AMAU are the same patients that would be admitted as an in-patient from the ED had they remained there, based on the rationale that the AMAU will either admit them if necessary (to an SSW or an in-patient bed) or provide an ambulatory care service to avoid this admission. Given the heterogeneity of the health IT at hospitals, gathering national data on the acuity of patients on the different admission pathways was not feasible to undertake given the limited resources of the researcher.

Absence of hospital catchment area

Currently, there is no robustly defined catchment area for Irish hospitals and therefore no population estimates for individual hospitals and their demographics. The analysis of trends in rate of hospitalisations in Chapter 6 therefore used an ecological approach and looked nationally at all adult acute public hospitals to ascertain whether there was a reduction in the rate of overnight emergency admissions over the study period from a national perspective. Ideally, this analysis would be conducted at the individual hospital level taking into consideration the hospital's catchment population during that time period as well as the level of utilisation of their unit as a measure of exposure. This ecological approach may also be described as an intention-to-treat type analysis, given than several hospital do not participate in the Programme and therefore none of the medical patients admitted to these hospitals would have been exposed to the intervention.

Data quality and data coverage

There was underreporting of activity from two smaller acute hospitals to HIPE in the earlier years from 2009 to 2011 and it is likely that their inclusion from 2012 contributed to an increase in activity from that year. Given the nature of reconfiguration of the EDs during this time, it was not possible to clearly identify the contribution of this under-reporting to the increase observed. Prior to 2012, there was incomplete recording of activity in the AMAUs. Patients assessed and discharged from an AMAU without admission to an in-patient bed were *not* classed as in-patients and therefore this activity was not recorded on HIPE. From 2012 all activity in the AMAUs was recorded as in-patient activity, and this has several implications for the impact evaluation. This increase in reporting from January 2012 and the under-reporting of AMAU-discharge activity prior to 2012 was an issue in terms of setting the intervention start point in the estimation of programme impact in Chapter 6, which used an interrupted time series design. Interrupted time series designs are best suited to the evaluation of interventions where there is a clear starting point to compare trends and level before and after the intervention. In this instance however the Programme was deployed over a prolonged period. While the model of care was published in 2010; some Acute Medicine Assessment Units pre-dated this and others were established in 2010 and 2011. However, the majority opened between 2012 and 2013, and the decision was taken to set January 2012 to December 2012 as the intervention period, and examine the trend in monthly hospitalisation rate in the pre-intervention period (January 2009-December 2011) and the post-intervention period (January 2013-December 2017). This does not take into consideration that there was activity in the units pre-2012 and theoretically (if the Programmes logic is solid) this initial activity would have led to a reduction in overnight hospitalisation rates in the pre-intervention period.

5.2.3 Cohort creation and analysis

All hospital activity was included in this chapter, including a small number of inter-hospital transfers. All data presented here represents simple counts (e.g., counts of hospitalisations, counts of bed days) to highlight acute medicine activity and to facilitate comparison across the different admission pathways.[16]

Part 1 examined hospitalisations for medical conditions, while part 2 focused on hospitalisations for ambulatory care sensitive medical conditions. The cohorts used and the analyses conducted are described in Table 5.5.

[16] Changes in population were not taken into consideration in this chapter.

Table 5.5 Cohort creation and analyses conducted in the assessment of utilisation of the units

Part 1. Hospitalisation for medical conditions	
Cohort creation	**Analysis conducted**
Analysis 1. Medical activity vs. non medical activity, 2009-2017	
All hospitalisations among adults aged 16 years and over, discharged from adult acute public hospitals between January 1 2009 and December 31 2017 were extracted from HIPE. Age was coded into four categories: 16-44, 45-64 years, 65-84 year and 85+years. This data extract was termed the 'full dataset'. These hospitalisations were classified as in-patient or day-case episodes. In-patient hospitalisations were further classified into medical or non-medical based on the consultant responsible for the principal diagnosis.	In-patient medical and non-medical activity was compared in terms of the counts of hospitalisations and bed days used between 2009 and 2017. Distinction was drawn between all in-patients discharges, which include same day discharges (predominantly from the AMAU) and those with a minimum overnight stay in hospital.[17]
Analysis 2. Admission pathways of emergency hospitalisations for medical conditions, 2009-2017	
The full dataset above was restricted to in-patient hospitalisations for medical conditions only. These hospitalisations were classified as elective or emergency hospitalisations, and emergency hospitalisations were categorised by their admission pathway: admitted in-house from an emergency department, admitted in-house from the AMAU, admitted to the AMAU and discharged home from there without admission to an in-patient bed, or admitted as an in-patient from a source termed 'Other/Unknown'.	The count of hospitalisations for each of these emergency admission pathways was compared both yearly and monthly from 2009 to 2017.
Analysis 3. Characteristics of emergency hospitalisation for medical conditions, by admission pathway, 2017	
The cohort of emergency hospitalisations for medical conditions (above) was restricted to those episodes discharged in 2017. The Clinical Classifications Software (CCS) scheme was used to map the ICD-10-AM codes used in the principal diagnosis to a clinical condition.	A comparison of the following characteristics by emergency admission pathway: age, gender, ICU admission, Charlson co-morbidity Index, admission source, discharge destination, day of admission and discharge, common medical conditions
Analysis 4. Common medical conditions admitted as an emergency, by admission pathway, 2017	
The Clinical Classifications Software (CCS) scheme was used to map the ICD-10-AM codes used in the principal diagnosis to a clinical condition.	

[17] An overnight stay in hospital was defined as those with at least one day difference between 'date of discharge' and 'date of admission'. It was not based on 'time of admission' or 'time of discharge' as these time variables were incomplete on HIPE for this study period.

Analysis 5. Variation in utilisation of the units across hospitals, 2017	
The cohort of emergency hospitalisations for medical conditions in 2017 (above).	A comparison of utilisation of the units in each of the hospitals in terms of total utilisation, monthly variation in same and the trajectory of patients assessed in the units.
Part 2. Hospitalisations for ambulatory care sensitive medical conditions, 2009-2017	
Cohort creation	**Analysis conducted**
Using the full dataset described in 1 above, all in-patient emergency hospitalisations discharged between January 1 2009 and December 31 2017 were extracted. Hospitalisations for the 18 ambulatory care sensitive medical conditions were identified based on the ICD-10-AM code of the principal diagnosis. These hospitalisations were extracted and the new dataset coded to identify the admission pathways of emergency hospitalisations of these conditions (admitted from a non-AMAU source, admitted from an AMAU, discharged directly from an AMAU).	The admission pathways of each of these conditions between 2009 and 2017, and then for 2017 alone, were examined to provide a clear description of the level of utilisation of the units for all adults and for the four age categories: 16-44, 45-64 years, 65-84 year and 85+years. The trajectory of those assessed in an AMAU was examined for each age category and condition.

5.3 Findings

5.3.1 Hospitalisations for medical conditions

This section provides a comprehensive account of hospitalisation for medical conditions between 2009 and 2017.

Section 5.3.1.1 provides details of the number of hospitalisations for medical conditions and non-medical conditions, and the bed days used by them between 2009 and 2017. It examines the breakdown of emergency vs. elective admission routes for medical hospitalisations, and the proportion of emergency hospitalisations with a minimum overnight stay in hospital.

Section 5.3.1.2 focuses on the admission pathways of hospitalisations for medical conditions from 2009 to 2017, and the bed days used by hospitalisations on these different pathways.

Section 5.3.1.3 describes the characteristics of emergency hospitalisations for medical conditions by admission pathway in 2017.

Section 5.3.1.4 presents the most 'common' medical conditions admitted as an emergency to hospital in 2017, and the number of these hospitalisations (and bed days used by them) per admission pathway.

Section 5.3.1.5 provides details of the level of utilisation of the AMAUs at each acute hospital in 2017. It does so from the perspective of the proportion of emergency hospitalisations for medical conditions at each hospital that was streamed through their AMAU.

5.3.1.1 Medical activity vs. non-medical activity, 2009-2017

Between 2009 and 2017, <u>total in-patient hospitalisations</u> among adults aged ≥16 years, increased by 13% from 437,827 to 495,864, with this increase occurring from 2012, as numbers were stable from 2009 to 2011. During the same time period, day-case activity increased by 29% from 697,517 to 901,643 (Table 5.6).

In-patient hospitalisations for <u>medical conditions</u> increased by 38% between 2009 and 2017, with a significant increase in 2012 when hospitalisations increased by 15% in that year alone. In 2012, 'same day' discharges from the AMAU began to be recognised as in-patient activity; hence it can be assumed that a proportion of this increase is as a result of this change in coding.

In-patient hospitalisations for <u>non-medical conditions</u> fell steadily over this period. In 2017, the numbers of in-patients admitted with non-medical conditions was 9% lower than in

2009. By 2017, the breakdown between in-patient hospitalisations for medical vs. non-medical conditions was 57% vs. 43% compared with 46% vs. 54% in 2009.

The vast majority of in-patient hospitalisations for medical conditions are admitted to hospital as an emergency. In 2017, of the 281,786 in-patient hospitalisations for medical conditions, only 9% were elective admissions to hospital. The remaining 91% were admitted as an emergency. This relative proportion has remained constant since 2013.

The number of overnight emergency hospitalisations for medical conditions (i.e., those hospitalisations with a minimum one night stay in hospital), increased by 20% between 2009 and 2017, from 157,104 to 189,524. The greatest increase was seen in 2012, an 8% increase on 2011[18], after 2 years of no growth.

It is difficult to ascertain whether this rise in overnight activity in 2012 was the result of improved recording of AMAU activity in the hospitals, or whether the opening of the units in the hospitals led to an increase in overnight hospitalisations. This may also be attributed to the growth of SSWs affiliated to an AMAU, where patients were admitted for up to 48 hours. Additionally, as discussed in Section 5.2.2 there was slight under-reporting of activity in two smaller hospitals between 2009 and 2011 and it is likely that the complete recording of activity in these hospitals contributed to the increase in activity in 2012. A further plausible though non-testable hypothesis is that the hospital reconfiguration and closure of EDs in 2012 led to an increase in overnight emergency hospitalisations.

[18] Compared with a 15% in total emergency hospitalisations for medical conditions in that year highlighting that a substantial proportion of the increase observed in 2012 was as a result of the increase in the number of same day discharges from the AMAU recorded on HIPE.

Table 5.6 In-patient hospitalisations among adults aged 16 years and over, adult acute public hospitals (2009-2017)

	Adult acute public hospitals[1]										
						In-patient hospitalisations (adults aged ≥16 years)					
Year	Total	Total (≥16 years)	Day-case (≥16 yrs)	In-patient[2] (≥16 yrs)	% yr change	Non medicine [3]	Medicine[3]	Medicine as % of In-patient	Medicine (classed as emergency) (%)	Medicine (classed as emergency) (overnight) (%)	Yearly growth in medicine-emergency (overnight)
2009	1,221,733	1,135,344	697,517	437,827	NA	234,348	203,479	46%	176,094 (87%)	157,104 (89%)	NA
2010	1,247,496	1,161,042	730,889	430,153	-1.8%	225,885	204,268	47%	179,557 (88%)	156,267 (87%)	-0.5%
2011	1,275,591	1,186,373	759,357	427,016	-0.7%	221,495	205,521	48%	171,767 (84%)	155,460 (91%)	-0.5%
2012	1,353,533	1,261,081	801,550	459,531	7.6%	223,774	235,757	51%	210,847 (89%)	167,860 (80%)	8.0%
2013	1,376,514	1,288,463	820,260	468,203	1.9%	220,012	248,191	53%	224,802 (91%)	168,839 (75%)	0.6%
2014	1,409,843	1,321,454	845,413	476,041	1.7%	216,610	259,431	54%	235,231 (91%)	172,238 (73%)	2.0%
2015	1,430,018	1,340,840	861,597	479,243	0.7%	214,211	265,032	55%	240,669 (91%)	176,698 (73%)	2.6%
2016	1,464,778	1,377,671	887,326	490,345	2.3%	214,532	275,813	56%	251,438 (91%)	182,741 (73%)	3.4%
2017	1,479,896	1,397,507	901,643	495,864	1.1%	214,078	281,786	57%	257,270 (91%)	189,524 (74%)	3.7%

Source: HIPE 2009-2017

Notes.

1. Includes activity in adult acute public hospitals only. Includes a small number of hospitalisations transferred in from another hospital. Slight under-reporting of activity from smaller hospitals between 2009 and 2011.
2. In-patient hospitalisations are those hospitalisations that are not classified as day-cases, and include emergency hospitalisations assessed and discharged on the same day from an AMAU and those admitted from an ED but discharged home the same day.
3. Hospitalisations are classified as medical or non-medical based on the specialty of the principal diagnosis consultant. Medical hospitalisations are those where the principal consultant for that episode of care belonged to one of the following specialties: cardiology, dermatology, endocrinology, diabetes, gastro-enterology, genito-urinary medicine, geriatric medicine, haematology, transfusion medicine, neurology, oncology, nephrology, respiratory medicine, rheumatology, infectious diseases, tropical diseases, rehabilitation medicine, spinal paralysis, general medicine, clinical genetics, palliative medicine, metabolic medicine and clinical immunology.

Between 2009 and 2017, bed days used by total in-patient hospitalisations among adults aged ≥16 years increased from 2,901,645 to 3,004,292, an increase of 3.5% (Table 5.7). This is in comparison with a 13% increase in in-patient hospitalisations over the same time period. As with hospitalisations, this growth occurred from 2012, as there was a decline between 2009 and 2011. The bed days attributable to medicine activity increased from 1,729,502 in 2009 to 1,971,263 in 2017, an increase of 14%, while bed days used by hospitalisations for non-medical conditions fell by 12% from 1,172,143 to 1,033,029. In 2017, beds days used by hospitalisations for medical conditions constituted 66% of all bed days used by in-patient hospitalisations among adults aged 16 years and over; up from 60% in 2009.

As with hospitalisations, the majority of these beds days for medicine are attributed to emergency hospitalisations (91%), and nearly all are accounted for by episodes of care with a minimum overnight stay in hospital. Bed days used by emergency hospitalisations for medical conditions increased from 1,548,512 in 2009 to 1,794,955 in 2017, an increase of 16%. The greatest increase was observed in 2015, and not in 2012 as seen with counts of hospitalisations, with a 5.2% increase in that year alone. From 2009 to 2014, bed days used by hospitalisations for non-medical conditions fell year on year. However between 2014 and 2017, there was no further reduction in bed days used by non-medical hospitalisations, and total in-patient bed days increased by 6% between 2014 and 2017 alone, from 2,831,341 to 3,004,292. Importantly, these figures are merely counts; they do not take changes in the population structure into account. They are presented in this format to provide context for the remaining analyses in this chapter on the level of utilisation of the units. A comprehensive technical appendix (Appendix 5.3) provides an in-depth account of age-sex standardised and age specific hospitalisation rates over this period. A relevant extract is present here.

Much of this rise in hospitalisations for medical conditions from 2012 can be attributed to population growth. Despite the increase in the number of hospitalisations, the age-sex standardised rate of overnight hospitalisations for medicine remained unchanged in 2017 from that seen in 2009 (5,245/100,000 in 2017 vs. 5,212/100,000 in 2009). This rate reduced slightly between 2009 and 2011, and increased by 6.2% in 2012. From 2012 the rate reduced gradually until 2016 when it increased again to 2012 levels. To paraphrase, while there was a 20% increase in the number of overnight emergency hospitalisations for medical conditions between 2009 and 2017, the age-sex standarised rate in 2017 was unchanged from that in 2009. Similarly, even though the number of bed days attributable to overnight emergency hospitalisations for medical conditions in 2017 was 14% greater than that in 2012, the age-sex standardised rate was relatively unchanged.

Table 5.7 In-patient bed days among adults aged 16 years and over, adult acute public hospitals (2009-2017)

	Adult acute public hospitals[1]										
						In-patient hospitalisations (adults aged ≥ 16 years)					
Year	BDU	BDU (≥16 yrs)	Day-case[2] BDU (≥16 yrs)	In-patient[3] BDU (≥16 yrs)	% yr change	Non medicine BDU[3]	Medicine BDU[3]	Med BDU as % of all BDU	Medicine BDU (classed as emergency) (%)	Med BDU (classed as emergency overnight) (%)	Yearly growth in o/night med emergency BDU
2009	3,432,756	3,250,403	348,759	2,901,645	NA	1,172,143	1,729,502	60%	1,548,512 (90%)	1,539,017 (99%)	NA
2010	3,399,532	3,222,952	365,445	2,857,508	-1.5%	1,125,513	1,731,995	61%	1,565,311 (90%)	1,553,666 (99%)	1.0%
2011	3,312,018	3,131,641	379,679	2,751,962	-3.7%	1,075,385	1,676,577	61%	1,514,897 (90%)	1,501,743 (99%)	-3.3%
2012	3,384,849	3,202,684	400,775	2,801,909	1.8%	1,050,600	1,751,310	63%	1,567,724 (90%)	1,546,230 (99%)	3.0%
2013	3,351,961	3,177,160	410,130	2,767,030	-1.2%	1,029,882	1,737,148	63%	1,576,059 (91%)	1,548,077 (98%)	0.1%
2014	3,428,333	3,254,048	422,707	2,831,341	2.3%	1,017,317	1,814,025	64%	1,635,452 (90%)	1,603,955 (98%)	3.6%
2015	3,528,799	3,353,134	430,799	2,922,335	3.2%	1,030,681	1,891,654	65%	1,720,192 (91%)	1,688,206 (98%)	5.3%
2016	3,568,908	3,400,140	443,663	2,956,477	1.2%	1,031,315	1,925,163	65%	1,746,037 (91%)	1,711,688 (98%)	1.4%
2017	3,615,592	3,455,113	450,822	3,004,292	1.6%	1,033,029	1,971,263	66%	1,794,955 (91%)	1,761,081 (98%)	2.9%

Source: HIPE 2009-2017. Same day in-patient hospitalisations are give a bed days used of 0.5 days.

Notes.
1. Includes activity in adult acute public hospitals only. Includes a small number of hospitalisations transferred in from another hospital. Slight under-reporting of activity from smaller hospitals between 2009 and 2011.
2. In-patient hospitalisations are those hospitalisations that are not classified as day-cases, and include emergency hospitalisations assessed and discharged on the same day from an AMAU and those admitted from an ED but discharged home the same day.
3. Hospitalisations are classified as medical or non-medical based on the specialty of the principal diagnosis consultant. Medical hospitalisations are those where the principal consultant for that episode of care belonged to one of the following specialties: cardiology, dermatology, endocrinology, diabetes, gastro-enterology, genito-urinary medicine, geriatric medicine, haematology, transfusion medicine, neurology, oncology, nephrology, respiratory medicine, rheumatology, infectious diseases, tropical diseases, rehabilitation medicine, spinal paralysis, general medicine, clinical genetics, palliative medicine, metabolic medicine and clinical immunology.

Abbreviations. Med: medicine. BDU: bed days used

5.3.1.2 Admission pathways of hospitalisations for medical conditions, 2009-2017

The majority of in-patients admitted with a medical condition over this period were admitted as an emergency. The relative contribution of the different admission pathways to these emergency hospitalisations shifted over time with the introduction of the units (Table 5.8). The majority of the AMAUs opened in 2012-2013 and this is reflected in the substantial increase in AMAU activity in 2012 and 2013. Additionally, there was incomplete data capture for episodes assessed and discharged direct from an AMAU prior to 2012, which from 2012 was classed as in-patient activity. In 2013, there was a clear shift in the pathway of those admitted as an emergency, with a reduction in the numbers admitted from an ED and an increase in the numbers admitted to an AMAU. The numbers admitted in-house from an ED in 2013 were 8% less than in 2012; in 2014 there were 7% less than those admitted in 2013. However, from 2014 the numbers and relative proportions of medical hospitalisations admitted in-house from an ED increased year on year, while AMAU activity remained relatively stable and declined marginally in 2017.

In 2017, 36% of emergency hospitalisations for medical conditions were streamed through an AMAU. Once there, just under two-thirds (64%) were discharged directly, the remaining third were transferred to an SSW or to an in-patient bed in-house. The majority of the remaining 64% of emergency hospitalisations were admitted in-house from an ED (57%), while 7% were hospitalisations from a source termed Other/Unknown.

Bed days used by hospitalisations admitted from an ED decreased in 2013 and 2014, as activity in the AMAUs increased (Table 5.9). From 2015, activity increased in the EDs and the growth in bed days accounted for by those admitted through an ED accompanied a reduction in those admitted through an AMAU, mirroring the trends observed in hospitalisations. In 2017, almost three quarters (72%) of all bed days used by emergency hospitalisations for medical conditions were accounted for by admissions in-house from an ED. Hospitalisations admitted onwards from an AMAU account for approximately 16% of medical emergency bed days and those admitted from a source termed Other/Unknown accounted for 10%.

Table 5.8 Admission pathways of hospitalisations for medical conditions, adult acute public hospitals (2009-2017)

In-patient hospitalisations for medical conditions (adults ≥ 16 years), adult acute public hospitals[1]

				Source of admission of emergency hospitalisations for medical conditions (adults ≥ 16 years)							
Year	Total Med[2,3]	Elective Med	Emergency Med[2,3] (%)	Emergency department		Admitted from an AMAU		Discharged directly from an AMAU[4]		Other/Unknown	
				N	%	N	%	N	%	N	%
2009	203,479	27,008	176,094 (87)	145,012	NA	9,442	NA	8,372	NA	13,268	NA
2010	204,268	24,347	179,557 (88)	146,619	NA	9,926	NA	11,150	NA	11,862	NA
2011	205,521	23,270	181,767 (88)	143,945	NA	11,125	NA	13,852	NA	12,868	NA
2012	235,757	24,318	210,847 (89)	146,190	69	19,117	9	31,208	15	14,332	7
2013	248,191	22,885	224,802 (91)	135,028	60	31,017	14	46,380	21	12,377	6
2014	259,431	23,660	235,231 (91)	126,129	54	37,695	16	55,533	24	15,874	7
2015	265,032	23,890	240,669 (91)	128,411	53	36,875	15	56,759	24	18,607	8
2016	275,813	23,863	251,438 (91)	135,159	54	36,675	15	61,202	24	18,402	7
2017	281,786	23,931	257,270 (91)	146,042	57	34,703	13	58,702	23	17,823	7

Sources. HIPE 2009-2017

Notes.
1. Includes in-patient activity in adult acute public hospitals including those that do not participate in the Programme. Includes same day in-patient hospitalisations and also includes a small number of hospitalisations transferred in from another hospital, which are both excluded in Chapter 6 on programme impact.
Slight under-reporting of activity from smaller hospital between 2009 and 2011.
2. In-patient hospitalisations are those hospitalisations that are not classified as day-cases, and include emergency hospitalisations assessed and discharged on the same day from an AMAU and those admitted from an ED but discharged home the same day.
3. Hospitalisations are classified as medical or non-medical based on the specialty of the principal diagnosis consultant. Medical hospitalisations are those where the principal consultant for that episode of care belonged to one of the following specialties. cardiology, dermatology, endocrinology, diabetes, gastro-enterology, genito-urinary medicine, geriatric medicine, haematology, transfusion medicine, neurology, oncology, nephrology, respiratory medicine, rheumatology, infectious diseases, tropical diseases, rehabilitation medicine, spinal paralysis, general medicine, clinical genetics, palliative medicine, metabolic medicine and clinical immunology.
4. AMAU-discharged home is not complete for 2009-2012.

Abbreviations. Med: medicine. NA: Not applicable.

Table 5.9 Bed days used by hospitalisations for medical conditions, by admission pathway, adult acute public hospitals (2009-2017)

Bed days used by in-patient hospitalisations for medical conditions (adults >=16 years) adult acute public hospitals[1]											
				Bed days used by source of admission of emergency hospitalisations for medical conditions (adults ≥ 16 years)							
Year	Total Med BDU[2,3]	Elective Med BDU (%)	Emergency Med BDU (%)	Emergency department		Admitted from an AMAU		Discharged directly from an AMAU [4]		Other/Unknown	
				N	%	N	%	N	%	N	%
2009	1,729,502	179,423 (11)	1,548,512 (90)	1,330,374	86	62,957	4	4,186	<1	150,995	10
2010	1,731,995	165,392 (10)	1,565,311 (90)	1,357,278	87	64,212	4	5,575	<1	138,247	9
2011	1,676,577	159,823 (10)	1,514,897 (90)	1,290,994	85	78,664	5	6,927	<1	138,382	9
2012	1,751,310	182,090 (10)	1,567,724 (90)	1,262,994	81	137,296	9	18,145	1	149,290	10
2013	1,737,148	159,982 (9)	1,576,059 (91)	1,184,526	75	231,644	15	30,575	2	129,314	8
2014	1,814,025	177,280 (10)	1,635,452 (90)	1,118,949	68	319,046	20	36,661	2	160,797	10
2015	1,891,654	169,967 (9)	1,720,192 (91)	1,172,961	68	321,535	19	37,728	2	187,968	11
2016	1,925,163	177,743 (9)	1,746,037 (91)	1,215,988	70	301,764	17	40,720	2	187,565	11
2017	1,971,263	174,759 (9)	1,794,955 (91)	1,293,123	72	285,861	16	39,908	2	176,063	10

Sources. HIPE 2009-2017

Notes. As per Table 5.8.

Abbreviations. Med: medicine. BDU: bed days used

Monthly emergency hospitalisations for medicine, by admission pathway, are presented in Figure 5.2. Figure 5.3 presents similar information for those emergency hospitalisations with a minimum overnight stay in hospital. In both figures, the top solid red line represents total emergency hospitalisations for medical conditions. The first broken red line represents hospitalisations admitted from an ED; the large red line with markers, represents hospitalisations admitted from an AMAU (to a SSW or in-patient bed); the dark red line, represents those discharged directly from an AMAU, and the blue line, represents those admitted from a source termed Other/Unknown.

The increase in emergency hospitalisations in 2012 is quite clear (Figure 5.2 top red line). This is due to several factors: under-reporting of activity from smaller hospital between 2009 and 2011 and the inclusion of their activity from 2012 onwards, growth of AMAU activity and the reporting of its same day discharge activity as in-patient activity. From January 2012, there was a significant increase in AMAU activity and a decrease in ED-admitted hospitalisations. By May 2014, activity in the AMAUs was at its highest and admissions from the ED were at their lowest. From mid-2014 however, monthly hospitalisations from the ED increased and by the end of 2017, had grown to 2012 levels. AMAU activity plateaued during this time and declined slightly towards the latter half of 2017[19].

In terms of hospitalisations with a minimum one night stay in hospital (Figure 5.3), the increase in 2012 was much less dramatic than that seen in Figure 5.2 as many of the episodes assessed in an AMAU were discharged without an overnight stay. The majority of emergency hospitalisations for medical conditions with a minimum overnight stay in hospital are admitted from an ED (Figure 5.3 first broken red line). These ED-admitted hospitalisations decreased from January 2012 until mid-2014, as activity in the AMAUs increased. Overnight hospitalisations from the EDs started to increase from that time-point, and by December 2017 this admission pathway accounted for 73% of all medical emergency hospitalisations with a minimum overnight night stay in hospital.

[19] Likely as a result of the closure of the AMAU in a large model 4 hospital in that year.

Figure 5.2 Admission pathways of emergency hospitalisations for medical conditions, 2009-2017

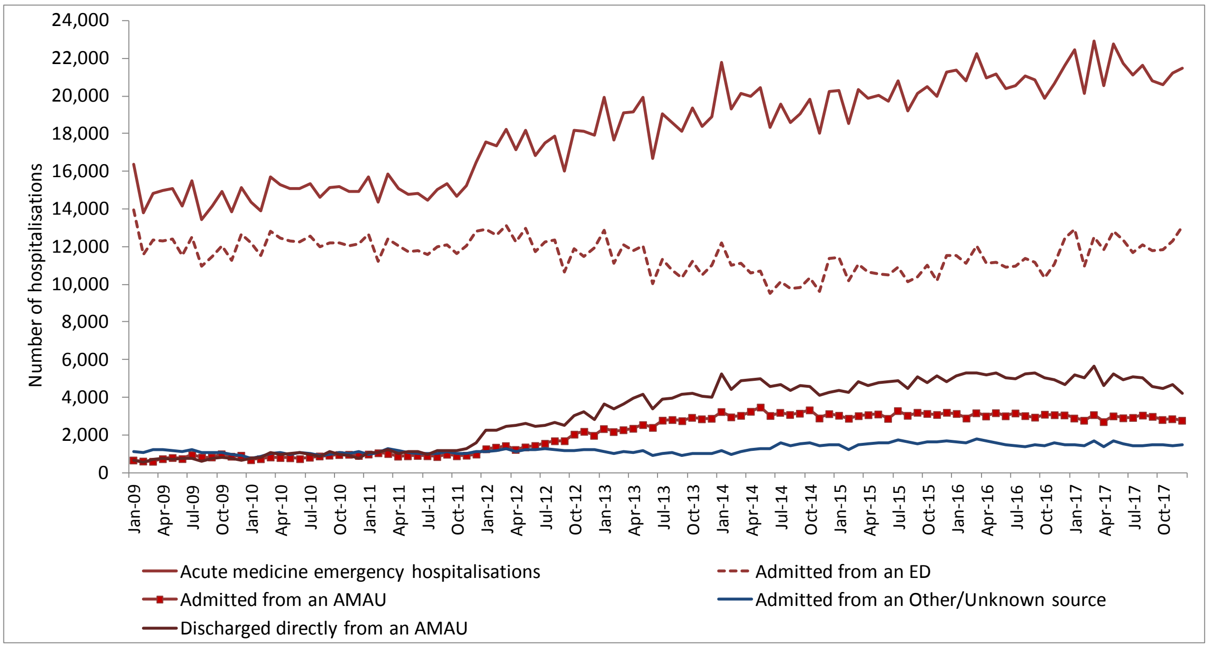
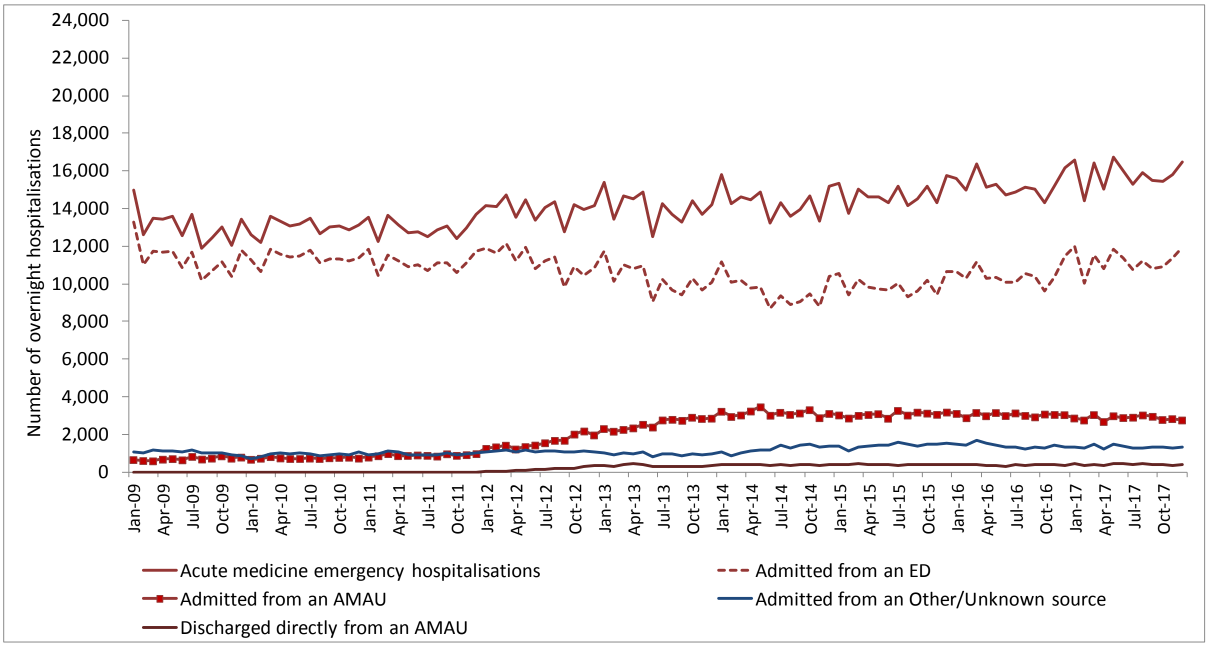


Figure 5.3 Admission pathways of <u>overnight</u> emergency hospitalisations for medical conditions, 2009-2017



5.3.1.3 Characteristics of emergency hospitalisations for medical conditions by admission pathway, 2017

There were 257,270 emergency hospitalisations for medical conditions in 2017. The characteristics of these hospitalisations by admission pathway are presented in Table 5.10. Admissions from the ED and Other/Unknown source were grouped into one pathway - 'admitted from a non-AMAU source'. The other two pathways are 'admitted from an AMAU' and 'discharged directly from an AMAU'. Patients that were admitted from a non-AMAU source constituted 64% of these hospitalisations; a further 13% were admitted from an AMAU (either to a SSW or to an in-patient bed), and the remaining 23% were discharged directly from an AMAU.

The mean age of emergency hospitalisations was 62 years (SD. 19.5); 54.1% were ≥65 years, 12% were aged ≥85 years. Patients admitted from a non-AMAU source had a mean age of 65.0 years (SD. 19.0); 58.8% were aged ≥65 and 13.9% were ≥85 years. There was little difference in age between those that were admitted from an AMAU and those admitted from a non-AMAU source: 66.3 years vs. 65.0 years; 62.0% of those admitted from an AMAU were aged ≥ 65 years and 15.0% were aged ≥ 85 years. Those that were discharged home from an AMAU without admission to an in-patient bed were younger - mean age 55.0 years (SD. 19.4); 36.6 % ≥ 65 years and 4.9% ≥ 85 years. They were also more likely to be female than those on other admission pathways.

The number of additional diagnoses fields populated in these hospitalisations was quite low, irrespective of admission source. Across all hospitalisations, the median number of additional diagnoses populated was 2 (IQR. 0 to 4). Hospitalisations admitted from a non-AMAU source and those admitted from an AMAU had the same median number of additional diagnoses populated (2), but the upper value of IQR was greater for those admitted from a non-AMAU source - (IQR of 1 to 5, vs. 0 to 4), meaning that 25% of hospitalisations admitted from a non-AMAU source had 5 or more additional diagnoses; while the corresponding figure for those admitted from an AMAU was 4 or more additional diagnoses. In terms of those hospitalisations that were seen in an AMAU and discharged home from there, the number of additional diagnoses fields populated was lower, a median of 0 and 75% of these hospitalisations had 1 or no additional diagnoses. It is not possible to state with any conviction whether this is because of the absence of co-morbidities or a reflection of the data entering process, given that these episodes of care, which were discharged home from an AMAU, would have only spent a few hours in an AMAU.

These additional diagnoses fields are used in the derivation of the Charlson co-morbidity index (CCI). The mean CCI of all emergency in-patient hospitalisations was 3.6 (SD. 6.4), with those admitted from a non-AMAU source having a slightly higher CCI (mean 4.5; SD. 7.0) compared with those admitted in-house from an AMAU (mean 3.8; SD. 6.5). Those that were assessed in an AMAU and discharged home had very low CCIs (mean 0.8, SD. 2.8). Again, it is not possible to state whether this is because of a lack of co-morbidities or the fact that coding of those hospitalisations that spend only a few hours in an AMAU is less comprehensive.

Across all hospitalisations, the number admitted to ICU was low at 7%. Those admitted from a non-AMAU source were twice as likely to spend time in an ICU as those admitted in-house from an AMAU (9.5% vs. 4.7%).

The majority of hospitalisations were admitted from home (93.4%); only 3.7% were admitted from a nursing home facility and 2.4% were transfers in from another acute hospital. The proportion discharged home was less than those admitted from home (80.5% vs. 93.4%), and the number that were discharged to a nursing home were twice that that of those admitted from a nursing home (from 3.7% to 8.1%). This increase was seen in those that were admitted from a non-AMAU source as well as those admitted in-house from an AMAU.

The ratio of weekday hospitalisations to weekend hospitalisations reflects the fact that many of the AMAUs are not operational at the weekend. Across all AMAU hospitalisations, 7.3% of hospitalisations took place on Saturdays and Sundays. This is in contrast with non-AMAU hospitalisations where 23.7% of hospitalisations took place over the weekend. The numbers discharged at the weekends were quite low, with only 9.3% of emergency in-patient hospitalisations for total medical conditions discharged at the weekend.

Bearing in mind that no comparison has been made on acuity or disease severity given the lack of information in the data on this, it appears that those admitted in-house from an AMAU in 2017 had a similar demographic profile to those admitted from a non-AMAU source, apart from the proportion admitted to the ICU, which is to be expected. The most notable difference lies in the volume of patients on the different pathways, with a significantly greater proportion admitted from a non-AMAU source.

Table 5.10 Characteristics of emergency hospitalisations for medical conditions, by admission pathway, 2017

	Admitted from a non-AMAU source[1] N=163,865 (63.7%) (a)	Admitted from an AMAU[2] N=34,703 (13.5%) (b)	Discharged directly from an AMAU[3] N=58,702 (22.8%) (c)	Total assessed in an AMAU N=93,405 (36.3%) (b) + (c)	Total emergency med hospitalisations N=257,270 (a) + (b) + (c)
Mean age (SD)	65.0 (19.0)	66.3 (18.5)	55.0 (19.4)	59.2 (19.8)	62.0 (19.5)
Age category, n (% column)					
16-44 years	26,899 (16.4)	5,134 (14.8)	18,689 (31.8)	23,823 (25.5)	50,722 (19.7)
44-65 years	40,542 (24.7)	8,062 (23,2)	18,799 (32.0)	26,861 (28.8)	67,403 (26.2)
65 - 84 years	73,616 (44.9)	16,314 (47.0)	18,362 (31.3)	34,676 (37.1)	108,292 (42.1)
≥85 years	22,808 (13.9)	5,193 (15.0)	2,852 (4.9)	8,045 (8.6)	30,853 (12.0)
Female, n (%)	79,765 (48.7)	17,810 (51.3%)	32,997 (56.2)	50,807 (54.4)	130,572 (50.8)
Co-morbidity/complexity					
Additional Dx fields populated, median (IQR)	2 (1 to 5)	2 (0 to 4)	0 (0 to 1)	0 (0 to 2)	2 (0 to 4)
Mean Charlson co-morbidity Index (SD)	4.5 (7.0)	3.8 (6.5)	0.8 (2.8)	1.9 (4.8)	3.6 (6.4)
Charlson co-morbidity index ≥2, n (%)	66,453 (40.6)	12,443 (35.9)	6,955 (11.9)	19,398 (20.8)	85,851(33.4)
Intensive care admission, n (%)	15,583 (9.5)	1,614 (4.7)	NA	1,617 (1.7)	17,200 (7.0)
Admission source					
Home	149,407 (91.2)	32,852 (94.7)	58,027 (98.9)	90,879 (97.3)	240,240 (93.4)
Nursing home facility	7,526 (4.6)	1,443 (4.2)	418 (0.7)	1,861 (2.0)	9,387 (3.7)
Transfer from acute hospital	5,883 (3.6)	219 (0.6)	66 (0.1)	285 (0.3)	6,165 (2.4)
Other	1,049 (0.6)	189 (0.5)	191 (0.3)	380 (0.4)	1,429 (0.6)
Discharge destination					
Home	123,584 (75.4)	27,496 (79.2)	55,962 (95.3)	83,458 (89.4)	207,042 (80.5)
Nursing home facility	17,185 (10.5)	3,220 (9.3)	516 (0.9)	3,736 (4.0)	20,921 (8.1)
Transfer from acute hospital	9,933 (6.1)	2,052 (5.9)	1,099 (1.9)	3,151 (3.4)	13,084 (5.1)
Died in hospital/transferred to hospice	8,499 (5.2)	1,028 (3.0)	12 (0)	1,040 (1.1)	9,539 (3.7)
Transfer to external rehab	649 (0.4)	190 (0.6)	11 (0)	201 (0.2)	850 (0.3)
Other	4,015 (2.5)	717 (2.1)	1,102 (1.9)	1,819 (2.0)	5,834 (2.3)

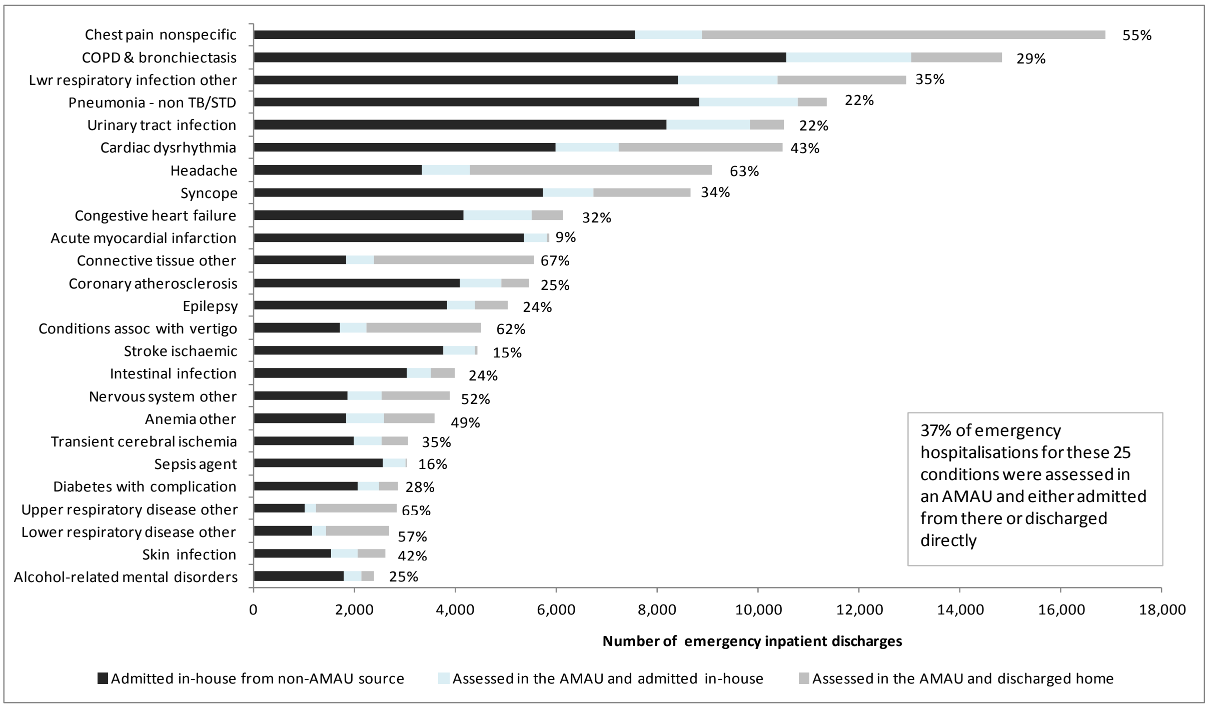
	Admitted from a non-AMAU source[1] N=163,865 (63.7%) (a)	Admitted from an AMAU[2] N=34,703 (13.5%) (b)	Discharged directly from an AMAU[3] N=58,702 (22.8%) (c)	Total assessed in an AMAU N=93,405 (36.3%) (b) + (c)	Total emergency med hospitalisations N=257,270 (a) + (b) + (c)
Day of admission					
Monday - Friday (%)	125,000 (76.3)	31,133 (89.7)	55,491 (94.5)	86,624 (92.7)	211,624 (82.3)
Saturday-Sunday (%)	38,865 (23.7)	3,570 (10.3)	3,211 (5.5)	6,781 (7.3)	45,646 (17.7)
Day of discharge					
Monday-Friday	146,038 (89.1)	31,498 (90.8)	55,809 (95.1)	87,307 (93.5)	233,345(90.7)
Saturday-Sunday	17,827 (10.9)	3,205 (9.2)	2,893 (4.9)	6,098 (6.5)	23,925 (9.3)

Notes.
1. Admitted from a non-AMAU source: admitted in-house directly from the emergency department and from Other/Unknown sources.
2. Admitted from an AMAU: assessed in the AMAU and admitted either to an associated SSW, or to an in-patient bed.
3. Discharged directly from an AMAU: assessed in the AMAU and discharged directly from there without admission to an in-patient bed.

5.3.1.4 Admission pathways of <u>common</u> medical conditions admitted as an emergency, 2017

The CCS mapping software was applied to the data extract of these emergency hospitalisations in 2017 to categorise them into medical conditions.[20] Of the 257,270 emergency hospitalisations for medical conditions, 63% of these hospitalisation were attributable to just 25 clinical conditions The admission pathways of emergency hospitalisations for these 25 medical conditions is presented in Figure 5.4 and Table 5.11. The black represents hospitalisations admitted from a non-AMAU source, blue those assessed in an AMAU and admitted, and grey those assessed in an AMAU and discharged directly from there. The percentage represents the proportion of emergency hospitalisations for that condition that were assessed in an AMAU.

Figure 5.4 Admission pathways of the top 25 medical conditions admitted as an emergency, 2017



Note. The percentage represents the proportion of the hospitalisations for that condition that was assessed in an AMAU and either admitted from there or discharged directly.

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[20] There may be a slight discrepancy in the number of hospitalisations for these individual conditions and those in the next section (5.3.2) on ambulatory care sensitive medical conditions. This is for two reasons. Firstly the CCS mapping may use different ICD-10-AM codes from those used in the definition of ambulatory care sensitive conditions. Secondly, the 'medical' dataset used here was derived based on the specialty of the consultant associated with the principal diagnosis. This was the only means of getting a full picture of 'medicine' activity. The ACS medical conditions were extracted from the full dataset based solely on ICD-10-AM code and not the specialty of the consultant. While the vast majority of these ACS medical conditions are associated with a consultant under the umbrella term of medicine, there may be a few minor exceptions.

Chest pain non-specific was the most common medical condition admitted to hospital as an emergency, with almost 17,000 in-patient emergency hospitalisations in 2017. Of those, 55% were assessed in an AMAU; the remaining 45% were admitted directly in-house from a non-AMAU source. The majority assessed in an AMAU with this condition (86%) were discharged directly without admission to an in-patient bed. The next most common medical condition admitted as an emergency to hospital was COPD/bronchiectasis with almost 15,000 emergency in-patient hospitalisations. Of these, 29% were assessed in an AMAU; the remaining 71% were admitted directly in-house from a non-AMAU source. Just less than half (42%) of patients assessed on an AMAU with this condition were discharged directly without admission to an in-patient bed. COPD/bronchiectasis was the medical condition with the highest number of in-house hospitalisations in 2017.

In line with the clinical pathways, conditions such as myocardial infarction and stroke by-pass the AMAU and are admitted directly in-house. Hence the proportion of emergency hospitalisations for these conditions that are assessed in an AMAU is lower.

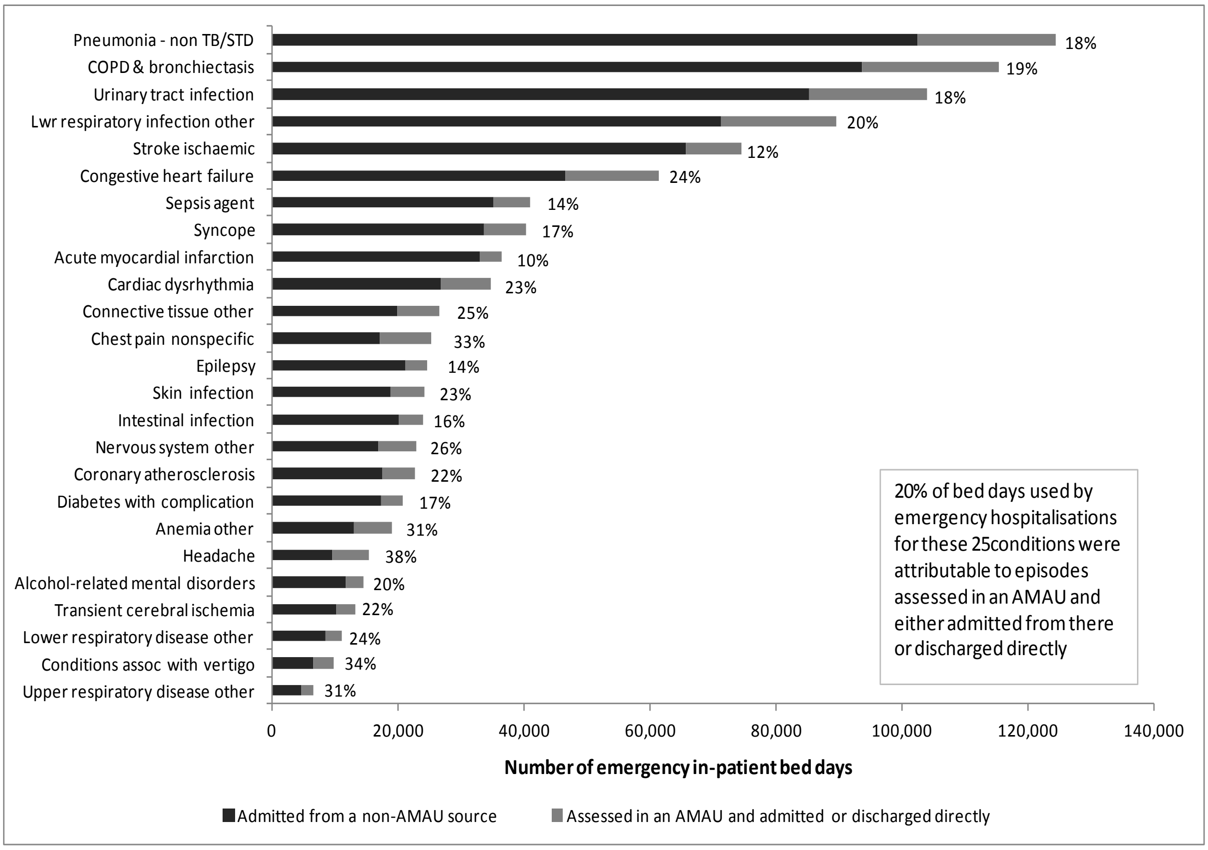
The five most common conditions streamed through to an AMAU - in descending order - were chest-pain non specific, headache, lower respiratory infection other, cardiac dysrhythmia, and COPD/bronchiectasis. Of total AMAU activity in 2017 (Table 5.11, 4th column), 10% of hospitalisations had a principal diagnosis of chest pain non-specific and 85.8% of these were discharged directly; 6.1% had a principal diagnosis of headache of which 83.6% were discharged directly; 4.9% had a diagnosis of lower respiratory infection (other) with 56.4% discharged directly; 4.8% had a diagnosis of cardiac dysrhythmia with 72.2% discharged directly, and 4.6% had a diagnosis of COPD/bronchiectasis with a lower proportion of 41.8% discharged directly.

Table 5.11 Admission pathways of the top 25 medical conditions admitted as an emergency, 2017

	Admitted from a non-AMAU source N=163,865 (a)	Admitted from an AMAU N=34,703 (b)	Total admitted in-house N=198,568 (a) + (b)	Discharged directly from an AMAU N=58,702 (c)	Total assessed in an AMAU N=93,405 (b) + (c)	Total medical emergency hospitalisations N=257,270 (a) + (b) +(c)
Clinical Classification Scheme Category	N (% column)	N (% column)	N (% column)	N (% column)	N (% column)	N (% column)
Chest pain non-specific	7,555 (4.6)	1,330 (3.8)	8,885 (4.5)	8,004 (13.6)	9,334 (10.0)	16,889 (6.6)
COPD/bronchiectasis	10,543 (6.4)	2,490 (7.2)	13,033 (6.6)	1,791 (3.1)	4,281 (4.6)	14,824 (5.8)
Lower respiratory infection other	8,395 (5.1)	1,979 (5.7)	10,374 (5.2)	2,559 (4.4)	4,538 (4.9)	12,933 (5.0)
Pneumonia - non TB/STD	8,822 (5.4)	1,966 (5.7)	10,788 (5.4)	555 (0.9)	2,521 (2.7)	11,343 (4.4)
Urinary tract infection	8,187 (5.0)	1,631 (4.7)	9,818 (4.9)	674 (1.1)	2,305 (2.5)	10,492 (4.1)
Cardiac dysrhythmia	5,966 (3.6)	1,257 (3.6)	7,223 (3.6)	3,257 (5.5)	4,514 (4.8)	10,480 (4.1)
Headache	3,336 (2.0)	941 (2.7)	4,277 (2.2)	4,793 (8.2)	5,734 (6.1)	9,070 (3.5)
Syncope	5,719 (3.5)	1,000 (2.9)	6,719 (3.4)	1,929 (3.3)	2,929 (3.1)	8,648 (3.4)
Congestive heart failure	4,145 (2.5)	1,347 (3.9)	5,492 (2.8)	624 (1.1)	1,971 (2.1)	6,116 (2.4)
Acute myocardial infarction	5,347 (3.3)	468 (1.3)	5,815 (2.9)	47 (0.1)	515 (0.6)	5,862 (2.3)
Connective tissue other	1,837 (1.1)	534 (1.5)	2,371 (1.2)	3,176 (5.4)	3,710 (4.0)	5,547 (2.2)
Coronary atherosclerosis	4,075 (2.5)	827 (2.4)	4,902 (2.5)	553 (0.9)	1,380 (1.5)	5,455 (2.1)
Epilepsy	3,815 (2.3)	572 (1.6)	4,387 (2.2)	649 (1.1)	1,221 (1.3)	5,036 (2.0)
Conditions associated with vertigo	1,705 (1.0)	511 (1.5)	2,216 (1.1)	2,291 (3.9)	2,802 (3.0)	4,507 (1.8)
Stroke ischaemic	3,764 (2.3)	607 (1.7)	4,371 (2.2)	60 (0.1)	667 (0.7)	4,431 (1.7)
Intestinal infection	3,020 (1.8)	494 (1.4)	3,514 (1.8)	465 (0.8)	959 (1.0)	3,979 (1.5)
Nervous system other	1,864 (1.1)	667 (1.9)	2,531 (1.3)	1,342 (2.3)	2,009 (2.2)	3,873 (1.5)
Anaemia other	1,832 (1.1)	757 (2.2)	2,589 (1.3)	976 (1.7)	1,733 (1.9)	3,565 (1.4)
Transient cerebral ischemia	1,965 (1.2)	559 (1.6)	2,524 (1.3)	519 (0.9)	1,078 (1.2)	3,043 (1.2)
Sepsis agent	2,561 (1.6)	439 (1.3)	3,000 (1.5)	35 (0.1)	474 (0.5)	3,035 (1.2)
Diabetes with complication	2,045 (1.2)	420 (1.2)	2,465 (1.2)	390 (0.7)	810 (0.9)	2,855 (1.1)
Upper respiratory disease other	1,001 (0.6)	229 (0.7)	1,230 (0.6)	1,605 (2.7)	1,834 (2.0)	2,835 (1.1)
Lower respiratory disease other	1,141 (0.7)	275 (0.8)	1,416 (0.7)	1,253 (2.1)	1,528 (1.6)	2,669 (1.0)
Skin infection	1,518 (0.9)	544 (1.6)	2,062 (1.0)	536 (0.9)	1,080 (1.2)	2,598 (1.0)
Alcohol-related mental disorder	1,770 (1.1)	366 (1.1)	2,136 (1.1)	237 (0.4)	603 (0.6)	2,373 (0.9)
Top 25 medical CCS (% column)	101,928 (62.2)	22,210 (64.0)	124,138 (62.5)	38,320 (65.3)	60,530 (64.8)	162,458 (63.1)
Total across all medical CCS	163,865 (100)	34,703 (100)	198,568 (100)	58,702 (100)	93,405 (100)	257,270

In terms of bed days, in 2017 there were 1.79 million bed days used by emergency hospitalisations for medical conditions, 56% of these were accounted for by the 25 conditions described above (Figure 5.5). Hospitalisations for pneumonia-non TB/STD accounted for the greatest number of emergency medical beds, with almost 125,000 beds attributed to this condition, which equates to 6.9% of total emergency medical beds in 2017. Of the top five conditions (in terms of emergency medical beds), three were respiratory: pneumonias-non TB/STD, COPD/bronchiectasis, and lower respiratory infection (other). The bed days used by emergency hospitalisations for these three conditions accounted for 18% of bed days used by all emergency hospitalisations for medical conditions. The other two conditions in the top five in terms of bed days used were urinary tract infection (5.8%) and stroke ischaemic (4.1%).

Figure 5.5 Bed days used by the top 25 medical conditions admitted as an emergency, 2017



Notes.

The conditions included here are those that had the highest number of emergency hospitalisation in 2017.

The percentage represents the proportion of emergency bed days for that condition that were attributable to episodes assessed in an AMAU and either admitted from there or discharged directly.

5.3.1.5 Variation in utilisation of the units across hospitals, 2017

The flow differential in each of the hospitals in 2017 in terms of the proportion of their emergency hospitalisations for medical conditions that were assessed in an AMAU is presented in Figure 5.6. The hospitals are categorised according to model type, and ordered by descending number of medical emergency hospitalisations in 2017, with the height of the bar representing the total count of these hospitalisations in that hospital. The black represents those hospitalisations admitted from a non-AMAU source; the light blue depicts those hospitalisations admitted from an AMAU to an in-patient bed in-house or to a SSW and the light grey those hospitalisations assessed in an AMAU and discharged directly.

Across model 4 hospitals, seven of the nine hospitals had an AMAU in 2017; two large hospitals did not have an AMAU, hence all their medical emergency in-patients hospitalisations were admitted via a non-AMAU source. In those hospitals that did have an AMAU, utilisation of their units ranged from 27% to 40% of medical emergency in-patient hospitalisations streamed through them. Of those hospitalisations assessed in an AMAU, there was considerable variation in the proportion admitted in-house or discharged directly. For example, the AMAU in Hospital 8 discharged very few patients directly, while the AMAU in Hospital 7 discharged the majority of its patients directly.

In model 3 hospitals, sixteen of the seventeen hospitals had an AMAU in 2017, and again there was there was considerable variation in the numbers and proportion of emergency hospitalisations streamed through them, as well as the trajectory of those assessed in them. Utilisation of the units ranged from 2% in Hospital 20 to 80% in Hospital 11. Hospital 10 had a very high number of medical in-patient hospitalisations, largely driven by high numbers of AMAU-discharge hospitalisations. In Hospital 11, the vast majority of medical hospitalisations were streamed through an AMAU there and only 20% of hospitalisations were admitted from a non-AMAU source. Of those assessed in an AMAU in this hospital, approximately half were admitted in-house for further care.

In model 2 hospitals, seven of the eight hospitals had an AMAU in 2017. Model 2 hospitals do not have an ED. Hence, the vast majority of medical emergency hospitalisations are streamed through an AMAU. Again, there is considerable variation across hospitals in their propensity to discharge or admit from their AMAU. Hospital 27 had the highest number of medical hospitalisations in this category. Interestingly, its AMAU admitted significantly more patients that it discharged directly, in contrast with the other model 2 AMAUs that tended to discharge a higher proportion than they admitted in-house. Hospital 28, with similar numbers of medical hospitalisations to Hospital 27, admitted much lower numbers from its AMAU, the vast majority were discharged directly. The monthly utilisation figures for each AMAU between January 2017 and December 2017, in terms of the proportion of emergency medical hospitalisations that were streamed through their AMAU is depicted in Figure 5.7 hospitals are categorised in the same order as Figure 5.6.

Figure 5.6 Admission pathways of emergency hospitalisations for medical conditions, per hospital, 2017

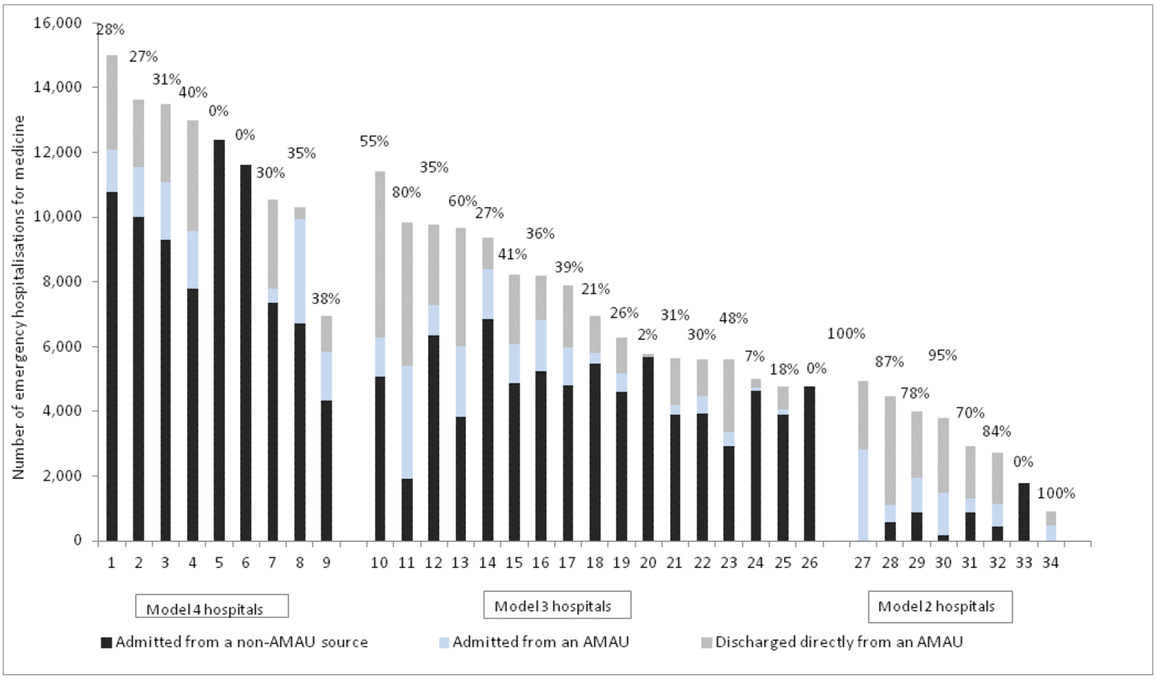
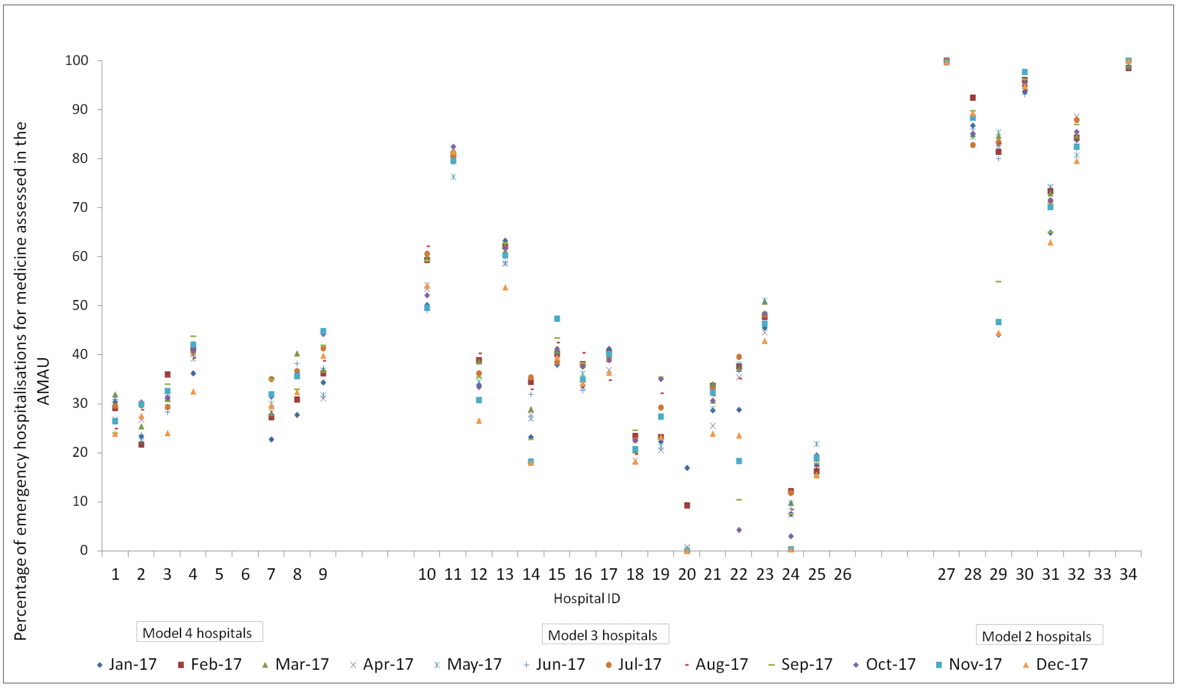


Figure 5.7 Proportion of monthly emergency hospitalisations for acute medicine assessed in each AMAU, January 2017 to December 2017



The wide variation in utilisation of the units, even amongst hospitals of the same model is quite apparent, as is the monthly variation within certain hospitals. In model 4 hospitals, the percentages through an AMAU month-on-month within each hospital, were much closer together than those seen in the model 3 hospitals, which had quite disparate monthly patterns. In model 4 hospitals, Hospital 4 had the highest proportion of its medical hospitalisations streamed through its AMAU (40% overall in 2017), though activity was lower in its winter months.

Across model 3 hospitals, Hospital 11 consistently had between 70-80% of its hospitalisations streamed through an AMAU. Hospitals 10 and 13 had similar percentages of medical in-patient hospitalisations through their AMAUs - approximately 45-60% each month. Hospital 14, which had the highest number of medical in-patient hospitalisations admitted in-house in 2017 across all model 3 hospitals (see previous figure), had very wide monthly variation in the utilisation of its unit. In 2017, overall 27% of medical emergency hospitalisations were streamed through the unit in this hospital. However this varied from 33% in July to 18% in December. Hospitals 15, 16 and 17 had consistent usage month on month with approximately 40% of medical in-patient hospitalisations streamed through their AMAU. Hospital 22 had enormous monthly variation in the utilisation of its unit in 2017, ranging from 40% in July to 4% in October, with a yearly figure of 30%. Hospital 23 had consistently high utilisation of its unit, while the unit in Hospital 24 had consistently low utilisation.

Model 2 hospitals also showed unequal patterns. In Hospital 27, all medical emergency in-patient hospitalisations were streamed though an AMAU and there was no variation on this month-on-month. This hospital had the highest number of medical hospitalisations in this category. Hospital 29 showed significant instability in terms of the proportion of medical in-patient hospitalisations that were streamed through an AMAU. The proportion fell monthly during the year and by December 2017 only 45% were streamed though AMAU; the remaining 55% were admitted from another source - either inter-hospital transfers, or the outpatients department. Hospital 30 had consistent utilisation with very little hospitalisations from a non-AMAU source. Hospital 31 only streamed 70% of its hospitalisations through an AMAU; the other 30% were admission from a non-AMAU source.

5.3.2 Hospitalisations for ambulatory care sensitive medical conditions

This section provides a comprehensive description of the utilisation of the Acute Medical Assessment Units from the perspective of emergency hospitalisations for ambulatory care sensitive medical conditions. It provides a detailed account of the proportion of emergency hospitalisations for these conditions on the different admission pathways (i.e., admitted from a non-AMAU source, admitted from an AMAU[21], and discharged directly from an AMAU) each year between 2009 and 2017. Findings are presented firstly for hospitalisations among all adults, and then for each of the four age categories under consideration.

The section closes with a detailed description of the trajectory of those conditions assessed in an AMAU - i.e. whether the patients are admitted to an in-patient bed in-house or to an SSW, or discharged directly. It details how the trajectory of those seen in the AMAU is highly contingent on the primary diagnosis and age of the patient.

5.3.2.1 Emergency hospitalisations for ambulatory care sensitive medical conditions, adults ≥ 16 years, 2009-2017

While there was a significant increase in the total number of emergency hospitalisations for ambulatory care sensitive medical conditions between 2009 and 2017 (from 92,428 to 132,144 in 2017, an increase of 43%), the numbers admitted in-house for further care[22] increased to a lesser extent (from 88,209 to 100,687 in 2017, an increase of 14%). AMAU activity for these conditions was low between 2009 and 2011; it increased considerably in 2012 and continued to do so until 2014 when it reached a plateau. Hospitalisations on the non-AMAU pathway increased marginally between 2009 and 2012, and fell to a low in 2014 before increasing again. Overall, there was a decline in hospitalisations admitted in-house from 2012 to 2015, and an increase in 2016 and 2017. Despite the increase in AMAU activity from 2012, the majority of emergency hospitalisations for these conditions were admitted from a non-AMAU source (63% in 2017, i.e. line A/line D), and the overwhelming majority of patients admitted in-house were admitted via this pathway (82% in 2017, i.e. line A/line E)

[21] Admitted from an AMAU describes those assessed in an AMAU and admitted for further care to an in-patient bed in-house or to an SSW.

[22] Admitted in-house includes all those episodes admitted from a non-AMAU source, and those admitted from an AMAU to an SSW or to an in-patient bed in house. It excludes those discharged directly from an AMAU.

Table 5.12 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017

	2009	2010	2011	2012	2013	2014	2015	2016	2017
A. Admitted from a non-AMAU source	82,952 (90)	83,189 (88)	83,171 (86)	85,518 (75)	77,331 (64)	72,990 (59)	74,773 (60)	78,872 (60)	82,746 (63)
B. Admitted from an AMAU	5,257 (6)	5,715 (6)	6,129 (6)	10,197 (9)	16,553 (14)	19,987 (16)	19,507 (16)	19,667 (15)	17,941 (14)
C. Discharged from an AMAU	4,219 (5)	6,066 (6)	7,704 (8)	18,210 (16)	26,487 (22)	30,993 (25)	30,786 (25)	33,194 (25)	31,457 (24)
D. Total ACSMC Hospitalisations	92,428	94,970	97,004	113,925	120,371	123,970	125,066	131,733	132,144
E. Total ACSMC admit in-house (A) +(B)	88,209	88,904	89,300	95,715	93,884	92,977	94,280	98,539	100,687

Notes. The percentage represents the proportion of total ambulatory care sensitive medical conditions admitted on that pathway in that year. Abbreviations. ACSMC: Ambulatory care sensitive medical conditions.

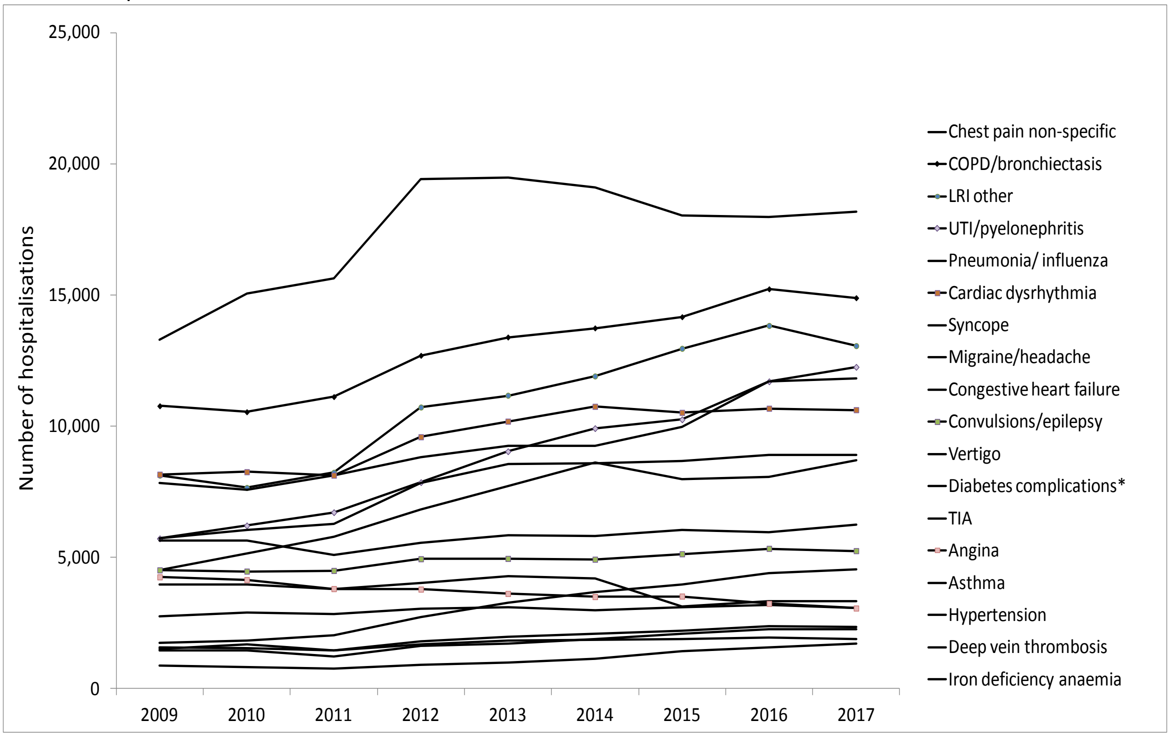
The numbers of emergency hospitalisations between 2009 and 2017 for each of the 18 ambulatory care sensitive medical conditions are presented in Figure 5.8. Graph A includes all hospitalisations (including same day discharges from the AMAU), while Graph B represents those hospitalisations that were admitted in-house.

Chest pain non-specific was the most common ambulatory care sensitive medical condition admitted as an emergency over this period, with a clear increase in hospitalisations in 2012 (Graph A). However, there was a dramatic reduction in the numbers with that condition admitted in-house in that year (Graph B). It is possible to infer from this that a substantial proportion of the rise in total hospitalisations observed in that year was due to an increase in discharges directly from an AMAU, which led to a decrease in the numbers admitted in-house. It is more difficult to decipher patterns in the other conditions, though the clear rise in hospitalisations for UTI/pyelonephritis is evident on both graphs.

See Appendix 5.5 for data.

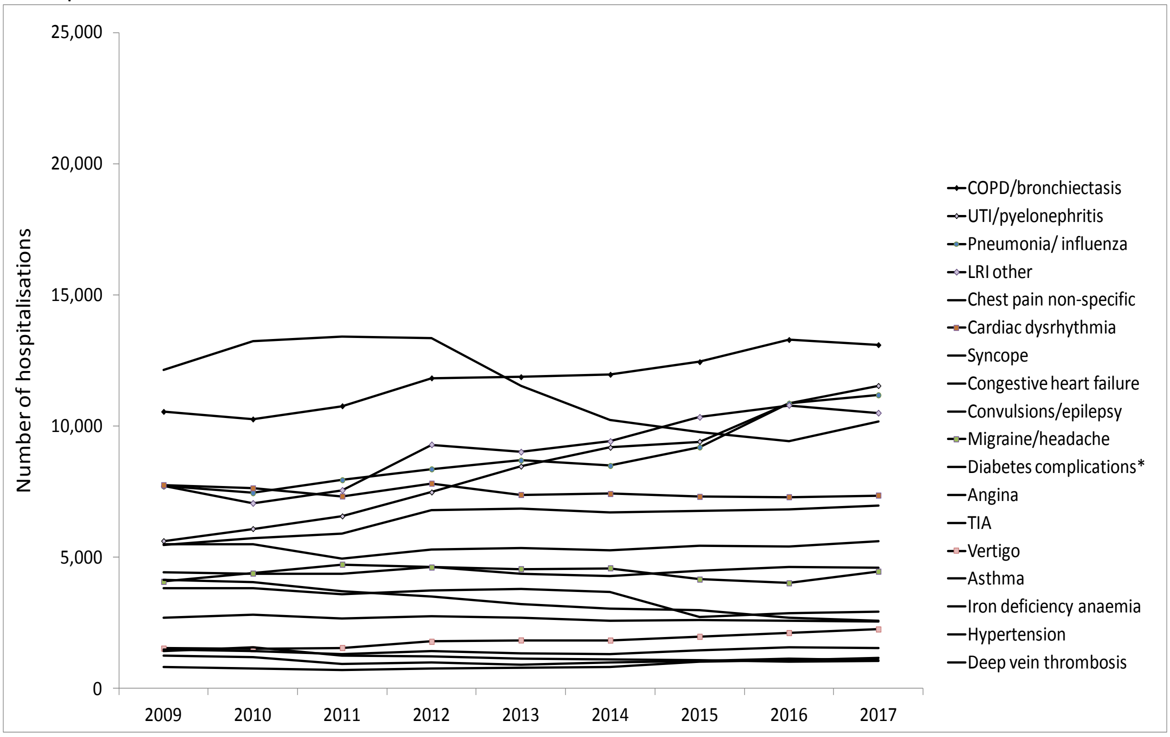
Figure 5.8 Emergency hospitalisations for each ambulatory care sensitive medical condition, 2009-2017

A. Total hospitalisations



* Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

B. Hospitalisations admitted in-house



* Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

The admission pathways of the emergency hospitalisations for these conditions, between 2009 and 2017, are presented in Figure 5.9. Graph A represents those hospitalisations admitted from a non-AMAU source; Graph B, those admitted in-house from an AMAU, while Graph C shows those discharged directly from an AMAU.

There are several points of note from the graphs:

1. The numbers admitted in-house for these conditions from a non-AMAU source were significantly greater that those admitted in-house from an AMAU (Graph A vs. Graph B).

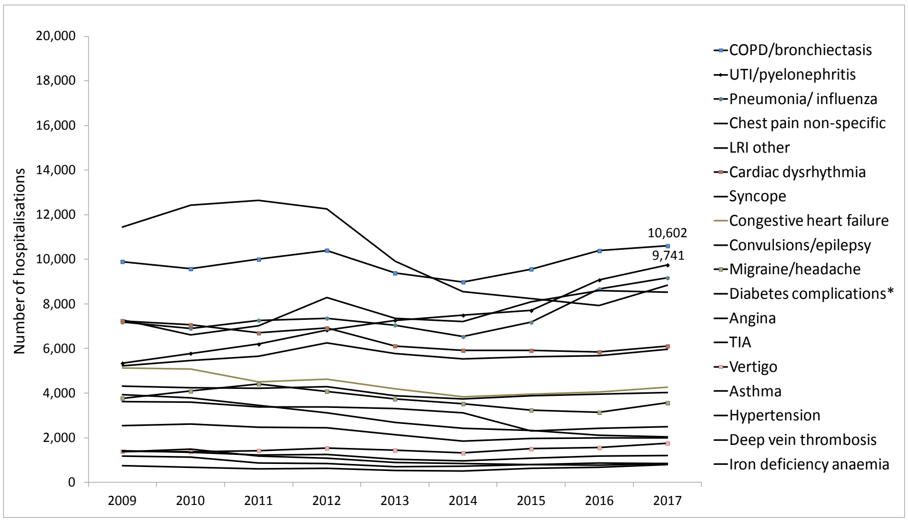
2. The numbers discharged directly from an AMAU were considerably greater than those admitted in-house from an AMAU.

3. Despite the increase in AMAU activity, the numbers admitted from a non-AMAU source for each of these conditions was higher than the numbers assessed in an AMAU. For example, in 2017, there were 10,602 emergency in-patient hospitalisations with a principal diagnosis of COPD/bronchiectasis admitted from a non-AMAU source, compared with 4,286 assessed in an AMAU (both admitted and discharged). COPD/bronchiectasis was the most common medical ambulatory care sensitive medical condition admitted from a non-AMAU source in that year, followed by UTI/pyelonephritis and pneumonia/influenza. For these three conditions there were significantly more hospitalisations from a non-AMAU source than were assessed in an AMAU (and either admitted or discharged home) (See Appendix 5.5 for data).

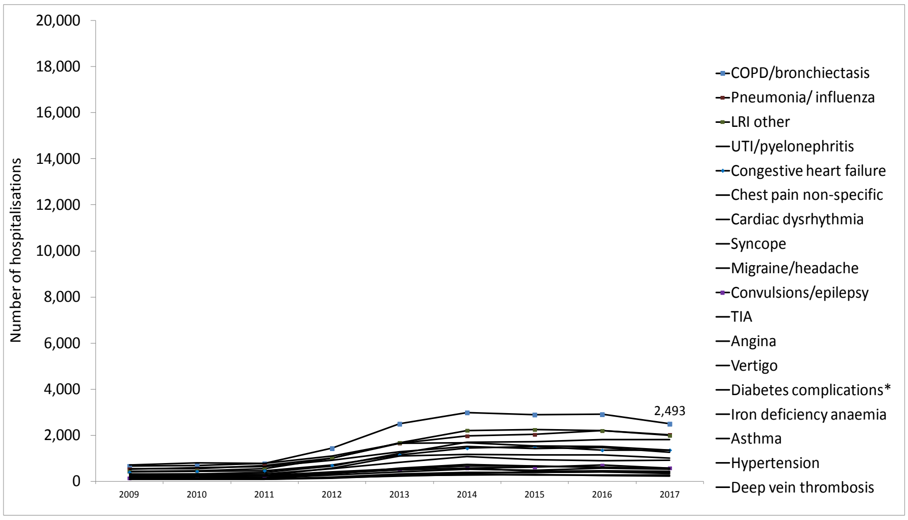
4. Chest pain non-specific was by far the most common condition assessed in an AMAU over this period, and these numbers increased significantly from 2012. Since then, each year, numbers assessed in an AMAU with this condition were approximately twice that of the next most common conditions assessed in the units - migraine/headache, LRI (other), cardiac dysrhythmia and COPD/bronchiectasis. The numbers admitted from a non-AMAU source for chest pain non-specific reduced significantly from 2012, accompanying the rise in AMAU assessment for this condition. Significant numbers of patients with this condition are still admitted from a non-AMAU source however.

Figure 5.9 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017

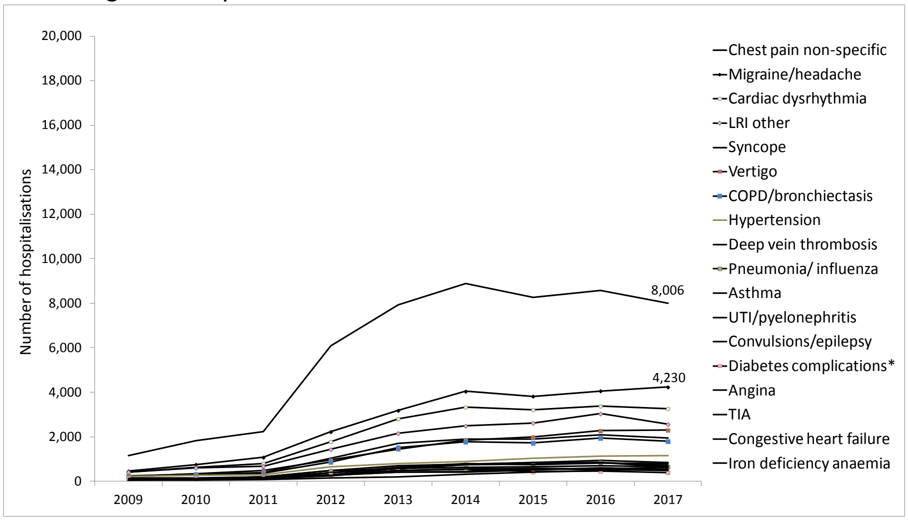
A. Admitted in-house from a non-AMAU source



B. Admitted in-house from an AMAU



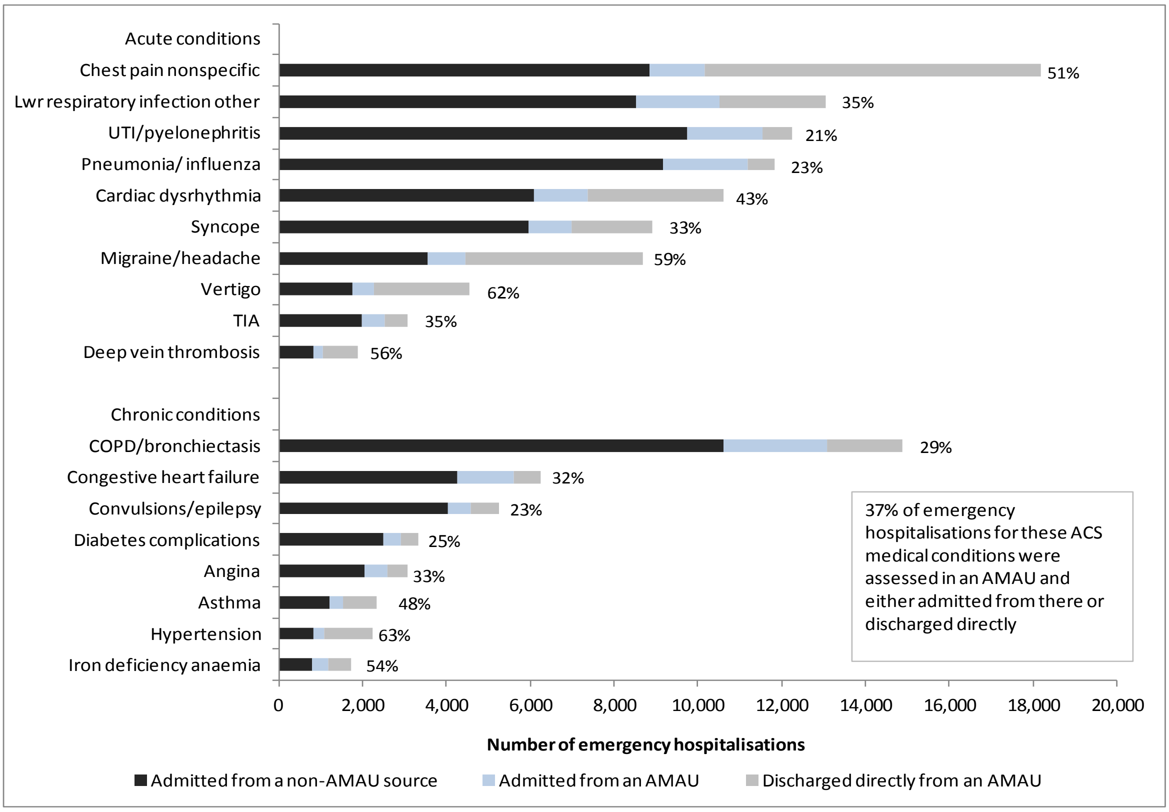
C. Discharged directly from an AMAU



* Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

The admission pathways of the emergency hospitalisations for each of these conditions in 2017 are presented in Figure 5.10. Across all emergency hospitalisations for all conditions combined, 37% were streamed through an AMAU. However this figure varied significantly by condition. Of emergency hospitalisations for chest pain non-specific, 51% were assessed in an AMAU (blue plus light grey), where the vast majority (86%) were discharged directly (light grey). At the other end of the spectrum, only 21% of the emergency hospitalisation for UTI/pyelonephritis in 2017 were streamed though an AMAU, the remaining 79% were admitted in-house from a non-AMAU source. Of those assessed in an AMAU, 72% were admitted onwards for further care, the remaining 28% were discharged directly (light grey).

Figure 5.10 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2017



Notes. The percentage figure represents the percentage of the emergency hospitalisations for that condition that was assessed in an AMAU and either admitted from there or discharged directly.
The scale of the x-axis differs across the age categories used in subsequent age-specific figures

5.3.2.2 Emergency hospitalisations for ambulatory care sensitive medical conditions, adults aged 16-44 years, 2009-2017

The number of emergency hospitalisations in this age category was low (Table 5.13). The numbers admitted from a non-AMAU source declined significantly between 2012 and 2017, while the numbers assessed in an AMAU increased. In 2017, there were almost as many episodes assessed in an AMAU (line B+ line C) as were admitted from a non-AMAU source (line A). The vast majority of those assessed in an AMAU in this age category were discharged directly. For example, in 2017, 81% of those assessed in an AMAU within this category of conditions were discharged directly. The number of emergency hospitalisations admitted in-house reduced between 2012 to 2014, but increase marginally in 2016 and 2017 (row E). The vast majority of those admitted in-house, were admitted from a non-AMAU source. For example in 2017, this figure was 83% (Line A/Line E).

Table 5.13 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 16-44 years

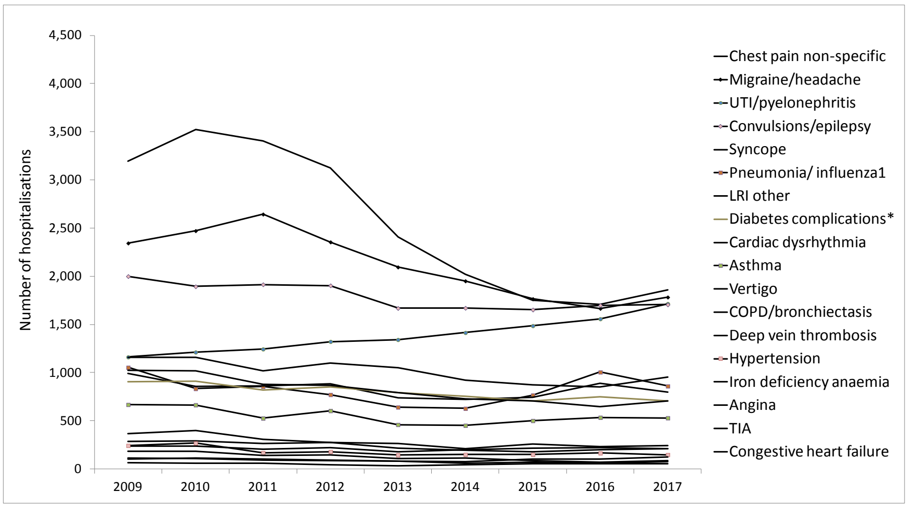
	2009	2010	2011	2012	2013	2014	2015	2016	2017
A. Admitted from a non-AMAU source	16,105 (87)	16,206 (84)	15,504 (80)	15,106 (65)	13,096 (53)	12,316 (47)	12,058 (49)	12,413 (48)	12,764 (50)
B. Admitted from an AMAU	860 (5)	935 (5)	894 (5)	1,566 (7)	2,347 (9)	2,730 (11)	2,572 (10)	2,658 (10)	2,374 (9)
C. Discharged from an AMAU	1,570 (8)	2,132 (11)	2,867 (15)	6,683 (29)	9,462 (38)	10,922 (42)	10,180 (41)	10,900 (42)	10,301 (40)
D. Total ACSMC Hospitalisations	18,535	19,273	19,265	23,355	24,905	25,968	24,810	25,971	25,439
E. Total ACSMC admit in-house (A) +(B)	16,965	17,141	16,398	16,672	15,443	15,046	14,630	15,071	15,138

Notes. The percentage represents the proportion of total ACSMCs admitted on that pathway in that year.

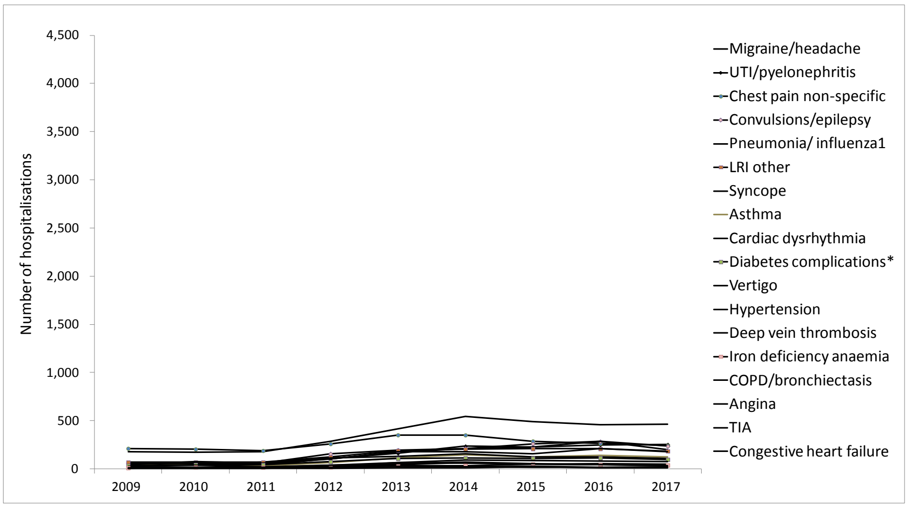
The admission pathways of these hospitalisations are presented in Figure 5.11. Two conditions had significant numbers discharged directly from an AMAU: chest pain non-specific and migraine/acute headache (graph C). These numbers increased quite significantly from 2012, and reached a plateau in 2014. Accompanying this increase in AMAU activity for these conditions was a decrease in the numbers admitted from a non-AMAU source. It is difficult to decipher patterns in the other conditions, though the increase in the number admitted in-house from a non-AMAU source with a principal diagnosis of UTI/pyelonephritis is clear.

Figure 5.11 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 16-44 years

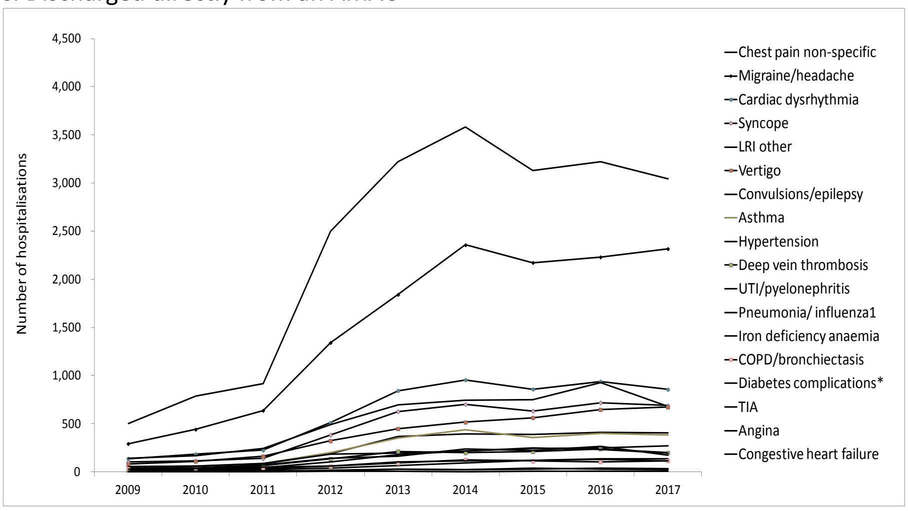
A. Admitted in-house from a non-AMAU source



B. Admitted in-house from an AMAU

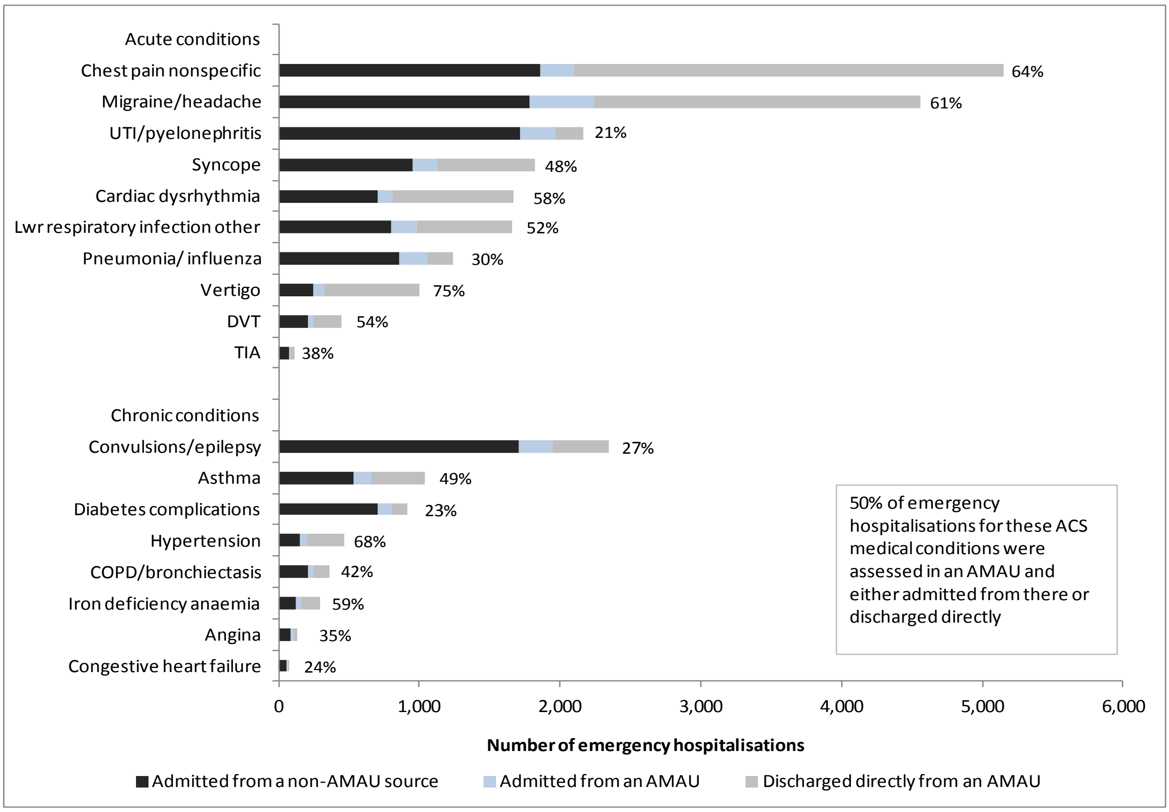


C. Discharged directly from an AMAU



The breakdown of the admission pathways of these hospitalisations in 2017 is presented in Figure 5.12. As with the total population, the two conditions with the lowest and highest proportion of their emergency hospitalisations assessed in an AMAU were UTI/pyelonephritis and chest pain non-specific, with a figure of 21% and 64% respectively. Of emergency hospitalisation for chest pain non-specific, 64% were assessed in an AMAU, where the vast majority (93%) were discharged directly. For UTI/pyelonephritis only 21% of emergency hospitalisations were assessed in an AMAU and of these only 43% were discharged directly.

Figure 5.12 Admission pathways of emergency hospitalisations for acute ambulatory care sensitive medical conditions, 2017, 16-44 years



Notes. The percentage figure represents the percentage of the emergency hospitalisations for that condition that was assessed in an AMAU and either admitted from there or discharged directly.
The scale of the x-axis differs across the age categories

5.3.2.3 Emergency hospitalisations for ambulatory care sensitive medical conditions, adults aged 45-64 years, 2009-2017

The number of emergency hospitalisations for ambulatory care sensitive conditions in this age category increased significantly during this period (Table 5.14). This rise however, was accounted for by the increase in numbers discharged directly from an AMAU. The numbers admitted from a non-AMAU source declined marginally during this period, with the growth in AMAU activity, especially in 2013-2015. These non-AMAU admissions increased again in 2016 and 2017. The number admitted in-house (line E) remained relatively stable over this period, with a slight reduction observed in 2013-2015. The vast majority of those admitted in-house over this period did so from a non-AMAU source. In 2017, this figure was 83% (Line A/Line E).

Table 5.14 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 45-64 years

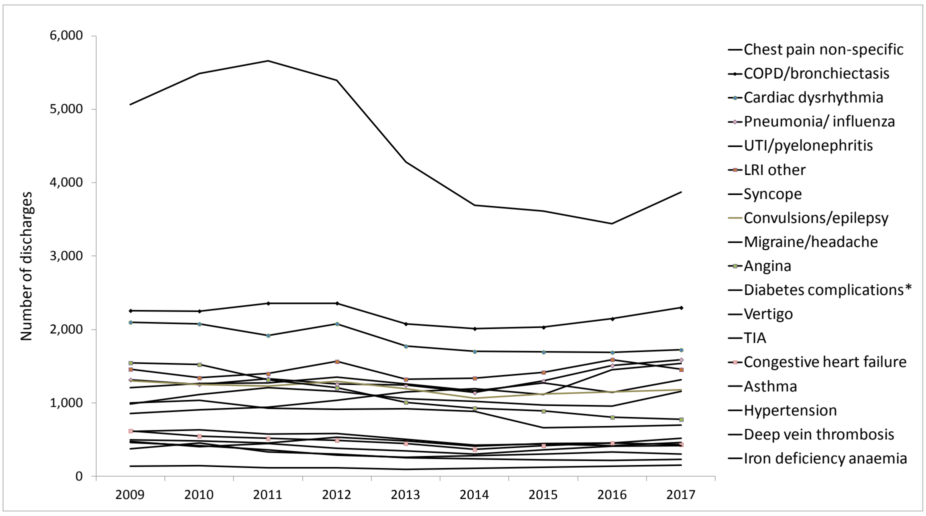
	2009	2010	2011	2012	2013	2014	2015	2016	2017
A. Admitted from a non-AMAU source	22,255 (89)	22,583 (86)	22,341 (84)	22,298 (72)	19,659 (60)	18,252 (55)	18,378 (56)	18,975 (55)	20,108 (58)
B. Admitted from an AMAU	1,380 (6)	1,516 (6)	1,613 (6)	2,579 (8)	4,021 (12)	4,741 (14)	4,445 (13)	4,605 (13)	4,095 (12)
C. Discharged from an AMAU	1,337 (5)	2,038 (8)	2,513 (9)	6,180 (20)	8,997 (28)	10,223 (31)	10,233 (31)	11,106 (32)	10,386 (30)
D. Total ACSMC Hospitalisations	24,972	26,137	26,467	31,057	32,677	33,216	33,056	34,686	34,589
E. Total ACSMC admit in-house (A) +(B)	23,635	24,099	23,954	24,877	23,680	22,993	22,823	23,580	24,203

Note. The percentage represents the proportion of total ACSMCs admitted on that pathway in that year.

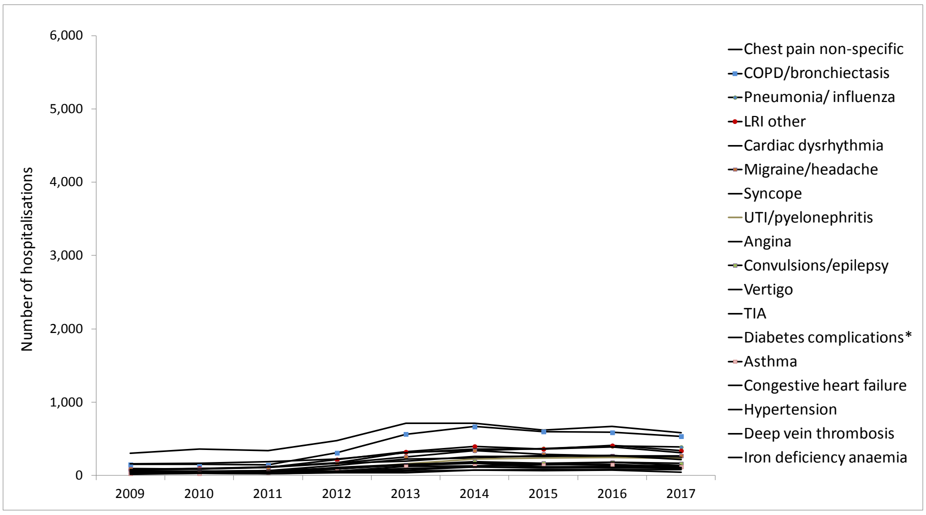
The admission pathways of these emergency hospitalisations are presented in Figure 5.13. Again, the number of emergency hospitalisations for chest pain non-specific that were discharged directly from an AMAU was quite substantial (Graph C). These numbers increased dramatically from 2012, plateaued in 2014 (as seen with other conditions in this age category) and fell slightly in 2017. Chest pain non-specific was also the most common condition admitted from a non-AMAU source (Graph A), and from an AMAU (Graph B), though the numbers admitted from an AMAU with this condition were minimal. There was a dramatic decrease in the admissions on the non-AMAU pathway in 2012, similar to the rise seen in AMAU-discharge activity during this period, though not to the same extent. Over this period, the number that were discharged directly from a AMAU with chest pain non-specific was approximately 3 times that of the next most common conditions discharged directly - migraine/headache, cardiac dysrhythmia.

Figure 5.13 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 45-64 years

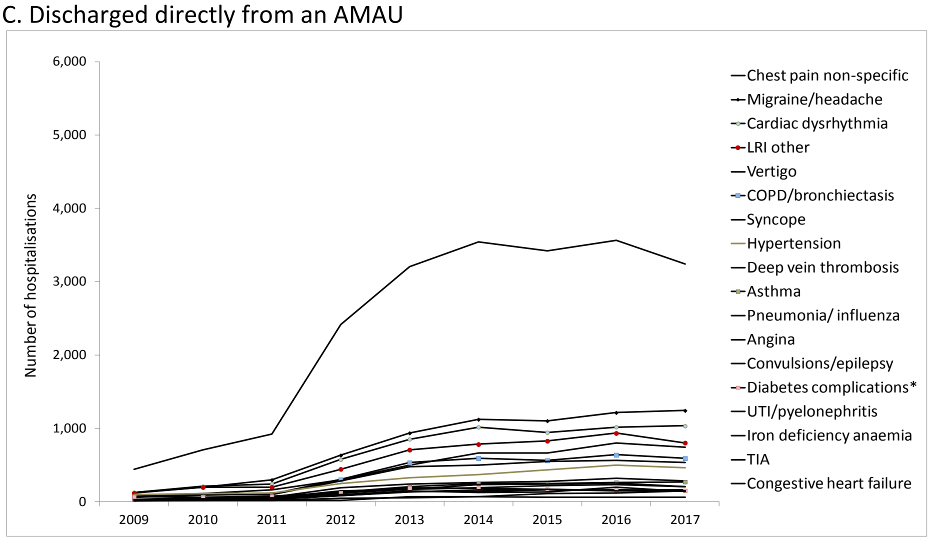
A. Admitted in-house from a non-AMAU source



B. Admitted in-house from an AMAU

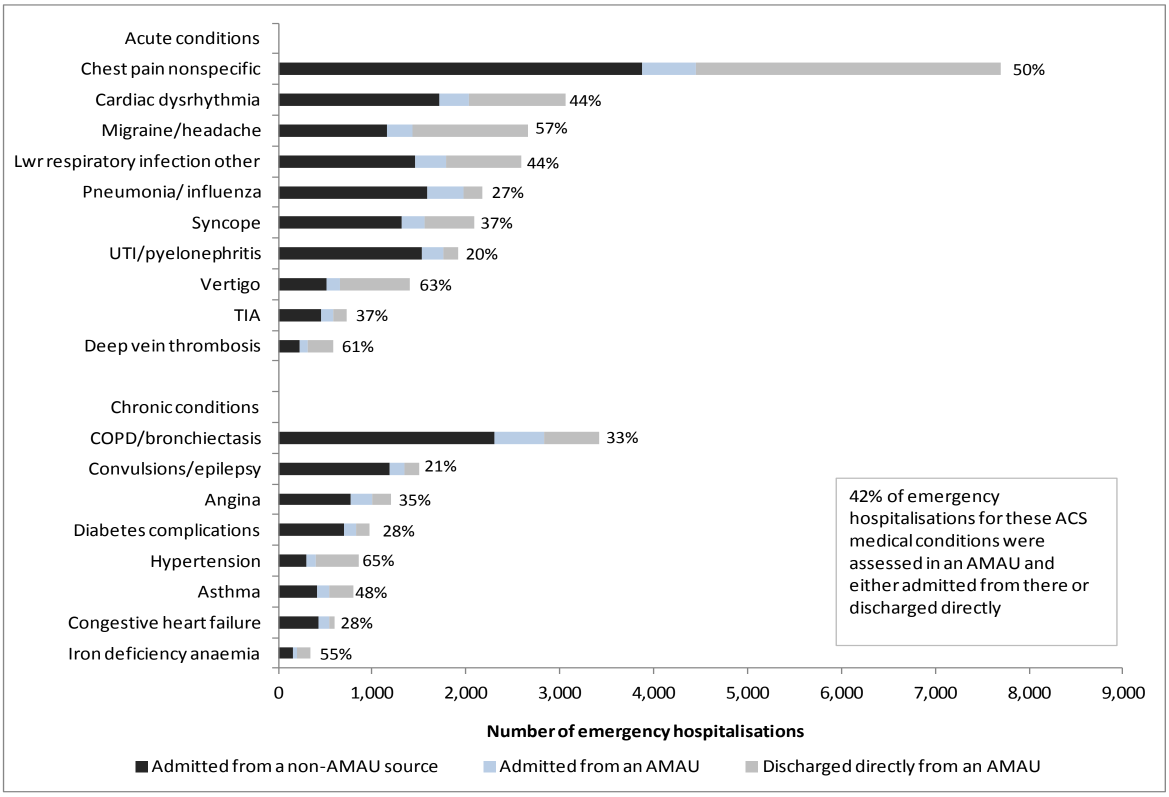


C. Discharged directly from an AMAU



The breakdown of the admission pathways of these hospitalisations in 2017 is presented in Figure 5.14. Across total emergency hospitalisations for these conditions, 42% were streamed through an AMAU. The two conditions with the lowest and highest proportion of their emergency hospitalisations assessed in an AMAU were UTI/pyelonephritis and hypertension with a figure of 20% and 65% respectively, though the numbers of hospitalisations for hypertension overall was quite low. As with the younger age category, chest pain non-specific was the most common ambulatory care sensitive condition admitted as an emergency in 2017. Of those hospitalisations, 50% were assessed in an AMAU, where the vast majority (85%) were discharged directly. For UTI/pyelonephritis only 20% of emergency hospitalisations were assessed in an AMAU and of these 39% were discharged directly.

Figure 5.14 Admission pathways of emergency hospitalisations for acute ambulatory care sensitive medical conditions, 2017, 45-64 years



Notes. The percentage figure represents the percentage of the emergency hospitalisations for that condition that was assessed in an AMAU and either admitted from there or discharged directly. The scale of the x-axis differs across the age categories.

5.3.2.4 Emergency hospitalisations for ambulatory care sensitive medical conditions, adults aged 65-84 years, 2009-2017

The number of emergency hospitalisations for ambulatory care sensitive conditions in this age category was the largest of all age categories (Table 5.15). There was a significant rise in the total number of hospitalisations for these conditions over the period. While some of this can be attributed to same day discharges from an AMAU there was also an increase in the numbers admitted in-house (line E). In contrast with the younger two age categories, where the majority of those assessed in an AMAU were discharged directly, the number of hospitalisations that were admitted from an AMAU were similar to those discharged from there. As with the other age categories, the majority of those admitted in-house were admitted from a non-AMAU source. In 2017, this figure was 81% (Line A/Line E).

Table 5.15 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 65-84 years

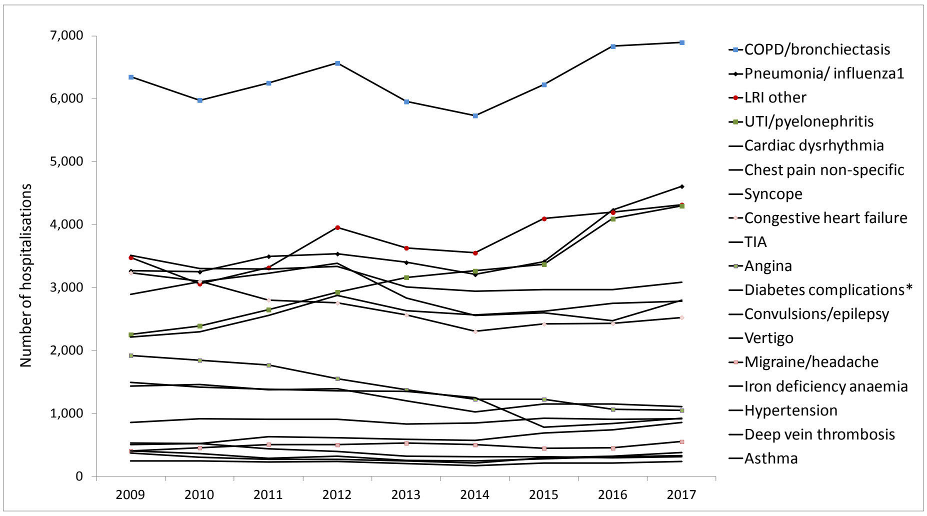
	2009	2010	2011	2012	2013	2014	2015	2016	2017
A. Admitted from a non-AMAU source	35,341 (91)	34,493 (89)	35,374 (88)	36,876 (80)	34,073 (69)	32,474 (64)	34,015 (65)	36,244 (65)	37,969 (68)
B. Admitted from an AMAU	2,404 (6)	2,575 (7)	2,798 (7)	4,737 (10)	7,839 (16)	9,634 (19)	9,481 (18)	9,477 (17)	8,654 (15)
C. Discharged from an AMAU	1,156 (3)	1,630 (4)	2,045 (5)	4,743 (10)	7,131 (15)	8,627 (17)	9,044 (17)	9,878 (18)	9,456 (17)
D. Total ACSMC Hospitalisations	38,901	38,698	40,217	46,356	49,043	50,735	52,540	55,599	56,079
E. Total ACSMC admit in-house (A) +(B)	37,745	37,068	38,172	41,613	41,912	42,108	43,496	45,721	46,623

Note. The percentage represents the proportion of total ACSMCs admitted on that pathway in that year.

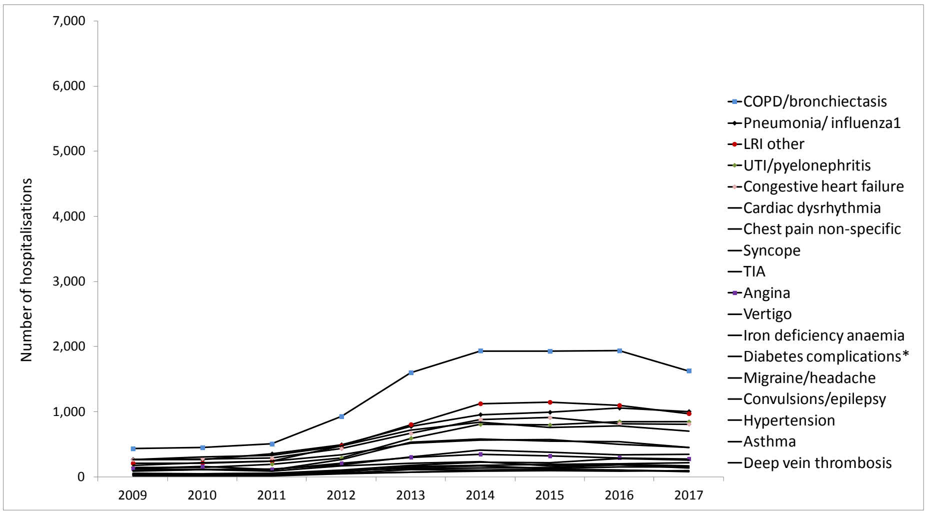
The patterns in this age category are quite different to those in the two younger age categories, where chest pain non-specific was the most common condition admitted as an emergency. In this age category, COPD/bronchiectasis was by far the most common condition admitted as an emergency to hospital, on both the non-AMAU and AMAU-admit pathways. Chest pain non-specific remained the most common condition discharged directly from an AMAU. While the numbers admitted with COPD/bronchiectasis from a non-AMAU source declined from 2012 to 2014 as AMAU assessments increased, these numbers increased steadily from 2014. Across all emergency hospitalisations for these medical conditions in 2017 in this age category, 32% were streamed through an AMAU (Figure 5.16). The high number of emergency hospitalisations for COPD/bronchiectasis in this age category is clearly visible from the graph, with only 27% of these being assessed in an AMAU; the remaining 63% were admitted in-house from a non-AMAU source.

Figure 5.15 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 65-84 years

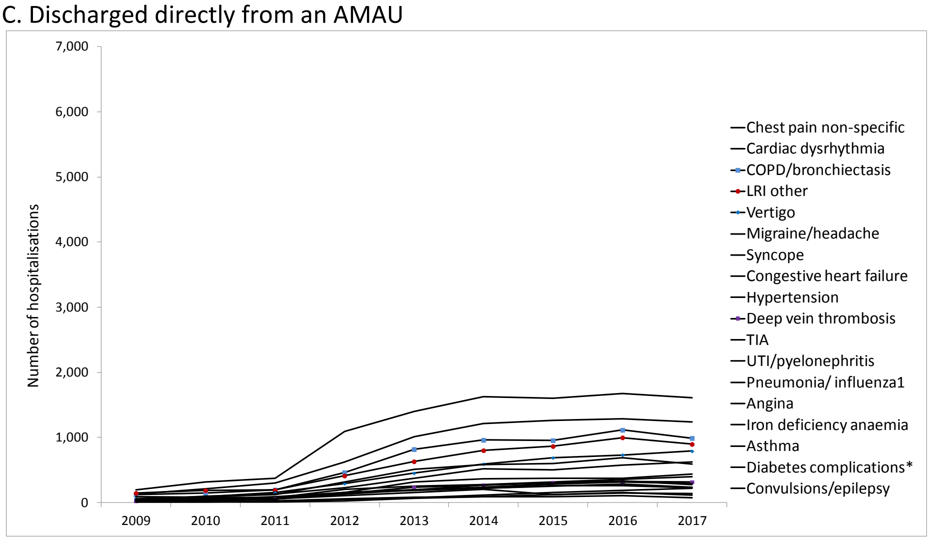
A. Admitted in-house from a non-AMAU source



B. Admitted in-house from an AMAU

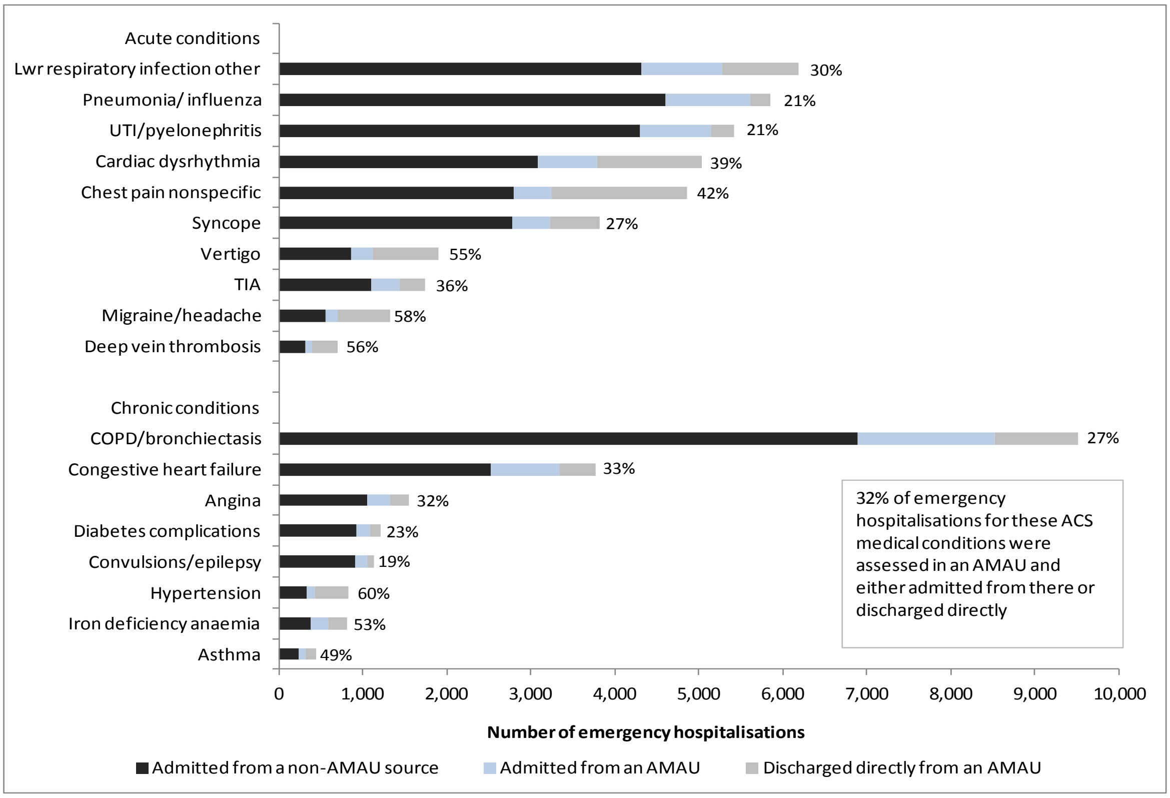


C. Discharged directly from an AMAU



The breakdown of the admission pathways of these hospitalisations in 2017 is presented in Figure 5.16. Across total emergency hospitalisations for these conditions, 32% were streamed through an AMAU. Chest pain non-specific, which was the most common condition admitted as an emergency in the two younger age categories, was ranked 6th in terms of the number of emergency hospitalisations in this age category behind COPD/bronchiectasis, LRI (other), pneumonia/influenza, UTI/pyelonephritis, and cardiac dysrhythmia. Convulsions and epilepsy, UTI/pyelonephritis, pneumonia/influenza had the lowest proportion of their emergency hospitalisations assessed in an AMAU with 19%, 21% and 21% respectively.

Figure 5.16 Admission pathways of emergency hospitalisations for acute ambulatory care sensitive medical conditions, 2017, 65-84 years



5.3.2.5 Emergency hospitalisations for ambulatory care sensitive medical conditions, adults aged 85+ years, 2009-2017

The number of emergency hospitalisations for ambulatory care sensitive conditions in this age category was low, but increased steadily over the period (Table 5.16). This rise was also observed in the numbers of emergency hospitalisations that were admitted in-house for further care.

Those assessed in an AMAU and discharged directly accounted for only 8% of hospitalisations, compared with the youngest age category where 40% of emergency hospitalisations for these conditions in that age category were discharged directly from an AMAU.

As with the other age categories, the majority of those admitted in-house were admitted via a non-AMAU source. In 2017, this figure was 81% (Line A/Line E), the same figure as the 65-84 year age category.

Table 5.16 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 85+ years

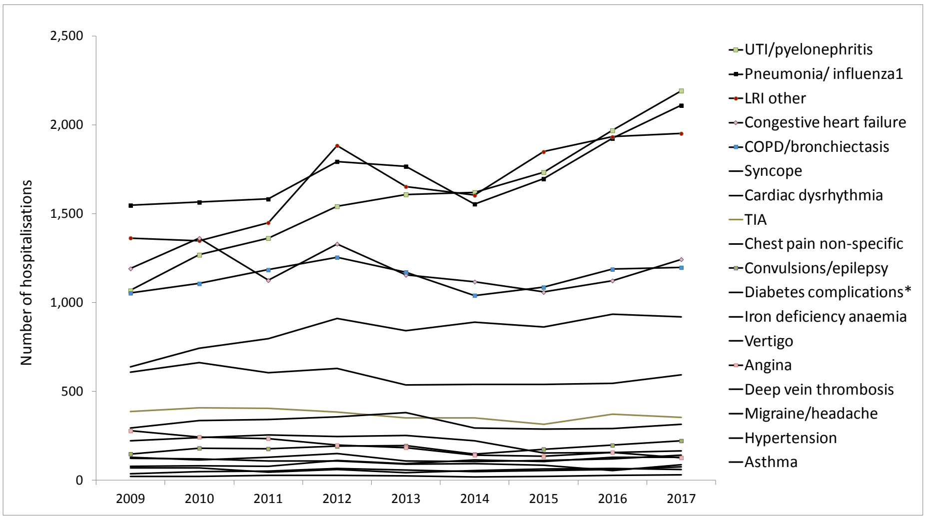
	2009	2010	2011	2012	2013	2014	2015	2016	2017
A. Admitted from a non-AMAU source	9,251 (92)	9,907 (91)	9,952 (90)	11,238 (85)	10,503 (76)	9,948 (71)	10,322 (70)	11,240 (73)	11,905 (74)
B. Admitted from an AMAU	613 (6)	689 (6)	824 (7)	1,315 (10)	2,346 (17)	2,882 (21)	3,009 (21)	2,927 (19)	2,818 (18)
C. Discharged from an AMAU	156 (2)	266 (2)	279 (3)	604 (5)	897 (7)	1,221 (9)	1,329 (9)	1,310 (8)	1,314 (8)
D. Total ACSMC Hospitalisations	10,020	10,862	11,055	13,157	13,746	14,051	14,660	15,477	16,037
E. Total ACSMC admit in-house (A) +(B)	9,864	10,596	10,776	12,553	12,849	12,830	13,331	14,167	14,723

Note. The percentage represents the proportion of total ACSMCs admitted on that pathway in that year.

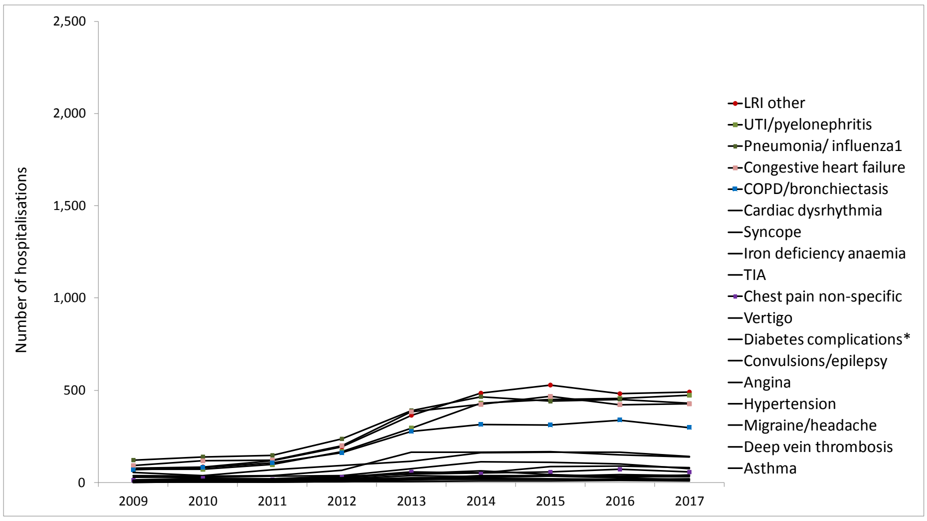
The admission pathways of these emergency hospitalisations are presented in Figure 5.17. The burden of UTI/pyelonephritis, pneumonia/influenza and LRI (other) on this age category is clearly visible from the graphs. The numbers assessed in an AMAU (and either admitted or discharged) for these three conditions were significantly less that those admitted from a non-AMAU source. Admissions from a non-AMAU source increased significantly since 2014, after an initial reduction in 2012-2014, as AMAU activity increased. However since 2014, the numbers assessed in an AMAU for these conditions have remained relatively stable.

Figure 5.17 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017, 85+ years

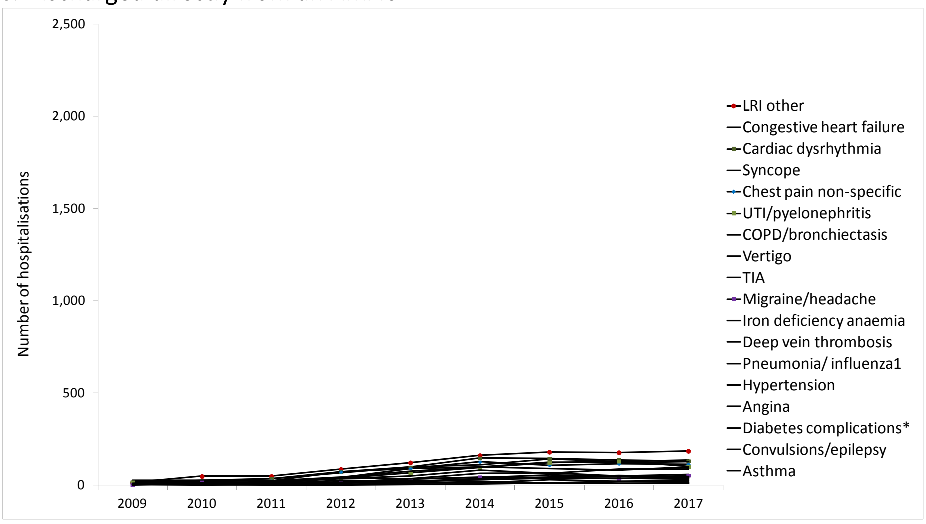
A. Admitted in-house from a non-AMAU source



B. Admitted in-house from an AMAU

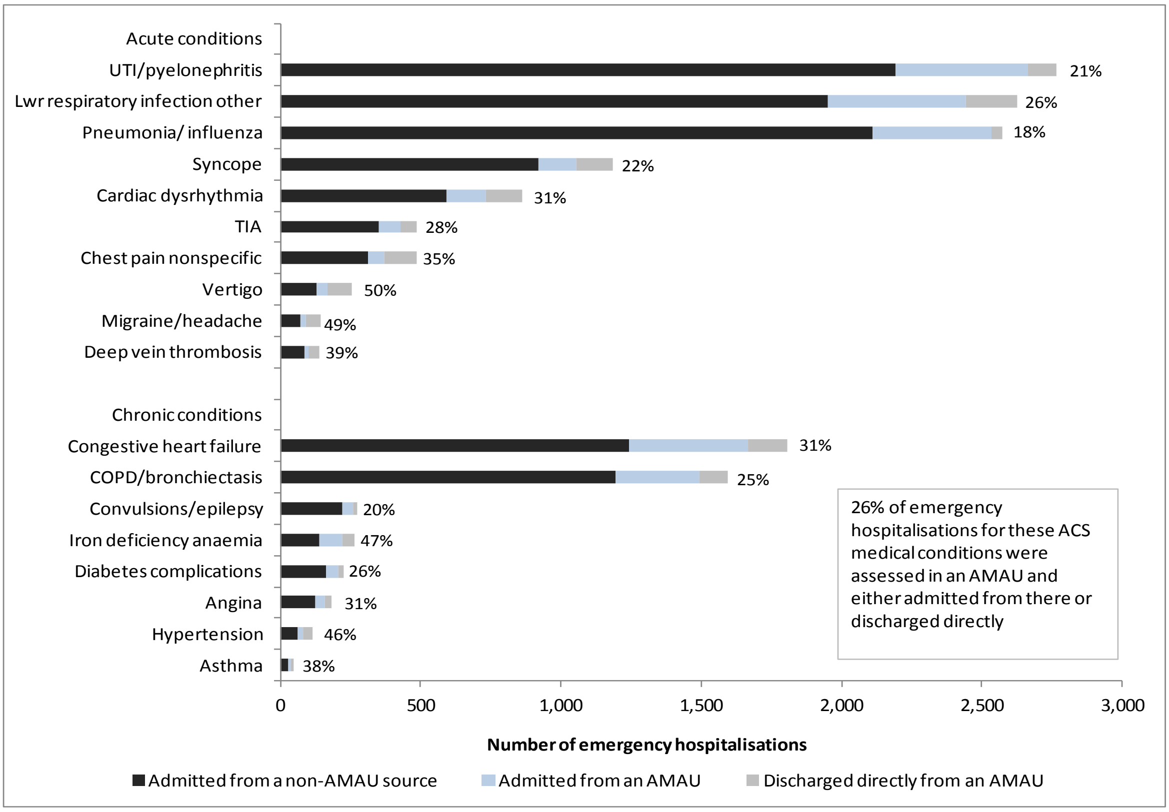


C. Discharged directly from an AMAU



Across all emergency hospitalisations for these conditions, 26% were streamed through an AMAU in 2017 (Figure 5.18). The high number of emergency hospitalisations for the three acute conditions discussed above is clearly visible from the graph, as is the similarity in each of their numbers. UTI/pyelonephritis was the condition which had the highest number of emergency hospitalisations that were admitted in-house for further care (black plus blue), the majority admitted from a non-AMAU source (79%). In that condition, only 21% of hospitalisations were assessed in an AMAU, and of those 82% were admitted in-house for further care. With pneumonia, only 18% were assessed in an AMAU (blue and light grey) and of those the vast majority (93%) were admitted for further care. Hospitalisations for the chronic conditions COPD/bronchiectasis and CHF were much less common in this age category than the acute conditions mentioned above.

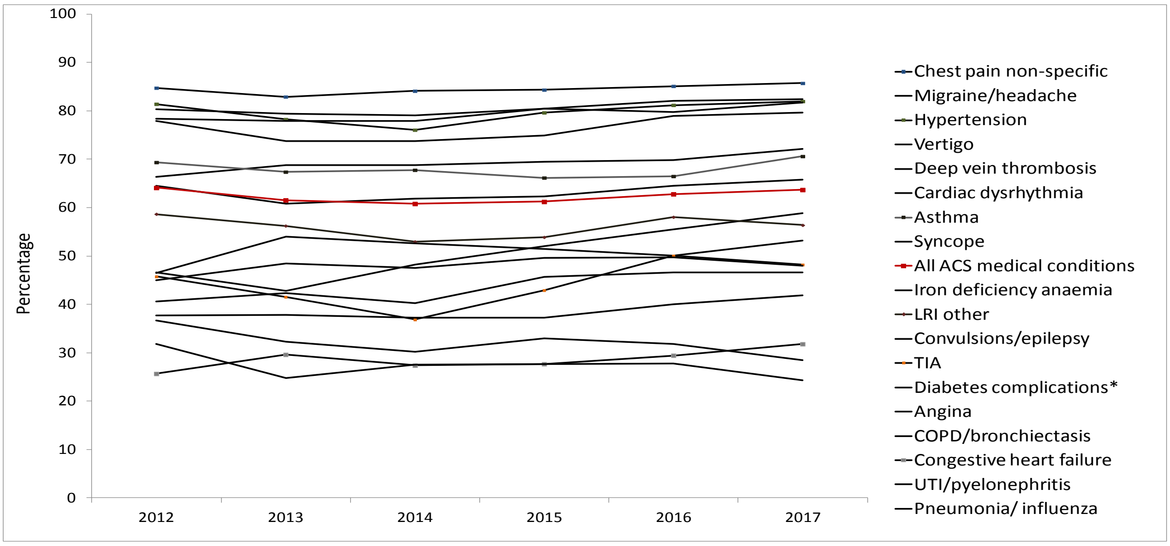
Figure 5.18 Admission pathways of emergency hospitalisations for acute ambulatory care sensitive medical conditions, 2017, 85+ years



5.3.2.6 Age and condition specific trajectory of ambulatory care sensitive medical conditions assessed in an AMAU

The proportion of episodes assessed in an AMAU that were discharged directly between 2012 and 2017 is presented for each of these conditions in Figure 5.19. Each year, approximately 63% of episodes assessed in an AMAU with these conditions as a totality were discharged directly (red line). This figure varied significantly by condition however. Of episodes with a principal diagnosis of chest pain non-specific assessed in an AMAU, 86% were discharged directly, while only 24% of episodes with a principal diagnosis of pneumonia/influenza were; the remaining 76% of these were admitted onwards for further care. Those assessed in an AMAU with a principal diagnosis of migraine/headache, hypertension, vertigo and deep vein thrombosis were highly likely to be discharged directly. Conditions with the least likelihood of discharge were pneumonia/influenza, UTI/pyelonephritis and congestive heart failure with discharge-direct rates of 24%, 28% and 32% respectively in 2017.

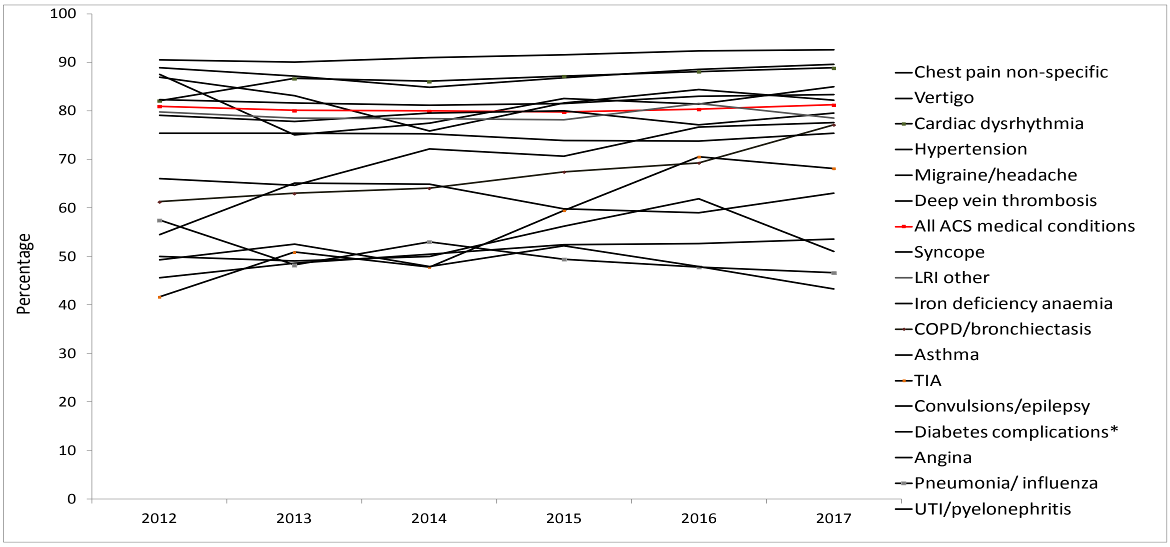
Figure 5.19 Proportion of emergency hospitalisations for ambulatory care sensitive medical conditions assessed in an AMAU that were discharged directly, 2012-2017



Note. Data from 2012-2017 only, given incomplete data capture prior to 2012.

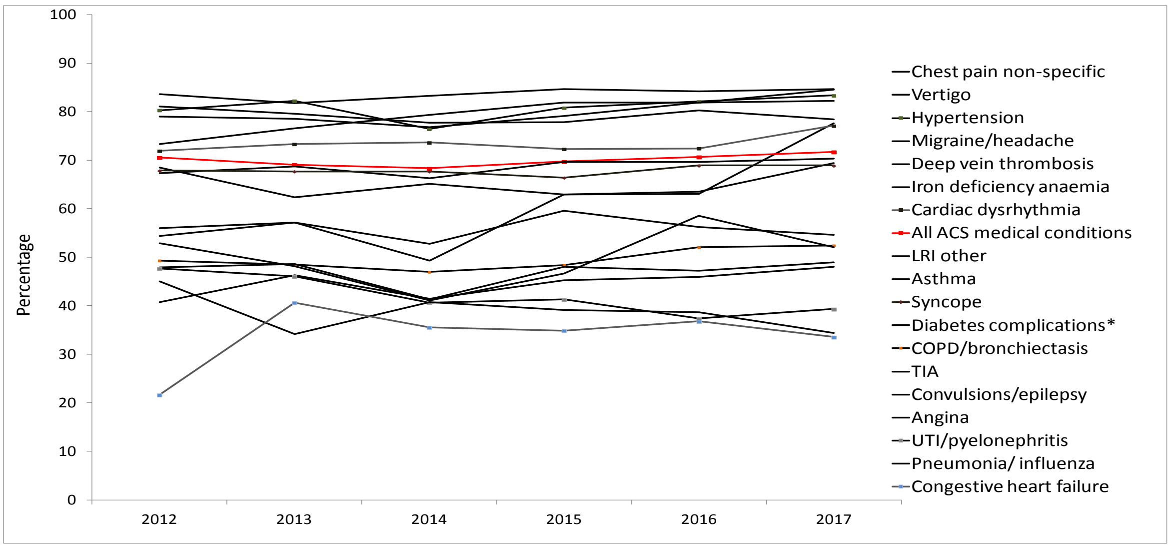
In the youngest age category (16-44 years), the vast majority of episodes that were assessed in an AMAU for these conditions were discharged directly (Figure 5.20); approximately 81% each year. Again, this figure hides considerable variation across conditions in the propensity of an AMAU to discharge directly. The vast majority of episodes with a principal diagnosis of chest pain non-specific, vertigo, cardiac dysrhythmia and hypertension assessed in an AMAU over this period in this age category were discharged directly. Conditions with a lower likelihood of discharge directly upon assessment in an AMAU were pneumonia/influenza (47% in 2017) and UTI/pyelonephritis (43%).

Figure 5.20 Proportion of emergency hospitalisations assessed in an AMAU that were discharged directly, 2012-2017, 16-44 years



In the 45-64 years age category, the proportion of episodes assessed in an AMAU that were discharged directly was also higher than that seen for all ages combined (approximately 72% each year) with this figure remained relatively stable between 2012 and 2017 (Figure 5.21). Chest pain, non-specific, vertigo, hypertension and migraine/headache were the conditions that were most likely to be discharged directly upon assessment in an AMAU. At the other end of the spectrum, patients with a principal diagnosis of UTI, pneumonia and congestive heart failure assessed in an AMAU were less likely to be discharged directly. In 2017, these figures were 39%, 34% and 34% respectively.

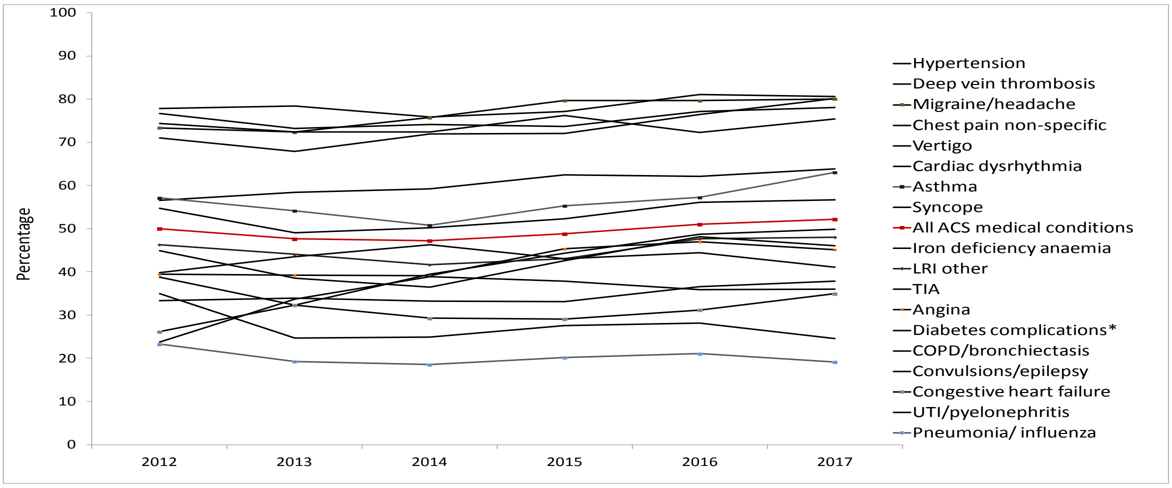
Figure 5.21 Proportion of emergency hospitalisations for ambulatory care sensitive medical conditions assessed in an AMAU that were discharged directly, 2012-2017, 45-64 years



In the 65-84 years age category, the proportion of those assessed in an AMAU discharged directly from there, was lower than those seen in the younger age categories (Figure 5.22).

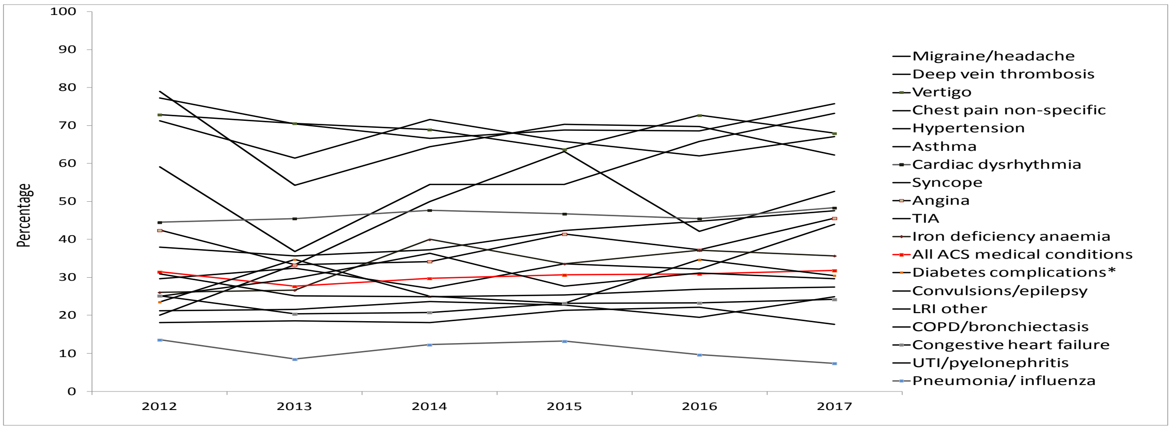
In 2017 this figure was 52% of episodes discharged directly, compared with 63% for all ages combined. As with the other age categories, those with a higher likelihood of discharge were hypertension (81% in 2017), deep vein thrombosis (80%), migraine/headache (80%), chest pain non-specific (78%) and vertigo (75%). Those with a lower likelihood of discharge directly upon assessment in an AMAU were congestive heart failure (35%), UTI/pyelonephritis (25%) and pneumonia/influenza (19%).

Figure 5.22 Proportion of emergency hospitalisations for ACS medical conditions assessed in an AMAU that were discharged directly, 2012-2017, 65-84 years



In the 85+ years age category, approximately 32% of episodes for these conditions assessed in an AMAU were discharged directly. Again, this propensity to discharge-directly from an AMAU varied considerably by condition. The condition that consistently had the lowest proportion of its AMAU assessments discharged directly over the years was pneumonia/influenza. In 2017, 7% of patients aged 85+ years, assessed in an AMAU with pneumonia/influenza were discharged directly; the remaining 93% were admitted onwards for further care. Other conditions in this age category with a low likelihood of discharge-direct upon admission to an AMAU were UTI/pyelonephritis (18% in 2017), congestive heart failure (24%), COPD/bronchiectasis (25%) and LRI (other) (27%).

Figure 5.23 Proportion of emergency hospitalisations for ambulatory care sensitive medical conditions assessed in an AMAU that were discharged directly, 2012-2017, 85+



The trajectory of those assessed in an AMAU for each of these conditions in 2017 is presented in Figure 5.24 for each age category, with the data provided in Table 5.17. It is apparent that some conditions regardless of age, had a higher propensity to be discharged directly once assessed in an AMAU. Migraine, deep vein thrombosis, vertigo and chest pain non-specific, all had discharge-direct rates above 65% in each age category. Others were quite age sensitive. For example, of those assessed in an AMAU with a principal diagnosis of LRI (other), 79% of those in the 16-44 years age category were discharged directly; by the 85+ age category this proportion had fallen to 27%. The three conditions with the lowest propensity to be discharged directly from an AMAU once assessed there, regardless of age, were congestive heart failure, urinary tract infection/pyelonephritis and pneumonia/ influenza. Of those assessed in an AMAU with pneumonia/influenza, 47% of those in the 16-44 years age category were discharged directly; by the 85+ age category this proportion had fallen to 7%. For UTIs/pyelonephritis, 43% of those assessed in an AMAU aged 16-44 years were discharged directly, by the age of 85+ years, this proportion had fallen to 18%.

Figure 5.24 Age-specific proportion of emergency hospitalisations for ambulatory care sensitive medical conditions assessed in an AMAU that were discharged directly, 2017

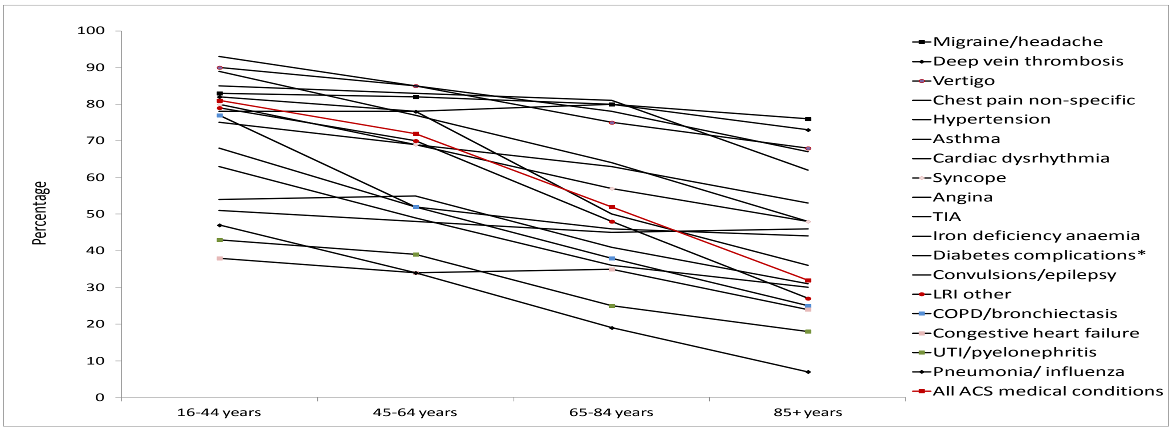


Table 5.17 Age-specific trajectories of emergency hospitalisations for ambulatory care sensitive medical conditions, 2017

	16-44 years			45-64 years			65-84 years			85+ years			All aged 16 years and over		
	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]
	N	N (%)[4]	N (%)[5]	N	N (%)[4]	N (%)[5]	N	N (%)[4]	N (%)[5]	N	N (%)[4]	N (%)[5]	N	N (%)[4]	N (%)[5]
Acute ambulatory care sensitive medical conditions															
Cardiac dysrhythmia	1,668	963 (58)	856 (89)	3,059	1,337 (44)	1,031 (77)	5,031	1,945 (39)	1,241 (64)	864	271 (31)	131 (48)	10,622	4,516 (43)	3,259 (72)
Chest pain ns	5,148	3,289 (64)	3,046 (93)	7,692	3,821 (50)	3,237 (85)	4,857	2,061 (42)	1,609 (78)	485	170 (35)	114 (67)	18,182	9,341 (51)	8,006 (86)
DVT	450	242 (54)	199 (82)	589	361 (61)	283 (78)	707	394 (56)	316 (80)	142	56 (39)	41 (73)	1,888	1,053 (56)	839 (80)
LRI (other)	1,662	862 (52)	677 (79)	2,593	1,138 (44)	801 (70)	6,182	1,866 (30)	897 (48)	2,626	675 (26)	185 (27)	13,063	4,541 (35)	2,560 (56)
Migraine/headache	4,562	2,779 (61)	2,317 (83)	2,664	1,509 (57)	1,241 (82)	1,324	773 (58)	619 (80)	144	70 (49)	53 (76)	8,694	5,131 (59)	4,230 (82)
Pneumonia/ influenz	1,235	375 (30)	175 (47)	2,179	590 (27)	203 (34)	5,848	1,239 (21)	237 (19)	2,571	462 (18)	34 (7)	11,833	2,666 (23)	649 (24)
Syncope	1,817	865 (48)	688 (80)	2,093	775 (37)	534 (69)	3,820	1,035 (27)	587 (57)	1,183	265 (22)	126 (48)	8,913	2,940 (33)	1,935 (66)
TIA	117	44 (38)	30 (68)	729	269 (37)	140 (52)	1,735	632 (36)	291 (46)	486	134 (28)	59 (44)	3,067	1,079 (35)	520 (48)
UTI/pyelonephritis	2,161	446 (21)	193 (43)	1,910	374 (20)	147 (39)	5,417	1,119 (21)	275 (25)	2,766	574 (21)	101 (18)	12,254	2,513 (21)	716 (28)
Vertigo	996	751 (75)	673 (90)	1,395	877 (63)	742 (85)	1,906	1,048 (55)	790 (75)	256	128 (50)	87 (68)	4,553	2,804 (62)	2,292 (82)
Chronic ambulatory care sensitive medical conditions															
Angina	136	47 (35)	24 (51)	1,196	421 (35)	202 (48)	1,547	498 (32)	225 (45)	184	57 (31)	26 (46)	3,063	1,023 (33)	477 (47)
Asthma	1,039	509	384	803	386	268	453	222	140	50	19	10	2,345	1,136	802

	16-44 years			45-64 years			65-84 years			85+ years			All aged 16 years and over		
	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]	Total[1]	AMAU Assessed[2]	Dis-charged from AMAU[3]
		(49)	(75)		(48)	(69)		(49)	(63)		(38)	(53)		(48)	(71)
COPD/bronchiectasis	359	149 (42)	115 (77)	3,423	1,125 (33)	590 (52)	9,512	2,615 (27)	989 (38)	1,594	397 (25)	99 (25)	14,888	4,286 (29)	1,793 (42)
CHF	68	16 (24)	6 (38)	599	167 (28)	56 (34)	3,768	1,242 (33)	434 (35)	1,805	562 (31)	136 (24)	6,240	1,987 (32)	632 (32)
Convulsions/epilepsy	2,345	639 (27)	403 (63)	1,498	317 (21)	155 (49)	1,131	214 (19)	77 (36)	276	54 (20)	16 (30)	5,250	1,224 (23)	651 (53)
Diabetes complics	918	211 (23)	113 (54)	971	273 (28)	149 (55)	1,206	280 (23)	115 (41)	224	59 (26)	18 (31)	3,319	823 (25)	395 (48)
Hypertension	462	314 (68)	267 (85)	854	553 (65)	461 (83)	823	494 (60)	398 (81)	114	53 (46)	33 (62)	2,253	1,414 (63)	1,159 (82)
Iron def. anaemia	296	174 (59)	135 (78)	342	188 (55)	146 (78)	812	433 (53)	216 (50)	267	126 (47)	45 (36)	1,717	921 (54)	542 (59)
Total ACSMC hospitalisations	25,439	12,675 (50)	10,301 (81)	34,589	14,481 (42)	10,386 (72)	56,079	18,110 (32)	9,456 (52)	16,037	4,132 (26)	1,314 (32)	132,144	49,398 (37)	31,457 (64)

Notes.
1. Total number of emergency hospitalisations, including all those admitted from a non-AMAU source, those admitted from an AMAU and those discharged directly from an AMAU.
2. Number of emergency hospitalisations that were assessed in an AMAU (proportion of total emergency hospitalisations that were assessed in an AMAU).
3. Number of emergency hospitalisations that were discharged directly from an AMAU (proportion of AMAU assessed emergency hospitalisations that were discharged directly.
4. This percentage represents the proportion of total hospitalisations for that condition in that age category that were assessed in an AMAU.
5. This percentage represents the proportion of hospitalisations that were assessed in an AMAU for that condition in that age category, that were discharged directly.

Abbreviations. ACSMC: Ambulatory care sensitive medical condition.

5.4 Chapter summary

This chapter provided a comprehensive account of hospitalisations for medical conditions in between 2009 and 2017, and the role the AMAUs played in that activity. The key findings are summarised here.

Utilisations of the units increased rapidly from 2012 but reached a plateau mid 2014

There was a rapid increase in AMAU activity from 2012 until mid 2014, whereupon activity in the AMAUs reached a plateau. ED-admitted hospitalisations decreased from January 2012 until mid-2014, as activity in the AMAUs increased. From mid-2014 onwards admissions from the EDs increased, and activity in the AMAUs reached a plateau and declined marginally in 2017.

The majority of patients with medical conditions that are admitted in-house as an emergency are admitted on a non-AMAU pathway

In 2017, of total emergency hospitalisations for medical conditions (N=257,270), 36% were streamed through an AMAU; the remaining 64% of hospitalisations were admitted in-house from an ED (57%) or from a sourced termed Other/Unknown (7%). Of those admitted in-house or to a SSW, 82% were admitted from a non-AMAU source.

In 2017, almost three quarters (72%) of all bed days used by emergency hospitalisations for medical conditions were accounted for by admissions from an ED. Hospitalisations assessed in an AMAU accounted for 18% of medical emergency bed days and those admitted from a source termed Other/Unknown for a further 10%.

The AMAUs discharge directly (the same day) significantly more medical patients than they admit to an in-patient bed in-house or an SSW. Since 2012 - the year for which there has been complete data capture in the AMAUs - almost two-thirds of patients assessed in an AMAU each year, have their full episode of care delivered there and are discharged directly. The remaining third are those that are admitted to an in-patient bed in-house or to an SSW. Hence, the numbers of medical patients that commence their journey in an AMAU and are admitted onwards for further care is small in comparison to the numbers that are admitted through the non-AMAU pathway.

Characteristics of emergency hospitalisations for medical conditions on the different admission pathways appear similar, though no data exists on acuity and complexity

In 2017, there were 257,270 emergency hospitalisations for medical conditions. The mean age of these hospitalisations was 62 years (SD. 19.5); 54% were ≥65 years and 12% were aged ≥85 years. There was little difference in the characteristics of those admitted in-house from a non-AMAU source to those admitted in-house (or to an SSW) from an AMAU, while those that were assessed in the AMAU and discharged directly were younger. The lack of data on disease severity prevents drawing inference on whether the acuity of the patients assessed in the AMAUs was similar to those admitted from the ED. The most notable difference between the admission pathways was the volume of patients on the different pathways, with the majority of medical emergency hospitalisations being admitted from a non-AMAU source, without accessing an AMAU.

Twenty five conditions account for almost two thirds of emergency hospitalisations for medical conditions

The top 25 medical conditions admitted as an emergency in 2017, accounted for approximately 63% of all emergency hospitalisations for medical conditions in 2017. Chest pain non-specific was the most common condition, followed by COPD/bronchiectasis, LRI (other), pneumonia-non TB/STD and urinary tract infection. Pneumonia non-TB/STD accounted for the largest number of bed days used by the 25 conditions, followed by COPD/bronchiectasis, urinary tract infection and lower respiratory infection (other). Bed days used by the three respiratory conditions alone accounted for 19% of total emergency medical beds in 2017. Chest pain non-specific, the most common medical condition admitted as an emergency to hospital, accounted for significantly fewer bed days, a reflection of shorter lengths of stay.

There was significant variation across the hospitals in term of the utilisation of their AMAU and discharge-direct rates

Some hospitals had a significant proportion of their emergency hospitalisations for medical conditions streamed through their AMAU, while others had significantly less AMAU activity. There was considerable variation month-on-month *within* hospitals in terms of this utilisation. This was most pronounced in the model 3 hospitals, but was also present in model 2 and model 4 hospitals. Several hospitals had consistently high utilisation of their units, while others had greater variation month-on-month, and frequently lower utilisation in the winter months.

There was also variation in terms of the trajectory of patients assessed in the individual AMAUs. Some AMAUs discharged the majority of the patients they assessed, while others had a tendency to admit nearly all patients to an in-patient bed or an SSW.

A significant proportion of activity in the AMAUs can be classed as ambulatory care sensitive

Of the emergency hospitalisations streamed through an AMAU in 2017 (N=93,405), 53% had a principal diagnosis of one of the 18 ambulatory care sensitive medical conditions examined. The top five ambulatory care sensitive medical conditions streamed to an AMAU in that year and their contribution to total AMAU activity were chest pain non-specific (10.0%), migraine/headache (5.5%), lower respiratory infection (other) (4.9%), cardiac dysrhythmia (4.8%), and COPD/bronchiectasis (4.6%).

However, ambulatory care sensitive medical conditions are still more likely to be admitted to an in-patient bed from a non-AMAU source than assessed in an AMAU

In 2017, of total emergency hospitalisations for ambulatory care sensitive conditions (N=132,144), 63% were admitted in-house from a non-AMAU source, 14% were admitted in-house from an AMAU and the remaining 24% were discharged directly from an AMAU. Among adults aged 85+, the proportion discharged directly from an AMAU was lower and the breakdown of the admission pathways of the emergency hospitalisations was 74% non-AMAU, 18% AMAU-admit and 8% AMAU-discharge. There was also significant disparity across conditions in the relative contribution of the different admission pathways. For example, more than half of emergency hospitalisations for chest pain were assessed in an AMAU, compared with 21% of emergency hospitalisations for UTIs/pyelonephritis and 23% of emergency hospitalisations for pneumonia/influenza.

There has been a significant decrease in the numbers admitted in-house with chest pain non-specific

Since 2012, there has been a significant reduction in the numbers admitted in-house with chest pain-non specific, despite total hospitalisations for this condition increasing. This is due to the substantial increase in the numbers discharged directly from the AMAUs. The numbers admitted from non-AMAU source declined as the numbers assessed in the AMAU with this condition increased. Because the AMAUs discharge the majority of patients with this condition directly, the tendency for patients with chest pain non-specific to be preferentially streamed to the AMAUs has led to a reduction in the overall numbers admitted in-house. This pattern is most pronounced for the younger age categories.

The trajectory of patients assessed in the AMAUs is highly age and condition sensitive

The AMAUs discharge a large proportion of their patients with ambulatory care sensitive medical conditions directly, though this propensity to discharge directly is age and condition-sensitive. In 2017, of those assessed in an AMAU with an ambulatory care sensitive medical condition, 64% were discharged directly. This ranged from 81% in the younger age category to 52% and 32% in the two older age categories.

This propensity to discharge directly from the AMAU also varies considerably by condition. The condition with the highest proportion of its AMAU assessments that were discharged directly was chest pain non-specific, with 86% of those assessed in an AMAU with this condition being discharged directly from there. At the other extreme were those assessed in AMAU with pneumonia/influenza and UTI/pyelonephritis, where only 24% and 28% of patients with these principal diagnoses were discharged directly.

Some conditions were highly age-sensitive, e.g., lower respiratory infection other (other), in that the difference in propensity to discharge patients directly declined significantly with age. Others conditions were less affected by age, for example, migraine, deep vein thrombosis, vertigo and chest pain non-specific, which all had discharge-direct rates above 65% in each age category. The three conditions with the lowest propensity to be discharged directly from an AMAU upon assessment there, regardless of age, were congestive heart failure, urinary tract infection/pyelonephritis and pneumonia/ influenza.

5.5 Discussion

The purpose of this chapter was to provide a comprehensive description of the level and quality of utilisation of the units to aid an understanding of the findings of the impact analysis in Chapter 6. There are four aspects of the findings that warrant further discussion and interpretation.

1. Two parallel emergency admission streams

There are two parallel admission streams of medical patients (including those that are deemed ambulatory care sensitive), in Irish hospitals. While the AMAUs assess and discharge significant numbers of patients, the majority of emergency hospitalisations for medical conditions and ambulatory care sensitive medical conditions that are admitted in-house, still do so via the non-AMAU pathway, without assessing the services in the AMAU. This is the case for total medical conditions, and for medical conditions deemed ambulatory care sensitive. The only condition which was preferentially streamed to an AMAU was chest pain non-specific.

The majority of the patients that are admitted to an in-patient bed start their journey in the ED and are admitted onwards from there. Considerably smaller proportions are admitted from an AMAU to an in-patient bed in-house or to an SSW. This dual pathway is the case across the majority of model 3 and model 4 hospitals.[23] This would lead one to believe the units have not been fully integrated into the hospitals, and/or are not recognised as being the primary area for the management and onward flow of medical patients as depicted in Figure 1.1. The more common pathway remains ED-assessment and admit in-house. This is in contrast with the UK, where the AMUs manage the majority of medical in-patients, with the 2018 Society of Acute Medicine Benchmark Audit (SAMBA), finding that only 19.1% of patients admitted through ED go directly to a medical ward or medical outlying ward, by-passing the AMU (Society for Acute Medicine, 2018). While the figures are not directly comparable, this study points to a greater tendency of the EDs to admit patients directly in-house rather than stream them to an AMAU for assessment and admission. Reid et al, 2018 recently summarised this in their study characterising AMUs in Scotland, and referred to the fact that in 2009, 75% of patients were admitted directly to AMUs in the UK (Reid et al., 2018).

When interpreting these findings, it needs to be taken into consideration that this study is based on national data, and not all Irish hospitals have units. Additionally, and crucially, as seen in Chapter 4, the units are of considerable variation in size, capacity, opening hours and resources, which is likely to a major influence on this pattern.

An examination of why the units have not been better integrated into the hospital system, to play a larger role in the management of medical in-patient requiring a hospital stay will be explored in Chapter 7, which presents the findings of the qualitative interviews with programme and clinical staff.

2. Appropriate use of the AMAUs/appropriate patient selection

In the absence of Ambulatory Emergency Care (AEC) units in Ireland, the AMAUs have taken on a substantial part of this ambulatory care activity, with at least 50% of the episodes streamed through the AMAU in 2017 classified as ambulatory care sensitive.[24]

No data exist on whether ambulatory care is being delivered in the EDs and what proportion of emergency presentations assessed in the ED with these conditions are discharged the same day. The high numbers of patients admitted in-house from the EDs with these conditions would lead one to believe that this is not currently the practice in Irish hospitals., though this hypothesis is current non testable.

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[23] Model 2 hospitals do not have EDs therefore the majority of their emergency hospitalisations are streamed though an AMAU.

[24] This figure is based on the 18 conditions assessed here. It is likely that there are other ambulatory care medical conditions that were not examined.

Data constraints meant that the study could not assess the 'appropriateness' of the patients that were streamed though the AMAU and discharged-directly there, to assess whether they were suitable for same day emergency care, and therefore an appropriate use of the service, or were too low an acuity and unlikely to be admitted had they remained in the ED. Patient selection is recognised as being critically important to the success of any AEC service, and incorrect patient selection is likely to have a negative impact on the service's ability to achieve its outcome of reducing potentially avoidable admissions. This is re-iterated in a recent NHS Improvement document co-published with the Ambulatory Emergency Care Network, which provides clear guidance on patient selection and the patient types that should *not* be streamed to an AEC/same day emergency care service (NHS England and NHS Improvement, 2019). Deciphering whether the units are streamed the 'appropriate patients' or not for this AEC service is a very complex question that cannot be answered without information on the acuity/severity of the conditions and the complexity of the patients. The fact that 64% of the admissions to the AMAUs in 2017 were discharged directly from there, implies that they either have a well resourced and well implemented ambulatory emergency care service in situ, and are successfully avoiding overnight admissions, or, that they are being streamed lower acuity patients that would not have been admitted had they remained on the conventional pathway. While it is likely that the answer is a combination of both of the above, data constraints hampered my ability to provide clarity on this issue. This aspect will also be explored in the interviews with clinical staff (Chapter 7).

The question therefore remains as to what this is the most 'appropriate use' of these units. Is it best practice to deliver ambulatory care and same day emergency care in the AMAUs? And if so why are they not receiving more patients with ambulatory care sensitive medical conditions, from the ED, rather than the EDs admitting these patients directly in-house? Or, should these units be streamed all medical patients who require a hospital stay and be admitted on-wards if required from there?

3. The trajectory of patients with ambulatory care sensitive conditions assessed in an AMAU

As is to be expected, there was considerable variation in the degree to which patients with the different conditions were discharged directly from the AMAU once assessed there. Some conditions, regardless of age, had high same day discharge rates (e.g., migraine, deep vein thrombosis, vertigo and chest pain non-specific, all had discharge-direct rates above 65% in each age category). Others were highly age-sensitive, in that the propensity to discharge patients upon assessment in the AMAU declined significantly with age. For example, while 56% of episodes with LRI (other) assessed in the AMAU were discharged directly from there, this fell from 79% of those in the youngest age category to 27% among patients aged 85+ years. Other conditions had a low same day discharge rate regardless of age (e.g., congestive heart failure, urinary tract infection/pyelonephritis and pneumonia/ influenza).

These discharge-direct rates can be compared with the 'potential to ambulate' from an AMAU/ED or an AEC unit set out in the consensus-based Ambulatory and Emergency Care directory in the UK (NHS Ambulatory Emergency Care Network, 2018). This directory identifies common conditions that are suited to ambulatory care, and categorises their potential to ambulate into low, moderate or high.[25] For example, the directory lists 'community acquired pneumonia' upon presentation at the ED as having a low potential to ambulate, with a percentage likelihood of same day emergency care (SDEC) discharge of 10-30%. The directory advises that the decision to ambulate should be influenced by clinical assessment and CURB-65 score based on the British Thoracic Society guidelines[26]. Those with a CURB-65 score of 0 or 1 are suitable for home treatment, while those with a CURB-65 score of 2 should be managed through short stay acute care or hospital supervised outpatient care. Importantly, this ability to ambulate is contingent on the availability of hospital supervised outpatient care. Other conditions that are listed in the directory as having a 'low' potential to ambulate include asthma and COPD, with only 10-30% probability of SDEC. Conditions that have a moderate potential to ambulate (30-60%) include UTI, low risk chest pain, acute headache and congestive heart failure. Those with a high potential to ambulate (60-90%) include anaemia, diabetes, seizure (first or confirmed as having epilepsy), TIA and LRI (without COPD). The only condition in this analysis which is listed in the AEC directly as having a very high potential to ambulate (>90%) is deep vein thrombosis.

There are some interesting differences (and similarities) between these 'potential to ambulate' ratings in the directory, and this study, which may provide *some* insight into the acuity of the patients assessed in an AMAU. For example, chest pain is listed as having a moderate (30-60%) potential to ambulate, while this study found that 86% of episodes

[25] There are differences in the ICD-10-AM codes used in the AEC directory and those used in the derivation of the ambulatory care sensitive medical conditions described here, which needs to be taken into consideration when comparing these findings.

[26] The CURB-65 score (confusion, blood urea >42,8 mg/dl, respiratory rate> 30/min, blood pressure < 90/60 mm Hg, age> 65) is a clinical prediction rule for determining the need for hospitalisation of patients with pneumonia. It was derived and validated based on 1068 patients from three prospective studies in the UK, New Zealand, and the Netherlands.

assessed in an AMAU with chest pain non-specific in 2017 were discharged directly, ranging from 93% in the youngest to 67% in the oldest age category. This is considerably higher than the potential to ambulate estimated in the directory. It may be possible to deduce from this that the AMAUs are streamed patients with chest pain that are less likely to be admitted, and/or that the patients presenting as an emergency to hospitals in Ireland with chest pain are 'less acute' than those presenting as emergency in the UK. Unfortunately it is not possible to answer this question definitively using this data, given the lack of clinical data on ED presentations.

Two conditions listed in the AEC directory as having a low likelihood of potential to ambulate are asthma and COPD. This study found that same day discharge rate from the AMAU was higher than expected for asthma (71%), decreasing from 75% of those in the youngest age group to 53% in the oldest age groups. Similarly, the same day discharge rates for COPD was 44% overall, from 77% to 25% in the oldest age category. Again, similar to chest pain non-specific, this suggests the hypothesis that the AMAUs are either selectively streamed patients with COPD and asthma that are less likely to be admitted, and/or that the patients presenting as an emergency to hospitals in Ireland with these conditions are less acute than those that presenting as emergency in the UK. In terms of COPD, the UK has quite well developed outreach, and it is likely that that those with moderate COPD exacerbations are managed before presentation to the ED. Therefore those that do present are likely to be more severe and less suitable for ambulatory care, hence the low 'potential to ambulate'. This is currently not the case in Ireland, though considerable effort is being invested into the improved integration of care for patients with COPD and the establishment and utilisation of COPD outreach (National Clinical Programme for Respiratory, 2019). The third condition, with a low potential to ambulate was pneumonia with the rates in the individual age categories broadly in line with the AEC directory of 10-30% potential to ambulate.

Those conditions with a high potential to ambulate (60-90%) as per the UK directory, include anaemia, diabetes, seizure (first or confirmed as having epilepsy), TIA and LRI (without COPD). None of these conditions reached that same day discharge rate from the AMAU in 2017, though they were quite close. Of the five conditions, TIA and diabetes were the conditions with the lowest same day discharge from the AMAU (48% same day discharge rate upon assessment in an AMAU). The only condition in this analysis which is listed in the AEC directly as having a very high potential to ambulate (>90%) is deep vein thrombosis. The same day discharge rate from the AMAU was slightly below this (80%) which was quite consistent across the age categories (from 82% in the youngest to 73% in the oldest age category). UTI and congestive heart failure were listed as having a moderate potential to ambulate (30-60%) which is broadly similar to the rate observed in the AMAUs for these two conditions. The same day discharge for UTI/pyelonephritis was 28 % while the values for CHF were 32%.

4. Variation across and within the hospitals in the level of utilisation of the units

The final point of interest from the analysis was the wide variation across the hospitals in terms of the utilisation of the units and the trajectory of those seen in them. There were quite stark differences in some hospitals between the levels of their utilisations of the AMAUs month-on-month, with utilisation lower in the winter months. This is likely to be indicative of 'boarding' in these hospitals in the winter months, impacting their ability to accept patients. The variation in the trajectory of patients either is due to the acuity/severity of the patients streamed to these units, or the internal processes/ pathways/resources in place at units to safely ambulate patients home. These aspects will be explored further in Chapter 7.

5.6 Conclusion

The majority of medical patients, and patients with ambulatory care sensitive medical conditions that are admitted in-house as an emergency, are still admitted via the non-AMAU route and do not avail of the services in the AMAU.

A large number of patients are streamed through an AMAU where they are seen and discharged directly. For some conditions, mostly notably chest pain non-specific, this has been accompanied by a notable decrease in the numbers admitted in-house from a non-AMAU source.

The next chapter will ascertain whether the increase in activity in the units from 2012 onwards led to a demonstrable change in the rate of overnight emergency hospitalisations and bed days used by these hospitalisations for medical conditions and for ambulatory care sensitive medical conditions.

Chapter 6. Impact of the Acute Medicine Assessment Units on overnight emergency hospitalisation rates

6.1 Introduction

The expected outcomes of the Acute Medicine Programme have been described in Chapter 3. From a patient perspective, the Programme expected to achieve improved health outcomes for medical patients presenting to hospital, by the adoption of standarised evidence-based protocols developed in conjunction with other National Clinical Programmes. Patients would be managed more efficiently and effectively in a timely manner in a more appropriate setting (i.e., a well staffed and well resourced AMAU), and as a result be more satisfied with the care they received in hospital. From a service perspective, the Programme firstly expected to reduce overnight admissions to hospital for those medical conditions deemed 'potentially avoidable'. It aimed to do this by increasing same day discharges from the AMAU of patients who would otherwise have been admitted to an in-patient bed had they remained on the conventional pathway. This was to be facilitated by the continuous presence of a senior decision maker in the AMAU with access to same day diagnostics and laboratory services, and the adoption of ambulatory care pathways created by other National Clinical Programmes (e.g. diabetes, COPD, congestive heart failure and epilepsy). The Programme also expected to reduce the length of stay of <u>all</u> medical patients admitted to hospital, and to do so without increasing re-admissions. This was to be achieved by the care delivered in the AMAU as well as the efficiencies introduced throughout the entire hospital stay (e.g., daily ward rounding, pro-active discharge planning, multi-disciplinary team input). This would result in a positive impact on hospitals, and should result in less overcrowding in EDs.

Many of these outcomes could not be measured given the constraints of the Irish Health IT infrastructure. The lack of a Unique Health Identifier prohibits the examination of the trajectory of patients assessed in an AMAU, to examine 'health outcomes' and whether admission to an AMAU results in a lower likelihood of re-admission. Changes in length of stay of medical patients as a result of the introduction of the AMAUs were also not examined. The Programme expected that only those with greater severity and need for an in-patient bed would be admitted in-house, that those who could be safely ambulated would have their care delivered in that manner and not be admitted overnight. Therefore, without being able to adjust for this expected change in the acuity and severity of those admitted, an analysis of changes over time in hospital length of stay would be flawed. This lack of data on acuity and severity also meant that it was not possible to do an unbiased estimation of the length of stay of AMAU-admitted vs. ED admitted patients. Any attempts to compare the trajectory of patients on these two pathways in the absence of data on acuity/severity and complexity would be heavily confounded. To do a robust analysis of these admission pathways would require access to greater depth of clinical information (such as an electronic patient record), perhaps at a single site, as has been done in other studies (Suthers et al., 2012). Hence, the outcome chosen for analysis of programme impact was the change in the rate of overnight emergency hospitalisations for medical conditions; especially those conditions deemed ambulatory care sensitive. Chapter 5 described the process for how this list of ambulatory care sensitive medical conditions was drawn up. It is pertinent to re-iterate that these are conditions where effective community and person-centred care can help prevent the need for a hospital admission (Tian et al., 2012). They have not been validated as a measure for the effectiveness of AMAUs. To re-iterate, these are conditions that can be:

- prevented, by a focus on prevention (e,g., COPD, diabetes, pneumonia, influenza),
- better managed in primary care to reduce the likelihood of an acute exacerbation warranting an emergency presentation (e.g., COPD, asthma, CHF, diabetes), and
- treated more effectively in primary care when an acute illness arises (e.g., UTI, LRI)

If access to or the quality of primary care deteriorates one would expect to see an increase in emergency presentations for these conditions, with a likely increase in overnight admission rate. It must be noted that while these conditions are rich in 'potentially avoidable' admissions, not all episodes which present to an ED with these conditions can be safely ambulated, even in the presence of well-resourced ambulatory care pathways. In that scenario, the safest and most appropriate management involves a length of hospital stay. This is identified as one of the major difficulties with using ambulatory care sensitive conditions as a proxy for preventable admissions. For example, even with management of heart failure following evidence-informed guidelines, patients' condition will gradually deteriorate and may eventually require admission. Therefore using chronic ACSC admissions overestimates the rate of preventable admission by capturing an unknown number of admissions that are necessary and could not feasibly have been prevented (Longman et al., 2015).

The primary hypothesis to be tested in this study was that the increase in activity in the units from 2012, led to a demonstrable reduction in the national monthly overnight emergency hospitalisation rate for medical conditions, and individual ambulatory care sensitive medical conditions. A secondary hypothesis was that this increase in activity in the units from 2012, led to a demonstrable reduction in the national monthly rate of bed days used by overnight emergency hospitalisation rate for medical conditions, and individual ambulatory care sensitive medical conditions.

A comprehensive technical appendix (Appendix 6.3) accompanies this chapter, presenting the yearly rate of overnight emergency hospitalisations for these conditions (both age-sex standarised rates, and age-specific rates) between 2009 and 2017. This facilitates an examination of the disparity in the burden of the conditions on acute hospitals, and enables comparison with international trends.

6.2 Methodology

Study design and data source

This was a retrospective observational study of emergency hospitalisations among adults aged 16 years and over, discharged from all adult acute public hospitals between January 1 2009 and December 31 2017, after an overnight emergency admission to hospital.[27]

The Hospital In-patient Enquiry (HIPE) scheme was used as the data source. Activity from all acute public hospitals was included, including those that do not participate in the Programme.[28] There were three reasons for this ecological approach. Firstly, as this was a national programme and all hospitals were expected to adopt this new model of care, any evaluation of programme impact warrants a national approach. Secondly, there are no robust catchment areas for these hospitals to facilitate comparison within hospital over time, and thirdly, even if catchment areas did exist, the level of restructuring of emergency services during this time period would render any interpretation of the findings problematic.

Outcome measures

The outcome measures were the change in monthly rates of overnight emergency hospitalisations and rate of bed days. These were calculated for (i) medical conditions, (ii) non-medical conditions[29], and (iii) ambulatory care sensitive medical conditions. Both age-sex standarised and age-specific rates were examined.

Age-sex standardised rates

[27] An overnight stay in hospital was defined as one with at least one day difference between 'date of discharge' and 'date of admission'. It was not based on 'time of admission' or 'time of discharge' as these time variables were incomplete on HIPE for this study period.
[28] Transfers in from another hospital were excluded in the calculation of rate of overnight hospitalisations, but included in the calculation of bed days used.
[29] Hospitalisation rates for non-medical conditions were used as a proxy comparison group.

The age-sex standardised rate is the number of cases per 100,000 population that would occur if the country (or in this case, the month) had the same age structure as a standard population and the age-sex specific rates (for month) applied. The standard population used was the OECD 2010 population (Appendix 6.1). Data were aggregated to provide counts of hospitalisations and bed days used by each sex, each month, for each of the age categories: 16-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, 45-49 years, 50-54 years, 55-59 years, 60-64 years, 65-69 years, 70-74 years, 75-79 years, 80-84 years, 85+ years. Age & sex specific rates were calculated for males and females for each age category using the population for that age and time period from the Central Statistics Office (CSO).[30] The age-sex standardised rate was then calculated as the sum of these age & specific rates (for year or month depending on the analysis) multiplied by the standard population, and divided by the total number of cases in the standard population. This is the approach taken in the OECD when comparing hospitalisation rates across jurisdictions (Department of Health, 2018).

<u>Age-specific rates</u>

Data were aggregated to provide counts of hospitalisations and bed days used each month for each of these age categories: 16 to 44 years, 45 to 64 years, 65 to 84 years and 85+ years. Age-specific rates were calculated by dividing the number of hospitalisations in that month by the CSO national population estimates for that year and multiplying by 100,000.

Analysis

Programme impact was estimated using an interrupted time series design. For the analysis of programme impact on the rate of hospitalisations for medical and non-medical conditions, both the age-sex standardised rates and age-specific rates were examined. For the analysis of programme impact on the individual ambulatory care sensitive medical conditions, only the age-sex standardised rates were examined. Where a significant programme impact on this rate was observed, the age-specific rates were analysed to examine whether this impact was observed across each of the four age categories.

Estimation procedure to assess programme impact

An interrupted time series (ITS) design was used to evaluate the impact of the opening of the units. This quasi-experimental design is frequently used when evaluating longitudinal effects of interventions, where randomised controlled trials are not feasible (Penfold and Zhang, 2013). The design distinguishes the effect of the intervention from change that

[30] Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019). See Appendix 6.1.

would have happened in the absence of the intervention (Taljaard et al., 2014). The approach usually involves constructing a time series of population-level rates for a particular quality improvement focus and testing statistically for a change in the outcome rate in the time periods before and time periods after implementation of a policy/programme designed to change the outcome (Penfold and Zhang, 2013). The causal hypothesis is that observations after treatment will have a different level or slope from those before the intervention. Segmented regression models were used to fit a least squares regression line to each segment before and after the intervention, assuming a linear relationship between time and outcome of interest within each segment (Wagner et al., 2002), as shown in Figure 6.1. The outcome of interest was the trend before the intervention (β1) and the trend after (β1 + β3), and it is these trends which are reported. Fitting this model allowed a 'level' change at the time of the intervention period, which was necessary given the visible increase in reporting from hospitals from the start of 2012. A linear model was specified throughout and linearity assessed by regressing time on hospitalisation rate and rate of bed days used and examining the residuals for unusual patterns, to ensure suitability of the modelling technique (Jandoc et al., 2015).

Figure 6.1 Segmented regression model

$\hat{Y}_t = \beta_0 + \beta_1 \text{*time}_t + \beta_2 \text{*intervention}_t + \beta_3 \text{*time\_after\_intervention}_t + e_t$

Yt = the outcome examined at time t;
time = the number of months from the start of the series
intervention =a dummy variable - 0 in the pre-intervention segment and 1 in the post-intervention segment
time_after_intervention is 0 in the pre-intervention segment and counts the months in the post-intervention segment at time t
β_0 estimates the baseline level of the outcome at the beginning of the series
β_1 estimates the baseline trend, i.e. The change in outcome per month in the pre-intervention
β_2 estimates the change in level in the post-intervention segment
β_3 estimates the change in trend in the post-intervention segment
e_t estimates the error

Monthly OECD age-sex standardised rates were calculated for each outcome measure, and comparison made between the linear trends in the pre-intervention period (January 2009 to December 2011) to those in the post-intervention period (2013-2017).

Segmented regression in interrupted time series studies has several methodological considerations:

i. Specifying the intervention time point

Interrupted time series designs are best suited to the evaluation of interventions where there is a clear starting point to compare trends and level before and after the intervention. However, in this instance the Programme was deployed over a prolonged period and setting a starting point was difficult. The model of care setting the framework for the delivery of acute medicine was published in 2010; some AMAUs pre-dated this and others were established between 2010 and 2011. However the majority of units opened between 2012 and 2013. Therefore the decision was taken to set January 2012 to December 2012 as the intervention period, and examine monthly trends in the pre-intervention period (2009-2011) and post-intervention period (2013-2017). This also helped alleviate concerns about the impact of the increased reporting visible from January 2012 on the analysis.

ii. Specifying the post-intervention period

With the intervention period set at 2012, this provided a 5 year post-intervention period, which is quite a significant length of time. Published work in methodological considerations in time series suggest that the post-intervention period should be considered at various time points after the intervention to examine whether any programme effect realised is maintained (Gebski et al., 2012). This depends on the nature of the intervention, and with an intervention of this type the rates would be expected to continue to trend downwards as the units become more established and ambulatory pathways become routinised. Graphical depictions are presented throughout.

iii. Use of a control group

As this evaluation examined national trends, use of a control group was not feasible. Instead, an analysis of hospitalisation rates for non-medical conditions, outside the remit of the Programme, was undertaken, to examine whether these rates showed similar patterns as medical conditions.

iv. Seasonality and autocorrelation

Autocorrelation (i.e. similarity between observations as a function of the time lag between them) was assessed using the 'acttest' in Stata and the 'lag()' specification used to correctly account for any significant autocorrelation and the coefficients estimated with Newey-West standards errors (Linden A., 2015). This was done as ordinary least squares regression assumes that the error terms are uncorrelated, and ignoring autocorrelation may overestimate the effects of an intervention (Linden A., 2015). Where a lag (12) in this test (along with visual inspection of the time series) suggested seasonality in the time series, a dummy variable for each month was added and removed sequentially to produce the most parsimonious model.

v. Data quality

There was slight under-reporting of medical activity between 2009 and 2011 from two small rural hospitals, and an obvious increase in 2012. Unfortunately, it is not feasible to quantify how much of this increase was as a result of increased reporting from these smaller model 2 hospitals, or as a result of the restructuring of ED services that took place in and around 2012, or as a result of the opening of the AMAUs. This data quality issue however should not have significantly influenced the findings as Jan 2012-Dec 2012 was set as the intervention period, and it is the pre- and post-trends that are being compared, not level changes.

vi. Reporting of outcomes

For all models, the baseline level and the trend estimates before and after the intervention are presented, with their p-values and 95% CI. A p-value of < 0.05 was considered to indicate statistical significance. When interpreting the findings, it is important to consider both the magnitude of the hospitalisation rate, and the monthly trend.

6.3 Findings

Finding are reported first for medical conditions, then non-medical conditions, and finally for ambulatory care sensitive medical conditions. For each analysis the trend of the rate in the pre- and the post-intervention period is presented, rather than a trend change. The rationale for same is that were significant bed closures in the pre-intervention period, a reduction of 9% from January 2009 to December 2011 alone, which will have influenced hospitalisation rate and rate of bed days used. There were no bed closures in the post intervention period, and a slight increase in the number in 2016 and 2017. (Appendix 1.1).

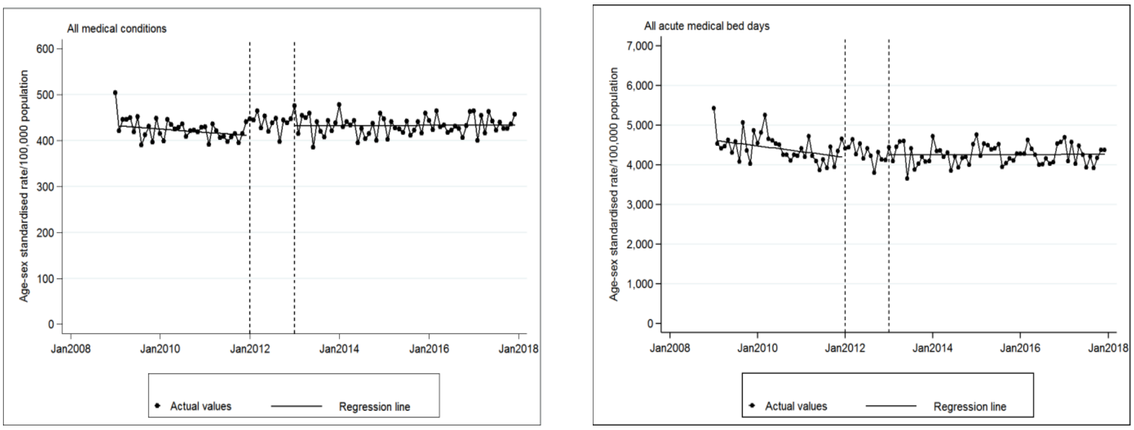
6.3.1 Medical conditions

At the start of the series, the modelled age-sex standardised rate of overnight emergency hospitalisations for medical conditions was 432.3/100,000 population/month. From 2009 to 2011, this rate decreased very gradually at the rate of 0.61/100,000 population/month (95% CI: -1.19 to -0.01; p=0.045) See Figure 6.2 and Table 6.1. There was an increase in the rate of hospitalisations in 2012. From 2013 to 2017, there was no evidence of a trend in this hospitalisation rate. At the end of the series, the modelled hospitalisation rate was 433.6/100,000 population/ month, unchanged from the start of the series. For three of the four age categories examined (16-44 years, 45-64 years, and 65-84 years), there was a significant downward trend in the hospitalisation rate between 2009 and 2011, while there no evidence of a trend in the oldest age category (85+ years). From 2013 to 2017, the 16-44 years age category experienced an upward trend of 0.13/100,000 population/month (95% CI:

0.04 to 0.21; p=0.004).There was no evidence of a trend in the rate for the other three age categories.

Figure 6.2 Monthly age-sex standardised overnight emergency hospitalisations (A) and bed days used (B) by medical conditions/100,000 population, 2009-2017

A. B.



The bed days used by hospitalisations for medical conditions showed similar patterns; small but significant downward trends between 2009 and 2011 in the age-sex standardised rate and in three of the age categories. Between 2013 and 2017, there was no evidence of a trend in the age-sex standarised rate There was a small but statistically significant increase in trend in the youngest age category of 2.12 bed days/100,000 population/month (95% CI: 1.43 to 2.81; p<0.001), and in the 45-64 years age category of 2.17 bed days/100,000 population/month (95% CI: 0.04 to 4.30; p=0.046). There was no trend in the 65-84 years age category. There was no evidence of a trend in the 85+ age category in either the pre- or the post- intervention period (Table 6.1).

Table 6.1 Trends in the overnight emergency hospitalisation rate and rate of bed days used by medical conditions

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Hospitalisation rate							
Age-sex std rate	432.3	-0.61	0.045	-1.19 to -0.01	0.04	0.827	-0.30 to 0.37
Age-specific rates							
16-44 years	118.2	-0.26	0.004	-0.43 to -0.08	0.13	0.004	0.04 to 0.21
45-64 years	343.86	-0.64	0.004	-1.07 to -0.22	-0.08	0.408	-0.28 to 0.11
65-84 years	1,293.7	-2.01	0.001	-3.18 to -0.85	0.07	0.842	-0.63 to 0.78
85+ years	3,005.8	1.73	0.497	-3.31 to 6.78	1.31	0.279	-1.07 to 3.69
Bed days used							
Age-sex std rate	4,622.0	-11.91	0.013	-21.23 to -2.60	0.06	0.976	-3.80 to 3.91
Age-specific rates							
16-44 years	656.3	-1.14	0.011	-2.01 to -0.27	2.12	<0.001	1.43 to 2.81
45-64 years	2,720.8	-9.75	<0.001	-13.69 to -5.82	2.17	0.046	0.04 to 4.30
65-84 years	14,861.3	-40.73	0.013	-72.60 to -8.85	-1.63	0.814	-15.37 to 12.11
85+ years	43,937.1	-121.00	0.188	-303. to 60.24	-51.66	0.056	-104.7 to 1.38

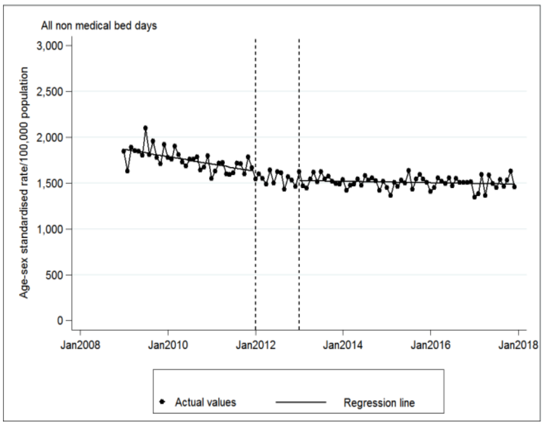
Baseline level and trends are all per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

6.3.2 Non-medical conditions

At the start of the series, the modelled age-sex standardised rate of overnight emergency hospitalisations for non-medical conditions was 234.8/100,000 population/month. Between 2009 and 2011, there was a significant monthly reduction in this rate of 0.76/100,000 population per month (95% CI: -0.96 to -0.57; p<0.001). Between 2013 and 2017, this monthly trend continued downwards but at a much slower pace than that observed in the pre-intervention period (post-trend=-0.16; 95 CI: -0.25 to -0.07; p=0.001). There was a significant downward trend in all four age categories in the pre-intervention period. In the post-intervention period, these trends continued downwards in three of the four categories, though again at much slower rates. The downward trend in the 45 to 64 years age category in the post-intervention period did not reach significance. In terms of bed days used, there was a clear downward trend in the monthly age-sex standardised rate between 2009 and 2011, and in all age categories apart from those aged 85+ years. This changed between 2013 and 2017, and there was no evidence of a downward trend in the age-sex standardised rate, or in three of the four age categories. The only rate that continued downwards, albeit at a much slower rate than the initial period, was that of the youngest age category.

Figure 6.3 Monthly age-sex standardised overnight emergency hospitalisations (A) and bed days used (B) by non-medical conditions/100,000 population, 2009-2017

A.



B.

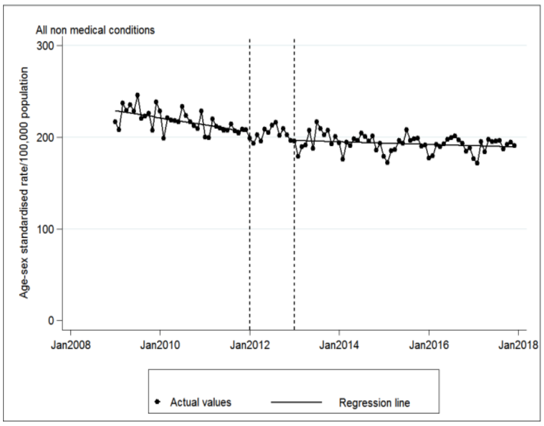


Table 6.2 Trends in the overnight emergency hospitalisation rate and rate of bed days used by non-medical conditions

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Hospitalisation rate							
Age-sex std rate	234.8	-0.76	<0.001	-0.96 to -0.57	-0.16	0.001	-0.25 to -0.07
Age-specific rates							
16-44 years	159.5	-0.41	0.001	-0.64 to -0.18	-0.20	<0.001	-0.27 to -0.12
45-64 years	202.0	-0.69	<0.001	-0.93 to -0.44	-0.03	0.432	-0.12 to 0.05
65-84 years	448.2	-1.91	<0.001	-2.37 to -1.45	-0.19	0.025	-0.35 to -0.02
85+ years	807.6	-2.79	<0.001	-4.00 to -1.58	-0.59	0.046	-1.18 to -0.01
Bed days used							
Age-sex std rate	1,909.1	-7.45	<0.001	-10.25 to -4.66	-0.89	0.088	-1.92 to 0.14
Age-specific rates							
16-44 years	693.9	-2.76	<0.001	-4.33 to -1.19	-0.49	0.034	-0.95 to -0.04
45-64 years	1,478.0	-5.50	<0.001	-7.87 to -3.13	0.93	0.082	-0.12 to 1.98
65-84 years	4,965.5	-19.59	<0.001	-30.26 to -8.92	-1.58	0.380	-5.14 to 1.98
85+ years	10,736.4	-17.25	0.413	-59.0 to 24.5	-12.54	0.110	-28.0 to 2.88

Baseline level and trends are all per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

6.3.3 Ambulatory care sensitive medical conditions

In terms of acute conditions, patterns were mixed. See Table 6.3. In the pre-intervention period (2009-2011), the age-sex standarised hospitalisation rates for cardiac dysrhythmia, deep vein thrombosis and transient ischaemic attack (TIA), had a significant downward trend, which was most pronounced for cardiac dysrhythmia. There was no evidence of a trend in the monthly hospitalisation rate for chest pain non-specific, LRI (other), pneumonia/influenza, syncope, or vertigo, while rates for migraine/headache and UTI were increasing each month.

In the post-intervention period (2013-2017), hospitalisation rates for conditions that were declining in the pre-intervention period continued to do so (i.e., cardiac dysrhythmia, deep vein thrombosis and TIA), albeit at a slower pace. Chest pain non-specific which had no evidence of a trend in the pre-intervention period experienced a substantial reduction in its monthly hospitalisation rate of the order of 0.11/100,000 population/month. Similarly, syncope, which had no evidence of a trend in the pre-intervention period, also experienced a reduction its monthly hospitalisation rate in the post-intervention period. The hospitalisation rate for migraine/acute headache, though small, was increasing prior to the intervention. In the post-intervention period this changed to a downward trend. With pneumonia/influenza, the hospitalisation rate was flat between 2009 and 2011, while between 2013 and 2017 this rate increased gradually. The hospitalisation rate for UTI/pyelonephritis was increasing considerably before 2012 and continued to do so after. The monthly increase in rate of hospitalisations for this UTI/pyelonephritis between 2013 and 2017 was equivalent to the decrease observed in the monthly hospitalisation rate for chest pain non-specific.

In terms of bed days used by these acute conditions, patterns were quite similar to those seen with hospitalisation rates. See Table 6.4. Cardiac dysrhythmia, deep vein thrombosis and TIA experienced a reduction in the monthly rate of bed days used in the pre-intervention period, which was most pronounced for cardiac dysrhythmia. Chest pain non-specific also experienced a downward trend in the age-sex standardised rate of bed days used, despite the stationary rate of hospitalisations for this condition. There was no trend in the monthly rate of bed days used by LRI (other), pneumonia/influenza, syncope or vertigo; similar to that seen with the hospitalisation rates. The bed days used by hospitalisations for migraine and UTI/pyelonephritis were increasing month-on-month in the pre-intervention period. This was most pronounced for UTI/pyelonephritis and the monthly increase was almost equivalent to the monthly reduction in cardiac dysrhythmia during that period.

In the post-intervention period, bed days used continued to decline for cardiac dysrhythmia, chest pain, deep vein thrombosis and TIA, again at a slower pace than in the pre-invention period. There was no evidence of a trend in the rate of bed days used by LRI (other), or pneumonia/influenza. The monthly rate of bed days used by syncope which was stationary prior to the intervention declined thereafter, while the rate for vertigo which was also stationary in the pre-intervention period increased, though again, the bed days used by this condition are the lowest of all acute conditions. The rate of bed days used by migraine/acute headache, which was increasing prior to the intervention, became flat, and UTI which was increasing continued do so at the same pace. The upward trend in the monthly rate of bed days used by UTI/pyelonephritis in the post-intervention period was equivalent to the total downward trend observed among all five conditions which experienced a reducing trend in that period (i.e., cardiac dysrhythmia, chest pain, deep vein thrombosis, syncope and TIA).

In terms of chronic conditions, patterns were also quite mixed. In the pre-intervention period, the hospitalisation rates for the majority of conditions were trending downwards. Hospitalisation rates for angina, asthma, congestive heart failure, hypertension and iron deficiency anaemia all had a significant downward trend, which was most pronounced for congestive heart failure. There was no evidence of a trend in the monthly hospitalisation rate for COPD/bronchiectasis or convulsions/epilepsy. None of the chronic conditions had an increasing hospitalisation rate in the pre-intervention period. In the post-intervention period, hospitalisation rates for conditions that were declining in the pre-intervention period either continued to do so (i.e., angina, and congestive heart failure) - albeit at a slower pace - or levelled off, and the monthly rates had no evidence of a trend (i.e., asthma and hypertension). As with the pre-intervention period, there was no evidence of a trend in the post-intervention period in COPD/bronchiectasis and convulsions/epilepsy.

In terms of bed days used, the patterns were similar to those seen with hospitalisation rates. The majority of conditions experienced a reduction in the monthly rate in the pre-intervention period. The only exceptions were COPD/bronchiectasis and convulsions/epilepsy where there was no trend, similar to that observed with hospitalisations. In the post- period, bed days continued to decline for angina and congestive heart failure, again at a slower pace than in the pre-invention period. Asthma and hypertension had a reducing trend in the pre-intervention period but had no evidence of a trend in the post-intervention period, while the rate of bed days used by iron deficiency anaemia actually increased in the post-intervention period. As with hospitalisations, there was no evidence of a trend in the rate of bed days used in the pre- or post-intervention period for COPD/bronchiectasis and convulsions/epilepsy. A visual depiction of the segmented regressions analyses undertaken for each condition and a brief synopsis of the trends is presented in

Figure 6.4.

Table 6.3 Baseline level and trends in the age-sex standardised overnight emergency hospitalisation rate for ambulatory care sensitive medical conditions

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Acute conditions							
Cardiac dysrhythmia	20.2	-0.08	<0.001	-0.12 to -0.04	-0.04	<0.001	-0.05 to -0.02
Chest pain non-specific	25.9	-0.00	0.887	-0.05 to 0.04	-0.11	<0.001	-0.14 to -0.07
Deep vein thrombosis	4.1	-0.03	<0.001	-0.04 to -0.01	-0.01	<0.001	-0.02 to -0.01
LRI (other)	22.9	0.04	0.339	-0.04 to 0.12	0.02	0.529	-0.04 to 0.07
Migraine/headache	7.3	0.06	<0.001	0.03 to 0.08	-0.02	0.040	-0.03 to -0.01
Pneumonia/ influenza	21.4	0.00	0.908	-0.05 to 0.04	0.07	<0.001	0.04 to 0.09
Syncope	13.7	0.03	0.207	-0.01 to 0.05	-0.03	0.001	-0.04 to -0.01
TIA	8.0	-0.02	0.040	-0.04 to 0.00	-0.02	<0.001	-0.03 to -0.01
UTI/pyelonephritis	15.6	0.08	0.003	0.03 to 0.13	0.11	<0.001	0.09 to 0.13
Vertigo	3.5	0.01	0.644	-0.01 to 0.02	0.02	<0.001	0.01 to 0.02
Chronic conditions							
Angina	11.4	-0.08	<0.001	-0.10 to -0.05	-0.04	<0.001	-0.05 to -0.03
Asthma	3.8	-0.02	0.008	-0.04 to -0.01	0.01	0.152	0.00 to 0.01
COPD/bronchiectasis	32.4	0.03	0.305	-0.03 to 0.09	-0.02	0.367	-0.06 to 0.02
Congestive heart failure	17.8	-0.11	<0.001	-0.15 to -0.07	-0.03	0.004	-0.05 to -0.01
Convulsions/epilepsy	9.9	-0.01	0.668	-0.04 to 0.02	0.01	0.286	0.00 to 0.02
Hypertension	3.2	-0.03	<0.001	-0.05 to -0.02	0.01	0.015	0.00 to 0.01
Iron def. anaemia	2.5	-0.02	<0.001	-0.03 to -0.01	0.02	<0.001	0.01 to 0.02

Baseline level and trends are per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

Table 6.4 Baseline level and trends in the age-sex standardised rate of bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions

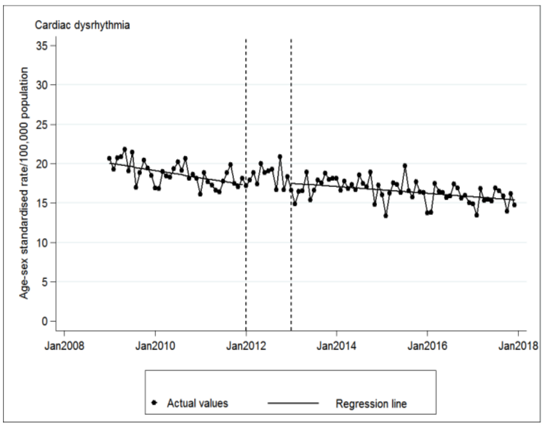
	Baseline level	Pre-trend	p-value	96% CI	Post-trend	p-value	95% CI
Acute conditions							
Cardiac dysrhythmia	136.7	-1.21	<0.001	-1.54 to -0.89	-0.28	<0.001	-0.40 to -0.15
Chest pain non-specific	84.6	-0.33	0.001	-0.48 to -0.19	-0.25	<0.001	-0.31 to -0.19
Deep vein thrombosis	32.3	-0.24	0.015	-0.44 to -0.05	-0.10	0.001	-0.15 to -0.04
LRI (other)	190.4	0.32	0.521	-0.66 to 1.30	0.25	0.349	-0.27 to 0.76
Migraine/headache	25.2	0.22	0.008	0.06 to 0.38	-0.01	0.707	-0.07 to 0.05
Pneumonia/ influenza	289.9	-0.05	0.918	-0.94 to 0.84	0.68	0.080	-0.08 to 1.44
Syncope	96.4	0.37	0.212	-0.21 to 0.95	-0.30	0.010	-0.52 to -0.07
TIA	58.2	-0.33	0.020	-0.60 to -0.05	-0.18	<0.001	-0.26 to -0.10
UTI/pyelonephritis	160.6	1.11	0.005	0.35 to 1.88	1.07	<0.001	0.72 to 1.42
Vertigo	15.3	0.04	0.416	-0.06 to 0.14	0.07	<0.001	0.04 to 0.11
Chronic conditions							
Angina	67.8	-0.42	<0.001	-0.64 to -0.21	-0.33	<0.001	-0.41 to -0.25
Asthma	19.2	-0.10	0.038	-0.18 to -0.01	0.05	0.053	0.00 to 0.09
COPD/bronchiectasis	322.2	-0.59	0.149	-1.38 to 0.21	-0.10	0.645	-0.56 to 0.35
Congestive heart failure	235.7	-1.88	<0.001	-2.61 to -1.15	-0.61	<0.001	-0.87 to -0.34
Convulsions/epilepsy	67.7	-0.26	0.123	-0.59 to 0.07	0.05	0.366	-0.06 to 0.16
Hypertension	15.0	-0.15	<0.001	-0.23 to -0.08	0.02	0.125	-0.01 to 0.05
Iron def. anaemia	21.6	-0.20	<0.001	-0.31 to -0.10	0.08	0.005	0.02 to 0.13

Baseline level and trends are per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

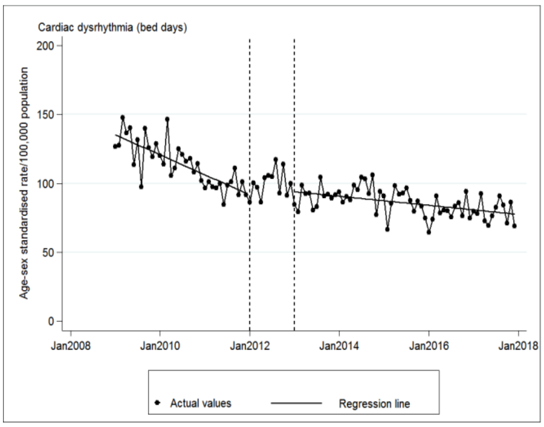
Figure 6.4 Monthly age-sex standardised overnight emergency hospitalisations (A) and bed days used (B) for each ACS medical condition, 2009-2017

Cardiac dysrhythmia

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population



At the start of the series, the modelled age-sex standardised hospitalisation rate was 20.2/100,000 population/month. By the end of the series, this had fallen to 15.7/100,000 population/month. Between 2009 and 2011, this rate was decreasing gradually at the rate of 0.08/100,000 population/month, and from 2013 to 2017 this rate continued to decline, though at a slower pace (-0.04/100,000 population/month, p<0.001).

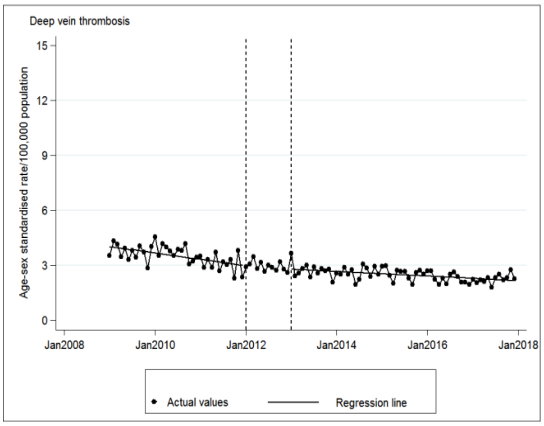
In terms of the bed days used, there was a steep downward trend in the monthly age-sex standarised rate between 2009 and 2011 of 1.21 beds/100,000 population/month, p<0.001. Between 2013 and 2017, the age-sex standarised rate continued downwards, though at a slower pace (-0.28/100,000 population/month, p<0.001).

Chest pain non-specific

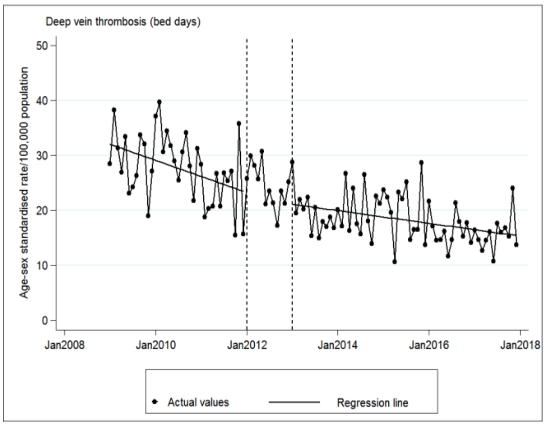
See Section 6.3.3.1.

Deep vein thrombosis

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

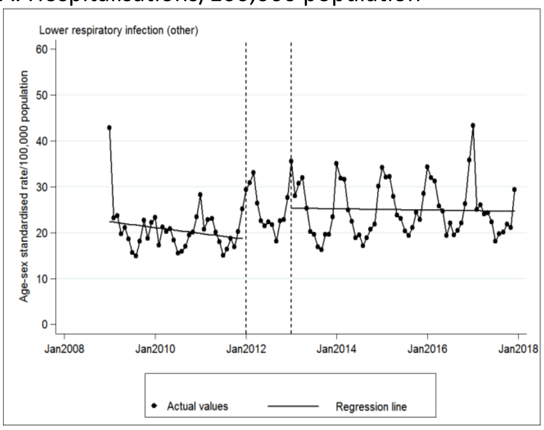


At the start of the series, the modelled age-sex standardised hospitalisation rate was low, at 4.1/100,000 population/month and it declined over the study period to 2.1/100,000 population/month. Between 2009 and 2011, the rate declined by 0.03/100,000 population/month, p<0.001. Between 2013 and 2017, the rate continued to reduce, though at a slower pace (-0.01/100,000 population/month, p<0.001).

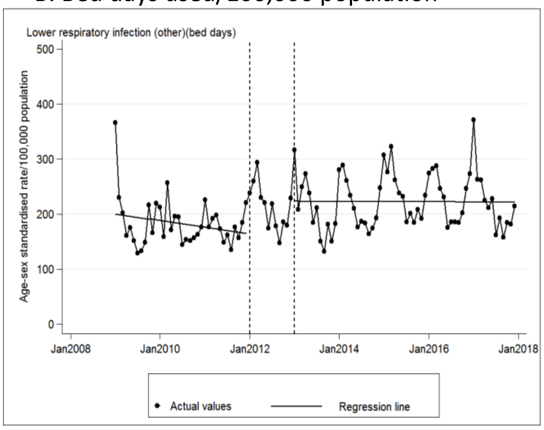
In terms of bed days, the age-sex standarised rate declined in both the pre- and post-intervention period, with the rate of decline greater in the pre- than in the post-intervention period (-0.24 beds/100,000 population/month, p=0.015 vs. -0.10 beds/100,000 population/month, p=0.001).

Lower respiratory infection (other)

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

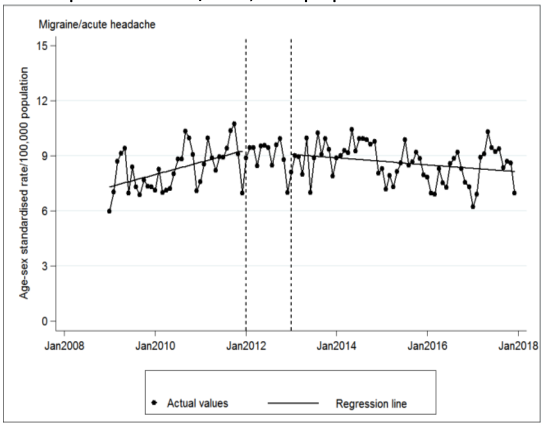


At the start of the series, the modelled age-sex standardised hospitalisation rate was 22.9/100,000 population/month. By the end of the series, this had increased to 28.9/100,000 population/month, one of the highest rates of all conditions examined. There was a very clear seasonal pattern with peaks in winter and troughs in summer, and this seasonality was more pronounced in the post- than in the pre-intervention period. There was no statistically significant linear trend in the pre- or the post-intervention period. However, as is visible from the graph, the monthly rate was higher from 2012 onwards.

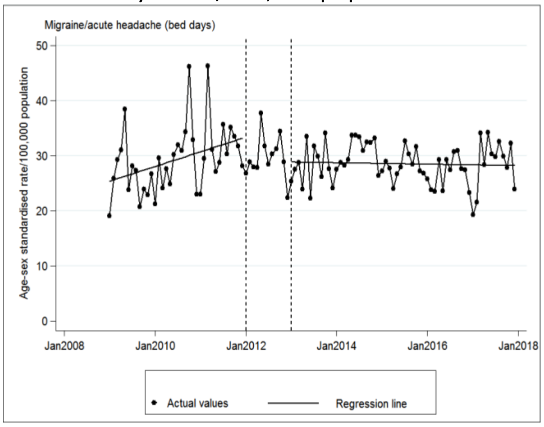
The patterns in rate of bed days used were similar, and there was no evidence of a trend in the age-sex standarised rate in the pre- or post-intervention period.

Migraine/acute headache

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population



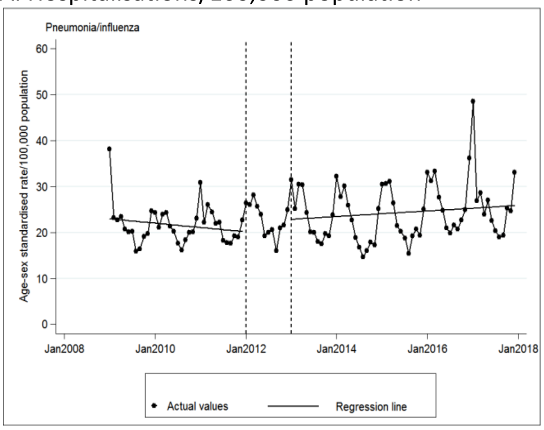
The modelled age-sex standardised hospitalisation rate for migraine/headache was low, at 7.3/100,000 population/month at the start of the series. Between 2009 and 2011 the monthly age-sex standardised hospitalisation rate was increasing gradually (0.06/100,000 population/ month, $p<0.001$). After the intervention, this trend changed to a downward trend, and reduced by 0.02 /100,000 population/ month, ($p=0.040$).

In terms of the bed days used, similar to hospitalisations, the age-sex standardised rate before the intervention was trending upwards (0.22 beds/100,000 population/month, $p=0.008$). After the intervention, the trend changed to a downward direction, though this trend did not reach statistical significance (-0.01 beds/100,000 population/month, $p=0.707$).

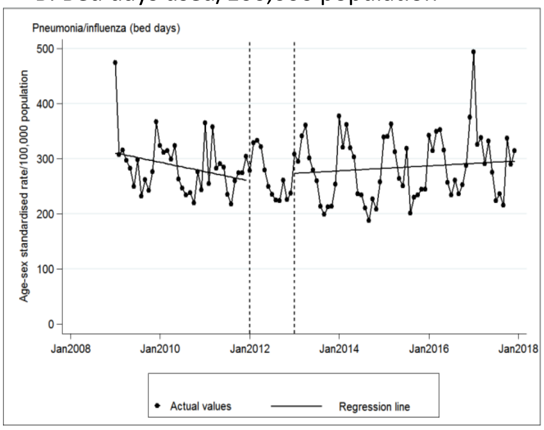
See Appendix 6.2 for age-specific analyses.

Pneumonia/influenza

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

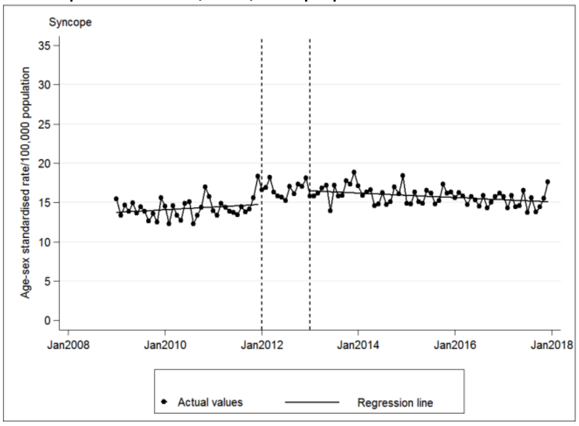


At the start of the series, the modelled age-sex standardised hospitalisation rate was 24.1/100,000 population/month. By the end of the series, this had increased to 30.3/100,000 population/month, the second highest rate after COPD. Between 2009 and 2011, there was no evidence of a trend in the age-sex standarised hospitalisation rate. Between 2013 and 2017, the rate trended gradually upwards at the rate of 0.07/100,000 population/month ($p<0.001$).

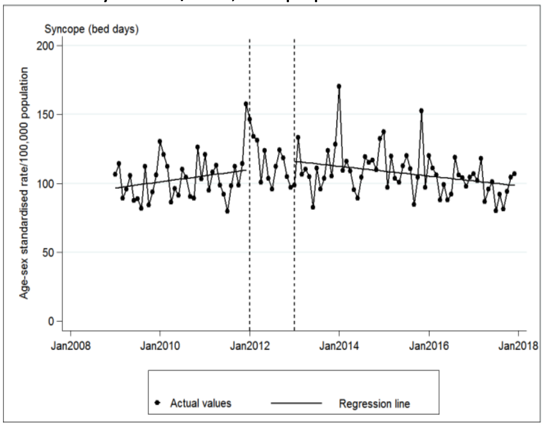
In terms of bed days used, neither the downward trend in the pre-intervention period nor the upward trend in the post-intervention period reached statistical significance.

Syncope

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population



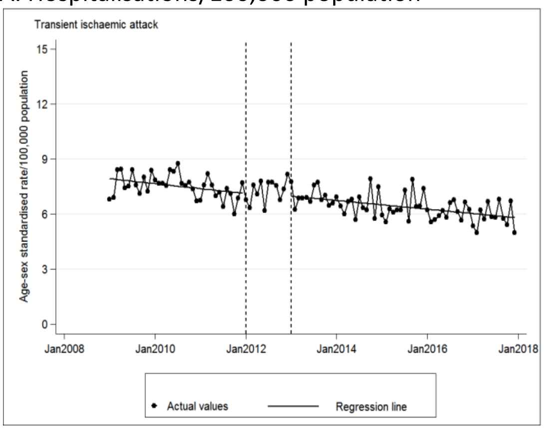
At the start of the series, the modelled age-sex standardised hospitalisation rate for syncope was 13.7/100,000 population/month. Between 2009 and 2011, there was no trend in the monthly rate of overnight emergency hospitalisations for syncope. From 2013 to 2017, the age-sex standardised hospitalisation rate trended downwards at the rate of 0.03/100,000 population/month (p=0.001).

In terms of bed days used, between 2009 and 2011, the upward trend in the monthly rate was not statistically significant. Between 2013 and 2017, there was a significant downward trend (as seen with rate of hospitalisations) in the rate of 0.30 beds/100,000 population/month (p=0.010).

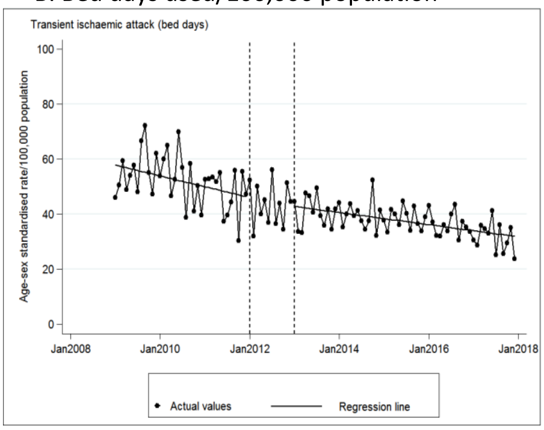
See Appendix 6.2 for age-specific analyses.

Transient ischaemic attack

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population



At the start of the series, the modelled age-sex standardised hospitalisation rate for transient ischaemic attack (TIA) was 8.0/100,000 population/month. Between 2009 and 2011 the rate was trending downwards at the rate of 0.02/100,000.month (p=0.04). This same magnitude of downward trend continued between 2013 and 2017.

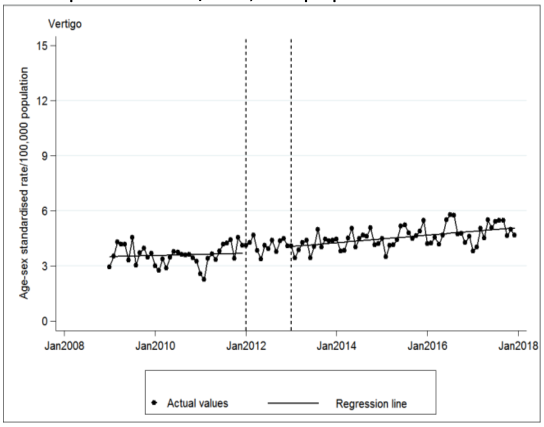
The monthly rate of age-sex standarised bed days used was also trending downwards between 2009 and 2011 (-0.33 beds/100,000population/month, p=0.020). This rate continued to trend downwards between 2013 and 2017 though at a slower pace (-0.18 beds/100,000 population/month, p<0.001).

UTI/pyelonephritis

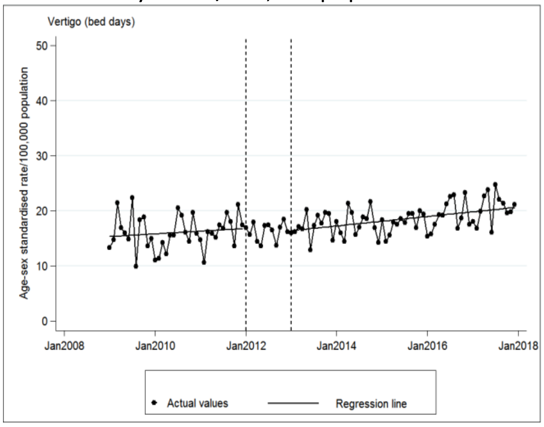
See Section 6.3.3.1.

Vertigo

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

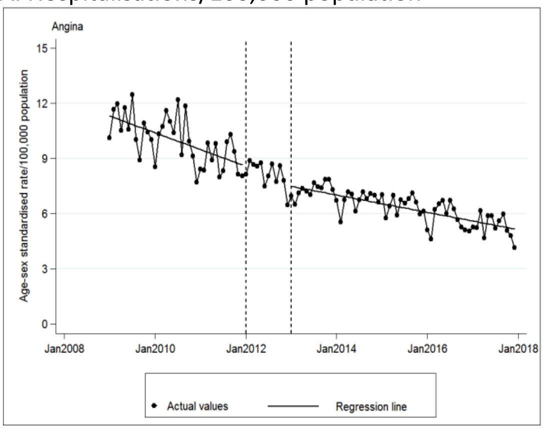


At the start of the series, the modelled age-sex standardised hospitalisation rate for vertigo was 3.5/100,000 population/month, one of the lowest rates. Between 2009 and 2011 there was no trend in the hospitalisation rate. Between 2013 - 2017, the rate trended gradually upwards at a rate of 0.02/100,000 population/month, p<0.001.

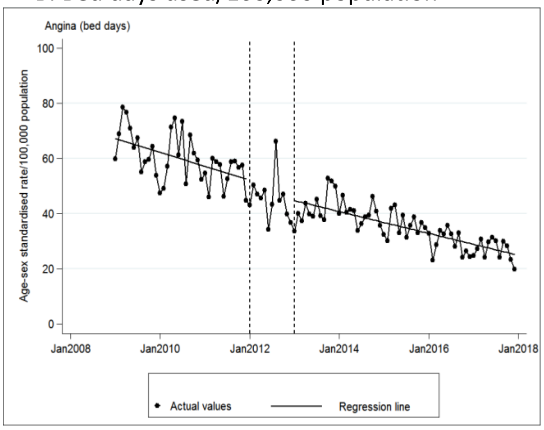
In terms of the rate of bed days used, there was no trend in this rate between 2009 and 2011, and a significant upward trend in this rate in the 2013-2017 period of 0.07/100,000 population/month, p<0.001.

Angina

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

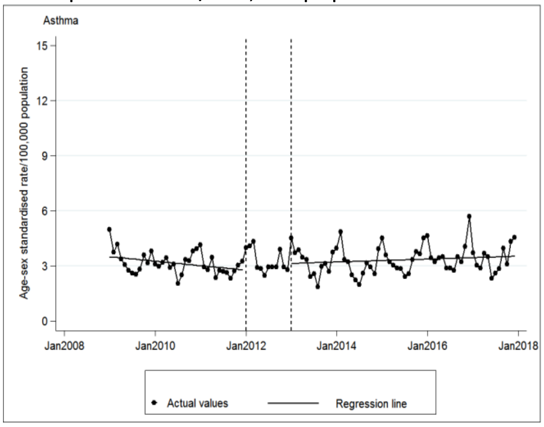


The hospitalisation rate for angina fell quite significantly over the study period, from 11.4/100,000 population/month at the start of the series to 5.4/100,000 population/month by the end of the series. Between 2009 and 2011, the age-sex standarised rate was trending downwards at the rate of 0.08/100,000 population/month, p<0.001. This trend continued between 2013 and 2017, though at a slower pace (-0.04/100,000 population/month, p<0.001).

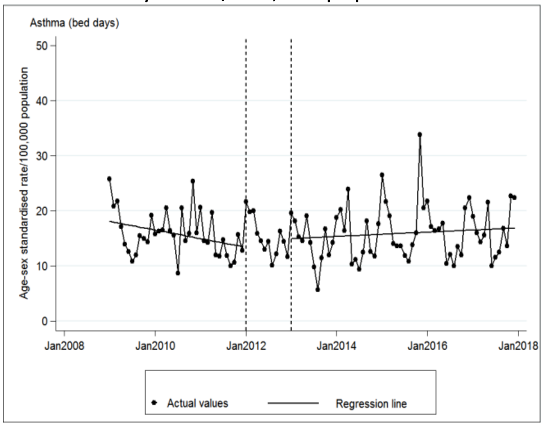
As with hospitalisations, the rate of bed days used by angina declined significantly over the study period, from 67.8 beds/100,000 population/month at the start of the series to 25.3 beds/100,000 population/month by the end of the series. There was a significant downward trend in each intervention period (-0.42 beds/100,000 population/month in the pre-intervention period, -0.33 beds/100,000 population in the post-intervention period).

Asthma

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

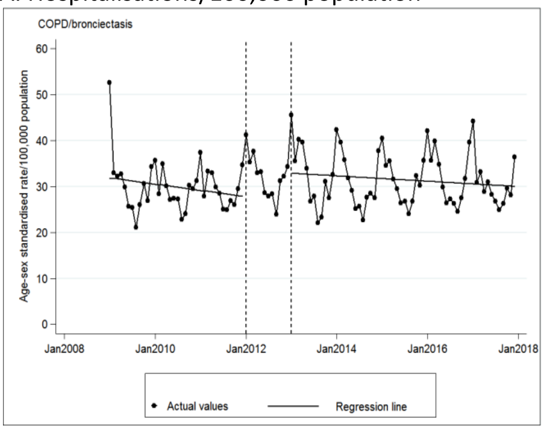


At the start of the series, the modelled age-sex standardised hospitalisation rate for asthma was low at 3.8/100,000 population/month, one of the lowest rates observed. Between 2009 and 2011 there was a gradual reduction in this trend, while between 2013 - 2017 there was no trend in this rate.

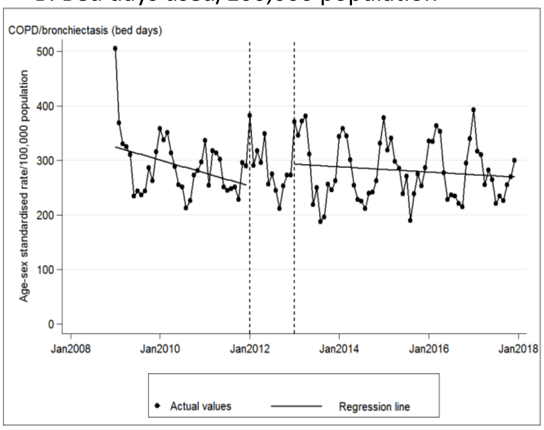
In terms of the rate of bed days used, there was a very gradual reduction in this trend between 2009 and 2011, and no trend in the rate in the 2013-2017 period.

COPD/bronchiectasis

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

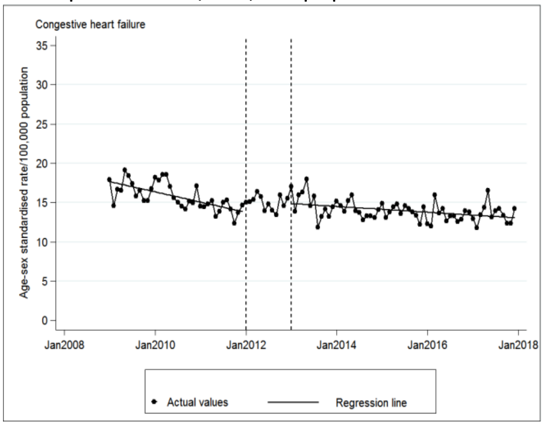


At the start of the series, the modelled age-sex standardised rates for COPD/bronchiectasis were the highest of all conditions examined (32.4/100,000 population/month). This figure was relatively unchanged by the end of the series (34.3/100,000 population/month). There was no significant trend in the age-sex standardised rate pre- or post-intervention period. However as seen with hospitalisations for lower respiratory infection (other), the seasonal peaks and troughs were more pronounced in the 2013-2017 period that in the earlier period.

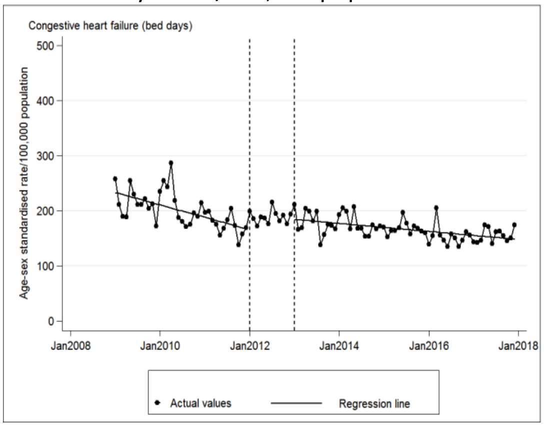
There was no significant trend in the rate of bed days used in either period. The monthly rate of bed days used by COPD/bronchiectasis at the start of the series was 322.2 beds/100,000 population/month. By the end of the series this figure was 303.7 beds/100,000 population/month. Similar to hospitalisations, the seasonal variation became more pronounced in the 2013-2017 period.

Congestive heart failure

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

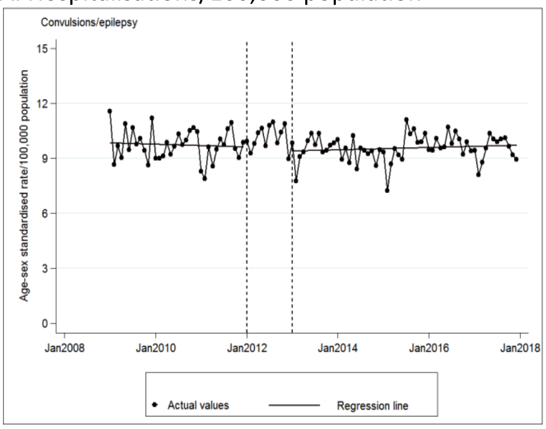


At the start of the series the modelled monthly hospitalisation rate was 17.8/100,000 population/month and this reduced to 13.1/100,000 population/month by the end of the series. This monthly rate trended downwards quite significantly in the pre-intervention period (-0.11/100,000 population/month, p<0.001). This monthly reduction was the highest across all conditions examined. In the post-intervention period, the monthly hospitalisation rate continued to trend downwards, but at a slower rate (-0.03/100,000 population/month, p=0.004).

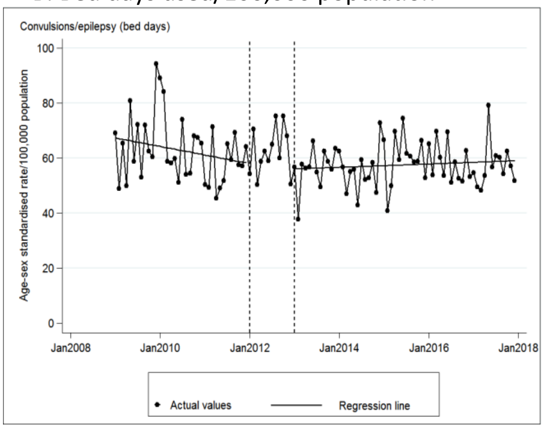
The monthly rate of bed days used declined significantly over this period, from 235.7 beds/100,000 population/month at the start of the series, to 149.0/100,000 population/month by the end of the series. In 2009-2011 there was a significant reduction in the monthly rate; the decline between 2013 and 2017 was less pronounced (-1.88 beds/100,000 population/month, p<0.001, in the pre-intervention period compared with -0.61/100,000 beds/100,000 population/month, p<0.001, in the post-intervention period). These monthly downward trends in both periods were the highest observed across all conditions examined.

Convulsions/epilepsy

A. Hospitalisations/100,000 population



B. Bed days used/100,000 population

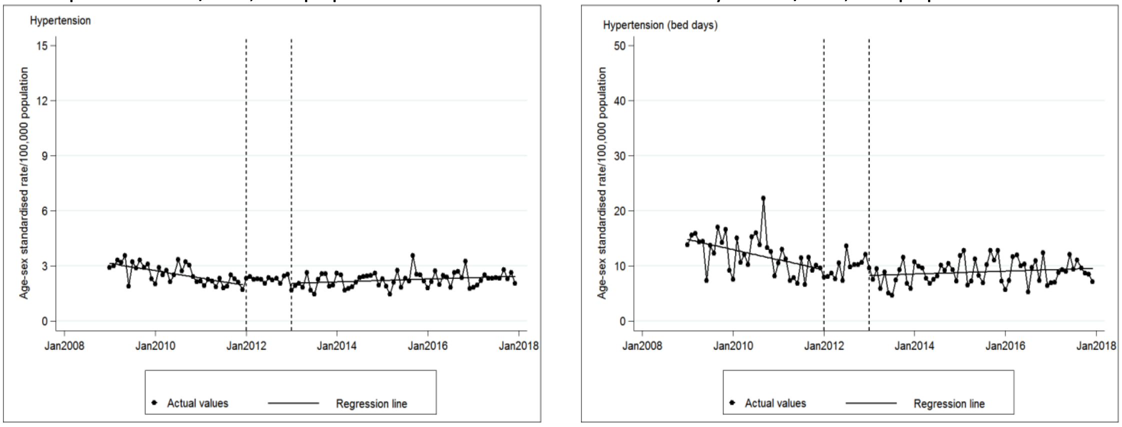


At the start of the series the modelled monthly age-sex standarised hospitalisation rate was 9.9/100,000 population/month and this remained relatively unchanged by the end of the series (9.7/100,000 population/month). There was no change in this rate before or after the intervention period.

Neither the pre- nor post-intervention trends in the monthly rate of bed days used were significant. At the start of the series the modelled rate of bed days used was 67.7 beds/100,000 population/month; by the end of the series this value had decreased to 59.0 beds/100,000 population/month.

Hypertension

A. Hospitalisations/100,000 population B. Bed days used/100,000 population

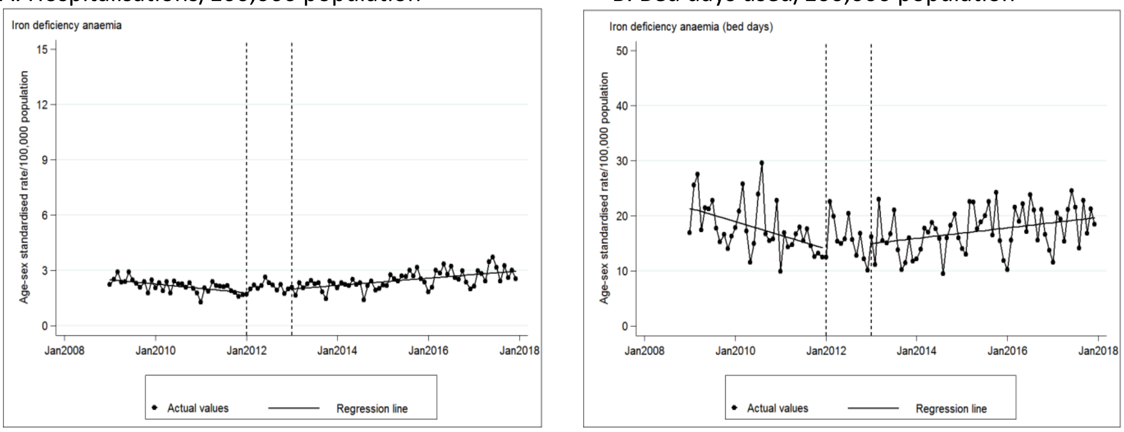


The modelled monthly age-sex standarised rate of emergency hospitalisations for hypertension at the start of the series was 3.2/100,000 population/month, the second lowest after iron deficiency anaemia. This rate trended marginally downwards in the pre-intervention period (-0.03/100,000 population/month, p<0.001). Between 2013 and 2017, there was a marginal increase in the monthly trend of overnight hospitalisations for this condition (0.01/100,000 population/month, p=0.015).

Similarly, the age-sex standarised rate of bed days used by emergency hospitalisations for hypertension each month was extremely low and the lowest of all conditions examined. While this rate trended marginally downwards in the pre-intervention period (-0.15 beds/100,000 population/month), the monthly rate after the intervention remained flat.

Iron deficiency anaemia

A. Hospitalisations/100,000 population B. Bed days used/100,000 population



The age-sex standardised hospitalisation rate for iron deficiency was very low at the start of the series (2.5/100/000 population/ month). The monthly rate declined marginally in 2009-2011 (-0.02/100,000 population/month p<0.001) but increased at the same monthly rate between 2013 and 2017 (0.02/100,000 population/month, p<0.001). With bed days, the rate was declining gradually in 2009-2011 (rate. 21.6; monthly trend=-0.20/100,000 month, p<0.001) but increased in the post-intervention period (0.08 beds/100,000/month p=0.005).

6.3.3.1 A comparison of trends in chest pain non-specific with those for UTI/pyelonephritis

Given the striking disparity in patterns of rates of hospitalisation and bed days used over the study period for chest pain non-specific and UTI/pyelonephritis it is pertinent to examine these in more detail.

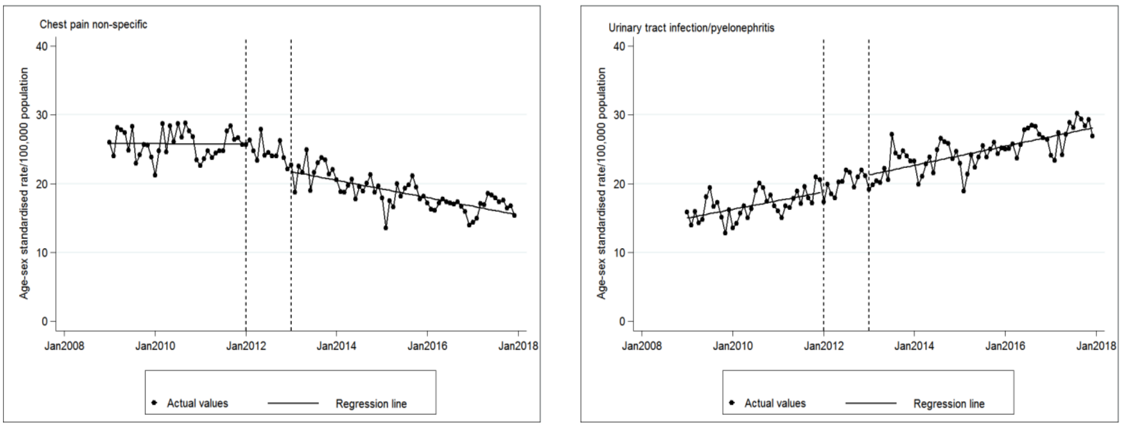
At the start of the series in 2009, the modelled age-sex standardised overnight emergency hospitalisation rate for chest pain non-specific was 25.9/100,000 population/month. This was the second highest rate of all conditions examined, after COPD/bronchiectasis. By the end of the series, this modelled monthly rate had fallen to 15.6 hospitalisations/100,000 population, fifth after COPD/bronchiectasis, UTI/pyelonephritis, pneumonia/influenza, and LRI (other).

Between 2009 and 2011, there was no evidence of a trend in the age-sex standarised hospitalisation rate for chest pain non-specific, while in the post intervention period, the age-sex standarised rate declined at the rate of 0.11 /100,000 population/month ($p<0.001$), the highest decline of all conditions examined.

In contrast, the age-sex hospitalisation rate for UTI/pyelonephritis increased continuously from 2009 to 2017 with the modelled rate almost doubling from 15.6/100,000 population/month at the start of the series to 28.1/100,000 population/month by the end of the series. In the pre-intervention period the monthly rate increased by 0.08/100,000 population/month ($p=0.003$), while in the post-intervention period, the rate continue to increase (0.11/100,000 population/month, $p<0.001$).

Figure 6.5 Monthly age-sex standardised overnight emergency hospitalisation rate for (A) chest pain non-specific and (B) UTI/pyelonephritis, 2009-2017

A. Chest pain non-specific/100,000 population B. UTI/pyelonephritis/100,000 population



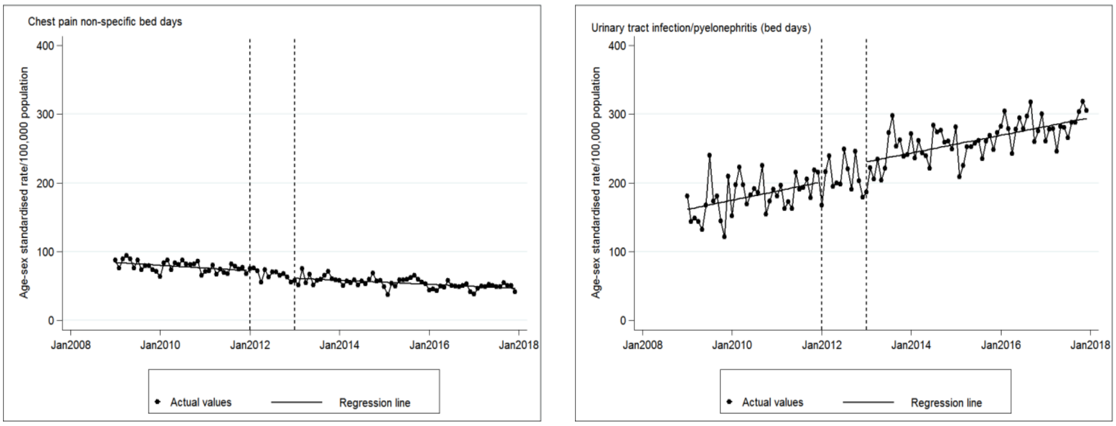
Note. The scale on the y-axis is the same on both graphs to facilitate comparison between the two conditions.

The age-sex standardised rate of bed days for chest pain non-specific reduced by almost a half over the study period from 84.6 beds/100,000 population/month at the start of the series to 46.8 beds/100,000 population/month by the end of the series. In contrast to that seen with hospitalisations, the rate of bed days used was declining before the intervention period (-0.33/100,000 population/month, p=0.001) and continued to do so in the post-intervention period (-0.25/100,000 population/month, p<0.001).

The monthly rate of age-sex standarised bed days used by UTI/pyelonephritis increased continuously between 2009 and 2017 with the modelled rate almost doubling from 160.6 beds/100,000 population/month to 294.1 beds/100,000 population/month by the end of the series. In the pre-intervention period, the rate was trending upwards at a value of 1.11 beds/100,000 population/month, p=0.005. In the post-intervention period this upward trend continued (1.07 beds/100,000 population/month, p<0.001).

Figure 6.6 Monthly age-sex standardised rate of bed days used by overnight emergency hospitalisations rate (A) chest pain non-specific and (B) UTI, pyelonephritis, 2009-2017

A. Chest pain non-specific/100,000 population B. UTI/pyelonephritis/100,000 population



Note. The scale on the y-axis is the same on both graphs to facilitate comparison between the two conditions.

At the end of the series the modelled age-sex standardised rate of hospitalisations for UTI/pyelonephritis was approximately twice that of chest pain non-specific. However, the age-sex standardised rate of bed days used was over six times greater, highlighting the much longer lengths of stay of patients admitted with UTI/pyelonephritis. In each of the four age categories, overnight emergency hospitalisation rates for chest pain non-specific were flat in the pre-intervention period. In contrast, in the post-intervention period, there was a significant downward trend in this rate in all age categories. See Table 6.5.

Table 6.5 Trends in the overnight emergency hospitalisation rate for chest pain non-specific

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Hospitalisation rate							
Age-sex std rate	25.9	0.15	0.802	-1.03 to 1.33	-0.11	<0.000	-0.14 to -0.07
Age-specific rates							
16-44 years	10.2	-0.00	0.977	-0.04 to 0.04	-0.06	<0.000	-0.07 to -0.04
45-64 years	36.9	-0.03	0.467	-0.10 to 0.04	-0.13	<0.000	-0.18 to -0.10
65-84 years	49.6	0.05	0.516	-0.10 to 0.20	-0.18	<0.000	-0.24 to -0.11
85+ years	41.9	0.12	0.437	-0.18 to 0.42	-0.23	0.002	-0.38 to -0.09

In comparison, an increase in the monthly overnight emergency hospitalisation rate for UTI/pyelonephritis was observed across all age categories between 2009 and 2017. In the pre-intervention period, not all upwards slopes were statistically significant; while they were all significant in the post- intervention period. See Table 6.6.

Table 6.6 Trends in the overnight emergency hospitalisation rate for UTI/pyelonephritis

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Hospitalisation rate							
Age-sex std rate	15.6	0.08	0.003	0.03 to 0.13	0.11	<0.001	0.09 to 0.13
Age-specific rates							
16-44 years	4.4	0.02	0.013	0.01 to 0.04	0.04	<0.001	0.02 to 0.05
45-64 years	7.20	0.02	0.135	-0.01 to 0.05	0.05	<0.001	0.03 to 0.07
65-84 years	44.0	0.17	0.056	0.00 to 0.34	0.27	<0.001	0.21 to 0.33
85+ years	160.3	1.65	<0.001	0.83 to 2.46	1.23	<0.001	0.79 to 1.66

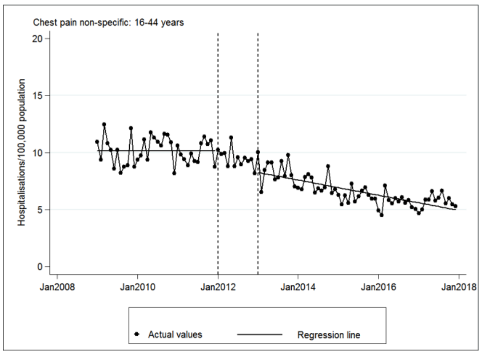
Baseline level and trends are per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

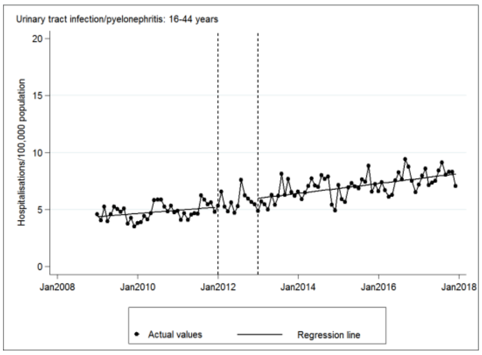
The patterns in the different age categories for these two conditions are quite visible from the graphs in Figure 6.7. In the younger age categories, the decrease in the monthly rate of emergency hospitalisations for chest pain in the post-intervention period was greater than the increase observed for UTI/pyelonephritis. However in the two older age categories, the increase in monthly rate of UTI/pyelonephritis during his period was significantly greater than the decrease observed for chest pain non-specific. By the end of the series, the overnight emergency hospitalisation rate for UTI/pyelonephritis had increased to twice than of chest pain in the 65-84 years age category and was almost seven times greater in the 85+ years age category.

Figure 6.7 Monthly age-specific overnight emergency hospitalisation rates for (A) chest pain non-specific and (B) UTI/pyelonephritis, 2009-2017

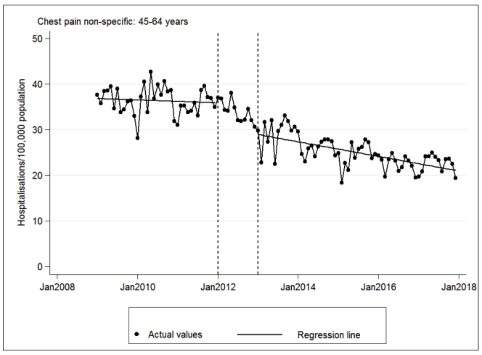
(A) **(B)**

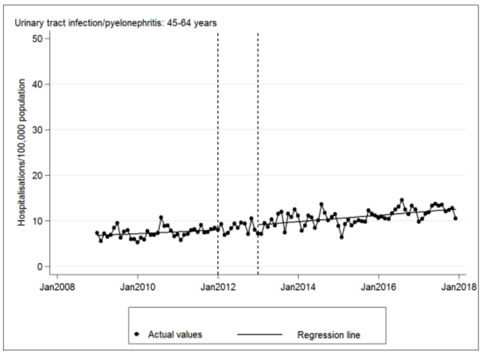
Aged 16-44 years



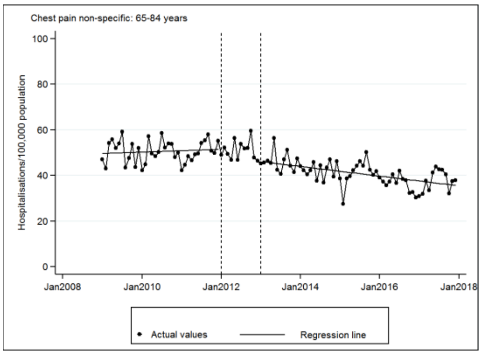


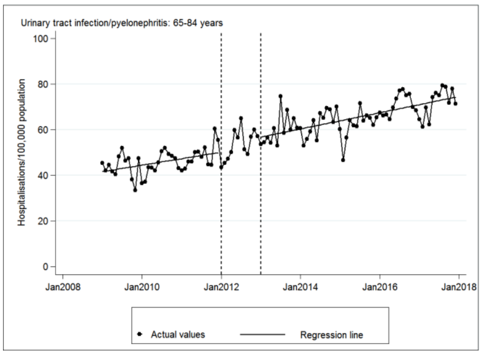
Aged 45-64 years



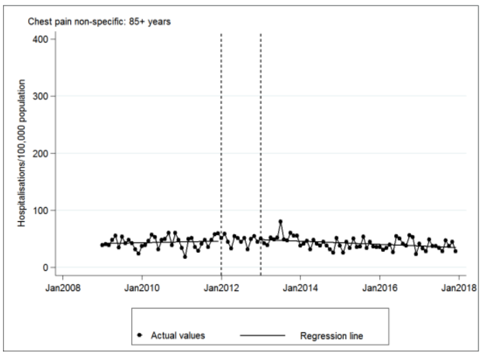


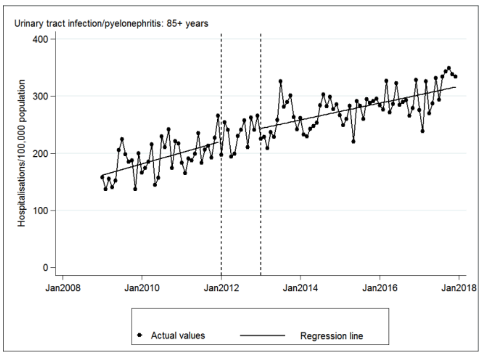
Aged 65-84 years





Aged 85+ years





Note. Within age categories the scale on the y-axis is the same to facilitate comparison

In terms of the age-specific rate of bed days used by emergency hospitalisations for chest pain non-specific, the flat monthly rate in the pre-intervention period in the youngest age category changed to a significant downward trend in the post-intervention period. See Table 6.7. The rate of bed days used was declining in the middle two age categories in the pre-intervention period, and the downward trend continued in the post-intervention period. In the oldest age category, the downward trend in the pre- or -post intervention period was not significant.

Table 6.7 Trends in the rate of bed days used by overnight emergency hospitalisations for chest pain non-specific

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Bed days used							
Age-sex std rate	84.6	-0.33	0.001	-0.48 to -0.19	-0.25	<0.001	-0.31 to -0.19
Age-specific rates							
16-44 years	23.9	-0.07	0.274	-0.9 to 0.05	-0.11	<0.001	-0.15 to -0.08
45-64 years	111.0	-0.50	0.003	-0.08 to -0.17	-0.28	<0.001	-0.40 to -0.15
65-84 years	201.8	-0.74	0.018	-1.4 to -0.13	-0.51	0.004	-0.86 to -0.16
85+ years	196.2	-0.44	0.576	-1.98 to 1.11	-0.88	0.081	-1.86 to 0.11

For UTI/pyelonephritis, in the pre-intervention period, only the upward trend in the 45-64 year age group was significant. In the post-intervention period, the rates trended significantly upwards in the first three age categories. The upward trend in the 85+ age category did not reach significance in each period. See Table 6.8.

Table 6.8 Trends in the rate of bed days used by overnight emergency hospitalisations for UTI/pyelonephritis

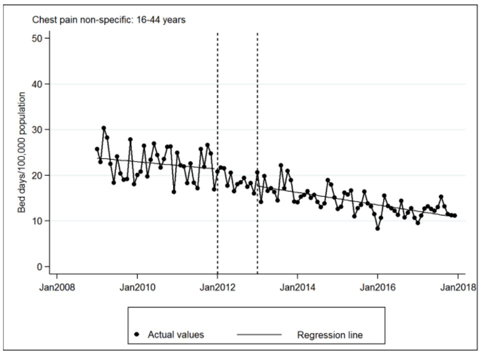
	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Bed days used							
Age-sex std rate	160.6	1.11	0.005	0.35 to 1.88	1.07	<0.001	0.72 to 1.42
Age-specific rates							
16-44 years	19.0	0.08	0.142	-0.03 to 0.19	0.19	<0.001	0.13 to 0.25
45-64 years	43.6	0.42	0.044	0.01 to 0.82	0.45	<0.001	0.26 to 0.64
65-84 years	498.9	2.80	0.057	-0.08 to 6.68	3.65	<0.001	2.43 to 4.86
85+ years	2,312.6	18.42	0.059	-0.69 to 37.5	6.42	0.272	-5.11 to 17.9

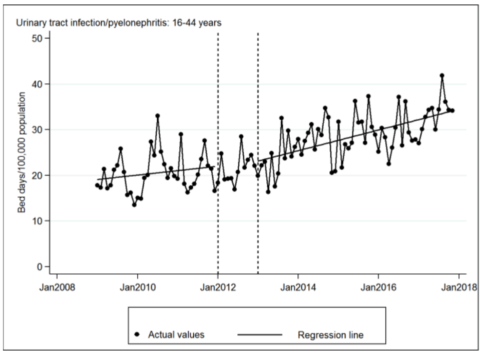
The comparison of patterns between the different age categories for these two conditions again is quite visible from the graphs in Figure 6.8. Across all categories the increase in the monthly rate of bed days used in the post intervention period was greater than the reduction observed fro chest pain non-specific during this period. By the end of the series, the rate of overnight bed days used for emergency hospitalisations for UTI/pyelonephritis was higher than chest pain for all age categories. This disparity was most pronounced for the oldest age categories.

Figure 6.8 Monthly age-specific overnight rate of bed days used for emergency hospitalisations for (A) chest pain non-specific and (B) UTI/pyelonephritis, 2009-2017

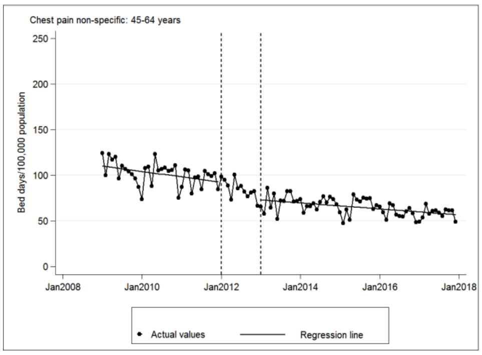
(A) **(B)**

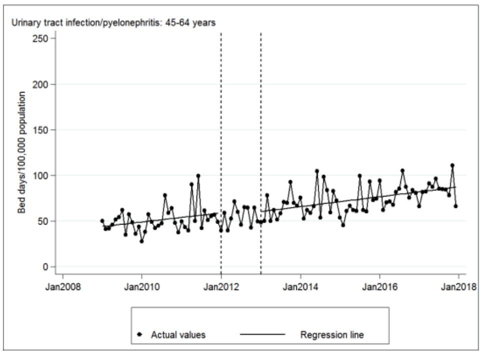
Aged 16-44 years



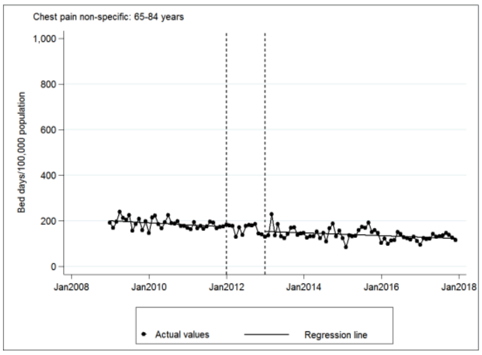


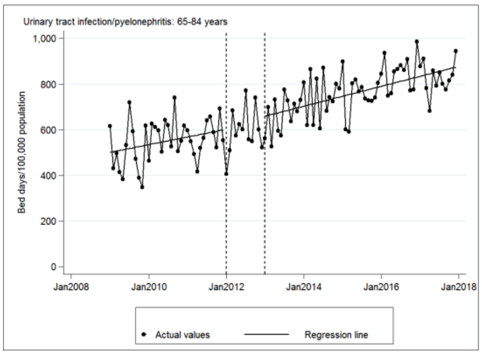
Aged 45-64 years



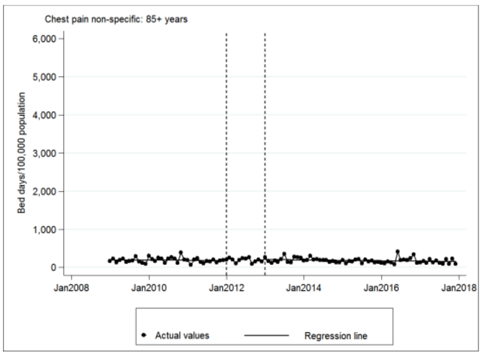


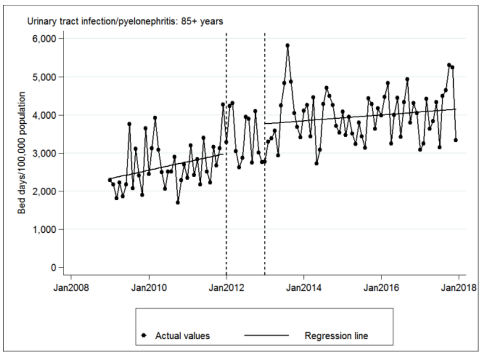
Aged 65-84 years





Aged 85+ years





Note. Within age categories the scale on the y-axis is the same for the two conditions to facilitate comparison.

6.4 Discussion

6.4.1 What did the analysis find?

The similarity of the patterns observed in the intervention group (i.e. medical conditions) with the comparison group (non medical conditions) would lead one to conclude that there is no evidence to support the hypothesis that the increase in activity in the units from 2012 onwards led to a demonstrable reduction in the rate of overnight emergency hospitalisations (or the bed days used by them) for medical conditions. The analysis found that there was a significant downward trend in the age-sex standardised monthly rate of emergency hospitalisation and bed days used by medical conditions in the pre-intervention period. These rates changed to a flat monthly rate in the post-intervention period, with no change in rates between 2012 and 2017. Most of the age-specific rates followed a similar pattern, downward trends in the pre-intervention period, followed by a flat monthly rate in the post-intervention period. An exception was the youngest age category where there was an increasing trend in both the hospitalisation rate and the rate of bed days used in the post-intervention period. Rates for non-medical conditions (served as a comparison group) showed a similar trajectory; namely significant downward slopes in the pre- compared with flat or weak downward trends in the post.

In terms of overnight emergency hospitalisations for ambulatory care sensitive medical conditions, patterns were mixed. For many of the conditions, overnight emergency hospitalisation rates (as well as bed days used by them) were reducing in the pre-intervention period and continued to do so in the post-intervention period, albeit at a slower pace. For others, flat monthly rate in the pre-intervention period continued in the post-intervention period. Chest pain non-specific, migraine/acute headache and syncope experienced significant downward trends in the post--intervention period, following a flat (or increasing trend as was the case for migraine/acute headache), in the pre-intervention period. This change was most pronounced for chest pain non-specific, where the rate declined by 0.11/100,000 population/month in the post-intervention period. By the end of the series, the modelled monthly age-sex standardised hospitalisation rate for chest pain non-specific had fallen from 25.9/100,000 population/month at the start of the series (the second highest rate of all conditions examined after COPD/bronchiectasis) to 15.6 /100,000 population, fifth after COPD/bronchiectasis, UTI/pyelonephritis, pneumonia/influenza, and LRI (other). For this condition, a similar pattern was observed across all four age categories examined, i.e., a flat trend in the pre-intervention period followed by a significant downward trend in the post-intervention period.

The emergency hospitalisation rate and rate of bed days used for UTI/pyelonephritis increased quite significantly in both the pre- and post intervention period, leading to an almost doubling in the rate of emergency hospitalisations and rate of bed days used by this condition. The monthly increase in age-sex standarised rate of hospitalisations for this condition of 0.11/100,000 population/month between 2013 and 2017 was equivalent to the decrease observed in the monthly hospitalisation rate for chest pain non-specific. This upward trend in the monthly age-sex standarised rate of bed days used by UTI/pyelonephritis in the post-intervention period was equivalent to the total downward trend observed among all five conditions that experienced a reducing trend in bed days in that period (i.e., cardiac dysrhythmia, chest pain, deep vein thrombosis, syncope and TIA combined). This increasing rate of emergency hospitalisation and rate of bed days used by UTI/pyelonephritis over the entire period (2009-2017) was observed across all age categories.

6.4.2 How do we interpret these findings in terms of programme impact?

There are several factors that need to be taken into consideration when interpreting these findings. Firstly, comparing the trends in the pre- with the post-intervention period is problematic given the dramatic bed closures that commenced in 2007 and continued until 2012, with a 9% reduction in in-patient bed numbers between 2009 and 2011 alone. It is probable, though it cannot be tested, that the downward trends observed in the pre-intervention period were heavily influenced by these bed closures. Had these not occurred, it is likely that the trend in the pre-intervention period would be different, perhaps flat. It is also likely that the efficiencies gained during the earlier years of the recession (Burke et al., 2014), contributed to the downward trends observed during that period. There were no further bed closures in the post-intervention period (2013-2017), with numbers increasing marginally in 2016 and 2017. Therefore it is plausible that the downward trends observed in the rate of overnight emergency hospitalisation (and bed day used by them) for several of the ambulatory care sensitive conditions were as result of, or influenced by, the activity in the AMAU during the post-intervention period. This cannot be stated definitely given the lack of control group, and with all quasi-experimental designs, consideration must be given to that fact that there may have been other factors external to the programme that influenced these post-intervention trends. However, it is far more likely that external influences during this period would have had a negative effect on the programme outcome measured, making it more difficult to detect programme impact. A discussion of these ensues.

There is no measure of total emergency presentations for these conditions over the study period. The data presented in this thesis covers in-patient hospitalisations only, i.e., patients admitted in-house from an ED and all those assessed in an AMAU. This precludes the examination of whether the rate of emergency presentations for these conditions increased (or decreased) in the post-intervention period at a faster pace than in the pre-intervention period. This is a likely scenario for the majority of conditions given that the post-intervention period spanned a time when the austerity measures imposed on the health system took hold (Burke et al., 2014). As these conditions are indicative of poor access to preventive and early management in primary care (Tian et al., 2012), and are independently associated with deprivation (Lynch et al., 2019) (O'Cathain et al., 2014a), it is entirely plausible that the rate of emergency presentations for these conditions actually increased in the post-intervention period faster than in the pre-intervention period. In this scenario, the analysis undertaken will have biased downwards any programme impact.

It is also plausible that there was a change in the underlying incidence of these conditions over the study period, which itself would have influenced the rate of emergency presentations and therefore rate of overnight hospitalisations. For example, it is entirely plausible that there has been an increase in the rate of emergency presentations for UTIs, driven by increasing incidence of this acute condition. If this were the case then one would expect an increase in the overnight emergency hospitalisation rate, which is what this study found. Similarly, one could argue that the reduction in overnight emergency hospitalisation rates observed for chest pain non-specific was simply due to a reduction in the incidence of this condition and not as a result of the increase in same day discharge rates from the AMAU. However, Chapter 5 examined the numbers of the emergency hospitalisations by admission pathways for each condition, and found that the number of emergency hospitalisations for chest pain actually increased significantly, over this period. But there was a clear reduction in those admitted in-house from a non-AMAU source in tandem with the increase observed in the numbers assessed in the AMAUs. Chest pain non-specific is by far the most common assessed in an AMAU - it repressed 10% of AMAU activity in 2017 - with over 50% of emergency hospitalisations for this condition being streamed to an AMAU. And as shown, almost 90% of those assessed in an AMAU with this condition were discharged directly in 2017 (ranging from 93% of those aged 16-44 years to 67% in those aged 85+ years). (See Table 5.17). Hence one can surmise from this that the reduction in overnight emergency hospitalisation rate for chest pain non-specific is most likely a result of the increase in the numbers with this condition streamed to an AMAU and discharged directly from there. In contrast, the proportion of emergency hospitalisations for

UTI/pyelonephritis that care streamed to an AMAU is low. In 2017, only 21% of emergency hospitalisations for this condition were assessed in an AMAU; the remaining 79% were admitted directly in-house from a non-AMAU source (predominantly an ED). The propensity of the AMAU to discharge patients directly with this condition is considerably lower than seen with chest pain non-specific. Of all those assessed in an AMAU with this condition in 2017, 28% were discharged directly, falling from 43% in those aged 16-44 years, to 18% in those aged 85+ years. This raises the question as to what would need to be implemented in an AMAU to ambulate these patients and safely avoid an overnight admission for those presenting to hospital with a UTI.

It is clear from the analysis that the large numbers of patients that are streamed to the AMAU with chest pain non-specific, and the high same day discharge rates from the AMAU for this conditions, identified during the utilisation study in Chapter 5, has had a demonstrable impact on the overnight emergency hospital rate for this condition. On emergency presentation to hospital with a complaint of chest pain, avoiding an overnight admission is contingent on several factors. Firstly, an evaluation of whether the symptoms are related to acute coronary syndrome (ACS) or not, is essential, as hospitalisation is required for the former. Clinical risk scores and risk prediction models, such as the Thrombolysis in Myocardial Infarction (TIMI) and HEART scores, have been used in accelerated diagnostic protocols to determine a patient's likelihood of having ACS (Caulfield, 2018). The combination of clinical evaluation and risk scoring with inexpensive clinical assays such as, troponin 1 assay is necessary to make the decision as to whether the patient requires in-patient hospitalisation or not. This is dependent on access to same day diagnostics, or diagnostics within a 72 hour period to safely ambulate the patient home, rather than admit to await procedures or tests. It also requires a clinical decision maker with the confidence to discharge the patient directly (contingent on the evaluation) rather than admit in-house. It is likely that it is these components of the AMAUs that have led to the significant reduction in overnight emergency stays for chest pain non-specific. Similarly for migraine and syncope, it is likely that access to diagnostics and the presence of a senior decision maker would lead to a tendency to discharge same day from the AMAU for these conditions, rather than admit.

6.4.3 How do these findings tie in with the literature?

There is a dearth of literature on the effectiveness of interventions in the hospital setting to avoid overnight emergency hospitalisations for ambulatory care sensitive conditions (Purdy, 2010, Purdy and Huntley, 2013, Tian et al., 2012). The literature focuses on a whole-systems approach to avoiding admissions, rather than individual interventions. The rationale is that multi-faceted interventions are warranted, as most avoidable admissions are due to a range of factors. Early review by a senior clinician in the emergency department is effective (White et al., 2010), GPs working in the emergency department are probably effective in reducing admissions (Carson, 2010), but may not be cost-effective (Purdy and Huntley, 2013), while structured discharge planning has also been found to be effective in reducing future re-admissions (Purdy and Huntley, 2013).

The literature on the effectiveness of AMAUs in avoiding overnight admissions for medical conditions is scant, and there is none on their ability to reduce admissions for ambulatory care sensitive medical conditions. The limited literature on the effectiveness of AMAUs tends to focus on mortality and length of stay. Van Galen found conflicting results to the question as to whether the introduction of an AMU reduced the number of emergency admissions (van Galen et al., 2017). Two articles from an Irish Acute Medical Assessment Unit[31] describe an increase in the number of medical admissions after the establishment of an AMAU (Moloney et al., 2006, Moloney et al., 2005), while Man Lo et al. (2014) in Hong Kong found a decrease in the average emergency admissions rate after reorganisation into an emergency medicine ward (Lo et al., 2014). In the UK, a 2008 study found a decrease in the number of medical admissions after reorganisation of a separate AMU and ED into one emergency assessment unit (Boyle et al., 2008). Again, the heterogeneity of the models studied and the methodology used hampers comparison with the findings of this study. NICE recently assessed whether admission or assessment through an AMU (compared with direct admission to a general medical ward) increased hospital discharges, improved patient outcomes and hospital resource usage, and found that there is mixed evidence for the benefit of admission through an AMU (National Institute for Health and Care Excellence, March 2018). With stricter inclusion and exclusion criteria, their review was limited to just three observational studies (Li et al., 2010, Rooney et al., 2008, Coary et al., 2014), which they classed as very low quality. None of these studies however measured impact on admission rates.

There is also a lack of evidence of the effectiveness of Ambulatory Care Units in avoiding overnight hospital admissions. Despite Ambulatory Emergency Care being promoted as

[31] As described in Chapter 1, a model 4 hospital in Dublin, Ireland, has an Acute Medical Assessment Unit that pre-dates the Acute Medicine Programme and operates a different model in that it has a 5-day medical admissions ward for medical patients admitted from the ED. The data on HIPE for this hospital lists all emergency hospitalisations as being ED-admitted. It does not differentiate those that are admitted to the AMAU. Hence the activity in this AMAU does not contribute to the National AMAU utilisation figures presented here.

best practice to minimise hospital admissions, improve emergency care flow, reduce costs of admission, and prevent harm by avoiding admission (NHS, 2019) (NHS England and NHS Improvement, 2019), there is a lack of evidence of its effectiveness (and its cost-effectiveness) or the most appropriate model by which it should be delivered. Evidence of conversion of care from in-patient to out-patient is clear and the philosophy of ambulatory emergency care holds promise for preventing unnecessary hospital admission but the current evidence-base to support the intended flow, cost, clinical and quality outcomes is lacking, highlighting the need for research in this emerging, internationally important field of practice.

6.4.4 Strengths and limitations

The strengths of this study of programme impact lie in its well considered study design and the analytical approach used. Quasi-experimental designs such as interrupted time series regression analysis are seen as the gold stand in programme evaluation, as they take into account historical trends and secular patterns to provide a more accurate estimate of programme impact (Wagner et al., 2002). The study examined programme impact on each of the ambulatory care medical conditions separately, to provide a rich description of patterns over time in each of these conditions. Had the data been aggregated to hospitalisations for all ambulatory care sensitive medical combined the impact on chest pain would not have been detected, neither would the dramatic rise in hospitalisations for UTI/pyelonephritis. As this was a formative evaluation this level of detail was required to provide useful information to the Programme team to focus efforts on those conditions with high rates of emergency hospitalisations and high rates of bed days used.

Along with the limitations already mentioned, this study had other limitations which were all data related.

Data constraints

Many of the expected outcomes of the Acute Medicine Programme could not be examined owing to lack of data. The outcome chosen for analysis - change in the rate of overnight emergency hospitalisations and the bed days used by them - was affected by data and methodological issues. The lack of data on the acuity/severity of these hospitalisations meant that it not possible to ascertain whether the acuity and/or complexity of emergency presentations for these medical conditions increased over the study period, thereby increasing the propensity to admit overnight. This is quite plausible, given that an increase in complexity of medical patients was recently noted in a UK audit of acute medical care (Society for Acute Medicine, 2018).

The lack of a control group

The use of a control group, or a comparison group where there was no introduction of AMAUs, would have answered the question as to what would have happened hospitalisation rates in the absence of the Programme. However this was not feasible, and in the absence of a natural control emergency hospitalisation rates for non-medical conditions over the same period were analysed. They showed very similar patterns as medical conditions, a significantly decreasing rate in the post-intervention period and a flattening of this rate in the post-intervention period. Another approach would be to do a hospital level analysis, by creating catchment areas for these hospitals, and then adjusting for changes in population and deprivation levels over time, to examine whether the level of utilisation of the units in the individual hospitals was associated with a reduction in rates.

Choice of intervention period

Interrupted time series is the gold standard used to measure policy/programme impact. It performs best when there is a clear intervention time point, to look at a level change and a trend change after the intervention. In this study, there is not a 'clear' intervention time point given the diffuse nature of the intervention. The year 2012 was chosen as the intervention time point as this was the year many of the AMAUs opened and activity increased. However several AMAUs were operational before then, and it is likely this has biased programme impact downwards.

Codes used in the derivation of ambulatory care sensitive medical conditions

As discussed in Chapter 5, there is considerable variation across the different definitions in terms of the ICD-10-AM codes used to identify these ambulatory care sensitive medical conditions. This was recently examined by Frick et al, who found that prevalence of emergency hospitalisation rates for ambulatory care sensitive conditions in their study cohort ranged from 19.1% to 36.6% depending on which definition was used (Frick et al., 2017). The analysis conducted here erred on the side of using a more exhaustive list of codes to identify these conditions. The rationale for same is that there appears to be a tendency at the hospital level to code rather 'ambiguously' and by restricting to certain codes, a large proportion of hospital episodes for these conditions would be would be excluded. For example, the vast majority of emergency hospitalisations for pneumonia in Ireland are coded as J18.9 'pneumonia unspecified organism'; very few are coded to the causative agent. This is clear from the table in Appendix 5.4, which provides a breakdown of the numbers of overnight hospitalisations each year between 2009 and 2017 per individual ICD-10-AM code. In the ACSC lists examined, not all include J18.9 and choose only some of those listed under J18 (J18.0:

bronchopneumonia, unspecified organism; J18.1: lobar pneumonia, unspecified organism; J18.2: hypostatic pneumonia, unspecified organism; J18.8: other pneumonia, unspecified organism; J18.9: pneumonia, unspecified organism). Were this approach to be taken here, the overnight emergency rate for pneumonia would be a fraction of the 'true' rate. This more inclusive version is likely to have made it more difficult to detect programme impact on avoiding overnight admission for pneumonia, given that many of the codes included here are excluded from definitions in other jurisdictions, likely because they have a lower potential to be managed safely in a non-acute hospital or ambulatory setting. This is why experts in the field have called for greater agreement and consistency in the use of codes for the different conditions deemed ambulatory care sensitive, to make this a more reliable indicator of health systems performance.

6.5 Conclusion

The study found no evidence to support the hypothesis that the increase in activity in the AMAUs from 2012 onwards led to a reduction in the national rate of overnight emergency hospitalisations for medical conditions, or the bed days used by them. The monthly age-sex standardised rate and the age-specific rates of overnight emergency hospitalisations for medical conditions remained unchanged between 2012 and 2017.

There was evidence to suggest that the increased activity in the units from 2012 onwards led to a sizeable reduction in overnight emergency hospitalisations for chest pain non-specific, with a reduction observed across all age categories. The modelled age-sex standarised rate of hospitalisations for chest pain non-specific reduced by approximately 40% between January 2013 and December 2017, after several years of no change in the hospitalisation rate for this condition. There was also evidence of a very modest monthly reduction in the rate of emergency rates of hospitalisation for migraine/acute headache and for syncope. For the other ambulatory care sensitive medical conditions, there was no discernible change in the trend, which either continued in a downward trajectory, or remained stable.

The influence of the bed closures on the emergency hospitalisations rate in the pre-intervention period made it difficult to decipher whether the downward trend observed in the post-intervention period in emergency hospitalisation for conditions such as cardiac dysrhythmia, deep vein thrombosis, TIA, angina and congestive heart failure, was evidence of programme impact, or the continuation of a downward trajectory, which would have continued in the absence of the programme. There was no evidence of a programme impact on the rate of hospitalisations for LRI (other), pneumonia/influenza, vertigo, asthma, COPD/bronchiectasis, convulsions/epilepsy, hypertension, and iron deficiency anaemia. The hospitalisation rate of UTI/pyelonephritis increased consistently over the study period. The rise in the rate of bed days used by this condition in the post intervention period greatly surpassed the reductions observed among those conditions that experienced a reducing rate over that period.

The ability of the units to make an impact on rate of overnight emergency hospitalisation rates is contingent on them being utilised in sufficient numbers, assessing patients who would have been admitted had they remained on the conventional pathway and having well implemented well resourced systems, processes and pathways in place to safely avoid an admission. The previous two chapters found serious deficits in implementation in all of those aspects. The next chapter presents the findings of the interviews with programme and clinical staff to try to elicit why.

Chapter 7. Factors influencing the implementation and operation of the Acute Medicine Programme

7.1 Introduction

As the Acute Medicine model of care was published in 2010, there is an expectation that the Programme would be routine in acute hospitals at this stage in its life course (Rogers, 2003). Appropriate patients with a medical condition presenting as an emergency to hospital (with or without a GP referral) should be streamed through to the AMAU to be seen within an hour by a senior decision maker, with a decision made within a 6 hour period to admit or discharge. Many of the Programme's recommendations for the management of medical patients throughout the hospital (e.g., daily ward rounding, nurse-facilitated discharge, expanded access to outpatient appointments and rapid access clinics, ambulatory care services to avoid overnight admissions) should also be routine practice.

As seen in the Chapters 4 and 5 which assessed implementation from the perspective of the organisational structures, processes and resources out in place to support the programme, and the utilisation of the AMAUs, this is not the case. Implementation can be described as partial, with a high level of heterogeneity across the sites. The purpose of this stage of the evaluation is to understand why this is the case and what has influenced implementation of the Acute Medicine Programme and its ability to achieve its expected outcomes.

7.2 Methodology

An explanatory qualitative study was undertaken adhering to the modified COREQ (consolidated criteria for reporting qualitative studies) standards (Tong et al., 2007). Face-to-face, semi-structured interviews were conducted with programme management and clinical staff from the medical and nursing disciplines.

7.2.1 Setting, participants and sampling

Two distinct groups of participants were interviewed - those serving as NAMP management since the inception of the programme (n=7) and clinical staff from selected hospitals (n=28). Six hospitals were purposively sampled based on the level of implementation of the Programme, with three 'high' and three 'low' implementation sites, defined by the proportion of medical patients admitted to hospital as an emergency in 2017 that were streamed through their AMAU in 2017. Purposive sampling allowed strategic selection of participants on the basis that they would be able to provide ‘information rich’ data to analyse (Braun and Clarke, 2013). Sampling cases at either end of the implementation spectrum allows the identification of the factors that contribute to or hinder successful implementation (Damschroder and Lowery, 2013). When it came to the analysis however, the deficits in this implementation outcome measure (i.e., utilisation of the units) as a precise indicator of implementation effectiveness had become apparent, given that those units with higher utilisation may not necessarily be accessing the appropriate patients for the AMAU. Hence all interviews were analysed collectively - i.e., no differentiation was made between interviewees at units with high vs. lower level of utilisation.

All six sites that were approached agreed to participate in the study. A list of participant types that were necessary to interview at each site was drawn up and these personnel approached. Not all those approached agreed to participate, with uptake being especially poor among one hospital. In total, there were 28 interviews conducted with clinical staff: medical consultants working in the AMAU (n=9), other hospital doctors (n=2), emergency medicine consultants (n=4), clinical nurse managers in the AMAU and/or ED (n=6), advanced nurse practitioners (n=2), assistant directors of nursing for patient flow (n=5).

7.2.2 Data collection

Semi-structured interviews were conducted with programme management between July and September 2017 and at the hospitals between October 2018 and March 2019. A topic guide was created for each group of participants, informed by the Consolidated Framework for Implementation Research (CFIR), the logic model, and other key articles (Sandelowski and Barroso, 2003) (Aarons et al., 2016). See Appendix 7.1. Questions were open ended and focused on collective perceptions of the Acute Medicine Programme, particularly as it pertained to Acute Medical Assessment Units. The questions posed covered several major topics: experience with the intervention, including participants' perception of it, its compatibility with the hospital system, and threats to sustainability.

Owing to time pressure and limited resources of the researcher, these interviews were conducted *concurrently* with the impact evaluation, rather than sequentially, as per the original protocol. Therefore the findings of the impact evaluation were not available for discussion during this stage of the study. This meant that the interviews did not explore the factors influencing the Programme's success in reducing overnight rates of emergency hospitalisations for chest pain non-specific. Rather a broader discussion was had as to the factors influencing the ability of the AMAUs to avoid overnight admissions in general.

Participants consented to the interview and provided written permission to record the interview. Data collection and analysis were discontinued when efforts to interview each of the relevant personnel at the individual sites were exhausted. It cannot be stated for certain that data saturation was reached as these personnel may have had different opinions given their reluctance to engage with the researcher. However amongst those that did participate, by the end of the interviews no new information or themes were emerging.

7.2.3 Analysis and interpretation

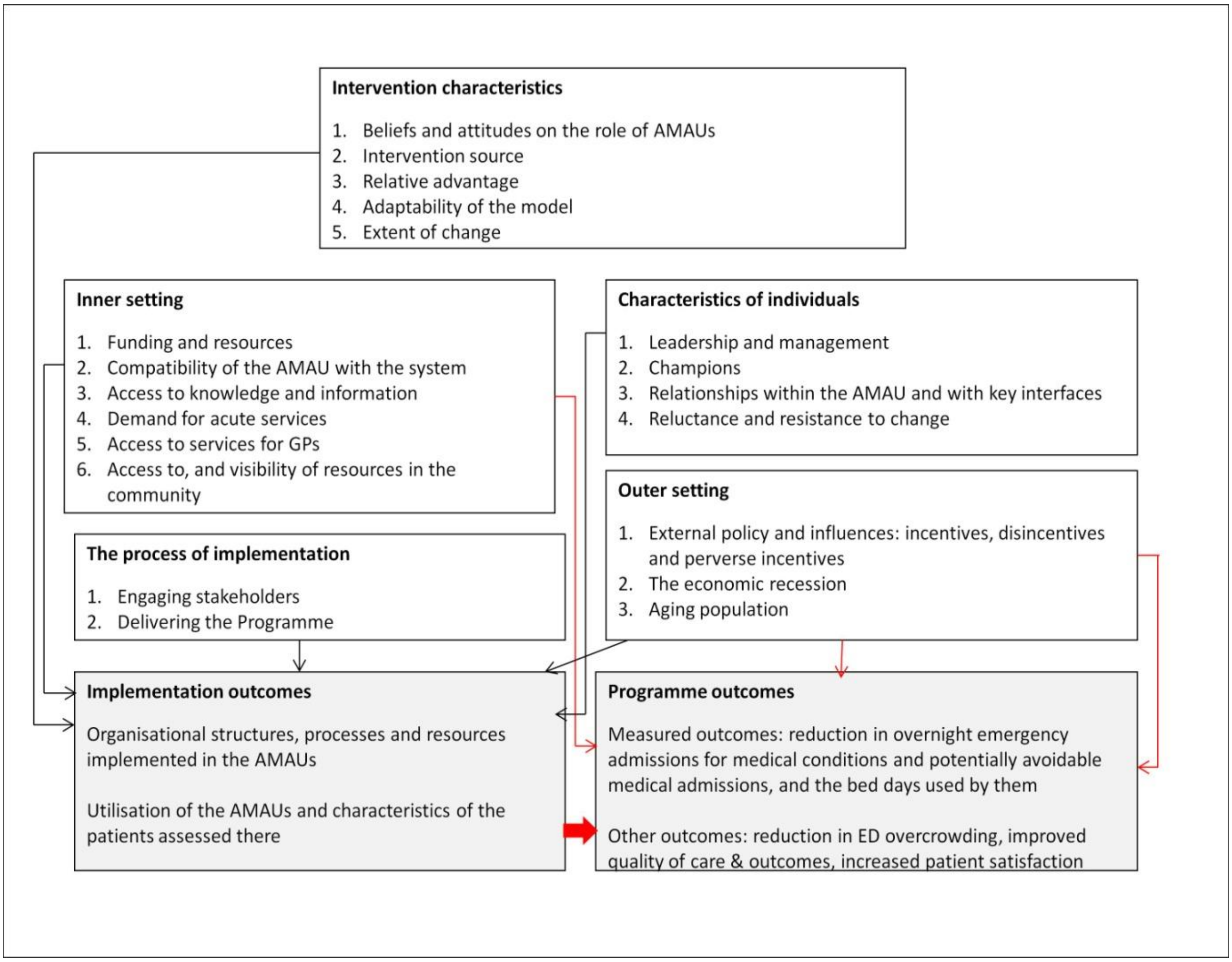
The descriptions of the views of the participants were analysed using reflexive thematic analysis. This approach provides a flexible and useful research tool to develop a rich and detailed account of the data (Braun and Clarke, 2013). All interviews were anonymised and fully transcribed by the researcher and saved in QSR Internationals NVivo Qualitative Data Analysis Software (Version 12). Data were anonymised, and coded with an identifier to distinguish between the different participant types. The researcher re-read each of the transcripts whilst also listening to the audio recording to become familiar with the whole interview.

Data were initially coded using complete coding throughout the entire dataset. Coding involved identification of words or brief phrases that captured the essence of the relevance of that piece of data to the research question. While a predominantly deductive approach was taken with coding informed by the CFIR constructs (Appendix 2.1), the transcripts was also open coded when data not did not fit within these constructs. The next phase of coding focused the analysis at the broader level and involved combining and refining these codes into individual factors and mapping them to the relevant domains. This map of domains and factors were reviewed by the primary supervisor and discussed. The researcher then further reviewed these factors by returning to the entire un-coded dataset, to ensure that they fully captured the meaning of the dataset. Each domain was them written up with a comprehensive summary of the associated factors.

7.3 Findings

There were 35 interviews conducted: programme management (n=7), clinical staff (n=28). The interviews identified a myriad of factors that influenced implementation. As hypothesised in the conceptual framework (Figure 2.3), there were also some factors that appeared to influence programme outcomes independent of programmme implementation.

Figure 7.1 Domains and factors influencing programme implementation and outcomes



7.3.1 Domain 1. Intervention characteristics

This first domain is concerned with the characteristics of the programme or intervention being implemented. There were five factors in this domain that the participants felt had influenced implementation and operation of the AMAUs.

- Beliefs and attitudes on the role of AMAUs
- Intervention source
- Relative advantage
- Adaptability of the model
- Extent of change

7.3.1.1 Beliefs and attitudes on the role of AMAUs

Participants commented that a lack of understanding or different perceptions about the role of the unit was a barrier to it functioning as per the model of care. There was a perception among some (predominantly those in the ED), that all medical patients should be assessed in an ED, and those requiring in-patient admission to hospital streamed to an AMAU from there. Others felt that this decision should be made *before* the patient reached ED, ideally at the front door by a person suitably qualified to stream patients, especially if those patients had been referred to the AMAU by a GP. This difference in opinions on the role of the AMAU had led to friction between the two departments (ED and the AMAU) and issues with the streaming of patients to the AMAU service. Participants lamented that their AMAU was being streamed patients whose acuity was too low; that these patients should have been discharged directly from the ED or at triage. Programmme management commented on how they observed during site visits a clear misunderstanding as to the role of the AMAU at some sites, with lower acuity patients being streamed there.

> *And some of that comes from a lack of understanding. You would have people saying, "Oh the patients are too sick to go over there". The bizarreness of it! You had very senior people, senior consultants, senior nurses who were working in the unit and ED jammed full of people and not enough resources and you had people saying the patients were too sick to go over there!* (respondent 2).

A minority of those interviewed believed that the AMAU was just an assessment unit and therefore should only be receiving patients that could be turned around the same day and referred to outpatients if needed, and not be streamed not those that required a hospital stay.

In terms of the Acute Medicine Programme as a whole; some firmly believed that the model of care was sound, that the evidence to support it was sound, and that there was ample engagement in its design. They believed that the model simplified a very complex area - the flow of medical patients through the hospital - to four areas for intervention and listed the activities that needed to be taken in each. Others firmly believed that the Programme was too ambitious, too large, and its vision was not clear across their hospital.

7.3.1.2 Intervention source

The source of the intervention influenced implementation, predominantly by fuelling a lack of buy-in from medical specialists, which resulted in a shortage of consultants to contribute to the AMAU rota. This had led to AMAUs not being able to operate the hours envisaged in the model of care. There were several opinions put forward about the source of the intervention and how this influenced implementation.

Firstly, implementing a model that had not originated in one's own hospital, but was national top down strategy influenced by the model in another hospital, was not palatable to clinicians, and therefore they had not bought in to the model. Secondly, participants felt that implementation of a model into Ireland from another jurisdiction (UK) was never going to be successful, as the resources to operate the model were not available.

> *It is the model in the UK. But the problem is as far as I can see is they took this UK model and they tried to plant it in Ireland but they did it in a typical Irish, they did it in a half assed way. You know the units are not big enough. They did not have enough staff to actually do this properly* (respondent 25).

Thirdly, the fact that the model was based on one that was working well in a model 3 hospital was a point of contention with participants in model 4 hospitals '*who felt that the problem was that [they've] had this model foisted upon the level 4 hospitals and it doesn't work. A small town solution [was] being put into a major cosmopolitan urban setting' (respondent 11).* There were two arguments put forward as to why the AMAU was suitable for model 3 hospitals, which are smaller, but not for model 4 hospitals. The first was that there was an inherent difference in the medical consultants who work in model 3 and model 4 hospital, and trying to get buy-in from specialists in model 4 hospitals, who were primarily motivated by advancing their specialty to cover the AMAU rota, was not a realistic endeavour.

> *In model 3 hospitals everyone is an AM physician, because they are all doing acute medicine. In model 4 hospitals, they say, "well I'm not an AM physician, I'm a chest physician, I'm a gastroenterologist and I'll have nothing to do with that place because it's not within my contract, I'm not going there." In a model 4 hospital it is their job to develop their specialty. That is less so in a model 3 hospital and that is the reason it works better* (respondent 33).

The second was that the industrial volume of patients going though the EDs in model 4 hospitals, with these EDs full on a 24/7 basis, lent itself to larger EDs and efficient streaming of patients away from them. These participants held the belief that the AMAU should take patients that an EM consultant had decided needed to be admitted to hospital, as opposed to '*it being an alternative door for patients to get into hospital*' (respondent 11).

7.3.1.3 Relative advantage

Despite the conflicting views on the compatibility of the AMAU with system, especially in model 4 hospitals, there was a common sentiment that the pathway led to a significantly better patient experience than that of admission from the ED to the medical team on-call.

> *It's the luck of the draw, the time of the day, the day of week, where you could go on this seamless pathway, where everything is efficient and works really well, or you can just go off on a parallel universe where everything takes days, and you might spend the first 48 hours on a trolley in ED where nothing will happen. No one will do an angiogram on you, because you cannot go back to ED, no one will do an OGD on you. Nobody will do most things for you* (respondent 29).

The components of the AMAU which were recognised as being beneficial to patients were immediate access to senior decision makers and allied health and social care professionals as part of the AMAU team, quicker access to diagnostics, and an overall quieter environment more conducive to the delivery of medical care.

> *In the AMAU there are consultants, on site, if you go in through the AMAU and stay under the AM physicians, you have the SSW. You have a whole team rounding and they are only a shout away if you need them or if the family needs them. There are fantastic doctors in there, consultants, senior doctors, junior doctors, ANPs, they are brilliant. You also have a little bit more access to priority diagnostics, especially in the assessment phase. Everything is done in a calmer, timely manner* (respondent 13).

The fact that some AMAUs had established review clinics to meet the shortfall in urgent outpatient appointments and had established good relationship with other specialties were seen as a factor driving the ability of the AMAU to avoid overnight admissions, a core programme outcome.

7.3.1.4 Adaptability of the model

The model of care provided guidance on what was to be implemented per hospital model to operate a successful AMAU. This was not prescriptive however, and sites were given the flexibility to adapt the model to suit the needs of the service at their hospital. This was seen as both an enabler and a barrier to implementation.

> *Ok, so in one way it was important and in another way it crucified you. Because it depended on how committed, how bought in to the model the site was. So if they were very bought in to it, that adaptability was quite enabling. If they were not bought in to it, and if the senior leadership was not bought into it, it was quite crippling. In some sites the acuity of patients*

going through it wasn't right, the whole nature of ambulatory care didn't happen, the intention of how long the unit would be open etc. All those kind of things did not happen. So you had units that opened at 8am and took their last patient at 3pm (respondent 2).

Fidelity to the model in terms of the type of patients being assessing in the AMAU, was negatively influenced by this level of autonomy at the sites to adapt the model as needed.

The type of patients going through was all wrong. In one hospital, they were saying they were adhering to the model but it was very clear the type of patients they were putting through the AMAU should have been sent to outpatients. And also people who were going with relatively minor things to the ED were being streamed into the AMAU (respondent 7).

7.3.1.5 Extent of change

The extent of change required to establish and operate the AMAUs in line with the model of care was recognised as a significant barrier to implementation. A common sentiment expressed by programme management was how they had underestimated the difficulty in getting all parties on board with this change. In particular, the units called for a profound change in the work practices of medical consultants in the hospitals who were to contribute to the AMAU rota by doing their general medical on-call through the units. This was met with clear resistance which prevented the operation of the AMAUs on a 24/7 or even a 12/7 service.

What we probably underestimated was that this was a huge cultural, behavioural, professional shift and we were asking people to radically change how they had practiced. A redirection of people away from specialism, and the recognition that you are not just accountable to your specialism, you are accountable for your hospital, and therefore you must take some responsibility for what is going on in the ED department (respondent 4).

7.3.2 Domain 2. Inner setting

The hospital environment had a major influence on implementation, with sites moulding the AMAU to suit the available resources, existing system and structures, and historic practices. There were six factors in this domain that influenced implementation and outcomes.

- Funding and resources
- Compatibility of the AMAU with the system
- Access to knowledge and information
- Demand for acute services

- Access to services for GPs in primary care
- Access to, and visibility of resources in the community

7.3.2.1 Funding and resources

A major barrier to the successful implementation of the Programme was the lack of funding made available to hospitals to implement the model. As this was at a time of drastic cutbacks in the health service, the national team put in funding requests to the HSE on behalf of hospitals, for what they realistically though they would get, not what was required to implement appropriately.

> *So I guess like everything in the HSE, there is no point estimating the full bill to do anything properly as you are not going to get it anyway. What we looked for, we got a certain number of those. So what you need and what you get are not linearly related!* (respondent 7).

This led to a myriad of resource issues in hospitals that negatively affected fidelity to the model of care and utilisation of the units. Those most commonly cited were (i) staffing (ii) capacity of the AMAU and hospital bed capacity, and (ii) diagnostic and laboratory services.

<u>Staffing</u>

The shortage of staff, especially medical consultants willing to cover the AMAU was a major barrier to the operation of the AMAU. When the Programme was designed in 2010, there were no acute medicine physicians. It was the responsibly of the Programme to secure consultant posts for hospitals. Unfortunately this coincided with major budget cuts in the health system, which greatly impacted the number of posts obtained.

> *When you looked then at the model 4s they tended to get maybe three AM physicians to operate a unit that was supposed to take a large volume of higher acuity medical patients. But that would not allow you a 7-day basis, certainly would not go anywhere near towards a 24 hour service* (respondent 2).

This link of the Programme with consultant posts was identified by programme managers as a fatal mistake as it meant *'some of the AMAUs were set up in name only as hospitals could only get physicians on approval from the Programme, but they did not adopt the process'* (respondent 1).

Participants identified the lack of support of their medical colleagues to contribute to the consultant rota of the AMAU as a major threat to the sustainability of the AMAU model. Rectifying this would likely necessitate a change in the consultants' employment contracts.

The current consultant cover of the AMAU is not sustainable; you have to feed it. We are not going to feed it with endless numbers of acute physicians so how are we going to feed it? We should really be trying to get the posts designed better, so that if your contract says that part of your respiratory or rheumatology job is general medicine, that you should be participating in the AMAU. That you are going to do x number of hours a week, a month in the AMAU, so that we can expand our service as per the model of care. I mean you are doing general medicine anyway; that is your job (respondent 5).

There was little funding made available for other essential staff, with hospitals left to re-organise staffing themselves. As this was at a time of a moratorium on staffing, the staff that moved from the ED or other medical teams to the AMAU were not replaced. This resulted in critical shortages, which caused acrimony between departments in the hospitals and also with the national programmme team. When questioned by the national team about under-performance of their AMAU and the lack of fidelity to the model of care, hospital management used the lack of provision of resources as a counter argument.

The hospital management would say to the team "this is your model; it looks great but where are the jigsaw pieces in the puzzle to put it together? Where are these allied healthcare professionals for instance? Where is the funding for a unit?" And they [NAMP] would say "well we've given you your three consultants" and hospital management say "well that's not enough. Where is the rest of it? I mean you are asking me to build pyramids and where is the straw to make the bricks? How can you criticize me for not making pyramids?" (respondent 33).

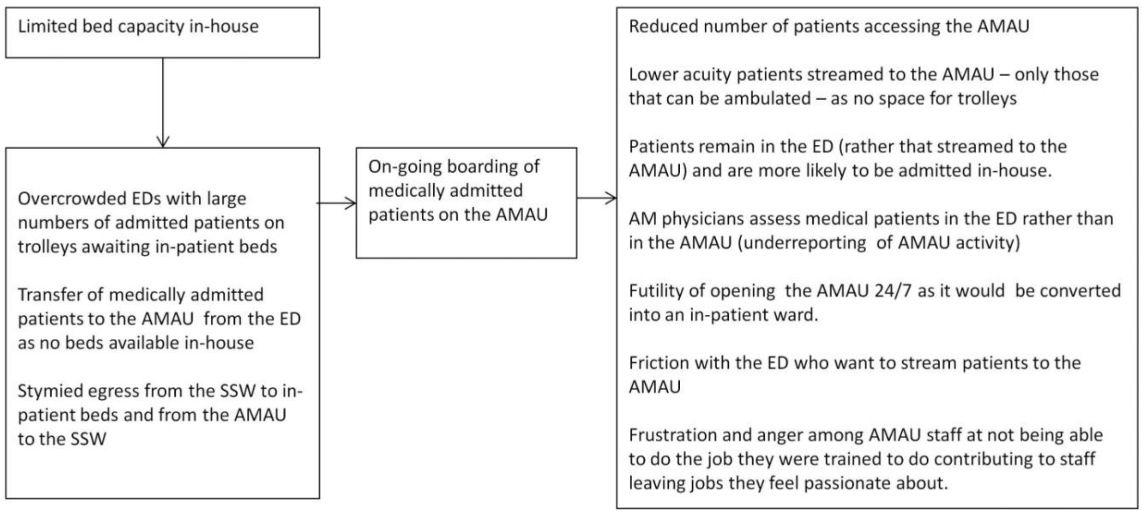
<u>Capacity of the AMAU and hospital bed capacity</u>

The impact of the limited capacity of the AMAU and bed capacity in the hospital on the operation of the AMAUs was the most frequently cited barrier to the operation of the AMAU. Participants felt their units were too small to meet the needs of their hospital. Some AMAUs were re-purposed wards, as plans for new builds had been waylaid by the recession. The limited capacity of the AMAU was exacerbated by problems with egress from the AMAU to the SSW or to an in-patient bed in-house, as well as the placing of medically admitted patients awaiting an in-patient bed (referred to as 'boarding') on the units. 'Boarding' was a direct consequence of hospital overcrowding resulting from in-patient bed shortages. Some AMAUs were actually closed for protracted lengths of time and re-purposed as overflow medical in-patient wards.

And we have just put in such a horrendous year last year. There was one morning we actually came in to fifteen patients in a ten bedded department. So fifteen boarded patients *and we were still expected to function as an AMAU. There was still ambulances coming in. There was still GP referrals coming in* (respondent 16).

Participants discussed how the 'boarding' of the AMAU negatively impacted its ability to operate as per the model of care (Figure 7.2).

Figure 7.2 The impact of limited hospital bed capacity on AMAU operation



A further impact of this limited in-patient bed capacity on implementation was that staff in the AMAU were often directed by management in the afternoon to only accept same day discharges, and not accept any patients that required an overnight admission, as there was no beds and these patients could not return to the ED when the AMAU closed.

Diagnostic and laboratory services.

Participants spoke of the strong working relationships established between the AMAU and the radiology and laboratory service, and how this had a positive influence on the development of allocated slots for the AMAU. This facilitated same day discharge of patients who would otherwise have been admitted overnight. However, many hospitals had limited access to diagnostics, particularly out of hours and at weekends

Ultra Sound is essentially non-existent at the weekend unless you can convince a radiology registrar to do that for you. At the weekend there is no vascular ultrasound doing on. So for instance if I saw somebody that had 2 TIAs on a Saturday afternoon in the Assessment Unit, I would not send them home, as I have no access (respondent 26).

This limited service was a barrier to the operation of the AMAU on a 7 day service.

You would need rapid diagnostics, and you need access to consultant led services. It's one piece in a big puzzle and it's not just about having the AMAU open. You can have it open but it may not have an impact unless it is really thought through (respondent 26).

Participants expressed a belief that the radiology service was greatly constrained by the shortage of radiologists, and those that were there, were '*overwhelmed with work, utterly overwhelmed'* (respondent 6).

7.3.2.2 Compatibility of the AMAU with the system

The compatibility of the AMAU with the hospitals system and the impact of this on its operation was discussed at length, from two main angles: (i) the interface of the AMAU and the ED, and (ii) the interface of the AMAU with the general medical service.

Interface between the AMAU and the ED

This was one of the most commonly discussed aspects of the Programme. Participants spoke of two departments working independently of each other, rather than having a seamless transfer of patients to the AMAU.

So I think that there should be one entity, that they are all on the one floor. I hate the word silo but that is what there is here and it should not. But we would all work together - the patient would come in and you would decide - medical, surgical, emergency - front door streaming -it is what the acute floor is all about (respondent 12).

Streaming of appropriate patients to the AMAU service was identified by the majority of participants as not working well and a major barrier to the Programme achieving its aim of reducing overnight admissions and shortening length of stay. There were several issues identified as negatively affecting patient streaming. Firstly, there was a lack of agreement between the ED and the AMAU as to how medical patients presenting to hospitals as an emergency should be streamed. Some participants were adamant that streaming should be done by consultants from a physical space in the ED, not at triage. Others felt that streaming of medical patients to the AMAU should occur before the ED, as streaming from the ED, was an '*inefficient* process, with patients '*being assessed for a number of hours in the emergency department and then coming to an acute medicine review late in the evening to where everything [access to investigations] is closed up*' (respondent 10). Secondly, there was a lack of clear professional de-lineation between the two services. EM consultants were keen to grow their discipline, with a believe that they should be doing a lot of the work that was being done by the AMAU. Participants expressed the opinion that if resources were put into the ED in the form of staffing and access to diagnostics, they would be able to discharge the same day many of the patients that were going to the AMAU. There was a high level of frustration among those in emergency medicine that the discipline of acute medicine had been introduced into Ireland at a time when resources should have been provided to emergency departments. Thirdly, 'boarding' of medically admitted patients and the limited capacity and operational hours of the AMAU were key issues having a negative influence on the streaming of patients. EM consultants were discontent that when they had a frail co-morbid patient who would benefit from the expertise of the medical staff in the AMAU, they were told that there was no space for that patient; their only option then was to refer that patient to the medical team on-call, who would admit them. Finally, participants discussed external drivers of this dysfunction. The first was the incongruence of the two models of care for Acute Medicine and Emergency Medicine. Neither models laid clear the 'how' of this patient streaming between the two services, or how they would work with each other. The second was the ED-block funding provided to hospitals, which took into consideration the level of ED presentations. Respondents felt that this had a profound negative influence on the streaming of patients into the AMAU, as hospitals used the number of ED presentations as leverage for funding.

Participants highlighted recent innovations which they felt were improving streaming; a registrar in triage for both ED and AMAU bringing the senior decision maker in earlier and a GP in the ED and a second in the AMAU working together to 'push and pull' appropriate patients to the AMAU.

<u>Interface between the AMAU and the general medical service</u>

The historic practice of patients being admitted from the ED to the medical team on-call was deeply entrenched and routinised in the hospitals, as were the rotas for the medical consultants providing this on-call service. The introduction of the AMAU model had resulted in the establishment of two parallel admissions pathways operating in silos, with the ED admission pathway continuing in tandem with the new AMAU pathway.

> *So at the moment depending on what time you check into the hospital you go on different streams of medicine. If you come between 8 and 6 m-f there is a large chance you will come down this stream, which I am not saying is better but it gives you more timely care. Whereas if you go the other stream, you are more likely to be on a trolley in ED, you are more likely to start your active treatment on Day 2 rather than Day 1. Then you go to various GM wards around the hospital* (respondent 27).

Participants attributed these parallel pathways to the lack of buy-in from the medical specialists to amend their rotas to do their on-call service through the AMAU. This resulted in a much stymied AMAU service, with hours of operation falling short of what was expected.

A further aspect of this parallel service was the myriad of combinations of patient handover from the AMAU to the GIM. Participants spoke about how unfavourable multiple handovers were on the quality of patient care, as well as length of hospital stay. Patients who were admitted from the AMAU, were admitted to the general medical team on-call (rather than specialty) who might re-distribute them the following day to the relevant specialty. One model 4 hospital had established a system with the teams to hand patients over to them either from the AMAU or at re-distribution the next morning. However this was not common to other hospitals who lamented the inefficiencies in how medical patients were re-distributed to the appropriate specialty.

While there was resistance on the part of medical specialists to work in the AMAU, some respondents spoke of the systems established in some hospitals for them to consult in, which was as an enabling factor to same day discharge. Again, this was not universal across all specialties or across all hospitals.

7.3.2.3 Access to knowledge & information

Participants commented that the lack of understanding or misconceptions about the role and the value of the unit in the hospital was a barrier to it functioning as per the model of care. Several lamented they did not have the time or the opportunity to go on an educational offensive to increase the level of understanding of the role, purpose and value of the AMAU.

7.3.2.4 Demand for acute services

The constant, unrelenting demand for acute medical services, which was leading to hospitals working consistently at over 100% capacity, was resulting in overcrowding in the EDs and AMAUs, and the 'boarding' of the AMAU, reducing its ability to operate as per the model of care. This increased demand was attributed to many factors: a growing, ageing population; excessively long wait times for outpatient appointments, reconfiguration of nearby hospitals, and inadequate access to services in primary and community care.

7.3.2.5 Access to services for GPs in primary care

The under resourced primary care service with limited access to diagnostics, urgent outpatient appointments, rapid access clinics and medical specialist opinion, was identified as having a major influence on the operation of the AMAU. Firstly, the lack of access to diagnostics and the in-ability of GPs to refer directly for diagnostics, was identified as having repercussions for the entire acute hospital system. GPs had no option but to send patients to the AMAU solely for diagnostics (contrary to the model of care), or place patients on excessively long outpatient wait lists to attend specialists for diagnostics.

I always try to keep in mind that the GPs here have limited access to diagnostics. So often times they are referring a patient in [to the AMAU], it is because they are stuck or they need diagnostics. Where I trained [different jurisdiction], GPs are allowed to book chest x-rays. They are allowed to refer patients. The GPs function at a much higher level (respondent 18).

I can pin point hospitals where they are taking cohorts of lower acuity patients as there is no other option for GPs. With the AMAU, their patients will get access to a senior decision maker, they will get access to diagnostics. (respondent 4).

Secondly, the lack of access for GPs to (urgent) outpatient appointments, rapid access clinics and to medical specialist opinion, was identified as being a major driver of inappropriate GP referrals to the AMAU of patients who should be managed elsewhere.

If GPs had rapid access urgent outpatient clinics then some of the patients would not need to be here [in the AMAU]. We looked at it in around 2014 and about 30% of the emergency presentations here could have been streamed into outpatient's clinics within 1-2 weeks (respondent 27).

7.3.2.6 Access to, and visibility of resources in the community

Efforts by hospitals to avoid overnight admission and shorten length of hospital stay were hampered by a lack of resources in the community, poor visibility of what was actually available, and inefficiencies in accessing these resources. These aspects was identified as contributing to hospital overcrowding resulting in the boarding of the AMAU and its inability to function as per the model of care. See Table 7.1.

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Table 7.1 Issues with community resources available to acute hospital to facilitate safe discharge and avoid admission

Community resource	Issues	Quote
Respite for a period of up to 2 weeks	Recognition that access to respite for a period of up to 2 weeks had been greatly helped by government funding, and the ease at which private nursing homes would take patients. Hospitals faced serious difficulties however if the length of stay was expected to be longer than 2 weeks, or if the patient needed rehab during this stay, as private nursing homes do not provide physiotherapy or other forms of rehab	The case manager can ring up the nursing home supports, complete the application and send someone over straight away for convalescence. (respondent 8)
Transitional beds in community hospitals for a period of up to 6 weeks	Community hospitals offering transitional beds were restricted in whom they could accept from the acute hospitals with a HIQA requirement of 6 weeks maximum length of stay for transitional beds. This resulted in these hospitals not accepting referrals from the acute hospitals until one of their staff reviewed the patient to see if they were suitable. This often resulted in the patient being admitted to hospital when community hospital staff were unavailable to do the assessment that day.	*It is all caught up in the quagmire of the community and the HSE and they will say its HIQA standards, which HIQA demands this of them, that they cannot bring someone into their facility unless they can access them, cater for their needs. This is what we are getting (respondent 13).*
Visibility of the beds available in the community to acute hospitals	The lack of visibility of beds in the community and the difficulty accessing them was identified as being responsible for capacity issues in the acute hospitals. This lack of visibility often resulted in the decision to admit rather than endure a tedious process of figuring out what the alternative options were and how to access them.	*Right now I do not know how many beds are in [district hospital]; all these places that potentially have capacity. And who is in those beds? Are those beds being used for patients that could be in a nursing home, not in a district hospital? Those beds need to be 24/7 performance managed (respondent 11).* *So knowing what services are available in the community. Very often if you try to tackle that it is just such a long and frustrating path you often think "you know what, let's just admit the patient. Let's just admit them and then it can be sorted out"* (respondent 31).
Long terms care beds	The lack of long term care beds, resulted in patients remaining in hospital after their acute period of care had finished referred to as 'delayed discharges'.	*And that is a huge problem, so we would have about 50 patients bed blocked at the moment, that need either homecare package hours or they need a nursing home, which massively impacts on our bed base* (respondent 22). *There is one woman in the SSW for 80 days. She is waiting long term care* (respondent 12).
Community resources such as day hospitals, community intervention	Some acute hospitals had no day hospital or geriatric day services for their patients to return to for follow up after discharge	*So we have a very active CIT. They are excellent. They will go in and it is not even just antibiotics or things like that. They will go in as like a home support as well. I think it is for up to ten days post discharge* (respondent 16).

Community resource	Issues	Quote
teams, geriatric outreach, integrated care teams.	In terms of home with supports, the community intervention teams were deemed excellent in getting the patient home, but not all geographic regions had access. Integrated teams were getting set up and providing rehab in the home. Not all geographical areas were covered with teams limited to within a small radius of the hospital.	*I had a 96 year old in ED on a trolley yesterday. We were only saying that she would be exactly the type of patient you would love to see in her home. I mean all she probably needed was CIT and a few days of antibiotics* (respondent 12). *It is a multi-disciplinary team for patients post falls or post minor stroke and its rehab in the home. So it is a bit like the integrated care team. But it is care assistant, nurse, physiotherapy, and occupational therapy. But it is only in the city though* (respondent 8).
Home care packages	Lack of access to home care hours was a major impediment to discharging patients home, at all hospitals. A further issue with home care was lack of staff.	*'…blocked in acute hospital because they're waiting on carers to deliver the home care packages'* (respondent 17).
Community hospitals	Nursing staff in community hospitals were not allowed administer IV fluids or antibiotics. This was resulting in elderly patients being transferred from community hospitals to an ED for IV antibiotics.	*We get elderly patients coming in here, patients in their 80's and 90's and they come into the acute hospital setting. They are in an emergency department on a trolley for hours, and could be there overnight if there are no beds. And they have pneumonia or whatever you know and they need IV antibiotics. I think its scandalous sending them into a setting like this to actually have that done when there are nurses in those hospitals. They do not give IV fluids or IV antibiotics* (respondent 17).

Abbreviations: HIQA=Health Information and Quality Authority.

7.3.3 Domain 3. Characteristics of individuals

The third domain is concerned with how the individuals involved with the programme and/or implementation process impact the intervention. There were four factors in this domain that influenced implementation and outcomes.

- Leadership and management
- Champions
- Relationships within the AMAU and with key interfaces
- Reluctance and resistance to change

7.3.3.1 Leadership and management

Respondents spoke about four tiers of leadership and management that influenced implementation. The first tier consisted of the Health Service Executive (HSE), the Royal College of Physicians of Ireland (RCPI) and the Department of Health (DoH); i.e., those that endorsed the model of care. The second tier was the national team with its clinical leadership and medical consultant advisory group, the third tier was hospital management, the fourth tier was the lead physician of the AMAU.

There was consensus among participants that the strategic leadership at the top tier, which was required to implement a change programme of this calibre, in the face of difficulties and resistance, was lacking.

> *At some point the leadership at a national level should have said this is the model of care that has been signed off nationally, this is the model that will be implemented. The due process and consultation period is over. And it was that type of brave leadership and diligence that was required that I did not witness* (respondent 2).

Participants felt that this lack of strategic leadership and authority was reflected in the fact that two incongruent models of care for Acute Medicine and Emergency Medicine were signed off. Some stated that this should never have happened and the onus was on this tier of leadership to ensure that the two programmes worked together to develop a joint model.

> *So, I think the biggest piece would be that the MoC for two programmes would have been aligned, and that would have been insisted upon from the very top of the organisation. When it was identified that these model were not aligned, that it would have been dealt with firmly, at that point. And this laissez fair attitude would not have been allowed to develop, with "you'll sort it out yourselves, wont you?"* (respondent 7).

A sentiment among programme management was that the RCPI, who endorsed the model of care, could have done more to facilitate an open and frank discussion among the physicians as to what this new model would look like and how they were to support and implement the model at their own hospital.

> *We repeatedly went to make representations to RCPI and at some point we came to the conclusion that the role of the professional bodies for medicine and surgery are more professional advocates, than what you would see from the Colleges in the UK* (respondent 2).

Some held the opinion that this first tier of leadership actually resented the Programme given the difficulty of implementing it, and this was witnessed as a lack of support for the national team endeavouring to implement it.

The second tier of leadership - the national team - encompassed a clinical lead and a small programme team, with an advisory group of physicians with nationwide representation. The lack of formal training provided to these clinician leaders was seen as a major failing of the top tier of leadership, who did not understand the skillset and training required for a clinician to lead a transformational programme like this. Additionally, this tier of leadership lacked power to mandate change and to ensure that the resources that were provided to the hospitals (predominantly consultancy posts) were utilised appropriately. This was a major barrier to implementation of the model with fidelity.

> *So they come and they say what they need to say, they make recommendations, but nothing comes of it, NEVER. They have no power. They can make the recommendation but they do not have the power to change things* (respondent 12).

> *Why aren't the clinical programmes turning up to hospitals and saying "we've given you this resource and why haven't you delivered, and if you don't deliver you do have to understand we have to pull the resource."*

The third tier of leadership was hospital management. Participants spoke about how they felt the attitude of hospital management to the Programme changed over the years. Site visits by the national team, which once were considered a big deal by management, declined in influence when the funding stopped. Priority was given to other initiatives, and the decision taken to allow the large scale 'boarding' of the AMAU become routine.

The fourth tier of leadership was provided by the lead physicians, which is discussed under champions.

7.3.3.2 Champions

Participants attributed successful programme implementation to either a *'solid governance structure or charismatic champions'* (respondent 2). These champions were typically the lead physicians who had the drive and commitment to implement the model.

> *I would credit [lead physician] passion and her team spirit and her leadership there. She enabled the rest of us to…She certainly enabled me as a nurse manager to develop it* (respondent 8).

However, these champions often had little power to implement things locally, because they were *'hamstrung by other things, especially politics'* (respondent 29). They had to devote considerable time advocating for the AMAU to be allowed function as per the model of care. Champions were over ruled in times of overcrowding when hospital management delegated authority to bed management and the decision was made to board the AMAU and the SSW.

> *Ultimately the decisions were made to facilitate TrolleyGAR.*[32] *And because the hospital felt under pressure to make that look better albeit artificially and short sighted decisions were made. Even though I thought that was very disingenuous to the patients* (respondent 29).

Programme management identified that champions had become burnt-out from lack of support *'because if they [champions] didn't get the improvement that they expected to get, commitment was lost very quickly from their followers* (respondent 2).

At the start of implementation, champions were routinely brought by the national team to other sites to explain how the model was working in their hospital. However, they were prone to being dismissed as not being relevant by those who were not bought into the model.

> *Say, for example we had a very good champion in [hospital a] and you brought that consultant somewhere. But the other hospital would say "well hospital A is not considered a big enough model 4, they're not relevant to us." So people used what suited them* (respondent 3).

[32] TrolleyGAR is a reporting system which was designed to improve ED performance by reporting on the number of patients in each acute hospital on a trolley awaiting admission to an in-patient hospital bed, at 8am, 2pm and 8pm. These numbers are listed on a public website: https://www.hse.ie/eng/services/campaigns/trolleygar.html

7.3.3.3 Relationships within the AMAU and with key interfaces

Good working relationships within the AMAU, and with other departments, were identified by as being an enabler to the operation of the AMAU. Respondents spoke of a strong sense of team, collegiality and a lack of hierarchy among the different professions within the AMAU.

> *I think a lot of it comes down to the relationships between the different professions in the unit. There's great respect, an open channel of communication. From the student nurses to the consultants, it's always been very open for discussion and everyone is included in the decision. There is no divide between any of the professions* (respondent 12).

Relationships had become strained between staff in the ED and the AMAU, despite a high level of professional respect. Contributing to this was the perception on the part of the EM consultants that the AMAU was not alleviating enough of the pressures on the ED, and what EM consultants perceived as a degree of *'intransigence'* (respondent 11) on the part of their AM colleagues who stopped receiving patients from the ED when the unit was full.

In terms of relationships with the GIM service, some AM physicians felt that this service did not value the contribution the AM physicians and the AMAU made to medicine, and that they were not appreciated or held in the same esteem as medical specialists.

> *I think we are under appreciated. I certainly would not like to be an acute physician without a specialty in this hospital* (respondent 24).

Respondents spoke of the relationships between the AMAU and the radiology and laboratory services. These relationships had been built up over a number of years and had been expanded as a result of the quality of referrals from the AMAU, thereby facilitated the AMAU to achieve its outcome of avoiding overnight admissions.

7.3.3.4 Reluctance and resistance to change

Participants lamented that when they had the opportunity to implement change locally, they were met with reluctance and often resistance by staff to operate the new model. Core parts of the model of care had not been implemented, as people felt that the change would create a huge amount of work for the hospital. For example, the concept of setting up systems to facilitate GP access to diagnostics was never implemented as the hospitals were *'very reluctant to create that. The radiologists don't want to create it as they thought they'd have a huge influx, a huge overflow'* (respondent 3). There was widespread resistance to providing rapid access clinic and urgent outpatient appointments to facilitate direct referrals from GPs, and same day discharges from the AMAU. Participants spoke about physicians, who '*absolutely and categorically resisted creating urgent slots in their outpatients. They never gave a reason. They just they absolutely refused' (*respondent 2). Even relatively straight aspects of the programmme, such as daily ward rounding, were met with reluctance on the part of consultants.

When it came to medical specialists changing their rota and doing their general medical on-call through the AMAU to facilitate 24/7 or 12/7 operation of the AMAU, again there was huge resistance. Participants put forward several opinions as to why medical specialists refused to cover the AMAU. *'There wasn't any monetary reward'* (respondent 2), it *'wasn't in their contract'* (respondent 3), specialists felt they had '*become unskilled at dealing with the type of environment*' (respondent 6), it '*didn't fit in with their own model, where they had their own on-call for their specialty, as well as their private practice' (respondent 1)*, and a '*potential loss of income from private practice*' (respondent 33). A further opinion frequently cited as the reason for the resistance to the new way of working was the *'change from the purity of specialism with its status and where they felt they were in the organisation, to being a generalist'* (respondent 2). Respondents identified several factors that enabled this resistance by medical specialists; their autonomy, the lack of accountability with no performance evaluation, a lack of authority of hospital management, and contracts for new consultant posts that did not align with what was needed to implement the model.

> *One of the major issues I feel, is the consultants have way too much control. So, no matter what the managers say, the consultants will do what they want themselves* (respondent 32).

> *And it's made worse by the fact that nurses run the hospitals. And what they don't do is challenge consultants. But I guarantee you if you had a senior academic in charge calling the shots. And I got called up to his office......* (respondent 33).

7.3.4 Domain 4. The process of implementation

This fourth domain is the implementation process. There were two factors in this domain that influenced programme implementation and outcomes.

- Engaging stakeholders
- Delivering the Programme

7.3.4.1 Engaging stakeholders

Participants raised this from two perspectives: the engagement of national bodies during the design and development of the model of care, and locally at the hospital level during implementation

During the design phase

There was a sentiment among participants that when designing the model of care, there was a high level of engagement with all relevant stakeholders. This was seen as an enabler to designing the model of care and getting it signed-off. Having the support of the RCPI who endorsed the model was seen as critical, given that *'clinicians have a much higher level of affinity with the college than they do with the HSE'* (respondent 1). The Programme's advisory group ensured that there was '*representation of physicians from the entire country*' (respondent 1). Absent from the list of stakeholders in the development of the model was the professional body representing GPs, the Irish College of General Practitioners (ICGP). Engagement with this body was described as difficult, because of its strained relation with the HSE over ongoing contract renewal negotiations. The engagement of Emergency Medicine was a core part of the development of the model of care, with a representative from the Association of Emergency Medicine on the working group. This was recognised as essential given the interface between the ED and the AMAU and the continuum of care for patients. However, shortly after the launch of the Acute Medicine model of care, the decision was made to establish a National Clinical Programme for Emergency Medicine. Participants spoke about the incongruence between these two programmes in terms of the different visions as to how medical patients presenting to hospital an emergency would be managed. This, they felt had led to serious operational difficulties in the hospitals.

During implementation

The widescale engagement during the design phase did not translate into an enabler to implementation; and operationalising the model was met with resistance from national stakeholders. Participants attributed this to several things: a degree of cynicism on the part of stakeholders that the model would ever be implemented, the amount of work that was required on their end to implement the model, and a realisation of what stakeholders stood to lose from this new model.

> *The majority of our time was spent doing stakeholder engagement, but what was happening was that nobody believed it was ever going to happen. So remember the history of the health service is people writing these documents and everybody going, that's lovely, it's beautiful, but it's never going to happen* (respondent 4).

Participants stated that early on in implementation, it became challenging engaging with stakeholders.

> *It was all about how it was affecting them. Yes, we'd all agree with the concept, but then when it came to well here's what YOU have to do, to support that, then that became a*

challenge. So there wasn't real engagement with them because if you engaged with them, you were going in to battle (respondent 2).

At a local level, the lack of clinical engagement at the hospitals was also identified as a barrier to implementation. While the Clinical Directors were involved with the planning and process of implementation locally, there was often little engagement from the wider physician group. In some hospitals there was total disengagement of the physician group, which contributed to two parallel admissions pathway becoming routinised in hospitals.

The engagement of local GPs and the establishment of a GP liaison committee were difficult, as hospitals didn't know how to go about it, given the independent nature of general practice in Ireland.

7.3.4.2 Delivering the Programme

There was a sentiment among participants that there was a gross underestimation of the amount of work required to operationalise the model of care, with hospitals lacking the manpower to implement the various components. Even though the Programme team advised on the setting up of the AMAU and conducted regular site visits, they were constrained in the amount of direct time that could be spent at the sites. As a result, implementation was *'very much left to sites themselves'* (respondent 2). Participants mentioned the lack of implementation teams in the hospitals supporting the team responsible for setting up the AMAU (lead physician, Clinical Nurse Manager (CNM) and programmme manager (if available)). Hospital staff were not trained in any quality improvement methodologies to enable them work with relevant staff to implement changes.

No one ever really sits down and works out with a doctor what the processes are. So if I was a respiratory physician, I would want a QI team and a data specialist to help me, to process map what currently happens to my patients to see where I can change (respondent 2).

Participants who had more recently been involved with implementing interventions at their own hospital mentioned that they '*wouldn't actually embark on a project now without that kind of planning and using the QI methodology*'(respondent 15).

Implementation was also hampered by the fact that the staff being asked to adopt new ways of working were totally overworked and not able to consider change.

So when people are overworked and then you come up and tell them they've to change the way they work it's very hard for them. So they're really difficult. And they don't even lift their eyes. They're working. They can't see the future. So that's very difficult (respondent 14).

7.3.5 Domain 5. Outer setting

The final domain describes the external context, whereby factors in the outer setting can influence implementation, often mediated through changes in the inner setting. This includes the social, economic, and political context.

- External policy & influences: Incentives, disincentives and perverse incentives
- The economic recession
- Aging population

7.3.5.1 External policy and influences: incentives, disincentives and perverse incentives

Disincentives and perverse incentives heavily outweighed incentives to implement the new model. Some participants felt that the reimbursement models by private insurers for care provided to private patients in public hospitals influenced the decision to admit patients and to hold them longer. Additionally, private patients were admitted solely for diagnostics as tests would not be reimbursed in an outpatient setting. There was no real impetus on hospitals or consultants to establish ambulatory care services as consultants and hospitals would lose income from private insurers by <u>not</u> admitting patients to hospital.

> *When radiologists and physicians do tests here in the AMAU and send patients home the same day there's no private charges apply. So the hospital loses the private charge. So do the physicians, so do the radiologists* (respondent 14).

Participants spoke of a rise in 'defensive medicine' with doctors fearing litigation. This was seen as a driver of the rise in admissions, all resulting in hospital overcrowding, which had a negative impact on the operation of the AMAU.

> *You know why they admit so many people here? It's because of the litigation. Your system here is americanised but you don't have the CT service, you don't have MRIs. In America, they have every facility available for ED, so everything happens quickly so you don't get blocked. Here you get blocked because you don't have a CT service, you don't have an MRI service and you've got all these people coming in demanding everything and its litigation. So I admit them. Because how are you going to get a CT otherwise? (respondent 20).*

The perverse behaviour of 'boarding' of patients on the AMAU, which was having a detrimental impact on its ability to function as per the mode of care, was driven by the extreme focus of the HSE and the Department of Health on TrolleyGAR.

> *The fact is when the minister rings you up on a Sunday and criticises you about trolleys you open every bit of capacity you can and that includes the AMAU* (respondent 33).

It's not right, but to the powers that be, the TrolleyGAR is more of an incentive to perform, than putting the AMAU out of action as a service for the rest of the day. It's so perverse (respondent 13).

Finally, government funding arrangements were also identified by several respondents as having a negative impact on the implementation of the programme. The ED block grant and resources for EDs were contingent on the number of ED presentations. This was identified by some respondents as likely contributing to the issues at the ED/AMAU interface with some hospitals encouraging all patients to go through the ED to boost numbers, including those with a GP referral letter directing them to the AMAU.

7.3.5.2 The economic recession

Programme implementation was severely impacted by the economic recession. As *'everything was to be done on a shoe string, the vision was way too small'* (respondent 2). A moratorium on staffing led to critical shortage and high stress levels among remaining staff and hospitals were trying to implement the new model without the necessary resources. A new employment contract for new medical consultants in 2012 with lower remuneration than those on the older contract, created a two-tier system, which resulted in widescale emigration of doctors, leaving hundreds of unfilled consultant posts

If you look at what's happened since the moratorium and even though we are coming back out of it, not only do you have a huge shortage of nursing, you have a huge shortage of doctors at all grades and at all levels. There's no positivity. Everything is about people being over worked...stressed, not enough resources, not enough people. So the younger people that are coming out don't want to stay around. (respondent 2).

Finally, the recession meant drastic cuts to community resources, which had a direct impact on the level of overcrowding in acute hospitals. Hospitals which were performing well before the introduction of these cuts, now had high trolley numbers, which ultimately led to the 'boarding' of the units.

Everything started to go wrong in 2013, and we were tracking this on the data, even in sites we knew were good sites, and when we looked into it, it wasn't on the front-end piece, it was on egress, which they really have very little control over and a lot of it was directly related to the closing of community nursing home beds, and reduction in home care packages in the cut backs. So perversely some of the best performing hospitals in the country now have trolley problems, which they never ever had prior to 2013 (respondent 7).

7.3.5.3 An aging population

The influence of the aging population on the implementation of the AMAUs was discussed from the perspective of the influence of the increasing numbers of frail elderly and the lack of capacity in the acute hospital system to manage these numbers and their specific needs. The lack of integration of budget between community and hospital was also seen as a barrier to the integration of care of the elderly, with more and more elderly sick patients arriving acutely unwell to the emergency department. Additionally, with the developments in preventive medicine, we were '*keeping people alive but eventually they get sick and they need a hospital. No GP in the world that's going to keep them out of hospital you know. So all the patients that we have on trolleys, they all need to be here. So having ten GPs seeing them is not going to keep them out of here* (respondent 25).'

7.4 Discussion

The aim of this study was to elicit the factors that influenced the implementation of the Acute Medicine programme, particularly the introduction and routinisation of the Acute Medical Assessment Units. Semi-structured interviews were conducted with programme management and a selection of clinical staff across six hospitals. The Consolidated Framework for Implementation Research (CFIR) informed the interview topic guides and was used as the overarching framework for the analysis of the interviews. This framework organises the factors that can influence implementation into five domains: characteristics of the intervention, the inner setting, the external setting, individuals and the process of implementation The key findings from each of these five domains will now be briefly discussed.

In terms of the first domain - characteristics of the intervention - it was clear that some participants had fundamental problems with the new model, as it was not compatible with their beliefs on *how* medical patients should be managed. Those in the ED felt that EDs should be bolstered to offer more of an acute medicine service, rather than the AMAU serve as a '*second door into hospital*'. A further perception of the model concerned its source, and the degree to which clinicians felt that they had ownership of it. Some were quite dismissive of implementing an innovation that had not originated in their hospital. The fact that the model was based loosely on one operating in a smaller (model 3 hospital) was repeatedly highlighted as a barrier, in that some respondents felt that it was not compatible with larger model 4 hospitals, which they felt had different needs.

In terms of the inner setting, the limited bed capacity in the hospital to stream patient to was the most frequently discussed barrier to the operation of the AMAU. This stymied egress to in-patient beds from the AMAU, with the effect that often those that could be discharged the same day were preferentially streamed to the AMAU, while those requiring onwards admission were held in the ED until an in-patient bed became available. Additionally, the use of the AMAU to hold medically admitted in-patients awaiting a bed in house (boarding) negatively impacted the operation of the AMAU. Other influences on implementation in this domain were the lack of funding and resources made available to hospitals (especially staffing), the perceived compatibility of the model with the existing admission pathways, and the deficiency of services provided in the primary and community care. These deficits were contributing to hospitals operating at over 100% capacity, EDs with large numbers of patients on trolleys awaiting in-patient beds, and the 'boarding' of medical patients in the AMAU.

In terms of the individuals, the study found that the most enabling characteristics of those implementing or adopting the new model was their capability, opportunity and motivation to implement the change, while key barriers were lack of buy-in to the new model and a resistance to re-design work practices. In terms of leadership, a deficiency of strategic leadership at the top led to a lack of joined up thinking and the implementation of two national programmes for emergency medicine and acute medicine, which did not integrate with each other, resulting in operational issues on the ground.

In terms of the process of implementation, sufficient stakeholder engagement during the design phase, did not translate into an enabler to implementation. This was attributed to a certain degree of cynicism of the relevant parties that the model of care would ever be implemented, and the realisation that the model of care called for a fundamental change in how medicine was to be practiced in hospital, which was not deemed attractive to some.

Finally, in terms of the external setting, the economic recession, which commenced in 2008, had a detrimental impact on implementation. It led to the continuation of bed closures, which had commenced in 2007; a drastic reduction in funding to acute hospitals leading to a scale back in what could be delivered; a reduction in funding for community resources; and a moratorium on staffing, with wage cuts leading to large scale emigration of healthcare professionals. Other external influences were the lack of incentives to adopt the new model, and a multitude of incentives (often perverse) to maintain the status quo. A further key negative influence was the intense focus of policy makers and the media on TrolleyGAR, a measurement tool that was designed to improve ED performance. Unfortunately a desire to not be the poorest performing hospital in the country led to perverse behaviours in the hospitals - most notably the 'boarding' of medical patients in the

AMAU to avoid these patients contributing to this metric. This greatly hampered the AMAU's ability to function as per the model of care.

Comparison with existing literature

There is absence of literature on the factors influencing the implementation of AMAUs in other jurisdictions to compare with the findings of this study. However. similarities can be drawn with the recent evaluation of the implementation of the London Quality Standards, discussed in Chapter 4. This evaluation found that the implementation of the standards for acute medicine in the hospitals was influenced by many of the same factors that influenced implementation of the Acute Medicine Programme. The evaluators found that clinical leadership at departmental level emerged as a critical success factor, particularly when coupled with high levels of belief in the need to improve services. At the service and clinical unit level, clinical engagement and buy-in and receptivity to change were further enablers of change. They found that there was a mix of internal and external aspects that impeded the implementation of the standards. The lack of attached funding was a major impediment. Other key obstacles were the lack of improvement capacity - with the limited application of formal quality improvement approaches to change - and lack of receptivity to change. The workforce required to deliver the service dictated by the standards was identified as a major barrier, with hospitals simply not having staff to do the work and being over reliant on locum staff. They found that the relentless increase in consultant workload coupled with chronic staff shortages was cited as a major barrier to the implementation of the standards in many hospitals. Some of the London Quality Standards required major reconstruction of consultant working patterns, something that managerial and even clinical colleagues often had great difficulty in negotiating, and was occasionally a show-stopper to successful implementation.

Medical autonomy and physician buy-in

This concept of medical autonomy and physician resistance to change was written about by Ham in 2003 in a review in the Milbank Quarterly on the lessons learnt from an evaluation of the redesign of work processes in the NHS (Ham et al., 2003). The findings of that evaluation were that the power of physicians, the inertia built into established ways of working, and the effort needed to implement new work processes can help explain why the impact of quality improvement initiatives is varied and often quite limited. Some of the key lessons learnt from that evaluation resonates with the findings of this study and are worth considering here. Firstly, that hospitals have an inverted power structure, in which people at the bottom generally have greater influence over decision-making than do those who are nominally in control at the top. In these disconnected hierarchies, organisational leaders have to negotiate rather than impose new policies and practices. Failure to recognise this fact and to carry professionals along with change will invariably result in part implementation of reform efforts. Policy theory refers to this as street level bureaucracy (Lipsky, 2010). Secondly, designing quality improvement programmes that stimulate change at all four levels, i.e., the individual, team, organisation and the larger system, is much more demanding than change that is directed at clinical teams willing to embrace new practices. Thirdly, clinicians need time and space to review established practices, and to introduce new and more effective ways of delivering services. Clinical commitment to change, ownership of change and support for change, constantly need to be checked, reinforced and worked upon. Fourthly, it is important to be realistic about the time needed to bring about and sustain change, and to build up the capacity for change and reform within hospitals. Because the challenges in sustaining improvement are many, and the momentum that accompanies quality improvement initiatives needs to be maintained, establishing long-term responsibility for quality programmes at the outset is essential. Finally, the staff affected by quality improvement programs must be able to see that they, as well as the patients, will benefit from the changes. They need to need to see tangible benefits of the programme. Without benefits, professionals such as physicians are likely to block improvements and frustrate the ambitions of reformers (Ham et al., 2003).

Role of leadership

The role of leadership warrants discussion, given the importance the respondents placed on its emphasis on implementation. A recent review of the literature on change management in health and social care, discussed the growing emphasis in the implementation science literature on the role of leadership, and the leadership skills required to lead and implement change (Barry, 2018). A key example of this recent recognition of the critical role of leadership in implementing and sustaining a programme can be seen in the Exploration, Preparation, Implementation, Sustainment (EPIS) framework (Aarons et al., 2011). In a mixed methods study by the authors of this framework, they demonstrated that leadership at both the outer system and inner organisational contexts were key in the sustainment of evidence based innovation (Aarons et al., 2016). Their study showed that it is not only leadership style or leadership behaviour, but how leaders at different levels coordinate, collaborate, and lead their systems or teams to actively support implementation and sustainment of evidence-based intervention. They posit that leaders at system, organisation, and team levels should consider actions that the leaders can take to signal their support and the importance for a strategic initiative. This resonates with the findings of the interviews, where a lack of joined up leadership at the system, organisational and team level, contributed to frontline staff feeling un-supported in their endeavours to implement the Programme. This was in addition to a perception that system leadership wasn't fully behind the Programme and what was required to implement it.

Clinical leadership and clinical engagement

Clinical leadership of the AMAUs was found to be a key enabler of implementation. These clinicians acted as champions for their units by advocating for resources and negotiating with other departments for essential services; building a team environment in the unit and enabling the staff, and endeavouring to protect and expand the service. The critical role of clinical leadership in improving the performance of health services has been recognised for decades. In 2003, Ham wrote that the development and strengthening of clinical leaderships was one of three conditions that needed to be in place for change to take place in the health service (Ham, 2003). The other two conditions were the engagement of clinicians to bring about change, and giving the professionals the time, resources and skills required to achieve change. Interviewees in this study described extensive clinician engagement during the development of the model of care and in the early planning phases, via large physician advisory group. But when it came to discussion with the hospitals as to how implementation should proceed, the wider physician group in the hospitals often disengaged. This lack of buy-in from the physician group was identified as one of the main impediments to implementation of the AMAU model as it greatly reduced the available medical manpower to facilitate longer opening units. It was also identified as the most significant threat to the sustainability of the AMAU.

Strengths and limitations of the study

To the best of my knowledge, this is the first qualitative study to explore the perceptions of clinical and programme staff as to the barriers and enablers of the implementation of AMAUs. The involvement of a range of clinical staff from the different departments and different sized hospitals allowed for a broad and diverse spectrum of perspectives to be conceptualised, providing an insight into the difficulties implementing change of this calibre into the acute setting. The recruitment of all involved with programme management since the inception of the Programme in 2010 provided a comprehensive exploration of the challenges encountered at the different stages of the implementation. The use of semi-structured interview questions, which were open-ended, exploratory and flexible, and evolved to suit the needs of the study, accommodated unanticipated ideas expressed by the participants. A further strength was the application of implementation science theory in that the Consolidated Framework for Implementation Research (CFIR) was used to focus the interviews and the analysis on five key domains that influence implementation.

The use of the CFIR in this study had some limitations, most likely because of the nature of the Programme, which was a large scale, health service delivery transformation, rather than a simple, stand alone intervention. It was felt that some of the constructs did not go far enough to describe concepts arising from the interviews. A key example was the 'extent of change' the model called for and how this influenced implementation. This could not be adequately mapped to any one construct; the closest construct 'complexity ', did not adequately capture this. A further limitation of the framework was that domain 'external setting' did not go far enough to describe the external contextual factors that influenced implementation. Hence, during the first round of coding, the decision was taken to code inductively and to group into factors rather than individual constructs.

The study was designed to elicit opinions from a broad range of programme and clinical staff with detailed applied experience of the Programme. During the analytic process no particular group's views were 'privileged' over those of others; that is to say, data analysis included a process of constant comparison between accounts of each group of participants. However, constrained by resources, not all perspectives could be obtained. For example, there is a noticeable absence of the opinions of medical consultants who do not contribute to the AMAU rota. Given that this was repeatedly identified as one of the major barriers implementation, and a key threat to the sustainability of the model, there is a need to explore their perspectives of the model. Additionally hospital management were not interviewed; this would have facilitated a view of the perceptions of that tier of management especially in terms of the interface between the Programme and existing hospitals structures. Despite interviewing all programme management since inception, and interviewing at AMAUs that had been in existence for various lengths of time it is likely that the study has not fully captured how the barriers and enablers changed over the life of the programme. This came to the fore for several factors; for example how support from management waned as funding ran out and other priorities took over, how champions became burnt out and isolated over time, and the length of the time taken to establish relationships and negotiate services for the AMAU (e.g., with radiology). It is acknowledged that the experiences reported in this study reflect those of clinical staff currently working in six model 3 and model 4 hospitals; model 2 hospitals that have AMAUs but don't have EDs were not included.

7.5 Conclusion

It was clear from the interviews that hospitals found implementation of the AMAU model very challenging, with some hospitals having more difficulty than others in implementing and sustaining the model. The lack of improvement capacity on the ground, for example in the form of implementation teams to drive implementation, meant that efforts to implement the AMAUs locally fell to a small body of clinical staff, who were often faced with insurmountable barriers, both internally and externally.

In all hospitals interviewed at, implementation of the new model resulted in the routinisation of two parallel admission streams working in silos. This was primarily caused by the limited operational hours of the units - driven by lack of staffing and the tendency of hospitals to re-purpose these units as overflow wards when they're open 24/7 - and a limited capacity of the units to accept a greater volume of medical patients for onward admission. This issue was driven by 'boarding' in the AMAU and poor egress from the AMAU and/or the SSW, with priority given to the ED for in-patient beds. There were a myriad of other factors identified that enabled or impeded the implementation of the AMAUs and the degree to which these units were utilised and operated with fidelity to the model.

Enablers included strong clinical leadership driving implementation locally; good multi-disciplinary relationships within the AMAU and with key departments such as radiology and laboratory services, and supportive management having an understanding of the value of the AMAU.

Barriers were more plentiful and included: extreme pressures on beds driving overcrowding and rendering it almost impossible to operate the AMAU as per the model of care; friction between departments and key interfaces driven by differing visions for the delivery of acute medical care; a lack of joined up coherent strategic leadership at the different levels; overworked staff with limited opportunity, capability and support to implement change; a lack of funding to implement the model; insufficient staffing, especially medical staffing; a resistance to a new way of working from medical consultants; a system over-reliant on the delivery of care in acute hospitals, and a striking imbalance between the incentives and disincentives to implementing the new model. The complex interplay between these factors warrants further investigation, as does the question as to whether removal of identified barriers would function as an enabler of implementation success.

Chapter 8. Conclusion

8.1 Practice and policy recommendations; areas for further research

The future of the AMAUs

In terms of the future of AMAUs in Ireland, much work remains to be done to enhance the service and to address the complex interplay between factors impeding their operation and routinisation of the service. A clear impediment to the implementation of these units has been the level of integration of the units with the emergency departments and the general medical services. This has resulted in the routinisation of two parallel admission pathways for patients presenting to hospital with a medical emergency. As described in Chapter 7, this is multi-factorial, and greatly exacerbated by the extreme pressure on in-patient beds in acute hospitals that are often operating at above full capacity. This results in severely congested patient pathways, and inefficient streaming of patients to the appropriate services. With the relentless growth in demand for acute services, it is imperative to change the way that care delivery is designed, with a move away from the current silo'ed approach to managing patients, to one that is more streamlined and integrated. This will involve collaboration across all services that cater for these patients, and will require a shift in vision, behaviours and work practices, structures and processes, and systems. This thesis has highlighted some of the many challenges in implementing change of that calibre.

Streaming of patients to the appropriate service at the appropriate time was repeatedly highlighted in the interviews as being highly inefficient and an ongoing source of friction across departments. It is unlikely in the absence of improved bed capacity in-house (or a severe reduction in demand for acute services), that dramatic improvements will be made in terms of appropriate patient streaming. According to those interviewed, much of the pressure on the current bed supply was as a direct consequence of deficits of provision of care in the community. Beds were frequently occupied by those whose acute period of care had ceased, yet their safe discharge home was hindered by these deficits. This thesis has shown that the burden of emergency medical hospitalisations is felt most acutely among the elderly, especially those aged 85 years and over. There is a need to understand how care for these elderly patients can be bolstered in the community, including those residing in long term residential facilities, and smaller community hospitals, to reduce the likelihood of an emergency presentation leading to an admission, and a lengthy stay in an acute hospital.

Evidence shows that there are an increasing number of patients in whom frailty is a feature of their emergency presentation. In the UK it is estimated that 5-10% of all emergency department (ED) attendees (NHS Improvement and NHS England and the Ambulatory Emergency Care Network and Acute Frailty Network., 2019) and 30% of patients in Acute Medical Units (Conroy and Dowsing, 2013) are older people with frailty. Managing frailty requires a clear focus on effective strategies for the delivery of care that range across the continuum of frailty severity, starting with frailty screening, case identification, and management of frailty. These patients do best when managed proactively by a multidisciplinary team and are less likely to have a protracted stay in hospitals. The survey of the AMAUs highlighted the clear gaps that currently exit in the structured approach to the identification, assessment and management of the frail elderly. Much work needs to be done to improve those services that identify and respond to the needs of frail, usually older people presenting to emergency services.

An impediment to the operation of the AMAUs was the reluctance of specialists to contribute to the rota of the AMAU, preferring the conventional pathway of admission in-house through the ED to the general medical team on call. The lack of buy-in was highlighted by many as a key threat to the sustainability of the AMAUs. Exploring the rationale for this resistance requires further research. It is likely that the move to more specialised training for doctors has resulted in a reticence to maintain exposure to undifferentiated acute presentations due to difficulties maintaining acute care skills. Hence, a key question remains as to who will work in these units and acute medicine as a whole, and manage the large cohort of undifferentiated medical patients who present to hospital as emergencies. There is a need to examine models of staffing of acute and general medicine in other jurisdictions. Some participants interviewed provided suggestions including amended contracts, a limited period of service to acute medicine (e.g., 10 years) followed by a indefinite period of no further general medical on call, and a new training scheme for generalists to take on this responsibility. This they felt would only be viable and attractive to doctors if this new role was held in the same esteem as those who have specialised in an area of medicine. These suggestion warrant further examination.

This thesis has identified many areas for further research in terms of the management of medical conditions presenting as an emergency to hospital. For example, there is a need to examine models for the delivery and incentivisation of ambulatory and whether removing some of the barriers to the delivery of ambulatory care identified in this evaluation would act as enablers to its delivery. Selecting suitable conditions, deciding what proportion of these could realistically be avoided, and agreeing how these should be coded and measured, has previously been identified as key areas where research needs to be undertaken if ambulatory care is to became a priority of service redesign and delivery (Purdy, 2010).

Lessons for Slaintecare

With the recent focus on integrated care in Ireland via Slaintecare - the government's 10 year plan for the improved delivery of care and a shift away from the acute hospital centric model, which currently exists - providing clear data on conditions suitable for management in primary care is essential. This thesis has provided much of this data and sheds light on those high volume conditions that theoretically could safely be managed in an outpatient setting or in primary care. For example, the burden of respiratory disease on our acute hospitals is quite apparent from this thesis. During its undertaking, the researcher co-authored the Irish Thoracic Society's Respiratory Health of the Nation report (O'Connor et al., 2018), which highlighted for the first time the disparate burden of respiratory disease on the Irish population, compared with other diseases. The researcher also contributed to the development of a new national model of care for the end to end management of COPD (National Clinical Programme for Respiratory, 2019). Both of these works have been taken on board by the implementation team of Slaintecare, with a significant investment in interventions at the hospital and community level to improve the management of COPD. These interventions and their impact on hospitalisations and patient quality of life needs to evaluated. An incidental finding of this thesis was the dramatic rise in emergency hospitalisations and bed days used for UTIs, which was not limited to the older age groups. While this has been recognised as a phenomenon in other jurisdictions, there is scant research undertaken on interventions to improve the management of these infections in primary care, (e.g., improving adherence to clinical prescribing guidelines), and in the introduction of ambulatory care pathways in hospital to avoid an overnight admission for these highly prevalent conditions.

A key driver of emergency hospitalisations for these conditions is likely an inability to access appropriate care in the community, resulting in an emergency presentation to hospital. The influence of socio-economic factors and deprivation as drivers of emergency hospitalisations should also not be under-estimated. This association has been well been well established, especially in the UK (O'Cathain et al., 2014a, O'Cathain et al., 2013, O'Cathain et al., 2014b) and more recently in the Irish setting (Lynch et al., 2019). The authors of the Irish study found that at a regional level, much of the variability in emergency hospitalisation rates for these potentially avoidable conditions could be explained by socioeconomic deprivation, hospital policies and private insurance coverage (Lynch et al., 2019). Importantly, deprivation is also independently associated with higher prevalence of these conditions. This holds true especially for respiratory conditions. The prevalence of respiratory disease is significantly higher in areas of social deprivation, where there is higher smoking incidence, exposure to higher levels of air pollution, poor housing conditions and exposure to occupational hazards (Smith, 2018). The American Thoracic Society and The European Respiratory Society issued a policy statement in 2013 on the disparity in respiratory health and stated that the lowest social categories are up to 14 times more likely to have respiratory diseases than are the highest social categories (Schraufnagel et al., 2013).

There are many similarities between the Acute Medicine programme and Slaintecare, whose vision for healthcare is one '*where patients are paramount, access to health and social care is timely and based on need and not ability to pay, care is seamless and integrated and is provided at the most appropriate service level with a strong emphasis on prevention and public health, and health services are planned and delivered on the basis of population need*.' Both reforms are concerned with a fundamental shift in how care is delivered which requires radical changes to work practices. Much of the learnings from this thesis, especially Chapter 7 that delved deeply into the barriers to implementation, have relevance for the implementation of Slaintecare.

The need to develop improvement capacity and capability within the health services

Crucial to the successful implementation of a large scale change programme is the need to build improvement capacity ad capability within the health services. Again, it was clear from the interviews with those implementing the new model in their own hospitals that they struggled with the lack of resources available to them to help with the implementation process. None had access to implementation teams, and few had any formal training in quality improvement (QI) skills, or access to those with those skills. Those that had spoke passionately about how QI techniques had improved the implementation of the intervention they were involved with, and were adamant that they would never implement an intervention again without first availing of QI assistance.

8.2 Reflections and learnings

While there were many learnings from the undertaking of this evaluation; two warrant discussion. The first is the pivotal role implementation evaluation plays in interpreting the findings of an impact evaluation. The second is the need to be acutely sensitive to context when undertaking evaluation.

Studying programme implementation is not easy, but it is essential (Durlak, 2015). Rossi et al. (2004) contest that one of the major roles of an implementation evaluation is to complement an impact evaluation and determine the quality and quantity of services provided so that this information can be used to interpret the findings on what impact those services have. Knowing what took place is a pre-requisite for explaining or hypothesising why a programme did or did not work. He argues that all too often a programme's impact is sharply diminished and, indeed, sometimes reduced to zero because the appropriate intervention was not delivered, or was not delivered to the right targets, or both. Measuring implementation however remains a great challenge to evaluators (Hasson, 2010), and has lagged behind advancements in the identification of factors that influence implementation (Ogden and Fixsen, 2014), as seen by the growth in implementation theories, models and frameworks that focus on determinants of implementation (Nilsen, 2015). Experts in the field have highlighted the great need for the development of instruments that operationalise and standardise the measurement and analyses of implementation processes and outcomes (Fixsen et al., 2009, Fixsen and Ogden, 2014, Ogden and Fixsen, 2014, Ogden et al., 2012).

This thesis has highlighted how necessary it is consider effect estimates in view of whether the intervention has been implemented as planned, and the extent to which the appropriate targets receive the intervention. Hence, a considerable focus of this thesis was on ascertaining the extent to which the programme has been implemented, and the degree to which the AMAUs are being utilised as expected. The assessment of programme impact, found there was no evidence to support the hypothesis that the increase in utilisation of the AMAUs from 2012 onwards led to a reduction in the rate of overnight emergency hospitalisations for medical conditions. This was not an unexpected finding given that the implementation evaluation firstly found critical gaps in implementation and secondly, and more importantly, that far greater numbers of medical patients continued to be admitted in-house from a non-AMAU source rather the availing of the services in the AMAU. For ambulatory care sensitive medical conditions, again while large numbers were assessed and discharged directly from AMAU over the study period, a greater number were admitted directly in-house from a non-AMAU source. A major exception to this was chest pain non-specific, where the utilisation study in Chapter 5 showed that there was a clear reduction in the number of patients admitted in-house from a non-AMAU source with this condition, in line with the growth in numbers streamed to an AMAU. As the vast majority of patients assessed in an AMAU with this condition are discharged directly, this led to a clear reduction in the rate of overnight emergency hospitalisation for this conditions as observed in the impact evaluation.

The second major learning of this thesis is that programme evaluators need to be sensitive to the influence of context on both implementation and programme outcomes. As complex interventions such as the Acute Medicine Programme tend to be highly context-specific in their effects, generalising the results of effect estimation, or lack thereof, for policy and practice requires more nuanced analyses of why these effects occur, or don't (Gillies, 2016). Across implementation frameworks, there is considerable variation in terms of *how* context is conceptualised, as a recent scoping review of these frameworks identified (Nilsen and Bernhardsson, 2019). Their review found that context is generally not described consistently, coherently or comprehensively in determinant frameworks (i.e. those frameworks describing the influences on implementation), and that there is inconsistency with regard to which contextual determinants are addressed. They identified common dimensions of context based on the frameworks; the most frequently used being *'organisational support, financial resources, social relations and support, leadership, and organisational culture and climate'*. However, often excluded from frameworks are those factors external to the organisation that are likely to influence implementation. Pettigrew (1992) defines context as *'the "why" and "when" of change and concerns itself both with influence from the outer context (such as the prevailing economic, social, political environment) and influences internal to the focal organisation under study (for example, its resources, capabilities, structure, culture and politics*)' (Pettigrew et al., 1992).

In implementation research, quantitative and qualitative methods are used either simultaneously, or sequentially to examine both intervention content and the influence of context on implementation. In this evaluation, qualitative inquiry was used to explore and obtain depth of understanding as to what had led to the high degree of heterogeneity across hospitals, and the widescale deficits in implementation. The influence of context on implementation was extensive. For example, the limited bed capacity in-house had a detrimental influence on the ability of the AMAU to function as per the model of care, with stymied patient egress from the units influencing not only the numbers assessed in them, but also the acuity of the patients streamed there. This limited in-patient bed capacity was exacerbated by bed closures that commenced in 2007, and continued until 2012. This contributed to hospitals frequently operating at over 100% capacity. As discussed in the introduction to the thesis, a recent OECD report found that in 2017, occupancy rates for acute beds in Ireland were at 94.5%, the highest of all OECD-28 countries reporting the metric (OECD, 2019). The influence of these bed closures also need to be take into consideration when interpreting programme outcomes. These occurred in the pre-intervention period and likely contributed to a very clear downward trend in hospital rates and rate of bed days used observed in that period. There were no additional bed closure in the post-intervention period, and in fact there was a slight increase in bed numbers in 2016 and 2017. This phenomenon is likely to have biased downwards any programme impact.

A contextual factor, which had influence both on implementation and outcomes, was the influence of cuts to community resources that took place from 2012 onwards. These had a sustained impact on the acute hospitals. They resulted in a greater hospitalisation rate and longer lengths of stay as safe discharge home to the community (a key focus of the programme) was greatly hammered by a deficit of services available in the community. It is likely that these influences were more severe among the older age categories, which carry the greatest burden of hospitalisations for medical conditions. A further influence was the demographic changes that took place over the study period. Between 2009 and 2017, Ireland's adult population grew by 5.1%, with growth being more pronounced in the elderly age groups. The 45-64 years age category increased by 15.1% from 1.00m to 1.15m, the 65-84 years age category increased by 30.4% from 444,928 to 580,184, and the oldest age category (≥ 85 years) increased by 29.1% from 53,974 to 69,693. This aging of the population had a significant influence on implementation and outcomes. Those interviewed spoke about the deficit of alternative options available for the burgeoning number of frail elderly patients requiring emergency medical care. This, they felt was resulting in a greater tendency to admit patients overnight because of lack of alternative options and patients having a protracted lengths of stay in hospital.

8.2.1 Reflection on the approach taken and the challenges encountered

At the conclusion of this evaluation, it is pertinent to reflect on the approach taken and the challenges encountered in undertaking a mixed method evaluation of a complex intervention for a PhD. The most significant challenge was the size and complexity of the evaluation, with many stages conducted, often concurrently. Mixed methods (or multi method) evaluations require considerable resources and a wide range of skills and expertise. A judicious balance needs to be struck between what is practically feasible in terms of resources, time and the skills of the evaluation team; what is needed to address the evaluation questions; and what is needed to ensure the scientific rigour of the evaluation (Odendaal et al., 2016). The MRC Framework highlights that there is a need to ensure that sufficient expertise and experience can be drawn upon to decide on and achieve the aims of the evaluation, with the evaluation team ideally having expertise in quantitative and qualitative methods. As this evaluation was undertaken for a PhD thesis, the researcher was limited in terms of access to resources and had to up skill on several areas that were new, including the conceptualisation of programme theory and the conduct of qualitative research. A balance had to be achieved between depth and breadth. Significant resources were expended early on in developing the programme theory. The same amount time were it available, would have facilitated in-person interviews to assess fidelity to the model, and would also have facilitated the collection of data on staffing in the units. Additionally, given the interdependencies between the different stages of the study, timing of the conduct of each stage of study was important. Were more resources available to the researcher, the results of the impact evaluation would have been available prior to undertaking the interviews. This would have facilitated a focus on the individual clinical conditions to elicit the factors influencing the ability of the AMAU to avoid overnight admission for these specific conditions and to shorten the length of stay of those admitted. This was not the case unfortunately, and the interviews had a much greater focus on implementation and utilisation of the units, with a generic focus on outcomes.

A second challenge was in assessing and measuring implementation. Many experts in the field have highlighted the difficulty in measuring implementation (Proctor et al., 2011, Proctor and Brownson, 2012, Chaudoir et al., 2013, Grol et al., 2007). Whether implementation was successful was assessed in this evaluation using two outcomes - namely utilisation of the units and the organisational function, structures and processes put in place to support the Programme. Both had their own unique challenges and did not fully provide an adequate measure of implementation. For example, those units with high utilisation may have been streamed patients that were not appropriate, with lower acuity etc. and therefore be a misrepresentation of an example of successful implementation. Using survey data to assess alignment of sites with the model of care as a measure of successful implementation also had drawbacks. Survey questions tended to focus on the presence or absence of specific Programme component, rather than how these were implemented. For example, the survey examined the presence of evidence-based protocols for managing chronic conditions, instead of the level of fidelity to these protocols. Therefore, assigning a level of implementation success to a site based on either of these two outcome measures was problematic.

The conceptualization and measurement of the factors that affect implementation success is also identified in the literature as an area that requires considerable advancement (Dearing and Kee, 2012). These gaps in measurement present a formidable barrier to efforts to advance implementation science. This was highlighted by Chaudoir et al, in their 2013 systematic literature review of the articles reporting the use or development of measures designed to assess constructs that predict the implementation of evidence-based health innovations (Chaudoir et al., 2013). They found that while there were over 60 measures of these factors, the majority had not been assessed in combination with implementation outcomes and concluded that for a vast majority of measures, criterion validity has either not been examined or has not been supported. Because of these shortcomings in measurement (both of implementation success and determinants of implementation) the evaluation was unable to directly attribute the presence or absence of these factors to implementation success and furthermore to successful programme outcomes.

The third challenge was that of undertaking retrospective impact evaluation with the limited health IT in Ireland. The fragmented health IT infrastructure in Irish hospitals, and the lack of a unique health identifier, meant it was not possible to examine the trajectory of care received by patients streamed through the units. Nor was it feasible to examine programme impact on outcomes such as 30-day mortality, re-admissions, health services utilisation and quality of life. In the absence of a unique heath identifier, the episode of care rather than the patient serves as the unit of analysis in the HIPE scheme. It currently it is not possible to use the HIPE scheme to track individual patients through the public hospital system. This presented serious implications for not only what analysis could be done, but also for how the analysis was undertaken. It also stymied the ability the utilisation study. For example, it was not possible to examine the 'appropriateness' of the patients streamed to the units in the absence of any measure of acuity or complexity. This also limited the ability to do any direct comparison between the admission pathways.

8.3 Strengths of the thesis

The main strength of this thesis was its well considered mixed methods study, designed to answer the research questions. According to Creswell (2015), combining statistical trends in the form of quantitative data with personal experiences (qualitative data), provides a better understanding of the research problem than either form of data alone (Creswell, 2015). Importantly, the value of mixed methods studies depend on how each method matches the evaluation questions plus the scientific integrity with which the methods are selected and implemented (Odendaal et al., 2016). Considerable time and attention was devoted to plan a well constructed mixed methods study. This involved an in-depth consideration of the appropriate methods and the sequencing of the stages, to do justice to the individual methods and allow data to be triangulated across methods.

A second strength was the use of implementation and programme theory throughout. Eliciting the programme theory, as recommended by the UK's Medical Research Council guidance on process evaluation of complex interventions was a crucial first step in formulating and prioritising evaluation questions, designing the evaluation research and interpreting the findings. It guided the key outcomes to be assessed, the measurement tools. data collection methods and the analytical approaches to be taken (Davidoff et al., 2015). Additionally, the Consolidated Framework for Implementation Research was used to guide data collection, measurement, coding, analysis and reporting of the findings of the qualitative study.

A third strength was the statistical methods to evaluate the impact of these Units. Recent reviews of the literature on the effectiveness of these Units have highlighted the shortcomings in the research to date with many studies reporting effect estimates that have not taken into consideration potential biases (such as selection bias), confounding and underlying secular and seasonal trends (Reid et al., 2016, van Galen et al., 2017, National Institute for Health and Care Excellence, March 2018). The approach taken in the estimate of programme impact was a judicious one, which is likely to have biased downwards any programme impact.

A fourth strength was the depth of age-and condition-specific analyses that were conducted to provide a rich insight into the trends in the age-sex standardised and age-specific rates of emergency hospitalisations for these ambulatory care sensitive medical conditions. These analyses provide detailed information on the burden of different diseases in the different age groups, and the disproportionate burden of these amongst the elderly. The rise in emergency hospitalisations rate for UTIs, and the rate of bed days used by hospitalisations for this condition was an incidental finding, as a result of these analyses.

Finally, a key strength was the collaboration with stakeholders, including the HSE (who commissioned the evaluation), and the national programme team. Achieving a high quality evaluation requires maintaining a balance between good working relationships with stakeholders involved in the intervention, against the need to remain credible as independent evaluators.

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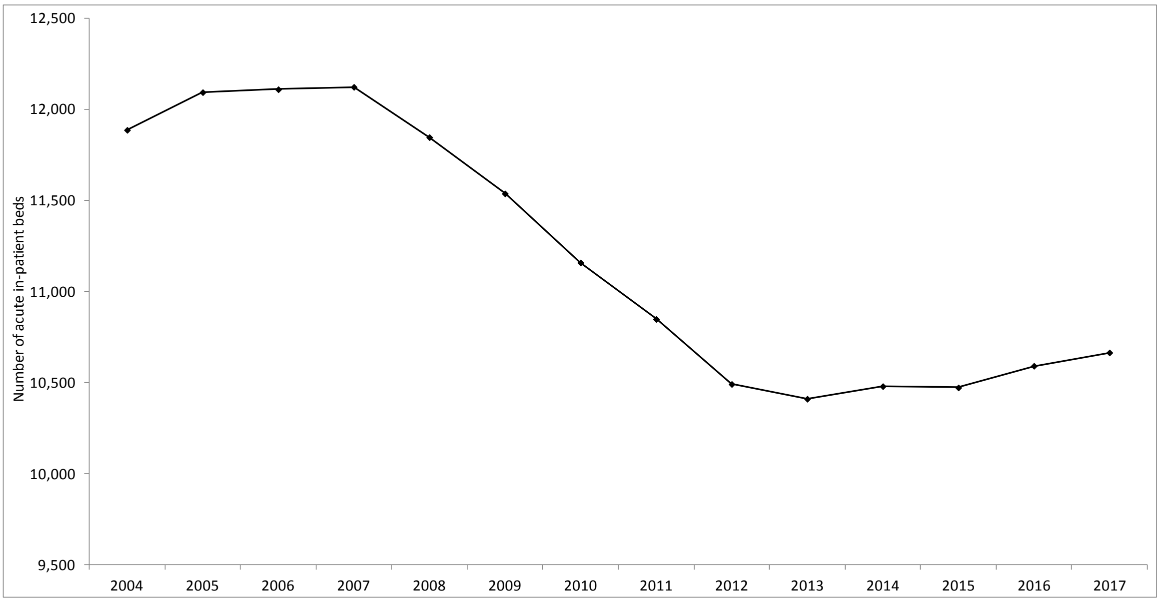
Appendices

Appendix 1.1 In-patient beds available in acute public hospitals, 2004-2017

From 2007, the number of in-patient beds in acute hospitals started to decrease after several years of stability in their numbers. By 2012 the numbers had fallen by 13.5%. In the 'pre-intervention' period used in Chapter 6 (January 2009 to December 2011), the number of in-patient beds deceased by 9% from 11,538 in 2009 to 10,492.

In-patient beds available in acute hospitals, 2004-2017



Source: Table 3.1 Acute hospital summary statistics, 2004 to 2017 from a report issued by the Business Intelligence units, Health Service Executive in response to an information request from the author.

In-patient beds available in acute hospitals, 2004-2017

Year	2004	2005	2006	2007	2008	2009	2010
N	11,887	12,094	12,110	12,123	11,847	11,538	11,159

Year	2011	2012	2013[1]	2014	2015	2016	2017
N	10,849	10,492	10,411	10,480	10,473	10,592	10,665

Source: Table 3.1 Acute hospital summary statistics, 2004 to 2017 from a report issued by the Business Intelligence units, Health Service Executive in response to an information request from the author.

Notes.

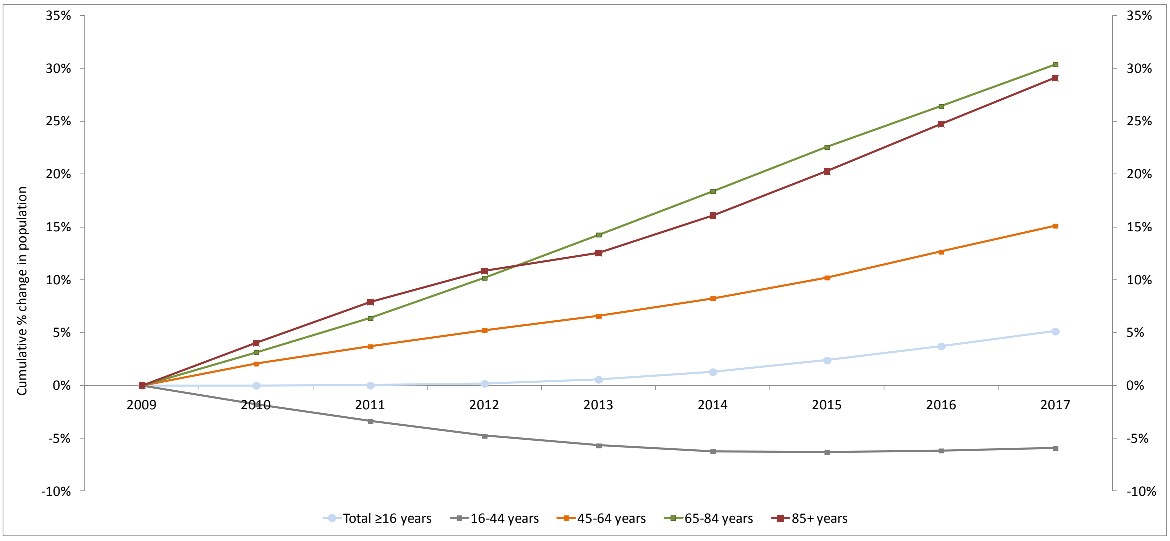
1. The average number of psychiatric beds is not available from 2013 for Cork University Hospital, Galway University Hospitals, Kerry General and Roscommon County Hospital.

Appendix 1.2 Demographics of the Irish population, 2009-2017

The population aged 16 years and over (i.e. the adult population used in this thesis) increased by 5.1% from 3.54m in 2009 to 3.72m in 2017, with most of this increase from 2013 onwards.

Between 2009 and 2012, there was actually no growth in the total population ≥16 years (blue line), likely driven by large scale emigration in the 16-44 year age. Between 2009 and 2015, this younger population (16-44 years) reduced quite significantly (grey line) from 2.04m in 2009 to 1.91 million in 2015, with most of this decrease pre-2013. Overall, this population declined by 5.9% between 2009 and 2017. The numbers in the other three age categories increased consistently year on year between 2009 and 2017. The 45-64 years age category increased by 15.1% from 1.00m to 1.15m, the 65-84 years age category increased by 30.4% from 444,928 to 580,184, and the oldest age category (≥ 85 years) increased by 29.1% from 53,974 to 69,693.

Cumulative percentage change in Ireland's population, by age category, 2009 to 2017



Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

The age distribution of the population aged 16 years and over has changed as a result of this. In 2009, 57.6% of this population were in the 16-44 year age category, 28.3% were aged 45-64 years, and the remaining 14.1% were aged 65+ years. By 2017, the proportion of the population that were in this younger age category had decreased by 6% to 51.6%, the proportion of the population that were aged 45-64 years increased by 2.7% to 31.0%, while the population that were aged 65+ years increased by 3.4% to 17.5%.

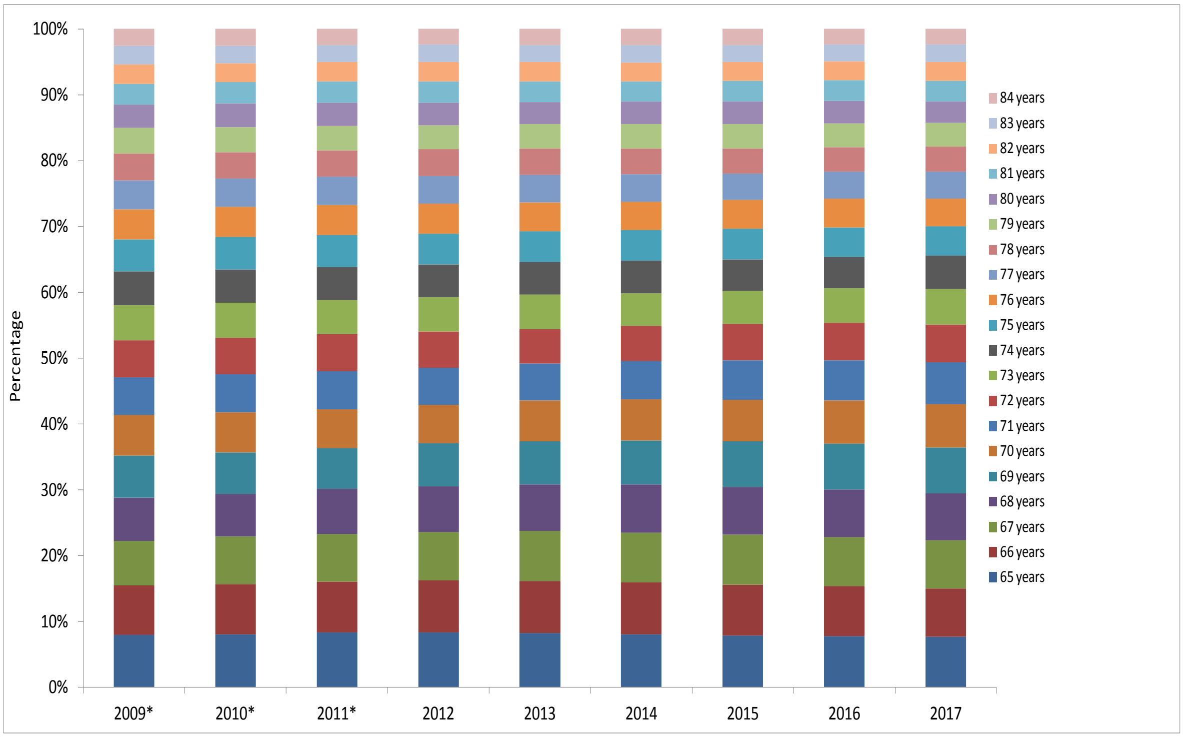
Population aged 16 years and over, 2009-2017

Year	16-44 yrs		45-64 yrs		65-84 yrs		85+ yrs		Total
	N	%	N	%	N	%	N	%	
2009	2,040,996	(57.6)	1,001,341	(28.3)	444,928	(12.6)	53,974	(1.5)	3,541,239
2010	2,003,985	(56.6)	1,021,940	(28.9)	458,913	(13.0)	56,140	(1.6)	3,540,978
2011	1,971,552	(55.7)	1,038,331	(29.3)	473,321	(13.4)	58,242	(1.6)	3,541,446
2012	1,943,476	(54.8)	1,053,753	(29.7)	490,240	(13.8)	59,817	(1.7)	3,547,286
2013	1,924,804	(54.0)	1,067,215	(30.0)	508,447	(14.3)	60,739	(1.7)	3,561,205
2014	1,913,552	(53.0)	1,083,895	(30.2)	526,824	(14.7)	62,660	(1.7)	3,586,931
2015	1,911,628	(52.7)	1,103,591	(30.4)	545,359	(15.0)	64,911	(1.8)	3,625,489
2016	1,915,093	(52.1)	1,128,049	(30.7)	562,514	(15.3)	67,333	(1.8)	3,672,989
2017	1,919,926	(51.6)	1,152,727	(31.0)	580,184	(15.6)	69,693	(1.9)	3,722,530

Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

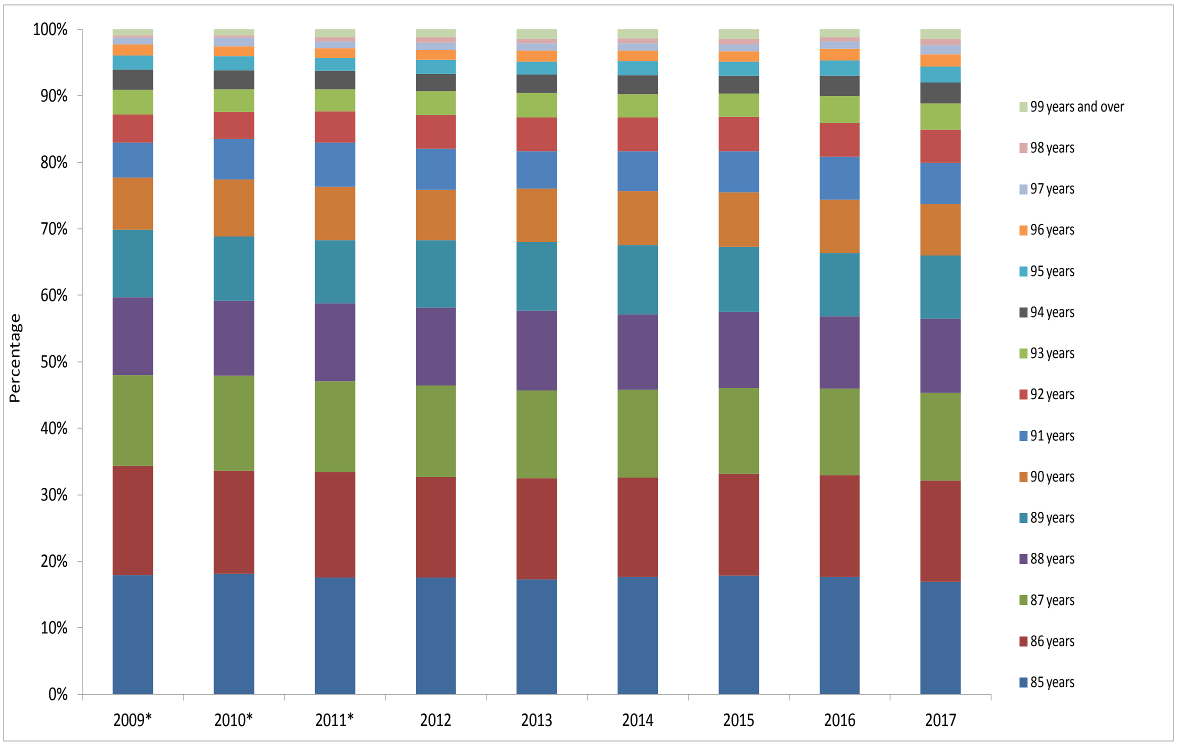
The composition (by individual year of age) of the two older age categories for each year between 2009 and 2017 is presented in the following graphs and tables. Its purpose is to ascertain whether this distribution has changed over the time period, with a larger proportion in each age category that are in the older years. This is not the case, with the distributions being virtually identical year on year. In the 85 + year age category, there has been a very slight increase in the proportion that are aged 90 years and over; in 2009, of adults in the 85+ age category, 30.1% were aged 90 years and over (the remaining 70% were aged 85-89 years). By 2017 this proportion had increased marginally to 34.0%.

Distribution of those aged 65 - 84 years, 2009-2017



Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

Distribution of those aged 85+ years, 2009-2017



Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

Distribution of those aged 65-84 years, 2009-2017

	2009		2010		2011		2012		2013		2014		2015		2016		2017	
Age	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
65 yr	35,275	7.9%	36,887	8.0%	39,558	8.4%	40,606	8.3%	41,988	8.3%	42,364	8.0%	42,829	7.9%	43,529	7.7%	44,146	7.6%
66 yr	33,426	7.5%	34,929	7.6%	36,249	7.7%	39,100	8.0%	40,246	7.9%	41,584	7.9%	42,050	7.7%	42,907	7.6%	43,063	7.4%
67 yr	30,320	6.8%	33,143	7.2%	34,386	7.3%	35,855	7.3%	38,736	7.6%	39,887	7.6%	41,280	7.6%	41,761	7.4%	42,387	7.3%
68 yr	28,964	6.5%	29,971	6.5%	32,464	6.9%	33,951	6.9%	35,470	7.0%	38,277	7.3%	39,499	7.2%	40,781	7.2%	41,315	7.1%
69 yr	28,646	6.4%	28,608	6.2%	29,414	6.2%	32,104	6.5%	33,585	6.6%	35,108	6.7%	37,908	7.0%	38,991	6.9%	40,353	7.0%
65-69 yr	156,631	35.2%	163,538	35.6%	172,071	36.4%	181,616	37.0%	190,025	37.4%	197,220	37.4%	203,566	37.3%	207,969	37.0%	211,264	36.4
70 yr	27,288	6.1%	28,149	6.1%	27,904	5.9%	28,911	5.9%	31,561	6.2%	33,073	6.3%	34,593	6.3%	37,344	6.6%	38,380	6.6%
71 yr	25,554	5.7%	26,798	5.8%	27,579	5.8%	27,418	5.6%	28,378	5.6%	31,015	5.9%	32,493	6.0%	34,090	6.1%	36,724	6.3%
72 yr	24,999	5.6%	25,122	5.5%	26,293	5.6%	27,072	5.5%	26,901	5.3%	27,849	5.3%	30,477	5.6%	31,888	5.7%	33,501	5.8%
73 yr	23,891	5.4%	24,436	5.3%	24,446	5.2%	25,750	5.3%	26,545	5.2%	26,381	5.0%	27,367	5.0%	29,768	5.3%	31,336	5.4%
74 yr	22,845	5.1%	23,442	5.1%	23,905	5.1%	23,979	4.9%	25,301	5.0%	26,079	5.0%	25,914	4.8%	26,812	4.8%	29,264	5.0%
70-74 yr	124,577	28.0%	127,947	27.9%	130,127	27.5%	133,130	27.2%	138,686	27.3%	144,397	27.4%	150,844	27.7%	159,902	28.4%	169,205	29.2
75 yr	21,708	4.9%	22,397	4.9%	22,895	4.8%	23,208	4.7%	23,301	4.6%	24,614	4.7%	25,329	4.6%	25,079	4.5%	26,081	4.5%
76 yr	20,263	4.6%	20,981	4.6%	21,600	4.6%	22,052	4.5%	22,472	4.4%	22,546	4.3%	23,865	4.4%	24,393	4.3%	24,231	4.2%
77 yr	19,332	4.3%	19,780	4.3%	20,506	4.3%	20,833	4.2%	21,363	4.2%	21,785	4.1%	21,878	4.0%	23,078	4.1%	23,604	4.1%
78 yr	18,245	4.1%	18,430	4.0%	18,734	4.0%	19,780	4.0%	20,118	4.0%	20,677	3.9%	21,075	3.9%	21,296	3.8%	22,315	3.8%
79 yr	17,238	3.9%	17,485	3.8%	17,631	3.7%	18,075	3.7%	19,100	3.8%	19,467	3.7%	20,023	3.7%	20,332	3.6%	20,604	3.6%
75-79 yr	96,786	21.8%	99,073	21.6%	101,366	21.4%	103,948	21.2%	106,354	20.9%	109,089	20.7%	112,170	20.6%	114,178	20.3%	116,835	20.1
80 yr	15,793	3.5%	16,643	3.6%	16,867	3.6%	16,763	3.4%	17,121	3.4%	18,221	3.5%	18,643	3.4%	19,113	3.4%	19,271	3.3%
81 yr	13,873	3.1%	14,665	3.2%	15,234	3.2%	15,876	3.2%	15,793	3.1%	16,188	3.1%	17,278	3.2%	17,705	3.1%	18,015	3.1%
82 yr	13,310	3.0%	12,993	2.8%	13,816	2.9%	14,328	2.9%	14,903	2.9%	14,977	2.8%	15,322	2.8%	16,237	2.9%	16,702	2.9%
83 yr	12,580	2.8%	12,615	2.7%	12,323	2.6%	12,937	2.6%	13,435	2.6%	14,049	2.7%	14,202	2.6%	14,391	2.6%	15,348	2.6%
84 yr	11,378	2.6%	11,439	2.5%	11,517	2.4%	11,642	2.4%	12,130	2.4%	12,683	2.4%	13,334	2.4%	13,019	2.3%	13,544	2.3%
80-84 yr	66,934	15.0%	68,355	14.9%	69,757	14.7%	71,546	14.6%	73,382	14.4%	76,118	14.4%	78,779	14.4%	80,465	14.3%	82,880	14.3
65-84 yr	444,928		458,913		473,321		490,240		508,447		526,824		545,359		562,514		580,184	

Distribution of those aged 85+ years, 2009-2017

	2009		2010		2011		2012		2013		2014		2015		2016		2017	
Age	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
85 yr	9,699	18.0%	10,153	18.1%	10,231	17.6%	10,483	17.5%	10,509	17.3%	11,068	17.7%	11,584	17.8%	11,886	17.7%	11,816	17.0%
86 yr	8,845	16.4%	8,737	15.6%	9,227	15.8%	9,065	15.2%	9,262	15.2%	9,383	15.0%	9,918	15.3%	10,291	15.3%	10,610	15.2%
87 yr	7,377	13.7%	7,988	14.2%	7,950	13.6%	8,207	13.7%	8,011	13.2%	8,245	13.2%	8,406	13.0%	8,757	13.0%	9,189	13.2%
88 yr	6,315	11.7%	6,341	11.3%	6,823	11.7%	7,029	11.8%	7,284	12.0%	7,131	11.4%	7,393	11.4%	7,365	10.9%	7,783	11.2%
89 yr	5,490	10.2%	5,460	9.7%	5,539	9.5%	6,047	10.1%	6,241	10.3%	6,512	10.4%	6,370	9.8%	6,402	9.5%	6,622	9.5%
85-89 yr	37,726	69.9%	38,679	68.9%	39,770	68.3%	40,831	68.3%	41,307	68.0%	42,339	67.6%	43,671	67.3%	44,701	66.4%	46,020	66.0%
90 yr	4,212	7.8%	4,804	8.6%	4,707	8.1%	4,554	7.6%	4,858	8.0%	5,088	8.1%	5,357	8.3%	5,362	8.0%	5,355	7.7%
91 yr	2,838	5.3%	3,394	6.0%	3,842	6.6%	3,686	6.2%	3,469	5.7%	3,760	6.0%	3,962	6.1%	4,370	6.5%	4,300	6.2%
92 yr	2,313	4.3%	2,276	4.1%	2,753	4.7%	3,059	5.1%	3,041	5.0%	3,200	5.1%	3,399	5.2%	3,414	5.1%	3,514	5.0%
93 yr	1,964	3.6%	1,933	3.4%	1,924	3.3%	2,146	3.6%	2,285	3.8%	2,198	3.5%	2,275	3.5%	2,727	4.1%	2,736	3.9%
94 yr	1,637	3.0%	1,613	2.9%	1,604	2.8%	1,535	2.6%	1,637	2.7%	1,790	2.9%	1,719	2.6%	2,061	3.1%	2,181	3.1%
90-94 yr	12,964	24.0%	14,020	25.0%	14,830	25.5%	14,980	25.0%	15,290	25.2%	16,036	25.6%	16,712	25.7%	17,934	26.6%	18,086	26.0%
95 yr	1,157	2.1%	1,172	2.1%	1,163	2.0%	1,257	2.1%	1,181	1.9%	1,297	2.1%	1,368	2.1%	1,548	2.3%	1,681	2.4%
96 yr	905	1.7%	828	1.5%	810	1.4%	916	1.5%	1,011	1.7%	974	1.6%	1,030	1.6%	1,201	1.8%	1,277	1.8%
97 yr	535	1.0%	725	1.3%	635	1.1%	630	1.1%	669	1.1%	699	1.1%	670	1.0%	730	1.1%	1,008	1.4%
98 yr	231	0.4%	236	0.4%	381	0.7%	508	0.8%	429	0.7%	455	0.7%	542	0.8%	449	0.7%	609	0.9%
99 yr+	456	0.8%	480	0.9%	653	1.1%	695	1.2%	852	1.4%	860	1.4%	918	1.4%	770	1.1%	1,012	1.5%
95+ yr	3,284	6.1%	3,441	6.1%	3,642	6.3%	4,006	6.7%	4,142	6.8%	4,285	6.8%	4,528	7.0%	4,698	7.0%	5,587	8.0%
85+ yr	53,974		56,140		58,242		59,817		60,739		62,660		64,911		67,333		69.693	

Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

Appendix 1.3 History of the introduction of Acute Medical Assessment Units in Ireland

The decision to establish Acute Medical Units in acute hospitals in Ireland can be traced back to the early 2000s when emergency departments were faced with increasing number of presentations, and a rise in the number of patients in trolleys in these departments awaiting admission to an in-patient bed. During this period, which correlated with an increase in Ireland's prosperity, there was a significant focus on increasing health spending to bring it in line with OECD expenditure, after years of austerity in the 80s and 90s. The 10-year Health Strategy 'Quality and Fairness - A Health System for All', released by the Department of Health and Children in 2001, clearly recognised the important inter-relationship between the hospital, community and primary care sectors in delivering whole system improvement (Department of Health and Children, 2001). With the increasing focus on person-centered healthcare, the strategy stated that *'only when people can access the right care, at the right time and in the right place (which is frequently not the emergency department), will person centred care become the reality'*. A critical focus for reform and a first priority for this shared agenda was improvement to relieve the waiting situation in national emergency departments.

In 2002, the report of the Committee on Accident & Emergency Services – Comhairle na nOspidéal, was published. This report was undertaken to review the structure, operation and staffing of Accident and Emergency Services and departments across the State. The report highlighted significant operational challenges to departments including, access to, and management of, in-patient beds, increased and more timely access to diagnostics and better use of care pathways. The report set out recommendations for the effective operation of emergency departments, within three distinct but interdependent streams in the hospital – emergency care, in-patient elective care, and day and outpatient care. Each stream required significant input and set up. Based on many of the recommendations in that report, in 2004, the Tánaiste and Minister for Health & Children issued the A&E 10 Point Action Plan. The Plan recognised the need to look at improvement at a system wide level, taking capacity issues into account with the practice of quality and efficient clinical and organisational processes, applicable across a whole health system. As a priority, the plan set out to improve patient flow and waiting times across the acute sector through a range of whole system initiatives. One of these initiatives was the provision of Acute Medical Units for non-surgical patients, to support a return to GP-direct admissions for patients assessed as requiring urgent medical admission, but not requiring the services of an emergency department, reducing trolley waits in emergency departments.

At the same time as Comhairle na nOspidéal established a committee to examine A and E services, they also established a committee in 2002 with the following terms of reference:

'...*to examine the role, organisation and staffing of Medical admissions / Medical Assessment Units and other similar initiatives that are taking place in hospitals around the country and to make appropriate recommendations to Comhairle na nOspidéal regarding how such units, if deemed a positive development, could best be developed, organised, staffed and integrated within the acute hospital system*.'

This report (Acute Medical Units - Comhairle na nOspidéal, 2004), concluded that the development of Acute Medical Units, in all general hospitals receiving acutely ill medical patients, under clear criteria outlined by the consultation process, would significantly contribute to a better and safer service for patients and reduce the need for trolley waits. The report stated that '*to be optimally effective, such units however needed to adopt a resource-focused approach to medical patients, operate to clear evidence-based protocols and be led by a consultant physicians dedicated to acute medicine. These were to re-establish the relationships between GPs and consultants which had been severed during the era of austerity and bed cuts in the 90s, when GPs lost the right to admit patients directly into in-patient beds.*'

The recommendations from this committee were informed by their visits to several hospitals around Ireland that had different models in place to manage medical patients presenting as emergencies. Additionally the committee conducted site visits at the Royal Infirmary of Edinburgh, Scotland, whose Medical Assessment Unit had been recommended as a useful model to study. The expert committee acknowledged the merits of a number of aspects of the approach being undertaken in the UK, especially the focus on increasing acute medical workload, but recognised that there were critical differences between Ireland and the UK in terms of how hospitals were networked, their size, consultant staffing, and catchment populations. They emphasized that this difference was most apparent in terms of catchment populations of acute general hospitals. In the UK, 'small and medium' sized hospitals serve populations of between 150,000 to 400,000, with 'large' hospitals serving a population of 400,000 plus. This is not comparable to Ireland, where a number of hospitals serve populations of 50,000 or less and no single hospital alone exclusively serves a local population greater than 300,000. The committee recognised that due to these significant differences, it would not be appropriate for Ireland to attempt to mirror exactly the approach being undertaken in the UK with respect to staffing acute medical services at consultant level. Therefore, the report envisaged that in every acute hospital in Ireland it would remain essential that consultant physicians in a range of medical specialties and sub-specialties continue to be involved in the acute general medical on-call rota.

The views of the Irish College of General Practitioners (ICGP), the Irish Association of Emergency Medicine (IAEM) and the Royal College of Physicians of Ireland (RCPI) were also sought regarding establishing units that would focus solely on acute medical assessment and admissions. The development of AMAUs was supported by the three professional bodies consulted. These views are presented here to provide insight into the development of these units and their envisaged role in acute medicine activity.

The ICGP supported the assessment component of units, stating that '*GPs do not always require admission in cases of clinical uncertainty, but they often require particular investigation or assessment, to clarify a diagnosis. The absence of an assessment option may result in unnecessary admission, even for a short period.*' In advocating that such units should accept direct GP referrals, thereby eliminating the need for such GP-referred patients inappropriately attending A&E departments, the ICGP stated that '*the failure to recognise and maximise the potential of General Practice results in duplication, time delay, and is an inefficient use of scarce resources and expertise in our healthcare system*.' They went on to state that *'lack of proper communication structures between the two sectors in effect ensures that the capacity of General Practice to reduce demand on A&E departments and hospital services, especially at times of crises, is underutilised*.' This view was supported by the Irish Association of Emergency Medicine (IAEM) who stated that 't*he use of emergency departments as admission units for all general practice referrals to hospital is inappropriate. A vast amount of resources in A&E departments are taken up dealing with patients who have already been assessed by GPs and other doctors who think that the patient requires assessment by a specialist or admission to hospital. It is unreasonable to expect A&E department staff to reassess these patients basically to check out the opinion of the referring doctor before they are passed on. We would envisage these patients bypassing the A&E department direct to an admission/assessment area for the attention of the specialist team.'* The RCPI, in expressing their support for acute Medical Units, commented that the successful operation of such units '*is as much an art of management and integration of a myriad of professionals, as it is about the specific disciplines of medicine.'*

The report made recommendations regarding how such units could best be developed, organised, staffed and integrated within the acute hospital system. It provided clear guidance on the operations of Acute Medical Units, in terms of their assessment and admission function, such as defining their hours of operations which would depend on whether they had an admission role or were purely assessment focused. It laid the foundations for the development of the model of care produced by the National Acute Medicine Programme in 2009/2010.

Appendix 2.1 Description of the constructs in the Consolidated Framework for Implementation Research

Construct		Short Description
I. **INTERVENTION CHARACTERISTICS**		
A	Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.
B	Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.
C	Relative Advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.
D	Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.
E	Trialability	The ability to test the intervention on a small scale in the organization, and to be able to reverse course (undo implementation) if warranted.
F	Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.
G	Design Quality & Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled.
H	Cost	Costs of the intervention and costs associated with implementing the intervention including investment, supply, and opportunity costs.
II. OUTER SETTING		
A	Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritized by the organization.
B	Cosmopolitanism	The degree to which an organization is networked with other external organizations.
C	Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or are in a bid for a competitive edge.
D	External Policy & Incentives	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.
III. INNER SETTING		

A	Structural Characteristics	The social architecture, age, maturity, and size of an organization.
B	Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.
C	Culture	Norms, values, and basic assumptions of a given organization.
D	Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention, and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.
1	Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.
2	Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.
3	Relative Priority	Individuals' shared perception of the importance of the implementation within the organization.
4	Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary, and less tangible incentives such as increased stature or respect.
5	Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals.
6	Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.
E	Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.
1	Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
2	Available Resources	The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time.
3	Access to Knowledge & Information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.
IV. CHARACTERISTICS OF INDIVIDUALS		
A	Knowledge & Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.

B	Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
C	Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.
D	Individual Identification with Organization	A broad construct related to how individuals perceive the organization, and their relationship and degree of commitment with that organization.
E	Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.
V. PROCESS		
A	Planning	The degree to which a scheme or method of behaviour and tasks for implementing an intervention are developed in advance, and the quality of those schemes or methods.
B	Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities.
1	Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention.
2	Formally Appointed Internal Implementation Leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.
3	Champions	“Individuals who dedicate themselves to supporting, marketing, and ‘driving through’ an [implementation]” [101] (p. 182), overcoming indifference or resistance that the intervention may provoke in an organization.
4	External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.
C	Executing	Carrying out or accomplishing the implementation according to plan.
D	Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

Source: Damschroder et al (2009).

Appendix 3.1 Documents reviewed to elicit the Programme's theories

Acute Medicine Programme documentation (2010-2017)		
NAMP literature review on Assessment Units	McGovern, E., Acute Medical Assessment Units. A Literature Review. 2013, Health Service Executive. Dublin. Available from. http.//www.hse.ie/eng/services/publications/Clinical-Strategy-and-Programmes/Acute-Medical-Assessment-units.pdf	Literature review
Programme reports	Royal College of Physicians of Ireland, et al., Report of the National Programme. 2010, National Programme. Dublin.	Report/Model of care
	Acute Medicine Programme. Quarter 1 Progress Report 2012. Acute Medicine Programme. Mid-year report. 2013 Acute Medicine Programme. End of year report. 2015	Report
Brochures/ description of key programme components	The National Acute Medicine Programme. Available from http.//www.hse.ie/eng/services/publications/Clinical-Strategy-and-Programmes/Acute-Medicine-Programme-Brochure.pdf (Undated) Key elements of the Programme to deliver the best patient outcomes. Available from http.//www.hse.ie/eng/about/Who/clinical/natclinprog/acutemedicineprogramme/documents/NAMPKeyElements.pdf (Undated)	Guidance documents/ information on the Programme
Programme Newsletters	Royal College of Physicians of Ireland, National Programme, HSE (2014). National Programme Newsletter Issue Number 2. February 2014	Print Newsletter
	National Programme Health and Social Care Professionals (HSCP) Newsletter. March 2015	
	Office of the Nursing and Midwifery Services Director (2016). ONMSD Newsletter. July 2016	
	Office of the Nursing and Midwifery Services Director (2016). ONMSD Newsletter. October 2016 Office of the Nursing and Midwifery Services Director (2016). ONMSD Newsletter. April 2017	
Examples of unit Protocols	Guidance Document from the Programme regarding conditions suitable for assessment and management in AMU/AMAU/MAU. 2012 (Unpublished word document provided to the author by NAMP team)	Policy/SOP doc
	Criteria for admission to Acute Medical Assessment Unit/ Emergency Department, St. Luke's General Hospital, Kilkenny, 2017.	
Implementation Plan	National Acute Medicine Programme, Work plan for 2011 & 2012 (Unpublished document, provided to the author by the Programme team)	Programme work plan
Official letters to stakeholders (2012) describing the Assessment Units	Programme & National Case mix Programme, Official notification letter to all acute hospitals, HIPE office & coders, and department of Health on 'Guidelines in Acute Medical Assessment Units'. 2012.Available from http.//www.iaem.ie/wp-content/uploads/2012/06/CX2-2012-Acute-Medical-Assessment-units.pdf	Letter to stakeholders
Programme Website	HSE Summary page 'Acute Medicine Benefits'. 2017. Available at. http.//www.hse.ie/eng/about/Who/cspd/ncps/acute-medicine/Benefits/	Programme web page

NAMP published journal articles, conference posters, presentations (2010-2017)		
	O'Reilly, O., et al., National Programme-improving the care of all medical patients in Ireland. J Hosp Med, 2015. 10(12). p. 794-	Journal article
	Courtney, G., Acute Medicine. The current perspective (Ireland). In The Society for Acute Medicine. 2012. Unknown. Available from. http.//www.acutemedicine.org.uk/wp-content/uploads/2012/05/acute_medicine_the_current_perspective%20.pdf	Oral presentation
	O'Neill S., C., G., National Programme 2010, in Irish Hospital Consultants Association (IHCA) AGM. 2010.	
	Carroll, J., Acute Medicine 'The Irish Experience' Cork University Hospital HSE-South, in The Society for Acute Medicine, Spring Meeting. 2012. Dublin	
	Carroll, J., Primary Care - Hospital Interface. 'Acute unselected medical admissions'. Is there a better way? In Unknown. 2012. Unknown. Available from. https.//www.slideshare.net/Investnet/01-jennifer-carroll-primary-care-hospital-interface-autosaved-2007	Poster
	O'Reilly, O.C., G., Croke, E., Irish Programme. in IFIC World Congress. 2016. Wellington, New Zealand	
	Acute Medicine Programme. Overarching Aims, Key benefits, Key components of the Programme, New pathways for medical patients, and Key deliverables for 2011. 2010. Unknown. Available from. http.//slideplayer.com/slide/4292667/	
	O'Reilly, O., Casey, A., Courtney, G., Keown AM., Irish National Programme, in International Forum on Quality & Safety in Healthcare. 2013, Health Service Executive (HSE); Royal College of Physicians of Ireland. London	
Health Service Executive Audits, Programme Monitoring (including surveys) & Single Site Evaluations		
HSE Audit of AMAUs	HSE Quality & Patient Safety Audit Service, Audit of characteristics, work practices and referral patterns of Acute Medical Assessment Units (AMAUs) in selected acute hospitals as per The National Programme Report, 2010. 2014.	Audit
Template for site self assessment	Acute Medicine Programme Site Self Assessment (3rd quarter 2011) (Unpublished document, provided to the author by the Programme team)	Checklist
Template for site visit by programme team	Programme, AMP Clinical Site Visit Information Template V4. 2011. (Unpublished document, provided to the author by the Programme team)	Checklist
Site reports	Individual site reports produced by the NAMP team following completion of site visits in 2016 & 2017. (Unpublished documents, provided to the author by the Programme team)	Site reports
Evaluation of an Assessment Unit	Migone, C., Emergency Medical Activity in Cork University Hospital. The impact of the opening of the acute medicine unit. 2015.	Report
	Sheahan, H. An Evaluation of a Medical Assessment Unit in a General Hospital. 2001	Report
	Acute Medicine Programme & Dublin Institute of Technology Working Category, Report of the Simulation study on 'The impact of the introduction of AMAU on Patient Experience'. Pilot study @ Tallaght Hospital. 2015.	Report
Acute Medicine Workforce documents		
SAOLTA document on consultant cover	Saolta University Health Care Category. Acute medicine Clinical Service Strategy Report. Draft V21. June 2017. (Unpublished draft; provided to the author by the Programme team)	Unpublished report

Report on the role of nurses in AMAUs	Corbally, M., Macri, G., Hawkshaw, S. An examination of the role and activities of nurses caring for patients who are admitted to a model 4 hospital as part of the National Programme. 2014, Dublin City University. Dublin, Ireland	Report
Nursing Education	AMAU/MAU/MSSW Nursing Education and Training Survey and Needs Analysis (2016)	National survey
Framework supporting Nursing Practice Skills	Casey, A. et al for the Acute Medicine Nursing Interest Category (2016). Setting the Direction. A Development Framework Supporting Nursing Practice Skills and Competencies in AMAUs and MAUs. Office of Nursing and Midwifery Services Director & National Programme, Clinical Strategy and Programmes Division, HSE, Dublin	Framework
Future Consultant Workforce Planning	Courtney, G. Chapter title. Future Consultant Workforce Planning, in National Programme Report 2015	Chapter in report
Overseas 1 - models of Care & Guidance on standards in Acute Medical Assessment Units from other jurisdictions		
Models of care	Royal College of Physicians, Acute Medicine care. The right person, in the right setting - first time. Report of the Acute Medicine Task Force., Royal College of Physicians, Editor. 2007. London. ACI Acute Care Taskforce Medical Assessment Unit Working Category, NSW Medical Assessment Unit model of care. 2014, NSW Agency for Clinical Innovation. Sydney Medical Assessment and Planning unit Working Category. Position Statement of the Internal Medicine Society of Australia and New Zealand Standards for Medical Assessment and Planning units in Public and Private Hospitals. 2006 Medical Assessment and Planning unit (MAP unit) Working Category. Medical Assessment and Planning units (MAP units) Reference Paper. State of Queensland department of Health, 2013. Brisbane, Queensland.	Models of care
Acute Care Toolkits	Royal College of Physicians, Acute Care Toolkit 1. Handover. May 2011. Royal College of Physicians, Acute Care Toolkit 2. High-quality acute care. October 2011. Including Appendix 1. Royal College of Physicians Position statement – care of medical patients out of hours. Appendix 2. Provision of consultant physician working on site for 12 hours per day 7 days per week Royal College of Physicians, Acute Care Toolkit 3. Acute medicine care for frail older people. March 2012 Royal College of Physicians, Acute care toolkit 4. Delivering a 12-hour, 7-day consultant presence on the acute medicine unit. October 2012. Including Appendix 1. Example calculation of numbers of patient contacts per day. Appendix 3. Example rotas Royal College of Physicians, Acute Care Toolkit 8. The medical registrar on-call. Maximising clinical experience, training and patient care. November 2013 Royal College of Physicians, Acute Care Toolkit 12. Ambulatory emergency care. October 2014	Guidance document
Standards by other bodies	NHS West Midlands Quality Review Service, Quality Standards for acute medicine units (AMUs). Version 2. 2012 Society of Acute Medicine. Clinical Indicators for acute medicine units (AMUs). Available at http.//www.acutemedicine.org.uk/wpcontent/uploads/2010/11/clinical_quality_indicators_for_acute_medical_units_v18.pdf Royal College of Physicians. Acute internal medicine. Overview of services. 2017 [cited 2017 18/10/2017]; Available from. http.//www.rcpmedicalcare.org.uk/designing-services/specialties/acute-internal-medicine/services-delivered/	

Guidance from Royal College of Physicians on acute medicine units	Royal College of Physicians. Acute internal medicine. Access. 2017 [cited 2017 10/18/2017]; Available from. http.//www.rcpmedicalcare.org.uk/designing-services/specialties/acute-internal-medicine/access/	Web pages
	Royal College of Physicians. Acute internal medicine. Maintaining quality. 2017 [cited 2017 10/18/2017]; Available from. http.//www.rcpmedicalcare.org.uk/designing-services/specialties/acute-internal-medicine/maintaining-quality/.	
	Royal College of Physicians. Acute internal medicine services. Acute medicine unit. 2017 [cited 2017 18/10/2017]; Available from. http.//www.rcpmedicalcare.org.uk/designing-services/specialties/acute-internal-medicine/services-delivered/acute-medical-unit/.	
	NHS England. Case study at Royal united Hospitals Bath, NHS Foundation Trust. September 2015. Improving access to senior clinical decision makers and diagnostics seven days a week. Available at. https.//www.england.nhs.uk/wp-content/uploads/2016/08/improv-access-senior-decisions.pdf	Case study
	Presentation from Jennifer Paris & David Milne, Frimley Park Hospital, NHS England Reducing delays to discharging patients from the acute medicine unit Available at https.//www.kingsfund.org.uk/sites/default/files/media/jenny-paris-frimley-park-hospitals-reducing-delays-discharging-patients-acute-medical-unit-kingsfund-may13.pdf	Presentation
Overseas 2 - Audit & Evaluation of acute medicine units in other jurisdictions		
UK Audit of AMUs	Society for Acute Medicine Benchmarking (SAMBA) Audit 2016. Annual report. Society for Acute Medicine, Editor. 2016, Society for Acute Medicine. Edinburgh.	Audit
Evaluation in NSW, Australia	NSW Ministry of Health, NSW Medical Assessment Unit Evaluation. 2013, NSW Ministry of Health. Sydney	Evaluation Report
Journal articles on measuring effectiveness of AMUs		
	National Institute for Health and Care Excellence, Chapter 24 Assessment through acute medicine units. Chapter 24 Assessment through acute medicine units. Emergency and acute medicine care in over 16s. service delivery and organisation. DRAFT NICE guideline for consultation July 2017, 2017	Systematic literature review
	Reid, L.E., et al., The effectiveness and variation of acute medicine units. a systematic review. Int J Qual Health Care, 2016. 28(4). p. 433-46.	Journal article
	Van Galen, L.S., et al., acute medicine units. The way to go? A literature review. Eur J Intern Med, 2017. 39. p. 24-31.	
	Scott, I., L. Vaughan, and D. Bell, Effectiveness of acute medicine units in hospitals. a systematic review. International Journal for Quality in Health Care, 2009. 21(6). p. 397-407.	
	Watts, M., et al., Acute Medical Assessment Units. an efficient alternative to in-hospital acute medicine care. Ir Med J, 2011. 104(2). p. 47-9.	
	Suthers, B., et al., The effect of context on performance of an acute medicine unit. experience from an Australian tertiary hospital. Australian Health Review, 2012. 36(3). p. 320-324.	
	Li, J.Y., et al., Outcomes of establishing an acute Assessment Unit in the general medical service of a tertiary teaching hospital. The Medical Journal of Australia, 2010. 192(7). p. 384-387	
	Coary, R., et al., Does admission via acute medicine unit influence hospital mortality? 12 years' experience in a large Dublin hospital. Acute Med, 2014. 13(4). p. 152-8.	

	Conway, R., et al., Emergency re-admissions are substantially determined by acute illness severity and chronic debilitating illness. a single centre cohort study. Eur J Intern Med, 2015. 26(1). p. 12-7.	
	Conway, R., D. O'Riordan, and B. Silke, Long-term outcome of the AMAU--a decade's experience. Qjm, 2014. 107(1). p. 43-9	
	Conway, R., et al., Deprivation as an outcome determinant in emergency medical admissions. Qjm, 2013. 106(3). p. 245-51.	
Journal articles, conference posters and presentations on AMU components influencing patients outcomes		
Articles	Reid, L.E.M., et al., How is it best to deliver care in acute medicine units? A systematic review. QJM. An International Journal of Medicine, 2017. p. hcx161-hcx161.	Journal article
	Bell, D., et al., Consultant Input in Acute Medicine Admissions and Patient Outcomes in Hospitals in England. A Multivariate Analysis. PLoS ONE, 2013. 8(4). p. e61476.	
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	Reid, l., Lone, NI., Morrison, SJ., Weir CJ., and Jones MC., An Examination of acute medicine units in Scottish Hospitals, in IMSANS 17. 2017. Wellington NS	Abstract
	Royal united Hospitals Bath NHS Foundation Trust, Improving access to senior clinical decision makers and diagnostics seven days a week. 2015. Available from. https.//www.england.nhs.uk/wp-content/uploads/2016/08/improv-access-senior-decisions.pdf	Case study report
Miscellaneous		
Recent reports/documents pertaining to Acute Hospitals in Ireland	National Programme Annual Conference (2017). Transforming the Delivery of Acute Medicine. Dublin, October 24th 2017	Conference book.
	HSE (2015). Emergency department Task Force Report. March 2015. Available from. https.//static.rasset.ie/documents/news/emergency-task-force-report.pdf	Report
	HSE. Special Delivery unit (2013). Unscheduled Care Strategic Plan. Quarter 1, 2013	Strategic plan

	HSE. Special Delivery unit (Undated). Technical Guidance. Introducing Demand and Capacity Planning. Available from. http.//www.ntpf.ie/home/pdf/TG%20Web.pdf	Technical document
	HSE. The Acute Hospitals Division (2017). Developing and Acute Floor model for Ireland. Version 0.26. September 2017. (Unpublished draft. Provided to the author by the Programme team)	Plan
	HSE & The Department of Health (2013). Securing the Future of Smaller Hospitals. A Framework for Development	Framework
	HSE. The Acute Hospitals Division (2017). Operational Plan 2017 for Acute Hospitals. Available from. http.//www.hse.ie/eng/services/publications/serviceplans/Service-Plan-2017/Operational-Plans-2017/acute-hospitals-operational-plans-2017.pdf	Operational Plan
	Smyth B., Marsden P., Donohue F., Kavanagh P., Kitching A., Feely E., Collins L., Cullen L., Sheridan A., Evans D., Wright P., O'Brien S., Migone C. (2017) Planning for Health. Trends and Priorities to Inform Health Service Planning 2017. Report from the Health Service Executive.	Technical document
Recent reports pertaining to flow in acute hospitals in UK	Karakusevic, S., for the Nuffield Trust. Understanding patient flow in hospitals. October 2016. Available from. https.//www.nuffieldtrust.org.uk/resource/understanding-patient-flow-in-hospitals	Technical document
	NHS Improvement (2017). Good practice guide. Focus on improving patient flow. National priorities for acute hospitals 2017. Available from. https.//improvement.nhs.uk/resources/good-practice-guide-focus-on-improving-patient-flow/	

Appendix 3.2 Topic guide for NAMP programme personnel

A. PROGRAMME DESIGN

1. Can you talk me through the Acute Medicine Programme and how it was developed?

PROBES

- Who were the partners in developing the Programme? How involved were they?
- Was there a consultation process? Can you talk me through what this entailed?
- How was this Programme working in tandem with the National Clinical Programmes?

2. How was it supposed to fit in with existing hospital structures and operations?

3. Can you talk me through the rationale behind the National Clinical Programmes and the concept of clinician leadership?

B. PROCESS OF IMPLEMENTATION

4. Who was driving implementation of the Programme/ where was support coming from?

PROBES

- Is that support still there?
- Are these reflected in the implementation of NAMP?

5. What do you think are the critical factors to successfully implement a wide reaching change programme like this?

PROBES

- Are these reflected in the implementation of NAMP?

6. Was this piloted in advance of national roll out?

7. So, what happened next?

PROBES

- Where did you start? Why did you start there?
- Why did sites want to adopt this model?
- What are your thoughts on how the Programme was implemented?

8. When a site expressed an interest in coming on 'board', can you talk me through what happened then?

PROBES

- How involved were the national team in negotiations with the sites as to how the Programme would operate in their hospital?
- What was done to assess a hospital's ability to conform to the model of care?

9. What is required to fully operate this model in a hospital?

PROBES

- Resources- such as staffing, and how did the team figure that out?
- How has resourcing of the Programme actually worked out?
- How did the cutbacks and moratorium on recruitment during the recession impact the Programme?

<u>C. WHAT DOES GOOD IMPLEMENTATION LOOK LIKE?</u>

10. How would you define 'good implementation', or the Programme 'working well' at a local level?

11. How were you monitoring implementation at the hospitals?

12. Can you think of a hospital where the Programme has been well implemented? What does this look like, and what do you think are the factors that have contributed to this?

PROBES

- What is the role of champions/clinician leads at sites?

<u>D. LESSONS LEARNT AND FUTURE DIRECTION</u>

13. What lessons did you learn from the process of implementation of NAMP that should be shared with others undertaking similar transformational programmes in the health system?

PROBES

- What would you do differently if you were to start again with a similar change programme?

14. How do you see the Programme continuing?

15. What do you see as the major threats to the Programme?

Appendix 3.3 Description of the Acute Medical Assessment Units to be established

The establishment of AMAUs was central to the Programme, and guidance was provided on the functioning, components and staffing of unit by hospital model. An AMU consists of an Acute Medical Assessment Unit (AMAU) with an associated Short stay ward (SSW) for patients whose length of hospital stay is not expected to be greater than 48 hours. This is what the international literature speaks of when it examines the effectiveness of these units. However, as will be described in the following section, the Programme described a different set-up depending on hospital size, whereby only the larger model 4 hospitals would have a SSW affiliated with their AMAU. To assist with the implementation of this service reconfiguration, the National Acute Medicine Programme 'categorised' hospitals into 4 generic hospital models, from the smaller model 1 community/district hospitals to the largest model 4 hospitals. The type of AMAU at each hospital was determined by the hospital's model. The smaller hospitals (i.e. model 2 and model 3) would have the AMAU but not an affiliated SSW and admission from the AMAU would be to an in-patient ward. This is an important differentiation from the international literature and one that will be discussed later in the thesis. The Programme recognised that units should be designed firstly around function, such as identifying and clarifying their role in the hospital's acute services and specifying the patient categories to be assessed there, rather than form (e.g., physical layout and structure) and sites were given the flexibility to adapt the units to suit local needs and resources (Royal College of Physicians of Ireland et al., 2010). This approach has been highlighted in Australia as being of significant importance in the performance of AMUs (Jenkins et al., 2010).

<u>Size and location</u>

Units were to be of adequate size to meet the need of the hospital. In model 4 hospitals, the units would ideally be co-located with the ED in an acute floor setting or failing that, in close proximity to the ED. Similarly with model 3 hospitals, the units should be co-located with the ED. In model 2 hospitals (which do not have an ED), the units were to consist of assessment beds in a defined area and offer a clinical support function.

<u>Hours of operation</u>

It was envisaged that units in model 4 hospitals would operate on a continuous 24/7 basis. Units in model 3 hospitals would operate over a 12-24 hour period, 7 days a week depending on service need, and units in model 2 hospitals would also be open 7 days a week but only from 8am to 8pm. In model 3 hospitals, where the AMAUs were expected to close at night, all patients presenting with medical conditions to hospital were to be managed in the ED by the acute medical team on-call, from two hours before the AMAU closed until it reopened.

<u>Short stay ward (SSW)</u>

The units in model 4 hospitals were to have an affiliated Short stay ward (SSW) for patients whose required length of stay in hospital was expected to be less than 48 hours. These SSWs would be open 24/7 and receive patients from the AMAU into ring fenced beds that were under the governance of the AMAU physicians. Model 3 and model 2 hospitals were not expected to have SSWs and admissions from these units would be to in-patient beds.

<u>Mode of access to the units</u>

In model 3 and 4 hospitals, patients would be referred from GPs, but a proportion would be onward referrals from other sources including the ED, outpatients and other care settings. Patients presenting to hospital without a GP referral would to be seen in the first instance in the ED, not the AMAU, and suitable patients then streamed to the AMAU. Patients attending model 3 and model 4 hospitals would access the ED and the AMAU through a common entrance and from there GP referred patients would be briefly assessed to ensure that they did not require immediate transfer to the ED rhesus areas. In model 2 hospital (do not have EDs), the patients to be seen in these AMAU were just GP referred patients, sent for assessment during daytime hours. These patients were expected to be low-risk medical patients (i.e. unlikely to require high intensity cardiopulmonary and/or neurological support). In model 3 and 4 hospitals self-referred medical patients (i.e. without a GP referral letter) would be triaged, undergo early warning score, be assessed and managed by the emergency medicine team. Suitable patients would only to be referred to the AMAU thereafter after discussion between the consultant in EM (or their delegate) and the AMAU physician on-call (or their delegate). In model 2 hospitals, only patients referred by a GP were to be seen.

<u>Patient flow through the unit</u>

The AMAU in model 4 hospitals would admit patients requiring a stay in hospital either to an affiliated SSW or to in-patient bed, depending on the expected length of stay. Where this was expected to be less than 48 hours the patient would be admitted to the SSW. Those requiring a longer hospital stay would be moved either directly from the AMAU to a ward, or from the SSW after the 48-hour period, to allow for continuous flow of patients from the AMAU. In model 2 and 3 hospitals, patients requiring a stay in hospital after assessment in the AMAU were to admitted be to an in-patient bed - including specialist units (e.g. CCU, ICU, HDU, acute stroke unit). A depiction of this flow is provided in **Error! Reference**

source not found./ Importantly this diagram which is taken from a NAMP publication (Royal College of Physicians of Ireland and Health Service Executive, 2012) depicts all hospitals as having a SSW. This was not the intention of the model of care, which clearly specifies than only model 4 hospitals would have a SSW.

<u>Best practice in the unit</u>

The model of care devoted significant attention to what best practice should look like in these units. In brief, all patients on arrival at the units regardless of the hospital model were to have nursing evaluation and Early Warning Score (EWS)/ observations performed within a certain time period and initial medical assessment to be performed by a senior decision maker within 1 hour. Consultant physician review with a decision made to admit or discharge was to be made within 6 hours and facilitated by dedicated radiology, laboratory and other services, including nursing, therapy professionals and medical social workers. On discharge, the relevant GP was to be informed (on the same day) of the decision, together with relevant clinical details and care plans.

<u>Staffing and medical cover in the unit</u>

All units were to have a designated lead consultant physician, and in the case of model 2 hospitals, this was to be a joint appointment with the associated model 3 or model 4 hospital. All units were to have a designated clinical nurse manager and assigned therapy resource. AMAUs in model 4 hospitals were to be staffed by acute medicine physicians and/or acute medicine physicians with a specialty interest, during core working hours (8am-8pm) weekdays, and for 5 hours per day on weekends and public holidays. It was envisaged that there would be 6-8 physicians who would work 80% in the unit and SSW and 20% in their specialty, and that hospitals would implement consultant rotas to suit resources, including physician of the day/week model. This consultant time while in the AMAU was to be protected. In model 2 and model 3 hospitals, the consultant physician on-call for the AMAU would have the responsibility to be present and make management decisions during core working hours 7 days per week. In all models, the consultant physician on-call for the hospital was to manage the AMAU out of hours.

<u>Governance of acute medicine</u>

The model of care made clear the need for governance and defined the roles of an acute medicine governance group (which would have representation on the unscheduled care governance group). It also recognised the need for clinical governance across the ED/AMAU interface in terms of clarifying the respective roles, responsibilities, authority and accountability of the emergency medicine and acute medicine staff to be explicitly stated with respect to the overlap/boundaries between the two services. The Programme recognised the pivotal role of GPs in the enhanced delivery of acute medicine in hospital and recommended the establishment of a GP liaison committee within each hospital to support GPs in primary care in the management of medical patients

Description of the AMAUs to be developed at each hospital model

Model 4 hospitals; Larger, teaching hospitals that admit undifferentiated medical patients and accept tertiary referrals AMAU and a Short stay ward (SSW)	
Hours of operation	Units should operate on a continuous 24/7 basis, dependent on the availability of medical, nursing and allied healthcare staff and services such as diagnostics available 24/7.
Location	Ideally co-located with the ED in an acute floor model or at least in close proximity to the emergency department. Should be co-located with a Short stay ward, which is dedicated to the rapid turnaround of medical patients in whom the anticipated length of hospital stay is 48 hours or less. The SSW should function 24 hours a day, seven days a week and be co-located with the AAU to provide rapid disposition of patients from the AAU, and the potential or shared functionality with regards to medical, nursing and support staff as required. AMAU physicians to have governance over the SSW beds.
Mode of access	Ideally patients will be referred directly from primary care but a proportion will be onward referrals from other sources including the ED, outpatients and other care settings, co-ordinated by a case manager. Patients presenting to hospital without GP referral will be seen in the first instance in the ED – not the AMU. Patients attending hospital should access ED and AMAU through a common entrance -AMAU accepted patients should be briefly assessed to ensure that they do not require immediate transfer to the ED rhesus areas.
Best practice in the unit	Upon arrival at the unit, all patients should have nursing evaluation and Early Warning Score (EWS)/observations performed within 20 minutes. Initial medical assessment should be performed by a senior decision maker within 1 hour. Consultant physician review with a decision made to admit or discharge should be made within 6 hours and will be facilitated by dedicated radiology, laboratory and other services, including nursing, therapy professionals and medical social workers. In the event of discharge, the relevant GP will be informed (on the same day) of the decision together with all relevant details and care plans.
Staffing and medical cover in the unit	There should be a designated lead consultant physician, clinical nurse manager and therapy lead. Should be staffed by acute medicine physician s and/or acute physicians with a specialty interest during core working hours (8am-8pm), weekdays and for 5 hours per day on weekends and public holidays. Ideally should be 6-8 physicians who work 80% in the unit and SSW and 20% in their specialty. Hospitals should implement consultant rotas to suit resources including physician of the day/week model. Consultant time while in the AMU should be dedicated/protected. The consultant physician on-call for the hospital will manage the AMAU out of hours. .
Patient flow	Should only admit patients for a short period for acute treatment and/or observation where the estimated length of stay is less than 48 hours. Patients who require admission for longer than 48 hours must move from this unit to an in-patient ward.

Model 3 hospitals. Larger hospitals that accept undifferentiated patients AMAU only; no SSW	
Hours of operation	Hours of operation may vary from 12 to 24 hours, 7 days a week, depending on service need
Location	Units will have assessment beds in a defined area, ideally co-located with the ED. It does not have access to ring-fenced Short Stay medical beds
Mode of access	The unit will see GP referred patients with the entire spectrum of medical conditions, some of whom may require urgent medical care. Patients presenting to hospital without GP referral will be seen in the first instance in the ED not the AMAU. Patients attending hospital should access ED and AMAU through a common entrance -AMAU accepted patients should be briefly assessed to ensure that they do not require immediate transfer to the ED rhesus areas. Model 3 hospitals will have a 24-hour ED and, when the AMAU is not open on a continuous basis, all patients presenting with medical conditions will be managed by the Acute Medical team on-call in the ED, from two hours before the AMAU closes until it reopens.
Best practice in the unit	Upon arrival at the unit, all patients should have nursing evaluation and Early Warning Score (EWS)/observations performed within 20 minutes. Initial medical assessment should be performed by a senior decision maker within 1 hour. Consultant physician review with a decision made to admit or discharge should be made within 6 hours and will be facilitated by dedicated radiology, laboratory and other services, including nursing, therapy professionals and medical social workers. In the event of discharge, the relevant GP will be informed (on the same day) of the decision together with all relevant clinical details and care plans.
Staffing and medical cover in the unit	There should be a designated lead consultant physician, clinical nurse manager and therapy lead. The consultant physician on-call for the AMAU in model 3 hospitals will have primary responsibility to be present and make management decisions during core working hours 7 days per week. The consultant physician on-call for the hospital will manage the AMAU out of hours.
Patient flow	Patients admitted to hospital from the AMAU will be to in-patient beds including specialist units (e.g. CCU, ICU, HDU, acute stroke unit). Patients who require category 3 or 3S ICU support will have guaranteed transfer to a model 4 hospital

Model 2 hospitals. Smaller hospitals that accept differentiated patients AMAU only; no SSW	
Hours of operation	Hours of operation from 8am to 8pm, 7 days per week, depending on service need.
Location	Unit will have assessment beds in a defined area and serve a clinical support function. It does not have access to ring-fenced Short Stay medical beds
Mode of access	The unit will manage GP referred, differentiated medical patients who have a low risk of requiring full resuscitation. Only patients referred by a GP will be seen. GPs will refer low-risk medical patient (i.e. unlikely to require high intensity cardiopulmonary and/or neurological support) for assessment during daytime hours. Patients with a significant risk of deterioration should be referred to the associated model 3 / 4 hospital.
Best practice in the unit	Upon arrival at the unit, all patients should have nursing evaluation and Early Warning Score (EWS)/observations performed within 20 minutes. A decision regarding discharge/admission should be made within 6 hours and will be facilitated by dedicated radiology, laboratory and other services, including nursing, therapy professionals and medical social workers.
Staffing and medical cover in the unit	Unit should have a designated lead consultant physician, who will be jointly appointed to the model 2 and associated model 3 or 4 hospital, a designated clinical nurse manager and assigned therapy resource. The consultant physician on-call for the AMAU in a model 2 hospital will have a primary responsibility to be present and make management decisions during core working hours.
Patient flow	Patients admitted to hospital from the unit will be to in-patient beds in a model 2 hospital. Patients who deteriorate unexpectedly will have guaranteed transfer to a model 3 /4 hospital.

Source: Royal College of Physicians of Ireland et al., 2012 (Royal College of Physicians of Ireland et al., 2010)

Appendix 4.1 Survey questions for Model 3/Model 4 hospitals

1. Select which Model 4 Hospital you are from the list below

2. Insert Your Name

3. What is your position within the hospital? Please select

4. Is the unit called AMU or AMAU?

- ☐ AMU
- ☐ AMAU

5. Does it have a dedicated location for the rapid assessment, diagnosis and commencement of appropriate initial treatment and ongoing management of acute medical patients?

6. Is it co-located with ED?

7. How many assessment spaces does it have?

- ☐ 0-4
- ☐ 5-10
- ☐ 11-15
- ☐ >15

8. How many total assessment spaces are available in your unit?

9. Please provide a breakdown of spaces available by bed, trolley, or chair

10. Does the unit have its own waiting area for patients? (Separate from ED etc.)

11. Is there an Ambulatory Care service (patients are assessed, treated and discharged following completion of care within same day or over a short defined period without a hospital admission)

12. Are there additional seats/recliners for Ambulatory Care?

13. Does it have Provision/Space protected for review/return patients seen under Ambulatory Care pathways?

14. Is there an AMU/ AMAU review clinic for AMU/AMAU patients?

15. Do you record AMU/AMAU review and Ambulatory Care follow up activity separately?

16. Do you have a designated consultant acute medical physician who will have a primary responsibility to be present and make management decisions during core working hours?

17. Do your Acute Medical Physicians have a 50/50 split (or more) commitment to the Acute Medical Unit (AMU/AMAU) and other requirements within their area of special interest (SI)? please detail split commitment below

18. Do you have a dedicated Short Stay Unit for Acute Medical Patients?

19. If yes, is it shared with Acute Surgical or other clinical assessment unit?

20. Does the AMU/AMAU Acute Physician also cover AMSSU?

21. Who provides out of hours cover to your AMSSU?

- ☐ AMU Acute Physicians on call
- ☐ GIM on call
- ☐ Other___________________

22. Does your AMSSU adhere to a policy of 48 hours admission? Add comment if answer is No

23. Is there a protocol for egress of patients out of AMSSU to other specialty wards after 48 hours? Add comment if necessary

24. Do you have an Acute Medicine Governance group? If Yes are they represented on the unscheduled care governance committee? Comment if necessary

25. Do you have a liaison committee that includes GP representatives? Add comment if necessary?

26. Does your hospital have a surge capacity protocol?

27. Does the surge capacity protocol state that AMU/AMAU is last possible option for boarding of patients?

28. Do you have patients boarding in AMU/AMAU? (Boarding patients are those that are not admitted on the NAMP pathway but are occupying space in AMU/AMAU as a consequence of overcrowding in other departments and significantly impede the work of the AMU/AMAU? Add comment if necessary

29. If Yes, state below approximate daily numbers, if daily numbers not available you can divide total monthly numbers by 30/31 days, tick below

30. Is your AMU/AMAU open 24 hours?

31. If not 24 hour, what time does your AMU/AMAU begin accepting patients from each day?

32. What time do you stop accepting patients, choose one below?

33. If not 24 hour, What are the closest hours to your opening hours, select from below

34. Do you have a case manager/navigation hub for streaming patients? Add comment if necessary

35. GP direct: Do you take direct GP referrals?

36. GP direct: Do you have protected daily slots for GP referrals? If Yes, select closest number

37. Streaming from ED: Do you stream patients from ED?

38. Streaming from Ambulance triage: Do you stream patients from Ambulance triage?

39. Streaming from ED: How does this streaming occur, chose most relevant from below. Comment if

necessary

40. Streaming from ED: Are patients prioritised according to their clinical need and appropriateness to Acute Medical Unit? Comment if necessary

41. Streaming from ED: Do the Acute Medical Physicians attend ED to assess patients? Comment if necessary

42. Streaming from ED: Do all clinical investigations and relevant documentation accompany the patient on transfer from ED to AMU/AMAU? Comment if necessary

43. Do all patients have NEWS recorded on arrival?

44. Do all patients see a senior decision maker within 1 hour of arrival?

45. Who is categorised as a Senior Decision Maker?

46. Following Assessment, diagnosis and treatment, is a decision regarding admission/discharge made within 6 hours? Comment if necessary

47. Do you Audit the above metrics (NEWS, I hour & 6 hour)? Comment if necessary

48. Tick from list which Medical Specialties you have access to Urgent OPD Slots

49. Inter-dependencies: From the list below tick all medical specialties who attend the AMU/AMAU to review patients? Add any additional that are not listed

50. Inter-dependencies: From the list below tick all ANP/CNS who attend the AMU/AMAU to review patients? add any additional that are not listed

51. Inter-dependencies: Do you have a pathway in place to manage an acute exacerbation/presentation of any of these conditions? add any additional that are not listed

52. Patient Discharge Assessment: Are all patients assessed with regard to estimated length of stay, the need for specialist care and early discharge planning?

53. Patient Discharge Assessment: Does it include information about the patient’s pre-hospital abilities in relation to potential discharge issues

54. Admitted Patients: Is the estimated length of stay determined by the consultant in conjunction with the MDT?

55. Admitted Patients: Is Estimated Discharge Date (EDD) documented in the notes?

56. Admitted patients: Is discussion on EDD discussed with and communicated to patient at the earliest available opportunity?

57. Discharge Planning: Do you have nurse facilitated discharge planning? Comment if necessary.

58. Discharge Planning: Do you have criteria led discharge planning? Comment if necessary.

59. GP liaison: Do you have mechanisms in place to liaise with GPs to manage patient discharge? Comment

if necessary.

60. On discharge: Is a copy of the transfer/discharge communication sent on the same day by agreed mechanism (ideally encrypted and sent electronically) to the patient's GP, public health nurse and other healthcare providers (e.g. nursing home)? Add comment on time frame if not same day please.

61. On discharge: Is a copy given to the patient?

62. Same Day: Do you have same day facilitated / priority access for any of the following diagnostic tests? tick all that apply

63. Ambulatory Care: Do you have facilitated / priority access to other urgent investigations within 72 hours for any of the following diagnostic tests? Tick all that apply, Add other tests available if not listed

64. Are patients admitted solely to await diagnostics

65. Storage: Are your diagnostic test requests and reports processed and stored electronically? Add comment if answer No please

66. Data: Do you have an IT data collection system? If Yes, Add name of system. If No, Add collection source of data

67. Data: Does IT data collection system record patients as admissions or patients as attendances or patients as OPD attendances

68. Are all new patients recorded?

69. Are all review patients recorded?

70. Do you have a mechanism for recording Ambulatory Care patients? Please add comment

71. Do you have an assigned admin/data person for collating of data?

72. Do you carry out audits on your activity

73. Do you use NQAIS Clinical for data analysis?

74. Please add comments on all of the above if any NO answers recorded

75. Which of the following clinical conditions do you have existing Ambulatory Care Pathways operating?

76. Frailty: Has an assessment area been allocated to the older adult with frailty in the AMU?

77. Frailty: Do you have one or more consultant acute physicians with a SI in Geriatric Medicine

78. Frailty: Is there a process in place to identify frailty? If Yes, please add name/details of tools used

79. Frailty: Is there a specific pathway in place for the delivery of acute medical care to the older person with frailty?

80. Frailty: Is there a frailty assessment and response team in place? If yes add disciplines involved and response times

81. Frailty: Do you carry out Comprehensive Geriatric Assessment within your AMU or AMSSU?

82. Frailty: Does your hospital have specialist geriatric service?

83. Frailty: IF Yes, are there referral criteria in place, to this service, for relevant patients in the AMU/AMAU?

84. How many of your staff have completed the National Frailty Education Programme?

85. Do you have a trainer for the National Frailty Education Programme?

86. Deteriorating Patient: Do you have systems in place to identify and review patients whose clinical status is deteriorating? Add comment if necessary

87. Do you have an Operational Policy?

88. Do you have patient information leaflets/ documentation providing information on AMU/AMAU?

Appendix 4.2 Complete results of the survey on the organisational structures, processes and resources put in place to support the Programme

Concept 1. Changes in the delivery of acute medicine throughout the hospital

1. Establishment of an AMAU in line with the guidance provided in the model of care

All participants that responded to the survey answered this question to indicate they had an AMAU. Concept 2 covers the structure and adherence to best practice within these units.

2. Enhanced streaming of medical patients via a navigational hub

Only model 3 and model 4 hospitals were asked about the presence of a navigational hub. Seven of the twelve model 3 hospitals had a navigational hub, with a further three commenting '*that instead of a navigational hub, the CNM held a phone for the streaming of patients/that they worked closely with bed management department and that there was a recent appointment of a patient flow manager'*. None of the four model 4 hospitals that responded had a navigational hub. Two commented that there used to be a navigational hub but it closed down and that its function was replaced by the bed management office, patient flow team and safety flow meetings. One hospital commented that the clinical nurse manager held the role of the case manager.

3. Governance of acute medicine in the hospital

Model 3 & model 4 hospitals were asked whether they had an <u>acute medicine governance group</u> and whether this category was represented on the unscheduled care governance committee. Eight of the model 3 hospitals had, though only half of these had representation on the unscheduled care governance committee. Of the model 4 hospitals that responded, all had a governance group, and all had representation on the unscheduled care governance committee. Five model 3 hospitals had a GP liaison committee with individual GP representatives, six did not, with one commenting that GPs in area were informed of admission criteria, referral pathways etc. as needs be, but there was no official liaison committee. Two of the four model 4 hospitals had a <u>GP liaison committee</u>.

Concept 2. Best practice in the Acute Medical Assessment Unit

This concept, which had five components, was concerned with the establishment and operation of the AMAUs. The majority of the questions focused on this concept.

1. Hours of operation, location, and capacity of the unit

The majority of units were operating on a 12 hour, 5 days a week schedule. None of the units in the model 4 hospitals were open 24 hours, and were only operational Monday through Friday, for a 12 hour period, commencing accepting patients between 7 and 9am and ceasing to accept patients between 5 and 7pm. One model 4 hospital commented that they '*ceased accepting patients before 5pm as a result of overcrowding and 'boarding' in the unit*'. In model 3 hospitals, none of the AMAUs were open 24 hours; only one was open at the weekend. The majority of the AMAUs were open 12 hours, though three had a shorter time frame of 9am to 5pm. The majority started accepting patients between 9-11am, and ceased before 5pm or 7pm in the case of a few, and closed before 8pm. One model 3 unit remained open until 10pm and ceased accepting patients at 7pm. Model 2 hospitals were similar; they commenced accepting patients between 7am and 9am, and the majority ceased accepting patients before 5pm, though several hospitals accepted patients until 7pm or 9pm in the case of one hospital.

There was significant variation across the AMAUs in terms of their location and capacity. The AMAU was co-located with the ED (or injury unit in the case of model 2 hospitals) in 5/7 model 2 hospitals, 7/12 model 3 hospitals and only 1/4 model 4 hospitals. Each model 2 AMAU had between 5-10 assessment spaces. In model 3 hospitals, three units had between 0 and 4 spaces, eight had 5-10 assessment spaces and one had between 10 and 15 assessment spaces. In model 4 hospitals, all four units had 11-15 assessment spaces, with one respondent commenting that '*of these spaces, 8-10 were occupied by admitted patients leaving only 2-4 spaces for assessment*'.

2. Access to the AMAU and appropriate patients streamed to the units and the SSW

'Boarding' was identified in many hospitals as a major impediment to the delivery of care in the AMAU. Boarding refers to medically admitted in-patients from the ED (or elsewhere) being placed in the AMAU due to a lack of capacity of in-patient beds in-house. All four model 4 hospitals answered that this was an issue in their unit, though it was especially problematic in one hospital. This unit commented that despite the hospital's surge capacity protocol explicitly stating that the AMAU was the last place to 'board' patients during surge, it was primarily the first place of surge. In the model 3 hospitals, nine units had medically admitted patients from the ED occupy some percentage of their trolleys, as did two model 2 units. Comments across both models included:

> *we use AMAU for admitted medical patients that cannot access a ward bed due to capacity issues or for isolation purposes.*
>
> *daily medically admitted patients from ED occupy some percentage of trolleys, usually 6*
>
> *while stated as last surge capacity it is primarily first area of surge.*
>
> *none ['boarding'] in 2016, very little 2017, frequent in 2018.*

this is last resort stuff now. We do accept 4 acutely admitted patients to AMAU beds each morning as there is a concept that these are patients who would have been AMAU patients, had the AMAU been open over night. This then supports the GIM on-call team and also supports ED.

Model 3 and 4 hospitals were asked whether their hospital had a surge capacity protocol and whether this policy stated that AMAU was the last possible option for 'boarding' of patients. All four model 4 hospitals had a surge capacity protocol, and three of these four protocols identified the AMAU as last resort for 'boarding'. Ten of the 12 model 3 hospitals had a surge capacity protocol, but only five of these stated that the AMAU was the last place to 'board'.

Streaming from the ED was the most common mode of entry to the AMAU for all model 3 and model 4 hospitals. There was significant heterogeneity in the mode of streaming. The most common method was on the basis of a clinical conversation between a senior nurse in the AMAU and a senior nurse in the ED. In some hospitals, streaming was made on the basis of a clinical conversation between an acute physician and an emergency medicine consultant, once assessed in the ED. The triage nurse was identified in several hospitals as playing a pivotal role in streaming in many hospitals, in highlighting patients as being appropriate for the AMAU and communicating with the AMAU nurse who would take these patients across when space was available. Other modes of streaming included emergency department clinicians referring patients once assessed in the ED.

Most AMAUs took direct GP referrals; but these were limited to specific time slots. In model 3 hospitals, eight of the eleven units that responded took direct GP referrals, and seven of these had protected time slots for GPs each day. Three out of the four model 4 units accepted referrals from GPs and of those, two had protected time slots. Some model 2 hospitals did not take direct GP referrals. It is difficult to understand where their patients come from as these hospitals do not have emergency departments. The model of care was clear that GPs would need to be able to directly refer lower acuity patients to consultant-led care within an ambulatory care setting and have access to in-patient admission in these model 2 hospitals.

Participants were asked whether their AMAU had an affiliated short stay ward (SSW), for the admission of patients from the AMAU for up to a 48 hour period, and whether they shared this unit with acute surgery or another unit. This question was asked of all hospitals, even though the model of care specified that only model 4 hospitals should have this service. In model two hospitals, only one had a dedicated SSW as did three model 3 hospitals, though two of these AMAUs shared their SSW with another department. All model 4 hospitals had an affiliated short stay ward (SSW), with one hospital sharing the SSW between the AMAU and another department. In all model 4 hospitals, the acute medical consultant had clinical governance over this unit, which was covered by either the acute medical team on-call, or the general medical team on-call. Of the units with an affiliated SSW, only one model 3 hospital responded that their protocol on egress after 48 hours was adhered to. In model 4 hospitals, none were adherent with the protocol.

Comments included:

....depending on diagnostics patients may overstay by 3-7 days

SSW is open to both AMU and GIM acute admissions, and whilst the aim is 48 hours, patients will frequently stay there longer

Transfer of patients out of the unit after 48 hours is not custom and practice.

..... poor egress from the unit if patients taken over by other consultants. Regularly admit medical admissions to the SSW due to lack of capacity elsewhere. Those that stay longer than 48 hours do not necessarily get in-patient beds.

Eight model 3 respondents stated that acute medicine physicians in the AMAU are often asked to assess patients in the ED rather than in the AMAU, because of limited assessment space in the AMAU. This was not common in model 4 hospitals.

3. Standardisation of care in the unit

Participants were asked about who was recognised as a senior decision maker (SDM). In the majority of units, consultants, registrars and senior registrars were recognised as a SDM, although some units just chose consultants as a senior decision maker. Only one unit recognised an advanced nurse practitioner (ANP) as a senior decision maker.

In terms of compliance with clinical indicators in the AMAUs (assessment within one hour by a SDM, decision to admit or discharge made within 6 hours, and the taking of an NEWS (National Early Warning Score) within a specified time), responses were mixed. Four model 2 units stated that their patients were seen by a SDM within an hour. Several model 2 hospitals commented that they did not have sufficient staff, and that there was no consultant presence in the AMAU unless requested or the workload required it. Comments included 'seen *by nursing staff within the hour and escalated if necessary; otherwise they were seen by the SHO and reviewed by the registrar'.* Only half of the model 3 units agreed that patients were seen by a SDM within one hour. In model 4 units, only one respondent definitively stated that this recommendation was met. Other units commented that *'patients were discussed with a senior decision maker within one hour and seen subsequently, but perhaps not within the hour.' 'Again that is goal but depends on space and staffing - approx 80 %'.*

In terms of the decision made to admit or discharge, within a 6 hour period, the majority of hospitals across all three models agreed that they were adherent with this. Additionally, all hospitals had a system in place to identify deteriorating patients, with NEWS listed as being taken mostly within 20 minutes of arrival, though a few hospitals stated that it was frequently between 20 and 40 minutes of arrival at the unit. Just over half of hospitals responded that the above metrics (i.e., seen within one hour, decision made to admit/discharge with 6 hours and NEWS taken within a specific time) were audited. All model 4 units audited their metrics. Auditing was less common in model 3 hospitals, with respondents in several hospitals not aware of whether these metrics were audited.

Participants were asked about pathways to manage acute exacerbations of common conditions and were asked to choose which of the following conditions they had pathways for: COPD, asthma, diabetes, mental health, renal/urology, and palliative care. The survey found significant variation in terms of which conditions had pathways. Pathways were less common in model 2 hospitals; only 5 hospitals actually answered this question. Four model 3 hospitals had no pathway in place for any of the conditions listed. All model 4 hospitals that responded had at least one pathway, with one hospital saying that they had a pathway in place for all of these conditions. COPD was the most common condition to have a management pathway in place, followed by asthma and diabetes. Very few hospitals had pathways in place for the management of an acute exacerbation of renal conditions, mental health or palliative care.

Pathways in place to manage acute exacerbation of common conditions

	Model 2 hospitals (N=5 answered this question)	Model 3 (N=12 answered this question)	Model 4 (N= 4 answered this question)
COPD	3	7	4
Asthma	2	5	3
Diabetes	3	4	3
Mental Health	2	2	1
Renal/urology	1	3	1
Palliative care	3	3	1
Access to all of the above	1	1	1
Access to none of the above	4*	4	0
Other		Acute Stroke (1), Acute Ischaemic Chest pain (1)	TIA (1)

*Based on the assumption that those that did not answer this question, but responded to adjacent questions, had no pathways established

4. Alternative pathways to admission for medical patients

Participants were asked whether they had an ambulatory care service in place in their unit where patients were assessed, treated and discharged following completion of care within same day or over a short defined period without a hospital admission. Nearly all AMAUs had some ambulatory care pathways in place, despite a significant number not having extra seats/recliners for the delivery of this ambulatory care, or the space for review/return patients seen under these pathways. Participants were asked to choose from a list of ambulatory care sensitive conditions and identify the conditions for which they had a pathway operating. Many hospitals had only one or two pathways established, while other hospitals had several. Three of the seven model 2 hospitals had some pathways in place; 8 model 3 hospitals had several, and all model 4 hospitals had some pathways in place. Of the three model 2 hospitals that answered this question, one had a pathway in place for all conditions listed apart from upper respiratory infection. A second hospital had several pathways in place, while the third just had a pathway for COPD. In model 3 hospitals, all except three hospitals had some ambulatory care pathways in place, with one having a pathway for all conditions listed. All model 4 hospitals had at least one pathway. COPD, transient ischaemic attack (TIA) and venous thromboembolism (VTE) were the most common conditions with a pathway in place across the units.

Ambulatory care pathways in place at the AMAUs

Condition	Model 2 (N= 3 answered this question)	Model 3 (N= 11 answered this question)	Model 4 (N= 4 answered this question)
Non-specific chest pain	2	4	0
COPD	3	7	2
Upper respiratory tract infection	0	3	0
Lower respiratory tract infection	1	1	1
Pneumonia	2	1	1
Urinary tract infection	1	1	0
Cardiac dysrhythmia	1	2	0
Syncope	2	3	1
TIA	2	6	4
VTE	2	5	2
GI intestinal infection	1	1	0
Anaemia	2	1	0
Heart failure	2	2	0
Vertigo	1	1	1
Headache	1	3	1
Access to all of the above	0	1	0
Access to none of the above	4*	3	0

*Based on the assumption that those that did not answer this question, but responded to adjacent questions, had no pathways established. Other.dka, stemi, ACS (1) dvt (1) cellulitis (lower limb) (1)

These pathways were to be facilitated by priority access to diagnostics and access to health and social care professionals, as well as the provision of rapid access clinics and medical outpatients to follow up patients discharged same day from the AMAU. Participants were asked about the availability of these outpatients' appointments and whether review patients, and patients on these ambulatory care pathways were reviewed in the AMAU or in an outpatient setting. The majority of participants responded that patients were followed up at review clinics in the AMAU and not in outpatient appointments (5/7 model 2s, 7/12 model 3s and 4/4 model 4s). Many units lacked the IT infrastructure to collate data on the number of patients attending the AMAU reviews clinics or attending for ambulatory care follow up. There was significant variation across the units in terms of the availability of urgent outpatient slots. Four model 3 AMAUs had no access to any urgent OPD appointments for any of the medical specialties listed. One model 4 hospital had no access to any urgent medical outpatient slots, stating that their patients only had access to the AMAU review clinic; the other three model 4 AMAUs had access to urgent OPD slots for some medical specialties. This was not asked of model 2 hospitals.

Medical specialties that facilitate the AMAU with urgent OPD Slots

Condition	Model 3 (N=12 answered this question)	Model 4 (N=4 answered this question)
Cardiology	5	1
Neurology	1	2
Respiratory	5	3
Cancer/oncology	3	1
Renal/urology	1	1
Gastroenterology	5	1
Haematology	1	0
Endocrinology	4	2
Access to all of the above	1	0
Access to none of the above	4	1

Other. General medical (1) Geriatric medicine, including stroke (1)

Comments included:

We do not have access to any urgent OPD slots.

We have access to all above OPD but many of the above clinics especially cardiology, neurology and respiratory have significant waiting times for OPD slots and the consultant physician would need to OK an urgent slot.

Only have access to cardiology for EST / HOLTER/Echo/CT SCANNING.

None - it is dependent on contact with the teams.

5. Discharge planning in the unit and throughout the hospital

Questions in the survey focused on discharge planning in the units rather than throughout the hospitals. There were no questions on core aspects of discharge planning that were recommended in the model of care to introduce efficiencies into the pathways of medical patients admitted to hospital e.g., daily ward rounding by medical consultants/senior registrars and the proactive identification of patients for discharge.

Participants were asked if all patients admitted to the unit were assessed with regard to estimated length of stay, the need for specialist care and early discharge planning. The majority of model 3 and all model 4 respondents stated that this was the case in their units and was done by the consultant in conjunction with the multidisciplinary team. Fewer answered that this was documented in the patients' notes. Discussion with the patients about this date was done in the majority of model 3 units; half of model 4 said this was only done sometimes. One model 4 respondent commented that this was consultant and nurse dependent, and that nursing metrics revealed this was an area that needed significant improvement.

Nurse-facilitated and criteria-led discharge were rare. The vast majority of units replied that there was no criteria-led discharge in their hospital. Nurse-facilitated discharge was more common in the model 3 units (6/12). There was no nurse- or criteria-led discharge in the model 4 hospitals, though one unit commented that the ANPs in their unit had their own case load and therefore managed all aspects, including discharge.

Units were asked whether they had a facility to liaise with GPs on discharge, and whether communication was sent the same day (ideally electronically) to the GP and other relevant healthcare services. None of the model 4 units had a GP liaison - two hospitals stated that these were ED-based roles and did not cover the AMAU. Most discharge summaries were posted, as electronic discharge summaries were not the norm in hospitals. Letters were printed and posted to GPs, with the majority stating they had no option to send electronically. Some hospitals commented that the IT infrastructure was not in place in the community with GP practices as the majority were small rural practices.

Concept 3. Essential resources in the unit: staffing

As discussed, this concept was not well covered in the survey. A few questions examined consultant cover but did not examine this in detail, nor was the level of nursing and health & social care professional staffing examined. The absence of data on this concept makes it difficult to draw any conclusions about whether the units have sufficient staff to operate as per the model of care. This is an area that warrants further investigation. Participants were asked if their unit had a designated consultant acute medicine physician who had a primary responsibility to be present and make management decisions during core working hours. Only half of the respondents in model 2 hospitals did. Six of the twelve model 3 hospitals that answered this question responded that they had a designated consultant acute medicine physician, while all model 4 hospitals answered they had. Comments by model 3 hospital respondents that did not have a designated consultant included:

No dedicated AMU physician, AMAU covered as part of call.

The medical physician on-call in the hospital for the day covers the Medical Assessment Unit

Model 4 hospitals were also asked whether the acute medicine physicians had a split commitment to the AMAU and other requirements within their area of special interest (SI). The model of care recommended a 50% split between the two at an absolute minimum, ideally with a greater proportion of their time allocated to the AMAU, depending on the availability of sufficient physicians to cover the AMAU rota. All model 4 units confirmed they had a dedicated acute medicine physician who had the primary responsibility for the unit during core working hours and who committed more of their allocated time to the AMAU than their area of special interest. In terms of the split between AMAU: SI, the responses varied with one hospital having a 70/30 and another an 80/20 split. One hospital did not outline the split percentage and the last hospital stated they had a 60/40 split, saying that it leaned heavily towards the area of special interest. With regard to clinical and other governance, the unit is covered either by the physician on-call or a dedicated physician appointed to AMAU only. Model 3 and Model 4 hospitals were asked if the acute medicine physician covering the AMAU also covered the SSW. All model 4 hospitals had a SSW, which was covered by the AMAU acute medicine physician. Out of hours cover for the SSW was provided by the general medical team on-call for the hospital in three hospitals, with one unit stating that this was a non consultant hospital doctor. In the fourth hospital, the AMAU acute physician on-call covered the SSW out of hours. The majority of model 3 AMAUs did not have an SSW. In the three that did, out of hours cover was provided by the medical team on-call in two and by the AMAU acute physician on-call in the third. Participants were asked about the availability of medical teams to consult into the AMAU. Nearly all model 3 hospitals had medical specialists who would consult into the AMAU in the disease areas of COPD, diabetes and asthma, and palliative care, while less than half of these units had access to a medical specialist consult for renal patients. One model 4 hospital stated that the medical specialists in their hospital did not review patients in the AMAU. The availability of ANPs and CNSs to consult into the AMAU was more common in model 4 hospitals than model 3 hospitals. All model 4 hospitals had access to consults from ANPs/CNS to assess patients with COPD, asthma, diabetes and mental health, while less than a third of model 3 hospitals had access to these specialist nurses.

Across all model 3 and model 4 hospitals there was only one unit that had access to a consult from an ANP/CNS for renal patients.

Medical speciality teams who provide consult to the AMAU to review patients

	Model 3 (N=12 answered this question)	Model 4 (N= 4 answered this question)
Medical specialists		
COPD	10	3
Asthma	9	3
Diabetes	11	3
Mental Health	6	3
Renal	5	3
Palliative care	8	1
Access to all of the above	1	1
Access to none of the above	0	1
Advanced nurse practitioners (ANP)/clinical nurse specialist (CNS)		
COPD	4	4
Asthma	3	4
Diabetes	3	4
Mental Health	1	4
Renal	1	0
Palliative care	2	0
Access to all of the above		
Access to none of the above	3	0

Other. Cardiac (1) Clinical Nurse Specialist liaison predominantly (1) Neurology, infectious disease (1) Neurology, Dermatology, Rheumatology, Cardiology (1) ANP. Cardiology ANP occasionally (1) Frail elderly (1) Wound care Neurology (MS, Epilepsy), Vascular / Tissue Viability. Parkinson's CNS, Resp CNS, Diabetes CNS

The availability of adequate numbers of skilled nursing staff was not examined in the survey. Model 2 hospitals were asked however whether they had a Clinical Nurse Manager 11 or above designated to work in the AMAU permanently. Four said they did, the remaining three commented that:

> *the CNM2 is in charge of the Medical Assessment Unit and injury unit/ Currently CNM 2 covering for ADON nights, senior staff nurse in acting position*

Concept 4. Essential resources in the unit: access to diagnostics, and enhanced information and communication technology

1. Enhanced information and communication technology (ICT)

Participants were asked about their ICT infrastructure and its ability to capture AMAU activity data, as it pertains to ambulatory care patients and AMAU review patients. Currently, patients that are assessed in the AMAU are considered in-patients and therefore this activity is captured. However the capture of data of those who return for review and ambulatory care patients, who are still in an acute episode of care and are not just for review, was an issue for units. The majority do not have the ability to capture this activity on their ICT system

2. Access to diagnostics

Units were asked whether they had same day facilitated/priority access to listed diagnostics tests (X-ray, CT, MRI, USS). None of these diagnostics were available on same day/priority access to all AMAUs; though nearly all had same day/priority access to X-Ray and CT. Ultrasound was available in the majority of model 2 and model 3 hospitals on a same day basis, but in only one model 4 unit. MRI was the diagnostic test with least same day availability. None of the model 2 unit had same day access to MRI; only three model 3 unit did, as did only one model 4 unit. In terms of facilitating ambulatory care pathways, units were asked whether they had access to the listed urgent investigations (ECHO, exercise stress test, Doppler, Oesophago-gastro -duodenoscopy (OGD), pulmonary function tests), within a 72 hour period. One model 2 unit commented that they did not have access to any of the diagnostic tests listed with a 72 hour period. In model 3 hospitals, all eleven units that responded had access to at least one to one of these tests within a 72 hour period, with EST and Doppler being the most widely available in these hospitals. In model 4 hospitals, there were no unit that had access to all tests, and none of the four units had access to pulmonary function tests within a 72 hour period. Only one of the four units had access to oesophag-gastro-duodenoscopy (OGD) within 72 hours. One model 3 unit only had access to same day X-ray out of all nine diagnostics test specified, and had no priority access to any of the other tests. Participants were asked whether patients were admitted to their hospital solely to await diagnostics. This was identified as being the case in 13/23 hospitals that responded to the survey. This was most pronounced in model 3 hospitals.

Access to diagnostics tests

Diagnostics	Model 2 (N=7 answered this question)	Model 3 (N=11 answered this question)	Model 4 (N= 4 answered this question)
Same day facilitated/priority access to diagnostics tests			
X-ray	7	10	4
CT	7	10	4
MRI	0	3	1
Ultrasound	5	10	1
Access to all of the above	0	0	1
Access to none of the above	0	1	0
Facilitated/priority access to urgent investigations within 72 hours			
ECHO	5	7	2
Exercise stress test	4	9	3
Doppler	4	9	2
Oesophago-gastro - duodenoscopy (OGD)	3	4	1
Pulmonary function	3	5	0
Access to all of the above	1	2	0
Access to none of the above	1	0	0

Other. Holter/24 ABPM if urgent; Holter monitor, BPM (3); OGD colonoscopy within 2 weeks (1)

Appendix 5.1 Adult acute public hospitals included in the analyses

Model	Hospital name	First AMAU activity	Presence of ED[1]
4	Beaumont Hospital, Dublin	Opened in 2012, closed end 2016	Yes
4	Cork University Hospital	Opened in 2012	Yes
4	Galway University Hospitals[2]	Opened in 2010	Yes
4	Mater Misericordiae University Hospital	Opened in 2012	Yes
4	St. James's Hospital, Dublin	Does not have the AMAU [3]	Yes
4	St. Vincent's University Hospital	Opened in 2013	Yes
4	Tallaght Hospital	Opened in 2012	Yes
4	University Hospital Limerick	Opened in 2012	Yes
4	University Hospital Waterford	Opened in 2012	Yes
3	Cavan General Hospital	Opened in 2009	Yes
3	Connolly Hospital, Blanchardstown	Opened in 2012	Yes
3	Letterkenny University Hospital	Opened in 2012	Yes
3	Mayo University Hospital	Data recorded on from 2007	Yes
3	Mercy University Hospital, Cork	Opened in 2012	Yes
3	Mid Regional Hospital, Mullingar	Data recorded on from 2007	Yes
3	Mid Regional Hospital, Portlaoise	Does not have the AMAU	Yes
3	Mid Regional Hospital, Tullamore	Does not have the AMAU	Yes
3	Naas General Hospital	Opened in 2012	Yes
3	OLOL Hospital, Drogheda	Opened in 2010	Yes
3	Our Lady's Hospital, Navan	Opened in 2009	Yes
3	Portiuncula Hospital, Ballinasloe	Opened in 2013	Yes
3	Sligo University Hospital	Data recorded on from 2007	Yes
3	South Tipp General Hospital, Clonmel	Opened in 2012	Yes
3	St. Luke's General Hospital, Kilkenny	Data recorded on from 2007	Yes
3	University Hospital Kerry	Data recorded from 2010	Yes
3	Wexford General Hospital	Data recorded on from 2007	Yes
2	Bantry General Hospital	Opened in 2012	No-closed in 2012
2	Mallow General Hospital	Opened in 2013	No-closed in 2013
2	Roscommon County Hospital	Opened in 2013	No-closed in 2011
2	St. Columcille's Hospital	Opened in 2014	No-closed in 2013
2	St. John's Hospital, Limerick	Opened in 2012	No-closed in 2013
2	St. Michael's Hospital, Dun Laoghaire	Does not have the AMAU	Yes
2	UL Hospitals, Ennis Hospital	Opened in 2013	No-closed in 2009
2	UL Hospitals, Nenagh Hospital	Opened in 2012	No-closed in 2012
Other[4]	South Infirmary Vic University Hospital	Does not have the AMAU	ED closed in 2012
	Louth County Hospital	Does not have the AMAU	ED closed in 2010
	Monaghan Hospital	Does not have the AMAU	ED closed in 2010

Source: HIPE 2009-2017. Based on first recording of activity in the AMAU. In situations where there were relatively few numbers in one year, the following year was given as the date of opening.

Notes. 1. EDs in the majority of model 2 hospital were downgraded to 12 hour EDs and eventually closed in 2012 and 2013 and replaced by minor injury units and AMAUs.

2. Includes data for University Hospital Galway and Merlin Park Hospital, which were reported separately in HIPE until 2010.

3. St. James's Hospital does not participate in the Acute Medicine Programme.

4. Included in the analysis as they contributed to acute medicine activity pre-ED closure.

Appendix 5.2 Detailed description of the ICD-10-AM codes used in the identification of hospitalisations for ambulatory care sensitive medical conditions

Disease	ICD-10-AM code	Condition
Acute conditions		
Cardiac dysrhythmia[1]	I47	Paroxysmal tachycardia
	I48	Atrial fibrillation and flutter
	I49.1	Atrial premature depolarisation
	I49.2	Junctional premature depolarisation
	I49.3	Ventricular premature depolarisation
	I49.4	Other & unsp premature depolarisation
	I49.5	Sick sinus syndrome
	I49.8	Other specified cardiac arrhythmias
	I49.9	Cardiac arrhythmia unspecified
	R00	Abnormalities of heart beat
Chest pain non-specific	R07.2	Precordial pain
	R07.3	Other chest pain
	R07.4	Chest pain unspecified
Deep vein thrombosis	I80	Phlebitis and thrombophlebitis
	I81	Portal vein thrombosis
	I82	Other venous embolism and thrombosis
Lower respiratory infection other	J20	Acute bronchitis
	J21	Acute bronchiolitis
	J22	Unsp acute lower respiratory infection
Migraine acute headache[2]	G43	Migraine
	G44.0	Cluster headache syndrome
	G44.1	Vascular headache NEC
	G44.3	Chronic post traumatic headache
	G44.4	Drug-induced headache NEC
	G44.8	Other specified headache syndromes
	R51	Headache
Pneumonia & influenza[3]	J10	Influenza dt other id influenza virus
	J11	Influenza virus not identified
	J13	Pneumonia due to Streptococcus pneumoniae
	J14	Pneumonia due to Haemophilus influenzae
	J15.3	Pneumonia due to Streptococcus category B
	J15.4	Pneumonia due to other streptococci
	J15.7	Pneumonia dt Mycoplasma pneumoniae
	J15.9	Bacterial pneumonia unspecified
	J16.8	Pneumonia dt oth spec infect organisms
	J18	Pneumonia organism unspecified
Syncope	R55	Syncope and collapse
Transient ischaemic attack[4]	G45.0	Vertebro-basilar artery syndrome
	G45.1	Carotid artery syndrome (hemispheric)
	G45.2	Mult & bil precerebral artery syndromes
	G45.4	Transient global amnesia
	G45.8	Other TIAs (cerebral) & related syndrome
	G45.9	Transient cerebral ischaemic attack unsp
UTI/pyelonephritis	N10	Acute tubulo-interstitial nephritis
	N11	Chronic tubulo-interstitial nephritis
	N12	Tubulo-interstitial nephritis, not specified as acute or chronic
	N13.6	Pyelonephrosis
	N39.0	Urinary tract infection, site not specified
Vertigo	H81	Disorders of vestibular function
	H83	Other diseases of inner ear

Disease	ICD-10-AM code	Condition
	R42	Dzziness and giddiness
Chronic conditions		
Angina	I20	Angina pectoris
	I24.0	Coronary thrombosis not resulting in myocardial infarction
	I24.8	Other forms of acute ischaemic heart disease
	I24.9	Acute ischaemic heart disease, unspecified
Asthma	J45	Asthma
	J46	Status asthmaticus
COPD & Bronchiectasis	J40	Acute bronchitis
	J41	Simple and mucopurulent chronic bronchitis
	J42	Unspecified chronic bronchitis
	J43	Emphysema
	J44	Other chronic obstructive pulmonary disease
	J47	Bronchiectasis
Congestive heart failure	I50	Heart failure
	I11.0	Hypertensive heart disease with (congestive) heart failure
	J81	Pulmonary oedema
Convulsions & epilepsy	G40	Epilepsy
	G41	Status epilepticus
	R56	Convulsions, not elsewhere classified
Diabetes Complications[5]	E10.1-E10.8	Type 1 diabetes mellitus
	E11.1-E11.8	Type 2 diabetes mellitus
	E12.1-E12.8	Malnutrition-related diabetes mellitus
	E13.1-E13.8	Other specified diabetes mellitus
	E14.1-E14.8	Unspecified diabetes mellitus
Hypertension	I10	Essential (primary) hypertension
	I11.9	Hypertensive heart disease without heart failure
Iron deficiency anaemia	D50.1	Sideropenic dysphagia
	D50.8	Other iron deficiency anaemias
	D50.9	Iron deficiency anaemia unspecified

Notes.
1. Includes all I49 apart from I40.0 'ventricular fibrillation under cardiac arrest'
2. The ACSC lists do not include G44.2 'tension type headache'
3. Not all ACSC lists include J18.9. Given that the vast majority of admissions for pneumonia in Ireland in 2017 were coded as J18.9 ('pneumonia unspecified'), the decision was made to use the definition by Freund et al, which includes all J18 codes and therefore captures J18.9
4. Includes all G45 apart from G45.3 'Amaurosis fugax'
5. Issues with change in coding of this from 6th Edition to 8th Edition in 2015 mean rates pre-2015 cannot be compared with rates post 2015

Appendix 5.3 Analysis of yearly overnight emergency hospitalisations for medical conditions and non-medical conditions, and the bed days used by them, 2009-2017

This appendix presents a comprehensive account of the yearly counts and rates of overnight emergency hospitalisations and bed days used by them for (1) medical conditions (2) non-medical conditions between 2009 and 2017. Both age-sex standardised and age-specific rates are presented.

Medical conditions

Between 2009 and 2017, here was a 20% increase in the number of overnight hospitalisations for medical conditions, from 154,260 to 184,349. The number of hospitalisations in each age category was relatively stable between 2009 and 2011; there was an increase of 8.0% in 2012 alone; and between 2012 and 2017 there were a 12% increase in hospitalisations, with most of this growth occurring from 2015 onwards. There was a change in the age distribution of these hospitalisations during this period, as a result of the increase in the number of hospitalisations in the older age categories. From 2009 to 2017, there was a 27.2% increase in hospitalisations among the 65-84 years age category and an increase of 29% in the 85+ age category, while hospitalisations in the 45-64 years age category increased by 9.0%, and actually declined by 1.2% in the 16-44 year age category. This increase in the two oldest age categories was from 2012 onwards, and can be clearly seen from the graphs,

Despite the increase in the number of hospitalisations, the age-sex standardised rate of overnight hospitalisations for acute medical remained unchanged in 2017 from that seen in 2009 (5,245/100,000 in 2017 vs. 5,212/100,000 in 2009). This rate reduced slightly between 2009 and 2011, and increased by 6.2% in 2012. From 2012 the rate reduced gradually until 2016 when it increased again to 2012 levels. To paraphrase, while there was a 19% increase in the number of overnight emergency hospitalisations for medical conditions between 2009 and 2017, the age-sex standarised rate in 2017 was unchanged from that in 2009.

In the individual age category, the number of hospitalisations in the 65-84 years age category increased by 17% between 2012 and 2017. However, this was in line with population growth in that age category as the hospitalisation rate in 2017 was 1.7% less than that in 2012. In the 85+ years age category however, the growth in hospitalisations from 2012 (22%) exceeded population growth, and in 2017 the hospitalisation rate in this age category was approximately 4.0% greater than it was in 2012.

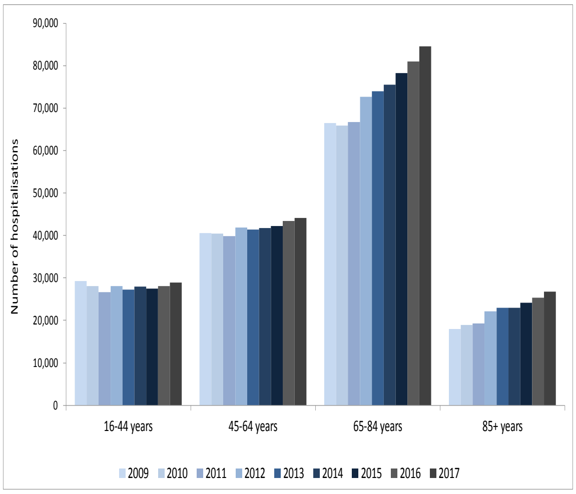
Bed days used by overnight emergency hospitalisations for medical conditions increased by 14 % from 1,539,017 in 2009 to 1,761,081 in 2017. In 2011, there was a drop of over 50,000 beds days; a relative decrease of 3% from the previous year. Numbers increased again in 2012, and from 2013 there was a continued growth in the number of bed days, with the largest increase observed in 2015, an increase of 5.3% on 2014. The number of bed days attributable to overnight emergency hospitalisations for medical conditions in 2017, was 13.9% greater than that in 2012. There was also a change in the distribution of these emergency acute medical bed days in the different age categories. The bed days used by those in the 65-84 years age category increased by 15.2% between 2009 and 2017 (compared with an increase in overnight hospitalisations of 27.2%), with most of this increase occurring in the latter half of the period. Prior to 2014, bed days used was relatively stable in this age category. The bed days used by hospitalisations among those aged 85+ years grew considerably over the period. Between 2009 and 2017, bed days used by this age category increased by 31.5%, from 273,705 to 359,960, with an increase of 9.4% in 2012 alone.

Taking population growth into account however, the age-sex standardised bed days/100,000 population remained relatively stable since 2011, signifying that the increase in bed days can be attributable to population growth. While the number of bed days attributable to overnight emergency hospitalisations for medical conditions in 2017 was 14% greater than that in 2012, the age-sex standardised rate was relatively unchanged. There was an increase in bed days used by overnight emergency hospitalisations for medical conditions in each age category from 2013 after several years of zero growth or even a decline in growth and a reduction in the rate of bed days used. However, as with hospitalisations, this increase in growth was accounted for by population growth. The rate in the 65-84 years age category declined consistently year on year, and the rate in 2017 was 11.7% lower than that in 2009. Similarly in the 45-64 year age category, the rate also declined over the period. In the youngest and the oldest age categories that population rates in 2017 were higher than in 2009. The growth in bed days in the oldest age category fluctuated over the years, but declined marginally from a peak in 2013.

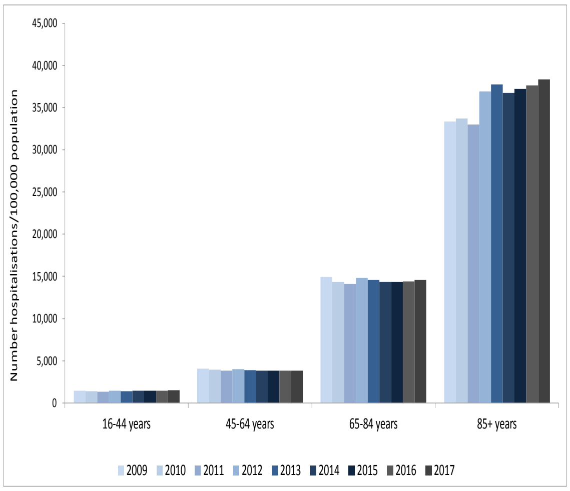
The burden of emergency hospitalisations and bed days among the elderly warrants special mention. In 2017, adults aged 65+ years, which made up only 17.5% of the population ≥ 16 years, accounted for 60.4% of overnight emergency hospitalisations for medical conditions and 71.5% of bed days attributable to these hospitalisations. Emergency hospitalisations among adults aged 85+ years, accounted for 14.5% of emergency hospitalisations for medical conditions and 20.4% of beds attributable to medical emergency hospitalisations, despite only accounting for 1.9% of the population age >=16 years.

Age-specific overnight emergency hospitalisations for medical conditions, 2009-2017.

A. Count

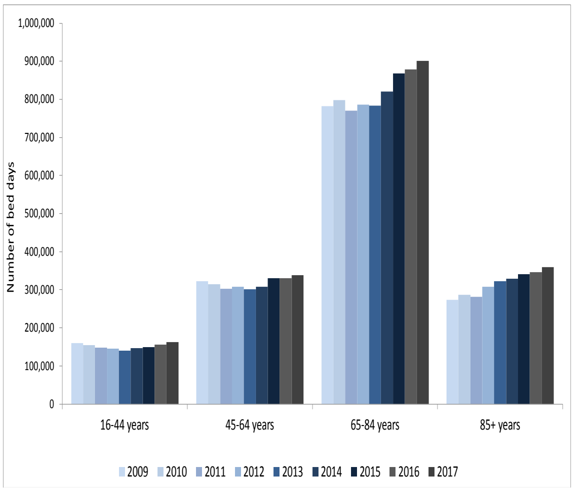


B. Rates/100,000 population

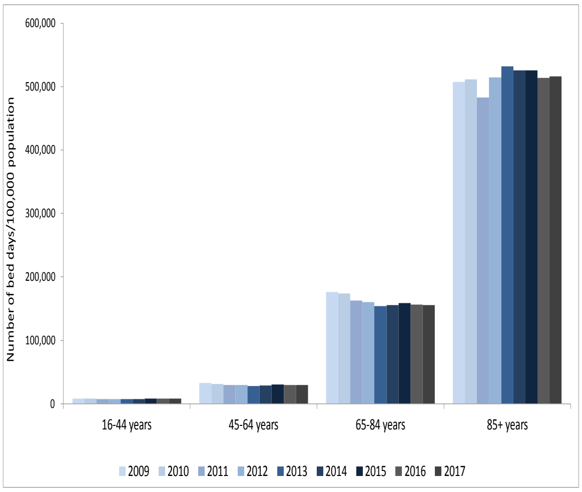


Age-specific bed days used by overnight emergency hospitalisations for medical conditions, 2009- 2017

A. Count



B. Rates/100,000 population



Age distribution of overnight emergency hospitalisations for medical conditions, 2009- 2017

Year	Number of overnight emergency hospitalisations for medical conditions [1,2] (% row total)						Number of bed days used by overnight emergency hospitalisations for medical conditions [1,2] (% row total)					
	16-44yr (%)	45-64 yr (%)	65-84yr (%)	85+yr (%)	Total ≥ 16yr	% change	16-44yr (%)	45-64yr (%)	65-84yr (%)	85+yr (%)	Total ≥ 16yr	% change
2009[3]	29,219	40,531	66,492	18,015	154,260	NA	160,524	322,873	781,915	273,705	1,539,017	NA
	18.9%	26.3%	43.1%	11.7%			10.4%	21.0%	50.8%	17.8%		
2010[3]	28,030	40,394	65,939	18,950	153,316	-0.6	155,216	313,871	797,596	286,983	1,553,666	1.0
	18.3%	26.3%	43.0%	12.4%			10.0%	20.2%	51.3%	18.5%		
2011[3]	26,733	39,805	66,709	19,229	152,457	-0.6	147,559	302,144	770,816	281,224	1,501,743	-3.3
	17.5%	26.1%	43.8%	12.6%			9.8%	20.1%	51.3%	18.7%		
2012	28,029	41,904	72,650	22,090	164,675	8.0	145,053	307,680	785,881	307,616	1,546,230	3.0
	17.0%	25.4%	44.1%	13.4%			9.4%	19.9%	50.8%	19.9%		
2013	27,215	41,348	74,014	22,938	165,518	0.5	139,937	301,199	784,018	322,923	1,548,077	0.1
	16.4%	25.0%	44.7%	13.9%			9.0%	19.5%	50.6%	20.9%		
2014	27,933	41,758	75,548	23,027	168,269	1.7	146,041	307,719	820,963	329,232	1,603,955	3.6
	16.6%	24.8%	44.9%	13.7%			9.1%	19.2%	51.2%	20.5%		
2015	27,484	42,256	78,250	24,151	172,144	2.3	149,734	330,007	867,326	341,139	1,688,206	5.3
	16.0%	24.5%	45.5%	14.0%			8.9%	19.5%	51.4%	20.2%		
2016	28,122	43,405	81,033	25,357	177,920	3.4	156,355	330,888	878,681	345,764	1,711,688	1.4
	15.8%	24.4%	45.5%	14.3%			9.1%	19.3%	51.3%	20.2%		
2017	28,868	44,182	84,549	26,747	184,349	3.6	162,059	338,645	900,417	359,960	1,761,081	2.9
	15.7%	24.0%	45.9%	14.5%			9.2%	19.2%	51.1%	20.4%		

Notes.

1. See prior notes on the delineation of hospitalisations on HIPE into medical and non-medical hospitalisations.
2. Hospitalisations of care transferred in from another acute hospital are excluded in the analysis of hospitalisations, but are included in the estimation of bed days used.
3. Under-reporting of activity from smaller hospitals in earlier years

Age-specific rate of overnight emergency hospitalisations for medical conditions/100,000, 2009- 2017

	Overnight emergency hospitalisations for medical conditions/100,000 population [1,2] (% change in rate from previous year)					Bed days used by overnight emergency hospitalisations for medical conditions[1,2] (% change in rate from previous year)				
	16-44yr (% change)	45-64 yr (% change)	65-84yr (% change)	85+yr (% change)	Total* (% change)	16-44yr (% change)	45-64 yr (% change)	65-84yr (% change)	85+yr (% change)	Total* (% change)
2009[3]	1,432	4,048	14,944	33,377	5,212	7,865	32,244	175,740	507,105	54,745
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2010[3]	1,399	3,953	14,369	33,755	5,079	7,745	30,713	173,801	511,192	53,999
	-2.3%	-2.3%	-3.8%	1.1%	-2.5%	-1.5%	-4.7%	-1.1%	0.8%	-1.4%
2011[3]	1,355	3,833	14,094	33,016	4,963	7,484	29,099	162,853	482,854	50,949
	-3.1%	-3.0%	-1.9%	-2.2%	-2.3%	-3.4%	-5.3%	-6.3%	-5.5%	-5.6%
2012	1,442	3,977	14,819	36,929	5,269	7,464	29,198	160,305	514,262	51,453
	6.4%	3.8%	5.1%	11.9%	6.2%	-0.3%	0.3%	-1.6%	6.5%	1.0%
2013	1,414	3,874	14,557	37,765	5,207	7,270	28,223	154,199	531,657	50,506
	-1.9%	-2.6%	-1.8%	2.3%	-1.2%	-2.6%	-3.3%	-3.8%	3.4%	-1.8%
2014	1,460	3,853	14,340	36,749	5,159	7,632	28,390	155,832	525,426	50,816
	3.3%	-0.5%	-1.5%	-2.7%	-0.9%	5.0%	0.6%	1.1%	-1.2%	0.6%
2015	1,438	3,829	14,348	37,206	5,150	7,833	29,903	159,038	525,549	51,874
	-1.5%	-0.6%	0.1%	1.2%	-0.2%	2.6%	5.3%	2.1%	0.0%	2.1%
2016	1,468	3,848	14,406	37,659	5,192	8,164	29,333	156,206	513,513	51,178
	2.1%	0.5%	0.4%	1.2%	0.8%	4.2%	-1.9%	-1.8%	-2.3%	-1.3%
2017	1,504	3,833	14,573	38,378	5,245	8,441	29,378	155,195	516,494	51,108
	2.5%	-0.4%	1.2%	1.9%	1.0%	3.4%	0.2%	-0.6%	0.6%	-0.1%

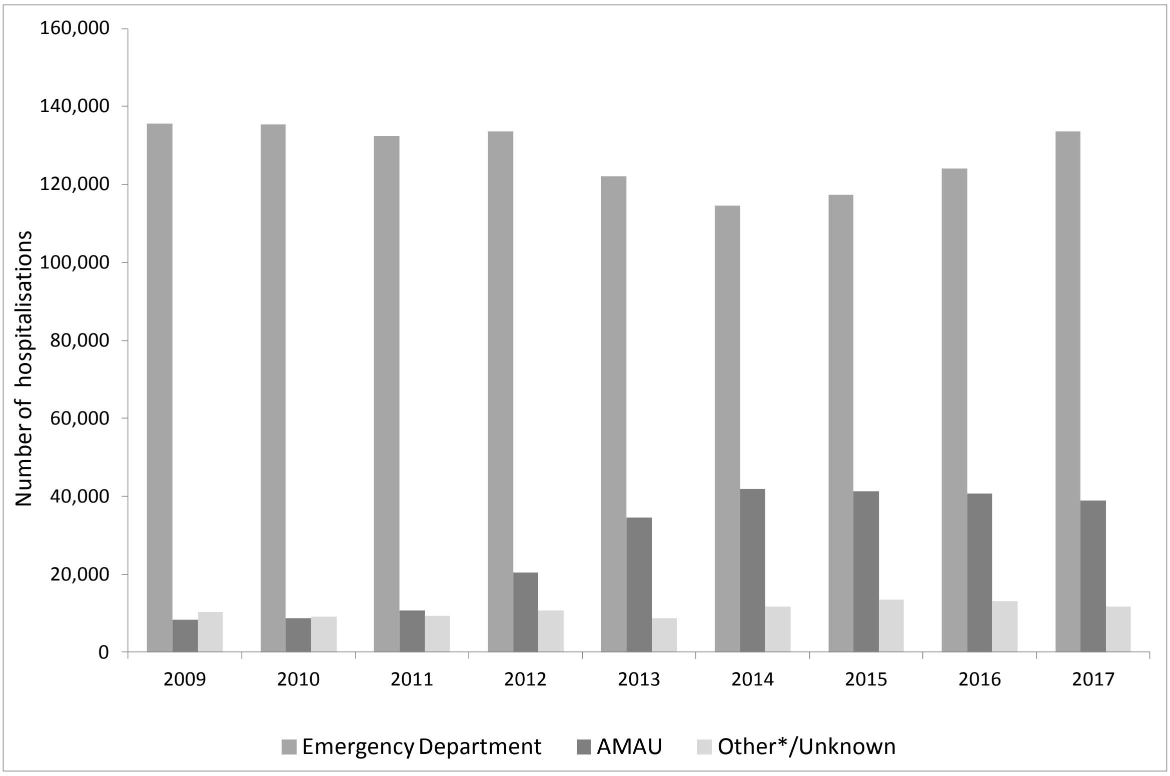
Notes. See previous table.

* Represents the age-sex standarised rate/100,000 population among adults aged 16 years and over.

Admission pathways of overnight emergency hospitalisations for medical conditions

The sources of admission of overnight emergency hospitalisations for medical conditions are presented below. Three admission pathways are presented: those admitted overnight from the emergency department, those whose admission to the AMAU resulted in an overnight stay in hospital, and those admitted from a source called Other/Unknown. The growth in AMAU activity from 2012 is clearly visible, as is the decline in ED hospitalisations. However since 2015, the numbers admitted overnight from the ED have risen steadily, while the numbers admitted overnight from the AMAU have plateaued and declined slightly in 2017.

Admission pathways of overnight emergency hospitalisations for medical conditions, 2009 - 2017



Source: HIPE 2009-2017. Emergency in-patient hospitalisations among adults aged 16 years and over in adult acute public hospitals with a minimum one night stay in hospital. Excludes hospitalisations of care transferred in from another acute hospital.

Notes. There was a small level of under-reporting of activity from some smaller hospitals in earlier years.

*'Other' admission pathway (also includes Unknown source) - no further details are provided on HIPE on this source, but it is assumed that the majority are direct emergency hospitalisations from outpatient departments.

Total emergency hospitalisations were stationary from 2009-2011, and there was an increase in numbers in 2012. Again, this increase can be partially explained by an increase in reporting, though it is difficult to quantity this given the major restructuring of emergency departments that took place in 2012. The number of ED hospitalisations in 2012 was the same as 2011, but AMAU hospitalisations were considerably higher. In 2013 ED hospitalisations went down commensurate with the increase in AMAU hospitalisations, and in 2013 total emergency admissions were the same as that in 2012. One can therefore assume from this that the increase in overnight emergency hospitalisations in 2012 was likely due to the increased reporting from smaller hospitals, and not the opening of the AMAUs. The proportion of overnight hospitalisations from 'Other' has remained relatively constant at 5-7% of overnight emergency hospitalisations.

Overall in 2017, of the 184,349 overnight emergency hospitalisations for medical conditions, 72.5% were admitted directly from the ED, 6.4% were admitted from a source termed Other/Unknown, and 21.% were hospitalisations from the AMAU. This ED-admit proportion had reduced from its peak in 2010 (86.9%), with the increase in numbers through the AMAU and was its lowest in 2014 (68.1%). Since 2015, however the numbers and proportions admitted directly from the ED has increased marginally while AMAU activity has remained stable. At the peak of AMAU activity in 2014, 25.3% of overnight emergency hospitalisations for medical conditions were admitted from the AMAU.

Admission pathway of overnight emergency hospitalisations for acute medicine, by age category, 2009 - 2017

		16-44 years			45-64 years			65-84 years			85+ years			All ages ≥ 16 years			
		ED	AMAU	Other[2]	ED	AMAU	Other[2]	ED	AMAU	Other[2]	ED	AMAU	Other[2]	ED	AMAU	Other[2]	Total
2009[1]	N	25,894	1,218	2,107	34,952	2,098	3,481	58,330	4,020	4,142	16,326	1,051	638	135,505	8,387	10,368	154,260
	%	88.6%	4.2%	7.2%	86.2%	5.2%	8.6%	87.7%	6.0%	6.2%	90.6%	5.8%	3.5%	87.8%	5.4%	6.7%	
2010[1]	N	24,897	1,341	1,792	35,193	2,160	3,041	58,071	4,110	3,758	17,303	1,157	490	135,467	8,768	9,081	153,316
	%	88.8%	4.8%	6.4%	87.1%	5.3%	7.5%	88.1%	6.2%	5.7%	91.3%	6.1%	2.6%	88.4%	5.7%	5.9%	
2011[1]	N	23,261	1,600	1,851	34,097	2,701	3,006	57,871	4,914	3,924	17,232	1,400	597	132,464	10,615	9,378	152,457
	%	87.1%	6.0%	6.9%	85.7%	6.8%	7.6%	86.8%	7.4%	5.9%	89.6%	7.3%	3.1%	86.9%	7.0%	6.2%	
2012	N	22,489	3,682	1,858	33,356	5,303	3,245	59,061	9,061	4,528	18,626	2,460	1,004	133,534	20,506	10,635	164,675
	%	80.2%	13.1%	6.6%	79.6%	12.7%	7.7%	81.3%	12.5%	6.2%	84.3%	11.1%	4.5%	81.1%	12.5%	6.5%	
2013	N	19,543	6,126	1,546	30,006	8,657	2,685	54,695	15,423	3,896	17,882	4,406	650	122,128	34,613	8,777	165,518
	%	71.8%	22.5%	5.7%	72.6%	20.9%	6.5%	73.9%	20.8%	5.3%	78.0%	19.2%	2.8%	73.8%	20.9%	5.3%	
2014	N	18,719	7,111	2,103	28,222	10,351	3,185	51,330	18,920	5,298	16,337	5,522	1,168	114,610	41,905	11,754	168,269
	%	67.0%	26.1%	7.7%	67.6%	25.0%	7.7%	67.9%	25.6%	7.2%	70.9%	24.1%	5.1%	68.1%	25.3%	7.1%	
2015	N	18,393	6,670	2,421	28,262	10,001	3,993	53,473	18,788	5,989	17,218	5,757	1,176	117,348	41,217	13,579	172,144
	%	66.9%	24.3%	8.8%	66.9%	23.7%	9.4%	68.3%	24.0%	7.7%	71.3%	23.8%	4.9%	68.2%	23.9%	7.9%	
2016	N	19,086	6,608	2,428	29,381	10,134	3,890	56,826	18,404	5,803	18,778	5,525	1,054	124,073	40,672	13,175	177,920
	%	67.9%	23.5%	8.6%	67.7%	23.3%	9.0%	70.1%	22.7%	7.2%	74.1%	21.8%	4.2%	69.7%	22.9%	7.4%	
2017	N	20,127	6,506	2,235	31,327	9,308	3,547	61,690	17,746	5,113	20,525	5,360	862	133,671	38,921	11,757	184,349
	%	69.7%	22.5%	7.7%	70.9%	21.1%	8.0%	73.0%	21.0%	6.0%	76.7%	20.0%	3.2%	72.5%	21.1%	6.4%	

Source: HIPE 2009-2017. Emergency in-patient hospitalisations among adults aged 16 years and over in adult acute public hospitals with a minimum one night stay in hospital.
Excludes a small number of hospitalisations of care transferred in from another acute hospital.

Notes.

1. Under-reporting of activity from smaller hospital in earlier years.
2. 'Other' admission pathway - no further details are provided on HIPE on this source, but it is assumed that the majority are direct emergency hospitalisations from outpatient departments

Non-medical conditions

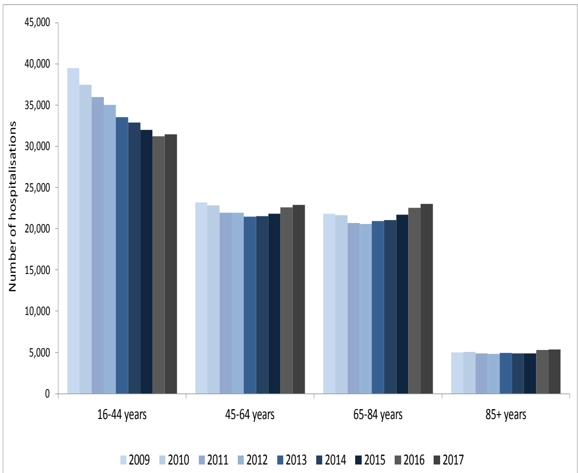
To contrast with acute medicine activity, those emergency hospitalisations, which are non-medical, are also presented.[33] The first thing to observe is the very different age distribution of hospitalisations for non-medical conditions compared with medical conditions, with a much greater proportion in the youngest age category. In 2017, 38% of non-medical hospitalisations were in the 16-44 year age category, in contrast with acute medicine where this age category constituted only 16% of hospitalisations. The two middle age categories (45-64 years, and 65-84 years) contribute equally to non-medical hospitalisations (28%, approximately 23,000 hospitalisations in each category in 2017), which contrasts greatly with acute medicine where the 65-84 years age category had almost twice the number of hospitalisations than the 45-64 year age category. Hospitalisations among adults aged 85+ years constituted 14.5% of medical hospitalisations in 2017 (N=26,747) and only 6.5% of non-medical hospitalisations (N=5,344). To summarise, each year there are more than twice as many overnight emergency hospitalisations for medical conditions as for non-medical conditions and the proportion of these that are over 65 years differs considerably. In 2017, among overnight emergency admission for medical conditions, 60% were aged 65+ years, compared with non-medical conditions, where only 34% were aged 65+ years.

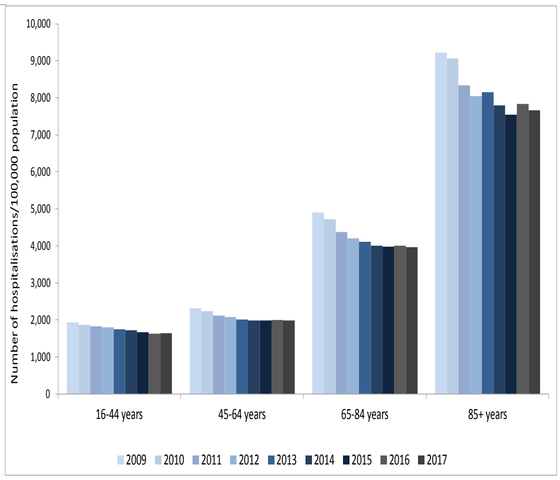
In 2017, there were 7.5% less overnight hospitalisations for non-medical conditions than in 2009. Hospitalisations decreased yearly from 2009 to 2014, and increased marginally thereafter until 2017. The age-sex standardised hospitalisation rate decreased consistently each year, with the greatest relative reduction in 2011 (4.9%). Over all, the age-sex standarised rate of overnight emergency hospitalisations for non-medical conditions reduced from 2,715/100,000 in 2009 to 2,276/100,000 in 2017, with most of this decline occurring pre-2013. In the individual age categories, there was a sustained reduction in hospitalisations and hospitalisation rates among the 16-44 year age category. In the 45-64 year age category, hospitalisations reduced each year from 2009 to 2014, whereupon they increased marginally. Hospitalisations in the 65-84 years age category decreased at the start of the series but increased since 2013. The rate decreased quite significantly between 2009 and 2013 and has been relatively flat since then despite the increase in hospitalisations, which can be interpreted as the growth in hospitalisations being in line with population growth in this age category.

[33] These are hospitalisations where the consultant responsible for the principal diagnosis belongs to a non-medical specialty.

Age-specific overnight emergency hospitalisations for non-medical conditions, 2009- 2017

A. Count **B. Rate/100,000**

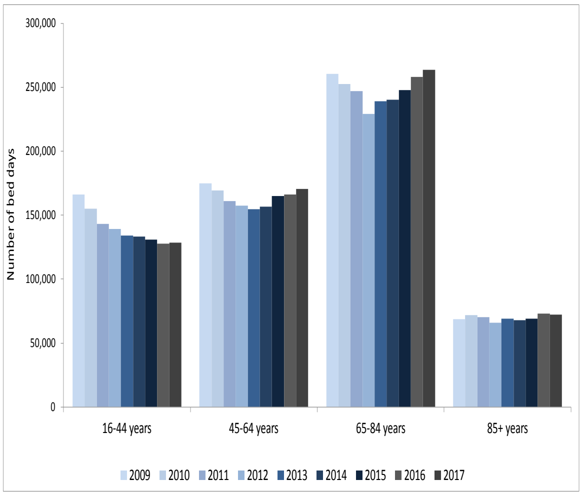




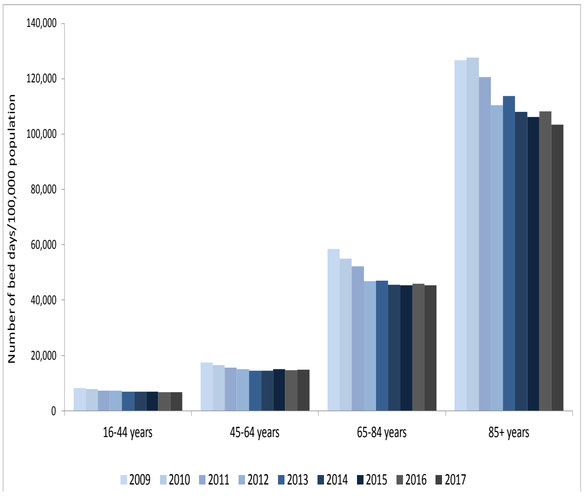
The bed days attributable to emergency overnight hospitalisations for non-medical conditions reduced each year between 2009 and 2012, and the numbers increased from 2013 to 2017, with the greatest increase observed in 2015 (2.1% increase on 2014). The age-sex standarised rate yearly fell until 2014 and remained relatively stable thereafter. The two middle age categories show very similar patterns to each other - an initial reduction in bed days each year between 2009 and 2012 and an increase from 2013/2014 onwards. This led to a very clear reduction in hospitalisation rates during the first part of the series and a relatively unchanged hospitalisation rate from 2014. The numbers of bed days used in the 85+ years age category has remained relatively stable over the time period, but because of the increase in the population in this age category over the time period, has led to a large reduction in the rate of hospitalisations for this age category. It seems that 2013 was a point of inflection for all age categories, as prior to then, bed days used were decreasing in all age categories as were the associated rates. However from 2012, there a notable increase in number of beds days used by overnight emergency hospitalisations for non-medical conditions, especially in the two middle age categories, in line with population growth resulting in a plateau in hospitalisation rates.

Age-specific bed days used by overnight emergency hospitalisations for non-medical conditions, 2009- 2017

A. Count



B. Rate/100,000



Age distribution of overnight emergency hospitalisations for non-medical conditions, 2009- 2017

Year	Overnight emergency hospitalisations for non-medical conditions[1,2], n (% row total)						Bed days used by overnight emergency hospitalisations for non-medical conditions [1,2], n (% row total)					
	16-44yr (%)	45-64 yr (%)	65-84yr (%)	85+yr (%)	Total	% change	16-44yr (%)	45-64yr (%)	65-84yr (%)	85+yr (%)	Total	% change
2009[3]	39,469	23,182	21,823	4,978	89,452	NA	166,290	174,914	260,269	68,443	669,916	NA
	44.1%	25.9%	24.4%	5.6%			24.8%	26.1%	38.9%	10.2%		
2010[3]	37,443	22,855	21,643	5,088	87,029	-2.7	155,117	169,291	252,537	71,665	648,610	-3.2
	43.0%	26.3%	24.9%	5.8%			23.9%	26.1%	38.9%	11.0%		
2011[3]	35,947	21,924	20,715	4,860	83,446	-4.1	142,989	161,079	247,004	70,217	621,289	-4.2
	43.1%	26.3%	24.8%	5.8%			23.0%	25.9%	39.8%	11.3%		
2012	35,033	21,946	20,596	4,810	82,385	-1.3	139,298	157,582	229,142	66,016	592,038	-4.7
	42.5%	26.6%	25.0%	5.8%			23.5%	26.6%	38.7%	11.2%		
2013	33,527	21,495	20,934	4,950	80,906	-1.8	133,868	154,621	239,127	69,126	596,742	0.8
	41.4%	26.6%	25.9%	6.1%			22.4%	25.9%	40.1%	11.6%		
2014	32,873	21,518	21,078	4,882	80,351	-0.7	133,163	156,681	240,146	67,715	597,705	0.2
	40.9%	26.8%	26.2%	6.1%			22.3%	26.2%	40.2%	11.3%		
2015	31,973	21,830	21,700	4,902	80,405	0.1	130,673	164,781	247,810	68,931	612,195	2.4
	39.8%	27.2%	27.0%	6.1%			21.3%	26.9%	40.5%	11.3%		
2016	31,238	22,596	22,563	5,272	81,669	1.6	127,831	166,194	258,252	72,851	625,128	2.1
	38.2%	27.7%	27.6%	6.5%			20.4%	26.6%	41.3%	11.7%		
2017	31,465	22,907	23,003	5,344	82,719	1.3	128,469	170,390	263,437	72,131	634,427	1.5
	38.0%	27.7%	27.8%	6.5%			20.2%	26.9%	41.5%	11.4%		

Notes.

1. See prior notes on the classifications of hospitalisations on HIPE into medical and non-medical hospitalisations.
2. Hospitalisations of care transferred in from another acute hospital are excluded in the analysis of hospitalisations, but are included in the estimation of bed days used.
3. Under-reporting of activity from smaller hospital in earlier years

Age-specific rate of overnight emergency hospitalisations for non-medical conditions/100,000, 2009- 2017

	Overnight emergency hospitalisations for medical conditions/100,000 population [1,2] (% change in rate from previous year)					Bed days used by overnight emergency hospitalisations for medical conditions[1,2] (% change in rate from previous year)				
	16-44yr (% change)	45-64 yr (% change)	65-84yr (% change)	85+yr (% change)	Total* (% change)	16-44yr (% change)	45-64 yr (% change)	65-84yr (% change)	85+yr (% change)	Total* (% change)
2009[3]	1,934	2,315	4,905	9,223	2,715	8,147	17,468	58,497	126,807	22,123
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2010[3]	1,868	2,236	4,716	9,063	2,624	7,740	16,566	55,029	127,654	21,069
	-3.4%	-3.4%	-3.8%	-1.7%	-3.4%	-5.0%	-5.2%	-5.9%	0.7%	-4.8%
2011[3]	1,823	2,111	4,377	8,344	2,496	7,253	15,513	52,185	120,561	19,886
	-2.4%	-5.6%	-7.2%	-7.9%	-4.9%	-6.3%	-6.4%	-5.2%	-5.6%	-5.6%
2012	1,803	2,083	4,201	8,041	2,442	7,167	14,954	46,741	110,363	18,536
	-1.1%	-1.4%	-4.0%	-3.6%	-2.2%	-1.2%	-3.6%	-10.4%	-8.5%	-6.8%
2013	1,742	2,014	4,117	8,150	2,379	6,955	14,488	47,031	113,808	18,446
	-3.4%	-3.3%	-2.0%	1.3%	-2.6%	-3.0%	-3.1%	0.6%	3.1%	-0.5%
2014	1,718	1,985	4,001	7,791	2,329	6,959	14,455	45,584	108,067	18,044
	-1.4%	-1.4%	-2.8%	-4.4%	-2.1%	0.1%	-0.2%	-3.1%	-5.0%	-2.2%
2015	1,673	1,978	3,979	7,552	2,294	6,836	14,931	45,440	106,193	18,053
	-2.6%	-0.4%	-0.5%	-3.1%	-1.5%	-1.8%	3.3%	-0.3%	-1.7%	0.1%
2016	1,631	2,003	4,011	7,830	2,291	6,675	14,733	45,910	108,195	18,020
	-2.5%	1.3%	0.8%	3.7%	-0.1%	-2.4%	-1.3%	1.0%	1.9%	-0.2%
2017	1,639	1,987	3,965	7,668	2,276	6,691	14,781	45,406	103,498	17,817
	0.5%	-0.8%	-1.2%	-2.1%	-0.7%	0.2%	0.3%	-1.1%	-4.3%	-1.1%

Notes. See previous table.

* Represents the age-sex standarised rate/100,000 population among adults aged 16 years and over.

Appendix 5.4 Yearly counts of overnight emergency hospitalisations for each ICD-10-AM code used in the identification of ambulatory care sensitive medical conditions, 2009-2017

ICD-10-AM	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cardiac dysrhythmia										
I47	Paroxysmal tachycardia	759	650	597	643	600	606	627	622	673
I48	Atrial fibrillation and flutter	4,735	4,559	4,323	4,574	4,364	4,558	4,512	4,437	4,367
I49.1	Atrial premature depolarisation	5	6	6	<5	9	8	5	4	10
I49.2	Junctional premature depolarisation	0	0	<5	0	<5	0	0	0	<5
I49.3	Ventricular premature depolarisation	34	31	22	25	21	19	35	39	29
I49.4	Oth& unsp premature depolarisation	13	17	7	7	7	12	11	10	12
I49.5	Sick sinus syndrome	94	74	72	76	71	68	86	77	116
I49.8	Other specified cardiac arrhythmias	43	44	46	23	22	24	39	36	36
I49.9	Cardiac arrhythmia unspecified	56	54	67	62	48	45	55	42	44
R00	Abnormalities of heart beat	1,214	1,263	1,304	1,476	1,400	1,421	1,321	1,261	1,262
Chest pain non-specific										
R07.2	Precordial pain	30	40	43	33	15	19	23	20	20
R07.3	Other chest pain	4,262	4,344	3,909	4,251	4,244	3,823	3,647	3,944	4,184
R07.4	Chest pain unspecified	5,489	5,829	5,990	5,577	4,644	4,208	4,006	3,183	3,175
Deep vein thrombosis										
I80	Phlebitis and thrombophlebitis	1,273	1,296	1,082	1,043	992	963	935	837	811
I81	Portal vein thrombosis	12	15	18	16	15	17	21	10	30
I82	Other venous embolism and thrombosis	86	115	72	75	58	64	84	122	135
Lower respiratory infection (other)										
J20	Acute bronchitis	51	23	37	45	69	59	57	68	69
J21	Acute bronchiolitis	10	15	15	13	17	17	14	14	15
J22	Unsp acute lower respiratory infection	7,311	6,676	7,162	8,908	8,692	9,174	9,953	10,365	10,042
Migraine/acute headache										
G43	Migraine	827	903	918	1,007	1,031	1,061	1,151	1,137	1,346
G44.0	Cluster headache syndrome	69	86	59	55	73	96	64	60	46
G44.1	Vascular headache NEC	0	3	3	3	7	23	8	0	<5
G44.3	Chronic post traumatic headache	19	12	15	13	13	5	6	13	14
G44.4	Drug-induced headache NEC	7	10	5	8	8	5	11	16	8
G44.8	Other specified headache syndromes	10	10	10	16	15	14	14	14	44
R51	Headache	2,359	2,486	2,824	2,758	2,628	2,850	2,396	2,237	2,337

ICD-10-AM	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pneumonia/influenza										
J10	Influenza dt other id influenza virus	14	<5	33	14	36	93	187	279	417
J11	Influenza virus not identified	151	48	108	41	72	99	164	180	196
J13	Pneu dt Streptococcus pneumoniae	103	98	109	91	122	130	138	165	239
J14	Pneu dt Haemophilusinfluenzae	26	24	14	11	16	14	12	35	37
J15.3	Pneu dt streptococcus category B	<5	<5	<5	<5	<5	0	<5	<5	5
J15.4	Pneumonia dt other streptococci	43	38	41	37	39	49	44	70	59
J15.7	Pneumonia dt mycoplasma pneumonia	<5	<5	<5	<5	<5	5	6	<5	7
J15.9	Bacterial pneumonia unspecified	42	38	78	81	52	80	84	48	56
J16.8	Pneumonia dt oth spec infect organisms	<5	<5	<5	<5	<5	<5	<5	<5	<5
J18	Pneumonia unspecified organism	7,062	6,929	7,327	7,895	8,203	7,886	8,428	9,860	9,993
	Of which									
(J18.9)	(Pneumonia, unspecified organism)	(6,438)	(6,411)	(6,757)	(7,293)	(7,753)	(7,412)	(8,015)	(9,267)	(9,565)
Syncope										
R55	Syncope and collapse	4,950	5,107	5,254	6,174	6,247	6,194	6,235	6,259	6,357
Transient ischaemic attack										
G45.0	Vertebro-basilar artery syndrome	7	3	<5	<5	<5	<5	<5	<5	<5
G45.1	Carotid artery syndrome (hemispheric)	1	4	<5	<5	<5	<5	<5	0	<5
G45.2	Mult & bil precerebral artery syndromes	0	0	0	0	0	0	0	0	<5
G45.4	Transient global amnesia	86	87	96	99	107	128	138	131	163
G45.8	Other TIAs (cerebral) & related syndrome	176	116	135	112	124	85	86	63	103
G45.9	Trans cerebral ischaemic attack unspec	2,294	2,449	2,269	2,401	2,338	2,276	2,287	2,252	2,161
Urinary tract infection/pyelonephritis										
N10	Acute tubulo-interstitial nephritis	124	135	153	160	171	168	188	253	346
N11	Chronic tubulo-interstitial nephritis	32	30	22	44	31	33	39	30	37
N12	Tubulo-interstitial nephritis, not specified as acute or chronic	294	280	349	413	473	513	626	771	789
N13.6	Pyelonephrosis	37	52	56	73	112	146	125	138	122
N39.0	Urinary tract infection, site not specified	4,948	5,385	5,733	6,547	7,437	8,049	8,148	9,296	9,807
Vertigo										
H81	Disorders of vestibular function	200	198	209	233	248	273	289	358	364
H83	Other diseases of inner ear	238	182	168	184	212	192	168	200	202
R42	Dizziness and giddiness	917	885	1,005	1,171	1,170	1,293	1,430	1,439	1,530
Angina										

ICD-10-AM	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017
I20	Angina pectoris	3,676	3,644	3,248	3,034	2,804	2,665	2,638	2,406	2,310
I24.0	Coronary thrombosis not resulting in MI	5	15	12	11	14	15	11	17	13
I24.8	Other forms of acute isch heart disease	47	6	12	11	<5	<5	7	5	<5
I24.9	Acute isch heart disease, unspecified	48	27	28	35	30	17	20	19	11
Asthma										
J45	Asthma	1,122	1,030	980	1,103	1,063	1,109	1,360	1,480	1,427
J46	Status asthmaticus	251	267	215	242	264	209	76	81	63
COPD/bronchiectasis										
J40	Acute bronchitis	55	46	68	69	76	68	71	52	94
J41	Simple &mucopurulent chron bronchitis	<5	<5	<5	<5	<5	<5	0	0	<5
J42	Unspecified chronic bronchitis	11	11	8	5	9	13	6	14	8
J43	Emphysema	60	69	65	55	58	57	45	46	44
J44	Other chron obst pulm disease	9,951	9,655	10,117	11,250	11,482	11,480	11,910	12,689	12,412
J47	Bronchiectasis	235	208	216	271	308	316	305	331	346
Congestive heart failure										
I50	Heart failure	5,106	5,137	4,635	4,996	5,085	5,016	5,204	5,163	5,397
I11.0	Hypertensive heart disease with (congestive) heart failure	36	40	37	26	24	19	15	7	11
J81	Pulmonary oedema	208	197	157	151	148	130	78	63	67
Convulsions/epilepsy										
G40	Epilepsy	1,925	1,830	1,692	1,913	1,852	1,858	1,863	1,964	1,976
G41	Status epilepticus	184	169	162	146	161	147	150	135	149
R56	Convulsions, not elsewhere classified	1,891	1,926	1,982	2,074	1,911	1,887	2,049	2,130	2,030
Diabetes complications										
E10.1-E10.8	Type 1 diabetes mellitus	1,079	1,106	1,006	1,109	1,135	1,166	1,000	1,123	1,041
E11.1-E11.8	Type 2 diabetes mellitus	2,517	2,455	2,356	2,419	2,409	2,303	1,589	1,622	1,714
E12.1-E12.8	Malnutrition-related diabetes mellitus	0	0	0	0	0	0	0	0	0
E13.1-E13.8	Other specified diabetes mellitus	8	8	6	9	15	5	19	17	15
E14.1-E14.8	Unspecified diabetes mellitus	0	<5	<5	<5	<5	<5	7	<5	<5
Hypertension										
I10	Essential (primary) hypertension	1,071	978	781	861	797	892	925	975	980
I11.9	Hypert heart disease w/out ht faiil	15	17	17	27	14	12	18	13	10
Iron deficiency anaemia										
D50.1	Sideropenic dysphagia	0	0	0	0	0	<5	<5	<5	<5

ICD-10-AM	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017
D50.8	Other iron deficiency anaemias	275	259	244	239	275	274	371	399	435
D50.9	Iron deficiency anaemia unspecified	537	490	441	516	508	542	652	664	758

Appendix 5.5 Admission pathways of emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017

	2009[1,2]	2010[1,2]	2011[1,2]	2012	2013	2014	2015	2016	2017
All ambulatory care sensitive medical conditions									
Admitted in-house from a non-AMAU source	82,952	83,189	83,171	85,518	77,331	72,990	74,773	78,872	82,746
Admitted in-house from an AMAU	5,257	5,715	6,129	10,197	16,553	19,987	19,507	19,667	17,941
Discharged directly from an AMAU	4,219	6,066	7,704	18,210	26,487	30,993	30,786	33,194	31,457
Total hospitalisations	92,428	94,970	97,004	113,925	120,371	123,970	125,066	131,733	132,144
Percentage from a non-AMAU source	90%	88%	86%	75%	64%	59%	60%	60%	63%
Total hospitalisations admitted in-house/SSW	88,209	88,904	89,300	95,715	93,884	92,977	94,280	98,539	100,687
Acute ambulatory care sensitive medical conditions									
Cardiac dysrhythmia									
Admitted in-house from a non-AMAU source	7,241	7,056	6,693	6,916	6,111	5,911	5,908	5,842	6,106
Admitted in-house from an AMAU	517	580	637	900	1,274	1,512	1,406	1,459	1,257
Discharged directly from an AMAU	404	622	797	1,775	2,800	3,327	3,205	3,376	3,259
Total hospitalisations	8,162	8,258	8,127	9,591	10,185	10,750	10,519	10,677	10,622
Percentage from a non-AMAU source	89%	85%	82%	72%	60%	55%	56%	55%	57%
Total hospitalisations admitted in-house/SSW	7,758	7,636	7,330	7,816	7,385	7,423	7,314	7,301	7,363
Chest pain non-specific									
Admitted in-house from a non-AMAU source	11,444	12,437	12,632	12,258	9,907	8,557	8,247	7,914	8,841
Admitted in-house from an AMAU	698	799	775	1,095	1,634	1,678	1,533	1,501	1,335
Discharged directly from an AMAU	1,151	1,827	2,233	6,076	7,921	8,874	8,252	8,572	8,006
Total hospitalisations	13,293	15,063	15,640	19,429	19,462	19,109	18,032	17,987	18,182
Percentage from a non-AMAU source	86%	83%	81%	63%	51%	45%	46%	44%	49%
Total hospitalisations admitted in-house/SSW	12,142	13,236	13,407	13,353	11,541	10,235	9,780	9,415	10,176
Deep vein thrombosis									
Admitted in-house from a non-AMAU source	1,372	1,494	1,184	1,076	882	831	791	768	835
Admitted in-house from an AMAU	71	77	79	138	250	272	279	247	214
Discharged directly from an AMAU	66	125	184	485	703	763	831	926	839
Total hospitalisations	1,509	1,696	1,447	1,699	1,835	1,866	1,901	1,941	1,888
Percentage from a non-AMAU source	91%	88%	82%	63%	48%	45%	42%	40%	44%
Total hospitalisations admitted in-house/SSW	1,443	1,571	1,263	1,214	1,132	1,103	1,070	1,015	1,049

Lower respiratory infection (other)

	2009[1,2]	2010[1,2]	2011[1,2]	2012	2013	2014	2015	2016	2017
Admitted in-house from a non-AMAU source	7,289	6,603	7,026	8,289	7,342	7,214	8,102	8,606	8,522
Admitted in-house from an AMAU	427	460	533	1,006	1,676	2,207	2,240	2,192	1,981
Discharged directly from an AMAU	412	595	677	1,428	2,154	2,486	2,618	3,033	2,560
Total hospitalisations	8,128	7,658	8,236	10,723	11,172	11,907	12,960	13,831	13,063
Percentage from a non-AMAU source	90%	86%	85%	77%	66%	61%	63%	62%	65%
Total hospitalisations admitted in-house/SSW	7,716	7,063	7,559	9,295	9,018	9,421	10,342	10,798	10,503
Migraine/acute headache									
Admitted in-house from a non-AMAU source	3,768	4,086	4,406	4,078	3,733	3,519	3,232	3,131	3,563
Admitted in-house from an AMAU	308	304	323	543	824	1,072	929	889	901
Discharged directly from an AMAU	453	749	1,072	2,219	3,178	4,036	3,814	4,055	4,230
Total hospitalisations	4,529	5,139	5,801	6,840	7,735	8,627	7,975	8,075	8,694
Percentage from a non-AMAU source	83%	80%	76%	60%	48%	41%	41%	39%	41%
Total hospitalisations admitted in-house/SSW	4,076	4,390	4,729	4,621	4,557	4,591	4,161	4,020	4,464
Pneumonia/ influenza									
Admitted in-house from a non-AMAU source	7,181	6,899	7,262	7,354	7,048	6,528	7,172	8,669	9,167
Admitted in-house from an AMAU	531	553	686	1,008	1,648	1,963	2,025	2,192	2,017
Discharged directly from an AMAU	117	125	189	471	543	748	775	845	649
Total hospitalisations	7,829	7,577	8,137	8,833	9,239	9,239	9,972	11,706	11,833
Percentage from a non-AMAU source	92%	91%	89%	83%	76%	71%	72%	74%	77%
Total hospitalisations admitted in-house/SSW	7,712	7,452	7,948	8,362	8,696	8,491	9,197	10,861	11,184
Syncope									
Admitted in-house from a non-AMAU source	5,219	5,457	5,642	6,240	5,772	5,541	5,629	5,681	5,973
Admitted in-house from an AMAU	259	265	253	562	1,098	1,160	1,143	1,150	1,005
Discharged directly from an AMAU	238	314	377	1,022	1,701	1,882	1,894	2,086	1,935
Total hospitalisations	5,716	6,036	6,272	7,824	8,571	8,583	8,666	8,917	8,913
Percentage from a non-AMAU source	91%	90%	90%	80%	67%	65%	65%	64%	67%
Total hospitalisations admitted in-house/SSW	5,478	5,722	5,895	6,802	6,870	6,701	6,772	6,831	6,978
TIA									
Admitted in-house from a non-AMAU source	2,529	2,613	2,458	2,451	2,130	1,853	1,966	1,995	1,988
Admitted in-house from an AMAU	164	201	211	319	563	718	656	595	559
Discharged directly from an AMAU	51	99	171	269	400	419	493	596	520
Total hospitalisations	2,744	2,913	2,840	3,039	3,093	2,990	3,115	3,186	3,067
Percentage from a non-AMAU source	92%	90%	87%	81%	69%	62%	63%	63%	65%
Total hospitalisations admitted in-house/SSW	2,693	2,814	2,669	2,770	2,693	2,571	2,622	2,590	2,547

	2009[1,2]	2010[1,2]	2011[1,2]	2012	2013	2014	2015	2016	2017
UTI/pyelonephritis									
Admitted in-house from a non-AMAU source	5,339	5,779	6,192	6,827	7,261	7,489	7,702	9,071	9,741
Admitted in-house from an AMAU	287	307	377	654	1,204	1,695	1,711	1,796	1,797
Discharged directly from an AMAU	92	126	146	378	573	734	841	836	716
Total hospitalisations	5,718	6,212	6,715	7,859	9,038	9,918	10,254	11,703	12,254
Percentage from a non-AMAU source	93%	93%	92%	87%	80%	76%	75%	78%	79%
Total hospitalisations admitted in-house/SSW	5,626	6,086	6,569	7,481	8,465	9,184	9,413	10,867	11,538
Vertigo									
Admitted in-house from a non-AMAU source	1384	1,372	1,421	1,529	1,432	1,312	1,499	1,550	1,749
Admitted in-house from an AMAU	147	133	133	262	410	526	482	574	512
Discharged directly from an AMAU	219	325	485	947	1,446	1849	1977	2264	2292
Total hospitalisations	1,750	1,830	2,039	2,738	3,288	3,687	3,958	4,388	4,553
Percentage from a non-AMAU source	79%	75%	70%	56%	44%	36%	38%	35%	38%
Total hospitalisations admitted in-house/SSW	1,531	1,505	1,554	1,791	1,842	1,838	1,981	2,124	2,261
Chronic ambulatory care sensitive medical conditions									
Angina									
Admitted in-house from a non-AMAU source	3,927	3,793	3,459	3,105	2,676	2,408	2,330	2,097	2,040
Admitted in-house from an AMAU	223	262	249	403	544	652	646	610	546
Discharged directly from an AMAU	102	90	96	276	399	440	543	533	477
Total hospitalisations	4,252	4,145	3,804	3,784	3,619	3,500	3,519	3,240	3,063
Percentage from a non-AMAU source	92%	92%	91%	82%	74%	69%	66%	65%	67%
Total hospitalisations admitted in-house/SSW	4,150	4,055	3,708	3,508	3,220	3,060	2,976	2,707	2,586
Asthma									
Admitted in-house from a non-AMAU source	1,407	1,334	1,225	1,247	1,029	948	1,090	1,179	1,209
Admitted in-house from an AMAU	78	85	89	171	307	373	376	407	334
Discharged directly from an AMAU	94	118	146	387	634	784	735	807	802
Total hospitalisations	1,579	1,537	1,460	1,805	1,970	2,105	2,201	2,393	2,345
Percentage from a non-AMAU source	89%	87%	84%	69%	52%	45%	50%	49%	52%
Total hospitalisations admitted in-house/SSW	1,485	1,419	1,314	1,418	1,336	1,321	1,466	1,586	1,543
COPD/bronchiectasis									
Admitted in-house from a non-AMAU source	9,897	9,573	9,999	10,401	9,382	8,983	9,557	10,385	10,602
Admitted in-house from an AMAU	655	690	767	1,429	2,492	2,982	2,889	2,905	2,493
Discharged directly from an AMAU	218	280	354	863	1,517	1,773	1,718	1,937	1,793
Total hospitalisations	10,770	10,543	11,120	12,693	13,391	13,738	14,164	15,227	14,888

	2009[1,2]	2010[1,2]	2011[1,2]	2012	2013	2014	2015	2016	2017
Percentage from a non-AMAU source	92%	91%	90%	82%	70%	65%	67%	68%	71%
Total hospitalisations admitted in-house/SSW	10,552	10,263	10,766	11,830	11,874	11,965	12,446	13,290	13,095
Congestive heart failure									
Admitted in-house from a non-AMAU source	5,113	5,069	4,504	4,616	4,202	3,831	3,952	4,058	4,253
Admitted in-house from an AMAU	396	435	461	692	1,150	1,432	1,505	1,347	1,355
Discharged directly from an AMAU	127	127	123	239	484	540	576	562	632
Total hospitalisations	5,636	5,631	5,088	5,547	5,836	5,803	6,033	5,967	6,240
Percentage from a non-AMAU source	91%	90%	89%	83%	72%	66%	66%	68%	68%
Total hospitalisations admitted in-house/SSW	5,509	5,504	4,965	5,308	5,352	5,263	5,457	5,405	5,608
Convulsions/epilepsy									
Admitted in-house from a non-AMAU source	4,301	4,241	4,222	4,296	3,888	3,726	3,875	3,952	4,026
Admitted in-house from an AMAU	136	145	148	346	491	568	610	692	573
Discharged directly from an AMAU	81	84	125	300	575	630	646	693	651
Total hospitalisations	4,518	4,470	4,495	4,942	4,954	4,924	5,131	5,337	5,250
Percentage from a non-AMAU source	95%	95%	94%	87%	78%	76%	76%	74%	77%
Total hospitalisations admitted in-house/SSW	4,437	4,386	4,370	4,642	4,379	4,294	4,485	4,644	4,599
Diabetes complications									
Admitted in-house from a non-AMAU source	3,620	3,600	3,387	3,371	3,314	3,108	2,296	2,427	2,496
Admitted in-house from an AMAU	197	219	212	365	497	570	427	455	428
Discharged directly from an AMAU	141	153	183	298	468	517	421	449	395
Total hospitalisations	3,958	3,972	3,782	4,034	4,279	4,195	3,144	3,331	3,319
Percentage from a non-AMAU source	91%	91%	90%	84%	77%	74%	73%	73%	75%
Total hospitalisations admitted in-house/SSW	3,817	3,819	3,599	3,736	3,811	3,678	2,723	2,882	2,924
Hypertension									
Admitted in-house from a non-AMAU source	1,168	1,115	859	849	700	727	792	870	839
Admitted in-house from an AMAU	79	91	89	146	219	279	263	263	255
Discharged directly from an AMAU	211	253	284	639	788	886	1,028	1,134	1,159
Total hospitalisations	80%	76%	70%	52%	41%	38%	38%	38%	37%
Percentage from a non-AMAU source	1,458	1,459	1,232	1,634	1,707	1,892	2,083	2,267	2,253
Total hospitalisations admitted in-house/SSW	1,247	1,206	948	995	919	1,006	1,055	1,133	1,094
Iron deficiency anaemia									
Admitted in-house from a non-AMAU source	753	668	600	615	522	504	633	677	796
Admitted in-house from an AMAU	84	109	107	158	272	328	387	393	379

	2009[1,2]	2010[1,2]	2011[1,2]	2012	2013	2014	2015	2016	2017
Discharged directly from an AMAU	42	54	62	138	203	305	419	490	542
Total hospitalisations	879	831	769	911	997	1,137	1,439	1,560	1,717
Percentage from a non-AMAU source	86%	80%	78%	68%	52%	44%	44%	43%	46%
Total hospitalisations admitted in-house/SSW	837	777	707	773	794	832	1,020	1,070	1,175

Notes. Includes activity in adult acute public hospitals including those that do not participate in the Programme. Includes a small number of hospitalisations transferred in from another hospital. 1. AMAU-discharged home is not complete for 2009-2012. 2. Under-reporting of activity from smaller hospital in earlier years

Key:

Discharged directly from an AMAU: patients assessed in an AMAU and discharged home without admission to an in-patient bed/SSW. The overwhelming majority of these are discharged on the same day as AMAUs do not operate on a 24 hour basis. Admitted in-house from an AMAU: patients assessed in the AMAU and admitted in-house or to an affiliated SSW for further care. Admitted in-house from a non-AMAU source: patients admitted as in-patient either from the ED or from a source termed Other, which is presumed to be outpatients hospitalisations direct to hospital, or from an Unknown source. Total hospitalisations: all emergency hospitalisations (including those discharged the same day from an AMAU). Percentage from a non-AMAU source: percentage of all emergency hospitalisations (including those discharged the same day from an AMAU) that were admitted from a non-AMAU source. Total hospitalisations admitted in-house/SSW: emergency hospitalisations admitted for further care to an in-patient bed in-house or a SSW (excludes those discharged the same day from an AMAU

Appendix 6.1 Population estimates used in the calculation of hospitalisation rates

OECD Standard population (2010)

	Males	Females
'16-19'[1]	33,547,256	32,086,872
'20-24'	42,405,900	41,230,290
'25-29'	43,126,280	42,701,000
'30-34'	43,065,080	42,860,920
'35-39'	44,174,210	44,137,550
'40-44'	43,943,110	43,921,700
'45-49'	43,687,440	44,139,770
'50-54'	40,451,530	41,312,320
'55-59'	36,150,420	37,820,510
'60-64'	32,674,670	34,839,810
'65-69'	25,058,360	27,873,490
'70-74'	20,313,040	24,210,950
'75-79'	15,198,940	20,547,610
'80-84'	10,035,220	16,020,840
'85 +'	6,985,911	15,679,010
Total	480,817,367	509,382,642

Source: OECD 2010 standard population

Notes.
1. 16-19 years was used instead of 15-19 years reported by OECD, and 80% of the 15-19 years age category used.

Age specific population estimates Ireland, 2009-2017, males

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Age category									
'16-19'	121,448	118,946	114,478	114,312	115,339	117,811	120,924	123,112	125,589
'20-24'	173,528	160,073	148,626	141,510	140,059	139,391	139,883	138,384	140,380
'25-29'	198,443	186,083	175,113	163,407	154,722	147,167	143,688	145,176	144,257
'30-34'	188,066	189,815	194,853	193,261	190,727	184,920	176,969	172,500	166,348
'35-39'	180,311	180,983	181,927	182,294	182,664	183,752	186,862	190,557	192,703
'40-44'	159,452	162,210	165,927	167,990	170,897	172,949	175,017	177,172	180,069
'45-49'	147,921	149,807	151,255	152,986	154,438	156,099	158,369	162,473	166,202
'50-54'	131,620	133,676	136,662	138,297	140,626	143,435	146,092	147,670	150,130
'55-59'	118,692	120,292	121,800	123,815	125,106	127,156	129,256	133,111	135,851
'60-64'	104,936	107,628	109,160	110,089	111,536	112,947	114,981	117,747	120,547
'65-69'	78,025	81,496	85,611	90,601	94,918	98,502	101,244	103,437	104,847
'70-74'	59,791	61,770	62,934	64,635	67,410	70,420	73,618	78,350	82,910
'75-79'	43,877	45,119	46,344	47,806	49,182	50,710	52,441	53,518	55,088
'80-84'	26,335	27,335	28,268	29,635	30,848	32,599	34,113	34,932	36,238
'85 +'	16,818	17,660	18,418	18,985	19,319	20,285	21,424	22,980	24,345
Total ≥ 16 years	1,749,263	1,742,893	1,741,376	1,739,623	1,747,791	1,758,143	1,774,881	1,801,119	1,825,504

Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

Age specific population estimates Ireland, 2009-2017, females

Age category	2009	2010	2011	2012	2013	2014	2015	2016	2017
'16-19'	117,053	114,398	109,836	108,786	109,491	111,775	114,616	116,996	120,014
'20-24'	180,858	166,248	149,945	143,558	138,834	137,252	135,594	135,081	135,871
'25-29'	202,112	195,562	187,764	178,070	167,118	158,715	155,000	151,503	148,186
'30-34'	186,422	191,395	198,514	200,760	200,638	197,559	192,182	187,802	181,552
'35-39'	176,035	178,695	181,162	182,893	184,184	187,849	192,913	197,508	201,946
'40-44'	157,268	159,577	163,407	166,635	170,131	174,412	177,980	179,302	183,011
'45-49'	147,664	151,142	152,855	154,725	155,679	156,493	158,639	162,444	166,934
'50-54'	130,689	133,723	137,075	139,856	142,152	145,796	149,096	150,779	153,157
'55-59'	117,047	119,296	121,580	124,172	126,021	128,522	131,298	135,102	138,153
'60-64'	102,772	106,376	107,944	109,813	111,657	113,447	115,860	118,723	121,753
'65-69'	78,606	82,042	86,460	91,015	95,107	98,718	102,322	104,532	106,417
'70-74'	64,786	66,177	67,193	68,495	71,276	73,977	77,226	81,552	86,295
'75-79'	52,909	53,954	55,022	56,142	57,172	58,379	59,729	60,660	61,747
'80-84'	40,599	41,020	41,489	41,911	42,534	43,519	44,666	45,533	46,642
'85 +'	37,156	38,480	39,824	40,832	41,420	42,375	43,487	44,353	45,348
Total ≥ 16 years	1,791,976	1,798,085	1,800,070	1,807,663	1,813,414	1,828,788	1,850,608	1,871,870	1,897,026

Source: Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 201

Appendix 6.2 Age-specific findings of the segmented regression analyses

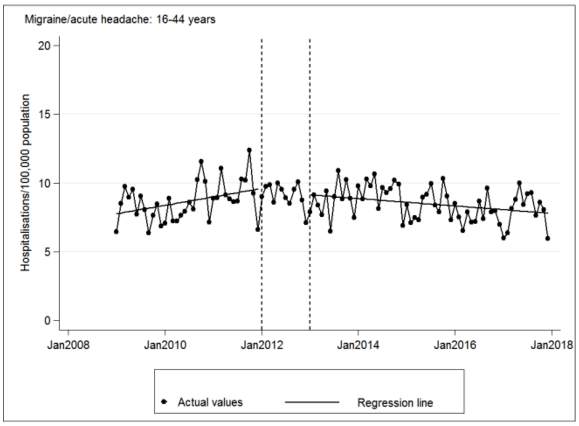
Migraine/acute headache

Overnight emergency hospitalisations rates for migraine/acute headache were increasing in the pre-intervention period in the first three age categories. The upward trend in the oldest age category did not reach significance. In the post-intervention period, there was a significant downward trend in the hospitalisation rate in the younger age category. The rate in the other two middle categories changed to a flat slope. In the older age category, the downward trend was not significance.

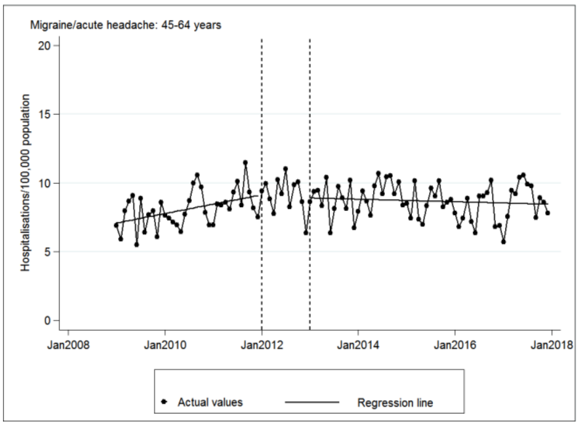
There were no statistically significant trends in any of the age categories in terms of bed days used before or after the intervention; the upward slopes in the pre-intervention period and the downward slopes in the post-intervention period did not reach statistical significance. In the older age category, the model was not fit due to the unstable rates as a result of low numbers. (Data not graphed for bed days).

Monthly age-specific overnight emergency hospitalisations for migraine/acute headache/100,000 population, 2009-2017

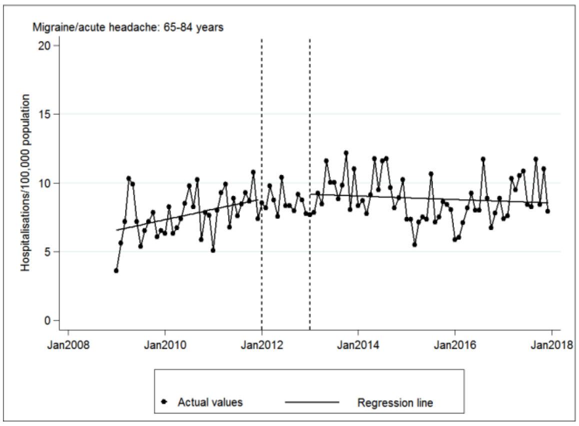
A. Aged 16-44 years



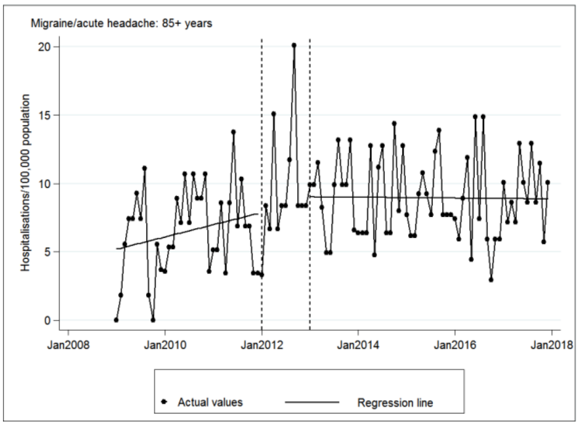
B. Aged 45-64 years



C. Aged 65-84 years



D. Aged 85+ years



Note the scales on the y-axis are the same in all four age categories

Trends in the rate for migraine/acute headache

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Hospitalisation rate							
Age-sex std rate	7.3	0.06	<0.001	0.03 to 0.08	-0.02	0.040	-0.03 to -0.01
Age-specific rates							
16-44 years	7.7	0.05	0.039	0.00 to 0.10	-0.02	0.015	-0.04 to -0.00
45-64 years	7.0	0.06	0.005	0.02 to 0.10	-0.01	0.413	-0.03 to 0.01
65-84 years	6.5	0.06	0.026	0.01 to 0.12	-0.01	0.373	-0.03 to 0.01
85+ years	5.1	0.07	0.184	-0.04 to 0.18	-0.00	0.909	-0.04 to 0.04
Bed days used							
Age-sex std rate	25.2	0.22	0.008	0.06 to 0.38	-0.01	0.707	-0.07 to 0.05
Age-specific rates							
16-44 years	23.8	0.09	0.265	-0.07 to 0.26	-0.02	0.641	-0.08 to 0.05
45-64 years	25.4	0.20	0.077	-0.02 to 0.42	-0.03	0.469	-0.10 to 0.04
65-84 years	31.9	0.26	0.118	-0.07 to 0.60	0.05	0.517	-0.11 to 0.20
85+ years	NA	NA	NA	NA	NA	NA	NA

Baseline level and trends are per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

Syncope

In each of the four age categories, there was no trend in the pre-internveion period. In the post-intervention period, the rates declined in the 65-84 year age category. The downwards trends in the other age categories did not reach significance.

Rates of bed days used were flat in each age category in the pre-intervention period. Rates declined significantly in the post-intervention period in the two older age categories, but there were no trends in the two younger age categories. (Data not graphed for bed days).

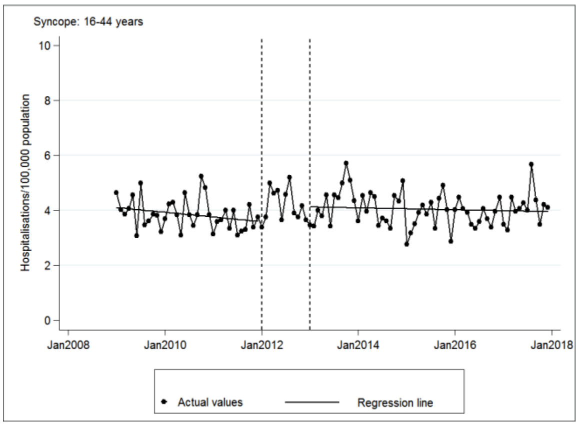
Trends in the overnight emergency hospitalisation rate and rate of bed days used by syncope

	Baseline level	Pre-trend	p-value	95% CI	Post-trend	p-value	95% CI
Hospitalisation rate							
Age-sex std rate	13.7	0.03	0.207	-0.01 to 0.05	-0.03	0.001	-0.04 to -0.01
Age-specific rates							
16-44 years	4.1	-0.14	0.058	-0.03 to 0.00	-0.00	0.554	-0.01 to 0.01
45-64 years	9.2	0.01	0.735	-0.03 to 0.04	-0.00	0.862	-0.02 to 0.18
65-84 years	40.1	0.09	0.145	-0.03 to 0.22	-0.11	0.001	-0.16 to -0.04
85+ years	94.0	0.74	0.114	-0.18 to 1.66	-0.21	0.068	-0.44 to 0.02
Bed days used							
Age-sex std rate	96.4	0.37	0.212	-0.21 to 0.95	-0.30	0.010	-0.52 to -0.07
Age-specific rates							
16-44 years	12.5	-0.03	0.415	-0.10 to 0.04	-0.01	0.773	-0.04 to 0.03
45-64 years	46.8	-0.08	0.660	-0.42 to 0.27	0.05	0.515	-0.10 to 0.20
65-84 years	312.8	1.27	0.134	-0.40 to 2.93	-1.00	0.011	-1.77 to -0.24
85+ years	1,034.0	7.69	0.339	-8.19 to 23.6	-6.44	0.019	-11.81 to -1.08

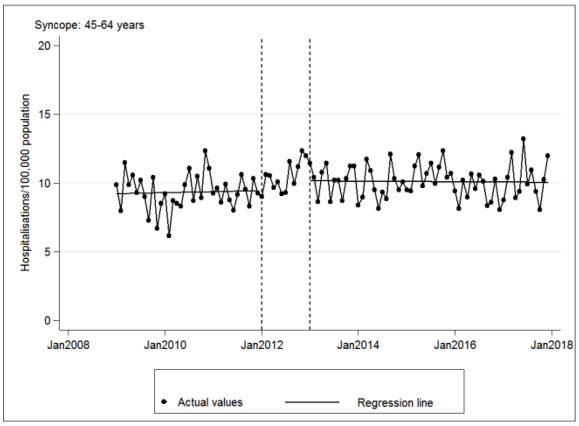
Baseline level and trends are per 100,000 population/month. Pre-trend: 2009-2011; post-trend: 2013-2017.

Monthly age-specific overnight emergency hospitalisations for syncope/100,000 population, 2009-2017

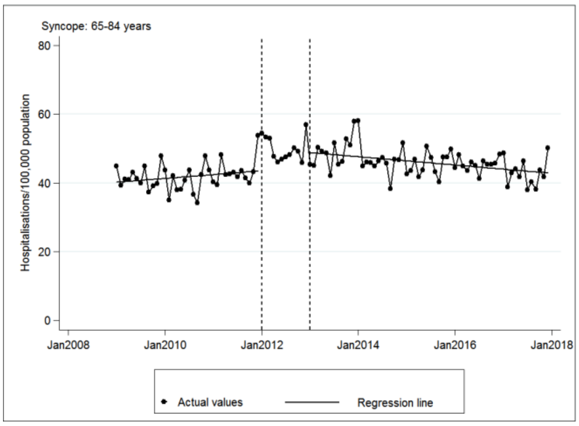
A. Aged 16-44 years



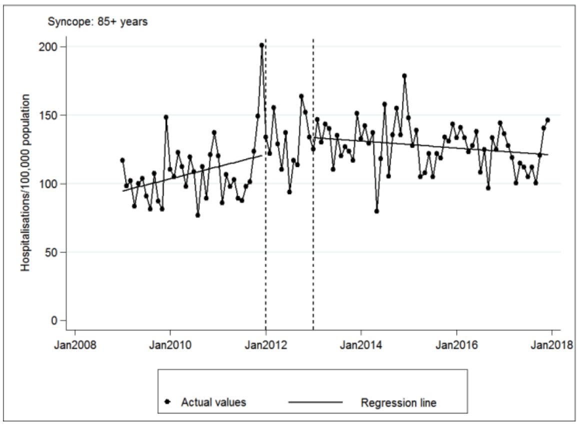
B. Aged 45-64 years



C. Aged 65-84 years



D. Aged 85+ years



Note the different scales on the y-axis in the different age categories.

Appendix 6.3 Detailed analyses of yearly overnight emergency hospitalisations for ambulatory care sensitive medical conditions, and the bed days used by them, 2009-2017

This appendix presents a comprehensive account of the yearly counts and rates of overnight emergency hospitalisations and bed days used by them for ambulatory care sensitive medical conditions between 2009 and 2017. Its purpose is to provide policy makers with essential information on recent trends in emergency hospitalisations for medical conditions, especially those medical conditions deemed ambulatory care sensitive. Having an in-depth understanding of the incidence of these emergency hospitalisations is crucial for policy makers, so that resources can be more effectively deployed to better manage these conditions, ideally in primary care, but additionally in acute hospitals via the adherence to evidence-based ambulatory care pathways and protocols.

The results are presented first for age-sex standardised rates in adults aged 16 years and over years and then age specific rates in each of the four age categories used throughout the thesis. This is then followed by a comparison of the condition specific rates in the different age categories in 2017 alone, to show the disparity in the burden of these diseases in the elderly. All tables and figures for these counts and rates follow the discussion.

Age-sex standardised, 2009-2017

Each year between 2009 and 2017, approximately 33%-35% of all overnight emergency hospitalisations (i.e. both medical and non-medical conditions), among adults aged 16 years and over were attributable to ambulatory care sensitive medical conditions. These hospitalisations accounted for 29-31% of all overnight emergency bed days used by adults aged 16 years and over each year.

While the number of overnight emergency hospitalisations for ambulatory care sensitive conditions increased by 15% from 80,835 to 93,144 between 2009 and 2017, the age-sex standardised hospitalisation rate declined marginally from 2,748/100,000 to 2,659/100,000. The number of bed days used by these conditions increased by 13% from 636,622 to 720,653 between 2009 and 2017, though again the age-sex standardised rate fell from 22,922/100,000 to 21,094/100,000. The age-sex standarised rate reduced considerably from 2009 to 2011, increased by 3.3% in 2012 and remained relatively stable thereafter.

Acute ambulatory care sensitive medical conditions

Hospitalisations with a principal diagnosis of UTI/pyelonephritis, pneumonia/influenza and LRI (other) account for a significant proportion of emergency hospitalisations and bed days used by ambulatory care sensitive medical conditions. In 2009, these three conditions were responsible for 25.1% of overnight emergency hospitalisations for ambulatory care sensitive medical conditions. By 2017, this had increased to 34.6%. Similarly for bed days used; in 2009, these conditions accounted for 33.5% of bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions. By 2017, this figure had increased to 45.2%. In 2017, approximately 1 in 8 of total overnight emergency hospitalisations (across all emergency hospitalisations - both medical and non-medical conditions), among adults aged 16 years and over discharged from acute public hospitals had a principal diagnosis of pneumonia/influenza or LRI (other), or UTI/pyelonephritis, up from 1 in 12 in 2009. In terms of bed days used by these overnight emergency hospitalisations, in 2009, 1 in 11 had one of these conditions as a principal diagnosis; by 2017, this had increased to 1 in 7.

The age-sex standardised overnight emergency hospitalisation rates for these three acute conditions also increased over the time period. This was most notable for UTIs, where the rate increased from 190/100,000 in 2009 to 328/100,000 in 2017 and the rate of bed days used increased from 1,987/100,000 to 3,395/100,000. The rate for pneumonia/influenza increased from 264/100,000 to 319/100,000, while the rate of bed days used remained unchanged at the end of the series - 3,675/100,000 in 2017 compared with 3,606/100,000 in 2009. The rate for LRI (other) also increased, though to a lesser extent, from 261/100,000 in 2009 to 295/100,000 in 2017 and the rate of rate of bed days used increased from 2,303/100,000 to 2,657/100,000.

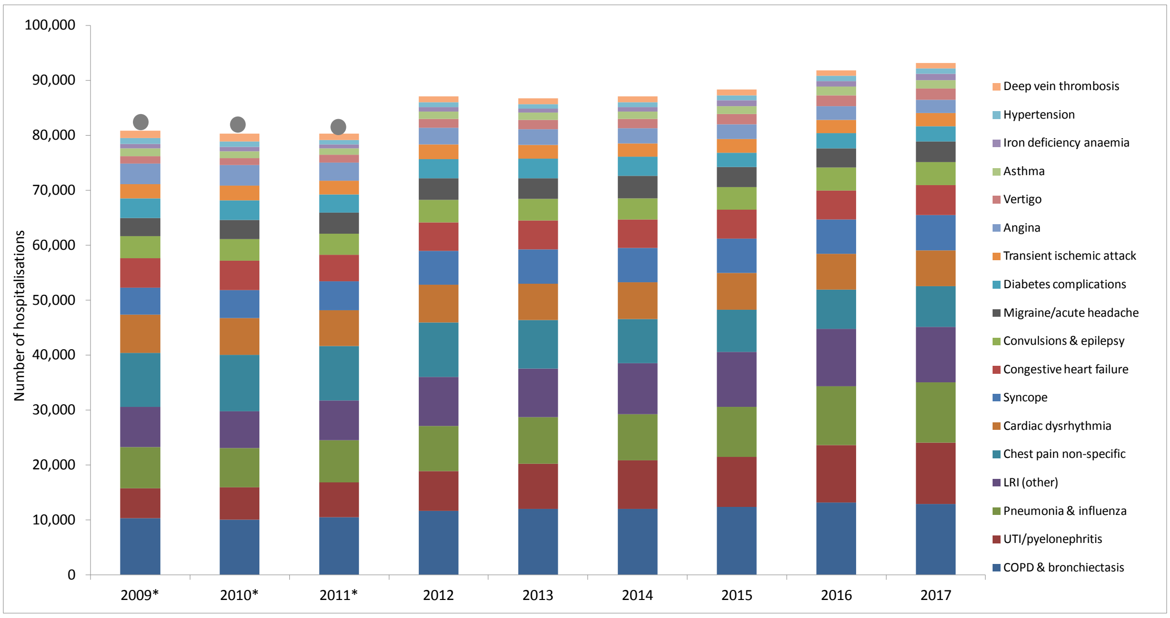
This increasing burden of urinary tract infection/pyelonephritis warrants specific mention, with a near doubling of the age-sex standardised overnight emergency hospitalisation rate and rate of bed days used over the study period. In 2017, of total overnight emergency hospitalisations (both medical and non-medical conditions), among adults ≥ 16 years, 4.2% had this as a principal diagnosis, up from 2.2% in 2009. Of total bed days used by overnight emergency hospitalisations in 2017, 4.7% carried a principal diagnosis of UTI/pyelonephritis, up from 2.4% in 2009.

There was a large reduction in emergency hospitalisations for chest pain non-specific from 2012. In 2009, chest pain non-specific was the second most common ambulatory care sensitive medical condition admitted overnight as an emergency, with an age-sex standardised rate of 309/100,000 population, second only to COPD/bronchiectasis (371/100,000). By 2017, this rate had fallen by over 50% to 202/100,000

Chronic ambulatory care sensitive medical conditions

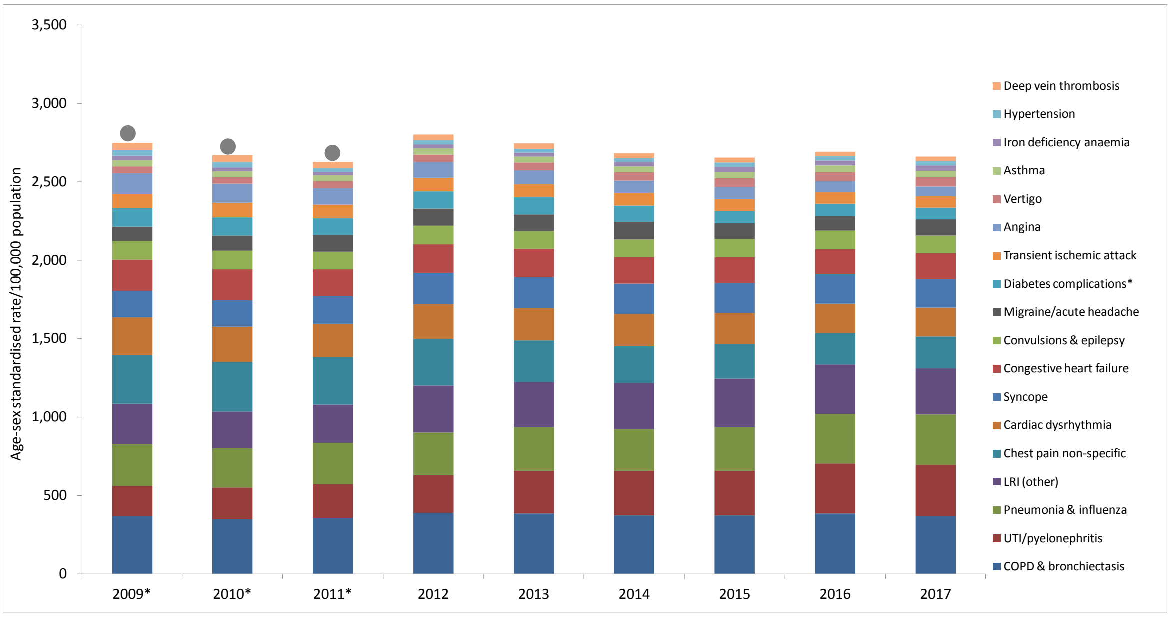
In terms of chronic ambulatory care sensitive medical conditions, COPD/bronchiectasis had by far the highest age-sex standardised hospitalisation rate and rate of bed days used over the period. While the hospitalisation rate remained unchanged by the end of the series (371/100,000 in 2009 to 368/100,000 in 2017), there was a modest reduction in the rate of bed days used from 3,668/100,000 to 3,333/100,000 population. Congestive heart failure was the second most common chronic ambulatory care sensitive condition admitted as an emergency and its hospitalisation rate reduced from 200/100,000 in 2009 to 163/100,000 in 2017, and the rate of bed days used from 2,570 /100,000 in 2009 to 1,870/100,000 in 2017. The hospitalisation rate for angina halved from 129/100,000 to 64/100,000 (with hospitalisations falling from 3,776 to 2,337) and bed days used/100,000 from 778 to 324 (bed days falling from 22,366 to 11,736). The hospitalisation rate for convulsions and epilepsy remained relatively unchanged over the time period, though the bed days used/100,000 decreased from 788 in 2009 to 689 in 2017. Hospitalisations and bed days used by hypertension and iron deficiency anaemia were considerably lower than those seen for other conditions. Because of changes to how diabetic complications were coded on HIPE it is likely that the reduction in 2015 was as a result of this.

Count of overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017



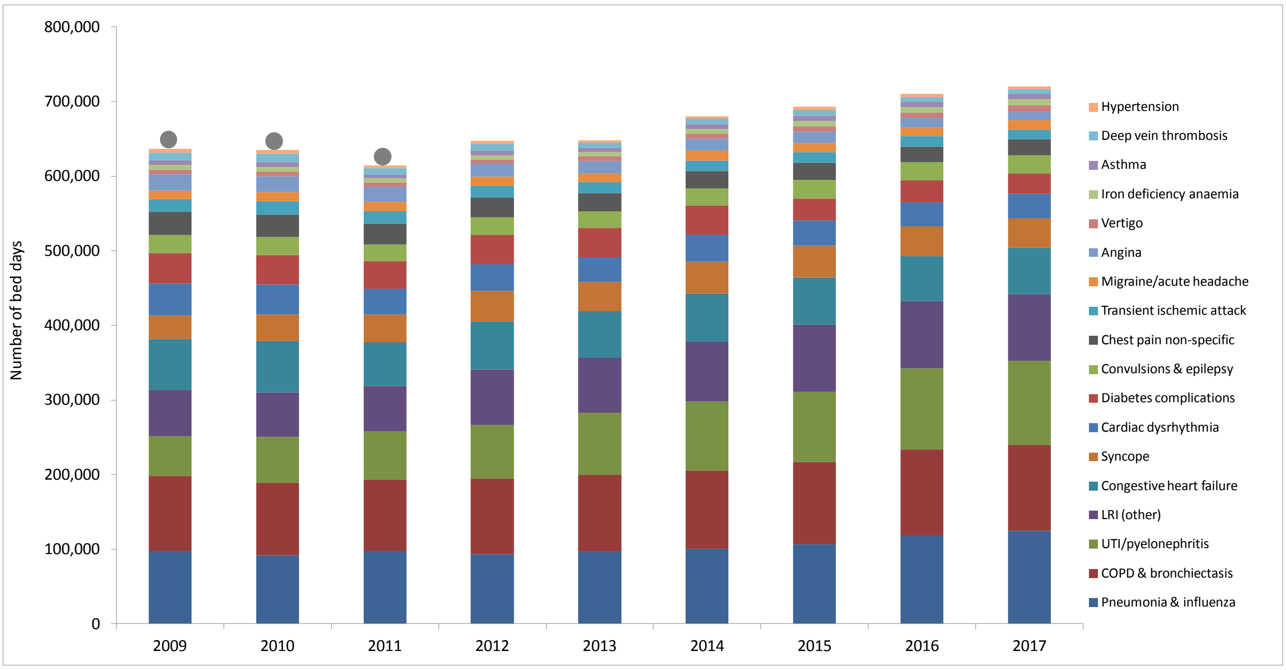
Notes. Under-reporting of activity from smaller hospitals has been depicted using a circle to show that the height of the bar should be slightly higher, though not considerably.
*The ICD-10-AM coding for diabetic complications changed in 2015 and it is not possible to extract the same data for years pre- and post 2015. Therefore pre-2015 cannot be compared with post 2015 for this condition.

Age-sex standarised overnight emergency hospitalisations for ambulatory care sensitive medical conditions/100,000 population, 2009-2017



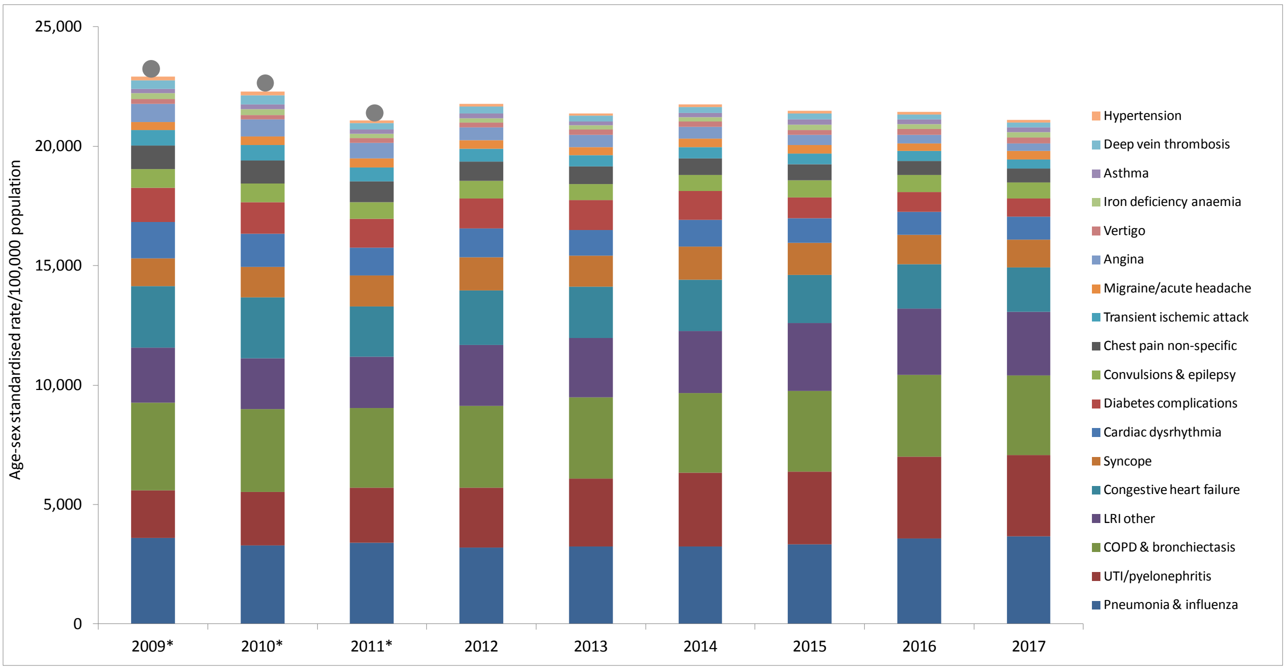
Notes. Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019). OECD 2010 Standard population used in the estimation of age-sex standardised rates.
*The ICD-10-AM coding for diabetic complications changed in 2015 and it is not possible to extract the same data for years pre- and post 2015. Therefore pre-2015 cannot be compared with post 2015 for this condition.

Count of bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017



Notes. Under-reporting of activity from smaller hospital has been depicted using a circle to show that the height of the bar should be slightly higher, though not considerably.
*The ICD-10-AM coding for diabetic complications changed in 2015 and it is not possible to extract the same data for years pre- and post 2015. Therefore pre-2015 cannot be compared with post 2015 for this condition.

Age-sex standarised bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions/100,000 population, 2009-2017



Notes. Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019). OECD 2010 Standard population used in the estimation of age-sex standardised rates.
*The ICD-10-AM coding for diabetic complications changed in 2015 and it is not possible to extract the same data for years pre- and post 2015. Therefore pre-2015 cannot be compared with post 2015 for this condition.

Age-specific counts and rates, 2009-2017

(Age-specific figures and tables follow the discussion)

Age category: 16-44 years

Each year between 2009 and 2017 approximately 21%-22% of all overnight emergency hospitalisations (both medical and non-medical conditions), among adults aged 16-44 years were for medical conditions deemed ambulatory care sensitive. These hospitalisations accounted for 16-18% of all emergency bed days used by adults aged 16-44 years each year. Hospitalisations for these conditions fell from 14,172 in 2009 to 12,950 in 2017, while the hospitalisation rate remained relatively unchanged (694 to 675/100,000). Bed days used by all ambulatory care sensitive medical conditions combined decreased from 53,014 in 2009 to 49,928 in 2017, but as with hospitalisations, the rate remained relatively unchanged (2,597/100,000 in 2009 to 2,601/100,000 in 2017).

Within acute ambulatory care sensitive medical conditions, there was a substantial reduction in the hospitalisation rate for chest pain non-specific from 119/100,000 in 2009 to 69/100,000 in 2017. In 2009 this was by far the most common acute ambulatory care sensitive medical condition admitted overnight as an emergency in this age category, followed by migraine/acute headache and UTI/pyelonephritis, whose hospitalisation rates were less than half of that observed for chest pain-non specific in that year. Over the period, there was a significant re-ordering of this ranking as a result of the decline in rate of hospitalisations for chest pain non-specific and a near doubling in the rate for UTI/pyelonephritis from 54/100,000 to 95/100,000. The other conditions remained relatively unchanged over the series, with minor yearly fluctuations. In 2017, migraine/acute headache had the highest overnight emergency hospitalisation rate in this age category, (96/100,000).As with hospitalisations, there was a doubling in the rate of bed days/100,000 for UTI/pyelonephritis from 227 in 2009 to 468 in 2017, and a halving for chest pain non-specific from 277 to 147/100,000 in 2017. Emergency hospitalisations with a principal diagnosis of UTI/pyelonephritis occupy the most beds in this age category. Convulsions/epilepsy and diabetes complications account for significantly more beds than other chronic conditions. These rates fluctuated modestly over the period with no discernible trend.

In terms of chronic ambulatory care sensitive medical conditions, there was very little change in the hospitalisation rate for these conditions over the period, and convulsions/epilepsy was by far the most common chronic ambulatory care sensitive medical conditions admitted.

Age category: 45-64 years

Each year between 2009 and 2017 approximately 32%-34% of all overnight emergency hospitalisations (both medical and non-medical conditions), among adults aged 45-64 years were for medical conditions deemed ambulatory care sensitive. These hospitalisations accounted for 24-26% of all emergency bed days used among adults aged 45-64 years each year. While there was a marginal increase in the total number of emergency hospitalisations for all ambulatory care sensitive medical conditions combined between 2009 and 2017 (21,137 to 21,601), the hospitalisation rate fell from 2,111/100,000 to 1,874/100,000. While the bed days for ambulatory care sensitive medical conditions remained stable (122,921 in 2009 and 122,123 in 2017), the rate declined over this period from 12,276 to 10,594/100,000.

Within acute conditions, there was a dramatic reduction in the hospitalisation rate for chest pain non-specific, from 438/100,000 in 2009 to 271/100,000 in 2017. In 2017, chest pain non-specific still had the highest overnight emergency hospitalisation rate across all acute ambulatory care sensitive medical conditions in this age category. In terms of the individual conditions, there was a rise in bed days used by pneumonia/ influenza, from 13,205 in 2009 to 18,066 in 2017. In 2017 for every 100,000 aged 45-64 years there were 1,567 bed days used by this diagnosis compared with 1,319 in 2009. There was also a clear rise in the bed days used by UTI. In 2009 there were 5,682 bed days used by this condition; by 2017 this figure had doubled to 11,693 resulting in an almost doubling of the rate from 567/100,000 in 2009 to 1,014/100,000 in 2017. There was a dramatic reduction in the bed days used by chest pain non-specific from 1,289/100,000 to 701/100,000 in 2017.

In terms of chronic conditions there was very little change in the hospitalisation rate for these, apart from a clear reduction in emergency hospitalisation for angina. COPD/bronchiectasis was by far the most common chronic ambulatory care sensitive medical condition admitted overnight as an emergency and this rate remained relatively unchanged over the time period (233/100,000 in 2009 to 243/100,000 2017). COPD/bronchiectasis contributes the most to bed days across all ambulatory care sensitive medical conditions in this age category. This rate has declined slightly from its peak in 2009 (1,905/100,000 to 1,744/100,000 in 2017). There has been a halving of the rate of bed days/100,000 for angina (from 743 in 2009 to 359/100,000 in 2017). Other chronic ambulatory care sensitive medical conditions experienced more minor reductions in the rate of bed days used over this time period.

Age category: 65 - 84 years

Each year between 2009 and 2017 approximately 40%-42% of all overnight emergency hospitalisations (both medical and non-medical conditions), among adults aged 65-84 years were for medical conditions deemed ambulatory care sensitive. These hospitalisations accounted for 32-34% of all emergency bed days used among adults aged 65-84 years each year. There was a significant rise in the number of emergency overnight hospitalisations for ambulatory care sensitive medical conditions combined between 2009 and 2017 (35,940 to 44,404), but a decrease in the hospitalisation rate from 8,078/100,000 to 7,653 /100,000, given the increase in the population in this age category over the period. While the bed days used by these conditions increased substantially over this period, from 340,506 in 2009 to 383,510 in 2017; the rate fell significantly from 76,531/100,000 in 2009 to 66,101/100,000 in 2017.

Within the acute conditions, there was a substantial increase in the hospitalisation rate for UTI/pyelonephritis from 528/100,000 in 2009 to 863/100,000 in 2017, as a result of a doubling in hospitalisations from 2,347 in 2009 to 5,007 in 2017. There was a less dramatic but noticeable increase in the hospitalisation rate for pneumonia/influenza from 771/100,000 to 955/100,000 in 2017. In 2017, pneumonia/influenza was the most common acute ACS discharged from hospital after an emergency stay, followed by LRI (other) (885/100,000) and UTI/pyelonephritis (863/100,000). There was a significant reduction in the hospitalisation rate for chest pain non-specific over this time period, from 605/100,000 in 2009 to 452/100,000 in 2017, and in cardiac dysrhythmia from 781/100,000 to 599/100,000 in 2017. There was a dramatic rise in bed days used by UTI/pyelonephritis, from 26,770 in 2009 to 57,659 in 2017. In 2017 for every 100,000 aged 65-84 years there were 9,938 bed days used by this diagnosis compared with 6,017 in 2009. The bed days used by pneumonia/influenza grew from 50,231 to 64,880 while the rate/100,000 was relatively unchanged from 11,290/100,000 to 11,183/100,000 in 2017, though it is clear that there was a reduction in this rate during the intervening years.

In terms of chronic conditions there was very little change in the hospitalisation rate for these conditions apart from a slight reduction in hospitalisation rate for angina and CHF. COPD/bronchiectasis was by far the most common condition admitted overnight as an emergency and this rate remained relatively unchanged over the time period - 1,491/100,000 in 2009 to 1,450/100,000 2017, though the numbers over this time period increased from 6,635 in 2009 to 8,412 in 2017. There was a reduction in the bed days used by cardiac dysrhythmia from 24,428 to 18,080; a rate reduction from 5,490/100,000 to

3,116/100,000. COPD/bronchiectasis again contributes the most to bed days across all ambulatory care sensitive medical conditions in this age category. This rate reduced slightly from 14,949/100,000 to 13,337/100,000 between 2009 and 2017, though the numbers increased from 66,512 to 77,377. There was a reduction in the rate of bed days used by congestive heart failure from 9,689/100,000 in 2009 to 6,202/100,000 and for angina from 2,821/100,000 in 2009 to 1, 090/100,000 in 2017.

Age category: 85+ years

Each year between 2009 and 2017 approximately 42%-45% of <u>all</u> overnight emergency hospitalisations (both medical and non-medical conditions), among adults aged 85+ years were for medical conditions deemed ambulatory care sensitive. These hospitalisations accounted for 35-39% of all emergency bed days used among adults aged 85 years and over, each year. This age category saw a significant increase in the number of emergency hospitalisations for all ambulatory care sensitive medical conditions combined (from 9,586 in 2009 to 14,189 in 2017), as well as the hospitalisation rate from (17,760/100,000 to 20,359/1000,000). Bed days used for ambulatory care sensitive medical conditions increased from 120,181 in 2009 to 165,092 in 2017, and the rate increased from 222,665/100,000 to 236,885/100,000 over the same time period.

Among acute conditions, there was a significant rise in the hospitalisation rate for UTI/pyelonephritis from 2,081/100,000 in 2009 to 3,721/100,000 in 2017, as a result of an increase in hospitalisations from 1,123 to 2,593. There was a less dramatic but noticeable increase in the hospitalisation rate for LRI (other) from 2,631/100,000 in 2009 to 3,389/100,000 in 2017. The hospitalisation rate for pneumonia/influenza increased from 3,000/100,000 in 2009 to 3,563/100,000 in 2017. In 2017, UTI/pyelonephritis was the most common acute ambulatory care sensitive medical condition discharged from hospital after an emergency stay, followed closely by pneumonia and then LRI (other).

There were considerable fluctuations year on year in terms of rate of bed days used. There was a substantial increase in bed days used by UTI/pyelonephritis, from 15,892 in 2009 to 33,977 in 2017. In 2017 for every 100,000 aged 85+ years there were 48,752 bed days used by this diagnosis compared with 29,444 in 2009. The bed days used by pneumonia/influenza grew from 26,959 to 35,556 while the hospitalisation rate was relatively unchanged from 49,948/100,000 to 51,018/100,000 in 2017. The bed days used by LRI (other) increased from 15,823 to 26,988, with a resultant increase in rate from 29,316/100,000 to 38,724/100,000.

In terms of chronic ambulatory care sensitive medical conditions there was very little change in the hospitalisation rate for these, though the rates for the two most common, COPD/bronchiectasis and congestive heart failure (CHF), fluctuated during this time period. Hospitalisations for CHF were marginally higher than hospitalisations for COPD/bronchiectasis. Both of these conditions had lower hospitalisation rates over the period than hospitalisations for the three acute conditions mentioned above. As with hospitalisations, CHF and COPD/bronchiectasis are by far the most common chronic ACS medical conditions admitted to hospital in this age category. The rate of bed days used by COPD/ bronchiectasis have remained relatively unchanged over the time period, while those for CHF have fluctuated considerably but in 2017 there was little difference in its rates per 100,000 from that seen in 2009 for this condition. Again these conditions are responsible for fewer beds in this age category that the three acute conditions discussed above.

Comparison of emergency hospitalisations for ambulatory care sensitive medical conditions among adults aged 85+ years and the general population, 2017

(See tables that follow)

Of total overnight emergency hospitalisations for ambulatory care sensitive medical conditions among adults ≥ 16 years in 2017 (N=94,144), 14% were in adults aged 16-44 years, 23% in adults aged 45-64 years, 48% in adults aged 65-84 years, and 15% in adults aged 85+ years. In terms of bed days used by these overnight emergency hospitalisations in 2017, (n=720,653), 7% were by adults aged 16-44 years, 17% by adults aged 45-64 years, 53% by adults aged 65-84 years, and 23% by adults aged 85+ years. The disparity in these proportions is striking when one considers that in 2017, only 1.9% of the population aged ≥16 years were aged 85+ years and a further 15.6% were aged 65 - 84 years.

The disparity in the burden of these conditions becomes even clearer when one examines the population rates. In 2017, for every 100,000 people in Ireland aged 16 years and over, there were 2,502 overnight emergency hospitalisations for these conditions. This rate ranged from 675 hospitalisations per 100,000 population aged 16-44 years, to 1,874 hospitalisations per 100,000 population aged 45-64 years, to 7,653 hospitalisations per 100,000 population aged 65-84 years, and finally, 20,359 hospitalisations per 100,000 population aged 85+ years. The hospitalisation rate in those aged 85+ years was 8.1 times the rate in the total population (i.e. that aged 16 years and over), 2.7 times the rate in those aged 65- 86 years, and 10.9 times the rate in those aged 45-64 years.

In terms of bed days, the differences in the age-specific rates were magnified even further, signifying the longer length of hospital stay for patients aged 85+ years. The rate ranged from 2,601 beds per 100,000 population aged 16-44 years, to 10,594 beds per 100,000 population aged 45-64 years, to 66,101 beds per 100,000 population aged 65-84 years and finally, 236,885 beds per 100,000 population aged 85+ years. The rate of bed days used by ambulatory care sensitive medical conditions in the population aged 16 years and over was 19,359/100,000. In those aged 85+ years the rate was 12.2 times greater at 236,885/100,000. This rate was 3.6 times the rate in those aged 65-84 years, and 22.4 times the rate in those aged 45-64 years.

There was considerable variation in the age distribution of hospitalisations for these conditions. For example, 90% of the overnight emergency hospitalisations for congestive heart failure were among those aged 65+ years (60% in those aged 65-84 years, 30% in those aged 85+ years). Other conditions with an unusually high proportion of their overnight emergency hospitalisations in the 85+ years age category were LRI (other) (23%), pneumonia/influenza (23%), UTI/pyelonephritis (23%), and iron deficiency anaemia (19%), though the number of hospitalisations for this condition were considerably lower than those for the other four conditions mentioned. Hospitalisations with a principal diagnosis of LRI (other) and pneumonia/influenza had almost an identical age-distribution: 9% in those aged 16-44 years; 17% and 18% respectively in those aged 45-64 years, 51% and 50% in those aged 65-84 years and 23% in those aged 85+ years. UTI/pyelonephritis differed slightly from these other two acute conditions in that it had a larger proportion of this hospitalisations in the youngest age category (16%) and less in the 65-84 years age category (45%) though the proportion of its hospitalisations that were in the 85+ age categories was the same (23%) as the other two conditions mentioned.

In terms of the age distribution of bed days used by these conditions, congestive heart failure was the condition with the highest proportion of its bed days in the two oldest age categories (similar to that seen with hospitalisation), with 91% of its bed days attributed to hospitalisations among patients aged 65+ years (33% in the 85+ age category alone). Other conditions with an unusually high proportion of bed days used by the 85+ years age category were LRI (other) (30%), pneumonia/influenza (29%), UTI/pyelonephritis (30%). Bed days used by LRI (other) and pneumonia/influenza again had almost identical age distributions: 5% in those aged 16-44 years, 13% and 14% in those aged 45-64 years, 52% and 51% in those aged 65-84 year and 30% in those aged 85+ years. The proportion of bed days for UTI/pyelonephritis in the oldest age category was the same as the other two conditions above (30%), but as with hospitalisations this condition had a slightly greater proportion of its bed days in those aged 16-44 years (8% vs. 5%).

For nearly all of the conditions examined, the hospitalisation rate and rate of bed days used in the 85+ years age category were significantly higher than in the other ages categories. Key exceptions were chest pain non-specific, migraine/acute headache, angina, asthma, where rates in the two oldest age categories were similar with each other. The greatest disparity in rates was seen for congestive heart failure. The rate in the total population aged 16 years and over, was 147/100,000, while the rate for those aged 85+ years was 15.9 time higher at a rate of 2,340/100,000, signalling that the greatest burden of CHF lies with the oldest age category. This is not surprising given that 30% of total hospitalisations for CHF were in this age category. Other conditions that had a significantly disparate burden in the 85+ age category were LRI (other), pneumonia/influenza and UTI/pyelonephritis all with ratios that are all approximately the same (12.5, 12.0, 12.5) i.e., the hospitalisation rate in those 85+ years was more than 12 times greater than the rate in the total population. COPD/bronchiectasis on the other hand, had a considerably lower ratio, (6.0 times that in the general population) despite the hospitalisation rate in the 85+ age category being similar to CHF. This is because the majority of the burden of COPD/bronchiectasis lies with the younger age category of 65-84 years and not the 85+ years age category - only 14% of hospitalisations for COPD/bronchiectasis were in the 85+ year age category; the majority (67%) were in the 65-84 year age category.

In term of bed days used, unsurprisingly, CHF again was the condition with the greatest disparity between the rate in those aged 85+ years and the rate in the adult population: a 17.5 fold difference. For the three acute conditions (LRI (other), pneumonia/influenza and UTI/ pyelonephritis), the ration of the rate in the age 85+ years age category and those in the general population was 16.2, 15.2 and 16.2 respectively.

Age-specific overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 2017

	16-44 years			45-64 years			65-84 years			85+ years			Total ≥ 16 years		
	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%
Acute conditions															
Cardiac dysrhythmia	634	(33)	10%	1,751	(152)	27%	3,478	(599)	53%	690	(990)	11%	6,553	(176)	100%
Chest pain non-specific	1,322	(69)	18%	3,125	(271)	42%	2,620	(452)	36%	312	(448)	4%	7,379	(198)	100%
Deep vein thrombosis	239	(12)	24%	287	(25)	29%	357	(62)	37%	93	(133)	10%	976	(26)	100%
LRI (other)	918	(48)	9%	1,714	(149)	17%	5,132	(885)	51%	2,362	(3,389)	23%	10,126	(272)	100%
Migraine/headache	1,852	(96)	49%	1,215	(105)	32%	650	(112)	17%	79	(113)	2%	3,796	(102)	100%
Pneumonia/ influenza	1,045	(54)	9%	1,941	(168)	18%	5,541	(955)	50%	2,483	(3,563)	23%	11,010	(296)	100%
Syncope	949	(49)	15%	1,422	(123)	22%	2,986	(515)	47%	1,000	(1,435)	16%	6,357	(171)	100%
TIA	81	(4)	3%	557	(48)	23%	1,381	(238)	57%	412	(591)	17%	2,431	(65)	100%
UTI/pyelonephritis	1,824	(95)	16%	1,677	(145)	15%	5,007	(863)	45%	2,593	(3,721)	23%	11,101	(298)	100%
Vertigo	285	(15)	14%	615	(53)	29%	1,038	(179)	50%	158	(227)	8%	2,096	(56)	100%
Chronic conditions															
Angina	104	(5)	4%	879	(76)	38%	1,209	(208)	52%	145	(208)	6%	2,337	(63)	100%
Asthma	616	(32)	41%	529	(46)	36%	307	(53)	21%	38	(55)	3%	1,490	(40)	100%
COPD/bronchiectasis	238	(12)	2%	2,805	(243)	22%	8,412	(1,450)	65%	1,450	(2,081)	11%	12,905	(347)	100%
CHF	55	(3)	<1%	525	(46)	10%	3,264	(563)	60%	1,631	(2,340)	30%	5,475	(147)	100%
Convulsions/epilepsy	1,683	(88)	41%	1,230	(107)	30%	997	(172)	24%	245	(352)	6%	4,155	(112)	100%
Diabetic complications	766	(40)	28%	776	(67)	28%	1,031	(178)	37%	201	(288)	7%	2,774	(75)	100%
Hypertension	181	(9)	18%	352	(31)	36%	385	(66)	39%	72	(103)	7%	990	(27)	100%
Iron def. anaemia	158	(8)	13%	201	(17)	17%	609	(105)	51%	225	(323)	19%	1,193	(32)	100%
ACS emergency hospitalisations	12,950	(675)	14%	21,601	(1,874)	23%	44,404	(7,653)	48%	14,189	(20,359)	15%	93,144	(2,502)	100%
Med emergency hospitalisations	28,868	(1,504)	16%	44,182	(3,833)	24%	84,549	(14,573)	46%	26,747	(38,378)	15%	184,349	(4,952)	100%

	16-44 years			45-64 years			65-84 years			85+ years			Total ≥ 16 years		
	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%
Total emergency hospitalisations	60,333	(3,142)	23%	67,089	(5,820)	25%	107,552	(18,538)	40%	32,091	(46,046)	12%	267,065	(7,174)	100%

Notes. N=Number of overnight emergency hospitalisations; % = Percentage of total emergency hospitalisations that were in this age category.

Abbreviations. ACS: ambulatory care sensitive conditions. Med: medicine

Age-specific bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 2017

	16-44 years			45-64 years			65-84 years			85+ years			Total ≥ 16 years		
	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	
Acute conditions															
Cardiac dysrhythmia	1,812	(94)	6%	6,680	(579)	20%	18,080	(3,116)	55%	6,338	(9,094)	19%	32,910	(884)	100%
Chest pain non-spec	2,820	(147)	13%	8,083	(701)	39%	8,908	(1,535)	42%	1,238	(1,776)	6%	21,049	(565)	100%
Deep vein thrombosis	1,647	(86)	25%	1,570	(136)	23%	2,600	(448)	39%	875	(1,256)	13%	6,692	(180)	100%
LRI (other)	4,074	(212)	5%	11,360	(985)	13%	46,675	(8,045)	52%	26,988	(38,724)	30%	89,097	(2,393)	100%
Migraine/headache	5,532	(288)	43%	3,954	(343)	31%	2,832	(488)	22%	404	(580)	3%	12,722	(342)	100%
Pneumonia/ influenza	6,199	(323)	5%	18,066	(1,567)	14%	64,880	(11,183)	52%	35,556	(51,018)	29%	124,701	(3,350)	100%
Syncope	2,705	(141)	7%	6,683	(580)	17%	20,526	(3,538)	52%	9,672	(13,878)	24%	39,586	(1,063)	100%
TIA	315	(16)	2%	2,242	(194)	17%	7,450	(1,284)	58%	2,853	(4,094)	22%	12,860	(345)	100%
UTI/pyelonephritis	8,980	(468)	8%	11,693	(1,014)	10%	57,659	(9,938)	51%	33,977	(48,752)	30%	112,309	(3,017)	100%
Vertigo	796	(41)	9%	2,031	(176)	24%	4,577	(789)	53%	1,179	(1,692)	14%	8,583	(231)	100%
Chronic conditions														0	100%
Angina	342	(18)	3%	4,135	(359)	35%	6,325	(1,090)	54%	934	(1,340)	8%	11,736	(315)	100%
Asthma	2,011	(105)	28%	2,871	(249)	40%	1,782	(307)	25%	436	(626)	6%	7,100	(191)	100%
COPD/bronchiectasis	1,298	(68)	1%	20,105	(1,744)	17%	77,377	(13,337)	67%	16,684	(23,939)	14%	115,464	(3,102)	100%
CHF	513	(27)	1%	5,513	(478)	9%	35,982	(6,202)	58%	20,470	(29,372)	33%	62,478	(1,678)	100%
Convulsions/epilepsy	6,319	(329)	26%	7,059	(612)	29%	8,347	(1,439)	34%	2,841	(4,076)	12%	24,566	(660)	100%
Diabetic complications	3,272	(170)	12%	7,734	(671)	28%	13,730	(2,366)	50%	2,529	(3,629)	9%	27,265	(732)	100%
Hypertension	643	(33)	17%	1,246	(108)	33%	1,514	(261)	40%	405	(581)	11%	3,808	(102)	100%
Iron def. anaemia	650	(34)	8%	1,098	(95)	14%	4,266	(735)	55%	1,713	(2,458)	22%	7,727	(208)	100%
ACS emergency hospitalisations	49,928	(2,601)	7%	122,123	(10,594)	17%	383,510	(66,101)	53%	165,092	(236,885)	23%	720,653	(19,359)	100%
Med emergency hospitalisations	162,059	(8,441)	9%	338,645	(29,378)	19%	900,417	(155,195)	51%	359,960	(516,494)	20%	1,761,081	(47,309)	100%

	16-44 years			45-64 years			65-84 years			85+ years			Total ≥ 16 years		
	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	%	N	Rate/ 100,000	
Total emergency hospitalisations	290,528	(15,132)	12%	509,035	(44,159)	21%	1,163,854	(200,601)	49%	432,091	(619,992)	18%	2,395,508	(64,352)	100%

Notes. N=Number of overnight emergency hospitalisations; % = Percentage of total emergency hospitalisations that were in this age category.

Abbreviations. ACS: ambulatory care sensitive conditions. Med: medicine

Discussion

This appendix presents a comprehensive account of the yearly counts and rates of overnight emergency hospitalisations and bed days used by them for ambulatory care sensitive medical conditions between 2009 and 2017.

Certain conditions warrant highlighting - notably the reduction in hospitalisations for chest pain non-specific, the increase in hospitalisations for infectious conditions (UTI/pyelonephritis, pneumonia/influenza and LRI (other)), especially among the elderly; and the high rates of hospitalisations for COPD. These will now be discussed in turn and comparison made with other jurisdictions to ascertain whether these rates and trends are mirrored elsewhere.

Chest pain non-specific saw a reduction of over a third in its age-sex standarised rate of emergency hospitalisations from 309/100,000 to 201/100,000 population between 2009 and 2017. Over the same time period in the UK, the overnight emergency hospitalisation rate for chest pain non-specific was one of the highest of all conditions examined. The rate declined marginally between 2002/09 and 2018/19 from 440/100,000 to 390/100,000 (Nuffield Trust, 2019).

There was dramatic rise in emergency hospitalisations for UTI/pyelonephritis in Ireland, with its contribution to total emergency hospitalisations and bed days doubling over the study period. The age-sex standarised rate increased from 190/100,000 in 2009 to 328/100,000 in 2017, a 73% increase. Increases in hospitalisation rates were observed across all age categories, though especially in the oldest age category. The number of emergency hospitalisations in the oldest age category (i.e. 85+ years) increased from 1,123 in 2009 to 2,593 in 2017, an increase of 131%. This was the highest increase (in absolute terms) among all conditions in this age category. The rate in this age group increased from 2,081/100,000 to 3,721/100,000, an increase in rate of 79%. The increase in bed days for this condition was also the highest increase (in absolute terms) of all conditions n this age category, an increase from 15,392 in 2009 to 33,977 in 2017 (representing a 114% increase). The population rate increased from 29,444 beds/100,000 to 48,752/100,000, an increase in rate of 66%.

This rise in the rate of emergency hospitalisations for UTIs has been observed in other jurisdictions. In the UK, the Nuffield Trust Quality Watch documented a very similar increase in the rate of emergency admission for UTI from 200/100,000 in 2008/09 to 300/100,000 in 2017/18, though there was a sharp decline in 2017/2018 attributed to improved coding for sepsis (Nuffield Trust, 2019). Similar rates have been observed in Australia, and in 2014/15, the age-sex standarised hospitalisation rate for UTIs was

286/100,000 population, with a 6 fold variation in this rate across small local areas (Australian Commission on Safety and Quality in Health Care, 2017).

Despite the high prevalence of hospitalisations for UTIs, published evidence on international rates and interventions for these conditions is lacking. Additionally, little has been written about the possible causes of this increase. Simmering et al (2017), conducted a time series analysis of hospitalisations for UTIs in the United States between 1998 and 2011. They found that the incidence of UTI hospitalisation was increasing while the severity of UTI admissions appeared to be decreasing, indicating that patients previously treated as outpatients were now being admitted to hospital (Simmering et al., 2017). The authors attribute much of this rise to increasing antimicrobial resistance. The authors of the Australian report which found a 6-fold variation in the yearly hospitalisation rate for UTI across small local areas attributed this to a myriad of factors including: adherence to evidence-based guidelines, including choice and length of antimicrobial treatment; access to primary care, including its availability, acceptability and affordability; the quality, efficiency and effectiveness of primary health care; access to hospital in the home and other community services; clustering of populations with a high risk of urinary tract infections, such as residents of aged care homes, people with type 2 diabetes, and Aboriginal and Torres Strait Islander Australians; the incidence of infection with multidrug-resistant, extended-spectrum ß-lactamase-producing bacteria; weather as hot conditions can increase the risk of dehydration and UTI; and diagnostic error.

We do not know from this study, whether the rise in overnight emergency hospitalisations in Ireland for UTI/pyelonephritis represents an increase in the prevalence of UTIs/pyelonephritis, increasing antimicrobial resistance, an increase in emergency presentation to hospital or changes to admission policies in hospitals, or is simply a result of change in coding practices. The over coding of UTIs, especially in the elderly, has also been identified as a likely contributor, and the extent of this over-coding is considered to have risen in recent years, especially in the elderly (Finucane, 2017), though it is unlikely that the entire increase is attributable to this. It is plausible that the increased focus on sepsis prevention in Ireland may have led to an increasing tendency to admit patients presenting with UTI/pyelonephritis to hospital. Finally, it needs to be noted that these high emergency hospitalisations rates are likely symptomatic of Ireland's fragmented healthcare system and under resourced primary care system, given that that the majority of UTIs can be adequately managed in primary care, with adherence to evidence-based guidelines including choice and length of antimicrobial treatment (Mahaffey, 2006, Australian Commission on Safety and Quality in Health Care, 2017).

Overnight emergency hospitalisation rate for pneumonia/influenza also increased over the period, though not to the same extent. The age-sex standarised hospitalisation rate for increased from 264/100,000 in 2009 to 319/100,000 in 2017, a 21% increase. Increases were observed across all age categories, though especially in the oldest age category. The number of emergency hospitalisations in the oldest age category (i.e. 85+ years) increased from 1,619 in 2009 to 2,283 in 2017, an increase of 54%, while the population rate increased by 19% from 3,000/100,000 to 3,563/100,000. The emergency bed days for pneumonia/influenza in this age category increased by 32% from 26,939 in 2009 to 35,556 in 2017, while the rate increased marginally by 2% from 49,948 beds/100,000 population to 51,018/100,000 population. The rise in emergency admissions for pneumonia/influenza could be due to a range of factors including population changes, coding practices and changes to hospital organisation (Trotter et al., 2008). However, this is unlikely to be just a coding issue since other countries have also experienced rises, such as the Netherlands (van Gageldonk-Lafeber et al., 2009) and the UK (Trotter et al., 2008). Meanwhile in the US, the emergency hospitalisation rate of pneumonia/influenza has decreased which they attribute to the introduction of the pneumococcal vaccine and greater treatment in the outpatient setting (Tong et al., 2018).

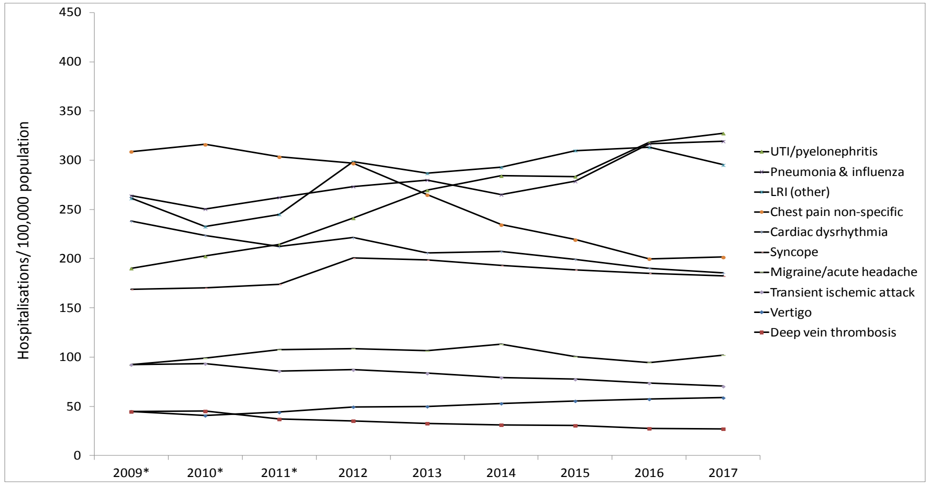
The third acute condition that experienced a rise over this period was lower respiratory infection (other). The age-sex standarised rate increased from 261/100,000 to 295/100,000 population while the rate of bed days used increased from 2,303/100,000 to 2,657/100,000 population. As with the other acute conditions the greatest increase in rate was observed in the 85+ age category. These three acute conditions are heavily concentrated in the elderly, and the rate of emergency hospitalisations and bed days used for these three conditions in the 85+ age category has increased over this period.

A fourth condition that warrants discussion is COPD. The burden of respiratory disease on Irish hospitals has recently been well documented in the Irish Thoracic Society's Respiratory Health of the Nation report (O'Connor et al., 2018). Ireland's rate of emergency hospitalisations for COPD are the highest of all OECD countries (OECD, 2017). Between 2009 and 2017, there was little change in the age-sex standarised hospitalisation (from 371/100,000 to 368/100,000), though the rate of bed days used declined from 3,668/100,000 to 3,333/100,000. In contrast with the acute conditions just discussed, the burden of COPD in the 85+ age category is considerably less, likely as a result of the lower life expectancy of adults with this disease. Over the same time period in the UK, the age-sex standarised rate for this condition fluctuated between 200 and 220/100,000. (Nuffield Trust, 2019). The high rates in Ireland are likely to be a result of disease prevalence, poor management the disease in primary care, and poor systems/structures in place to manage exacerbations when they do arise. The lack of resources to better manage COPD in the community is well recognised in Ireland, and considerable effort has been invested of late in improving the management of COPD with a new model of care launched in December 2019 (National Clinical Programme for Respiratory, 2019). This model focuses on the delivery of integrated care in the community with the expansions of COPD outreach, respiratory integrated care services, and pulmonary rehabilitation. One would expect to see the impact of this work on emergency hospitalisation rates for COPD over the coming decade.

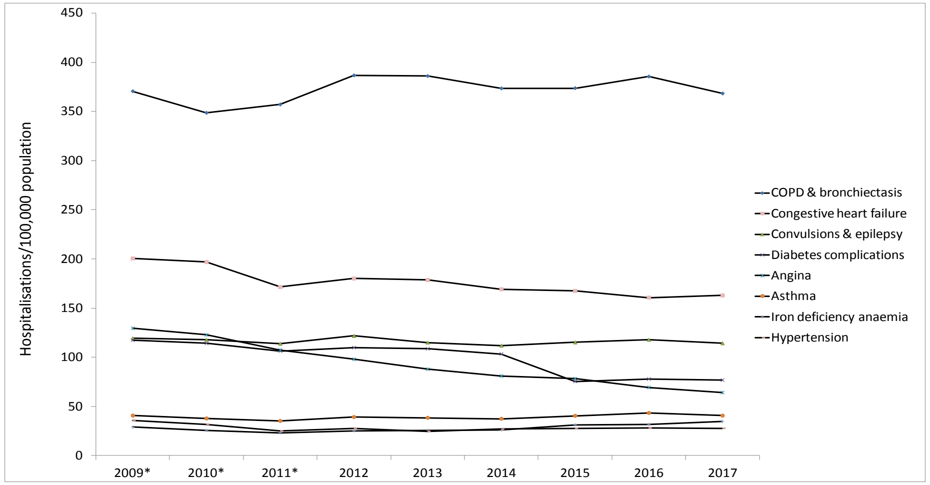
There was significant disparity observed in the burden of emergency hospitalisations for these ambulatory care sensitive medical conditions across the age groups. For all overnight emergency hospitalisations for these conditions in 2017, 15% were in the 85+ years age category, despite this population only accounting for 1.9% of the adult population in that year. The disparity in the burden of hospitalisation between this oldest age category and the population aged 16 years and over in 2017 was most pronounced for the acute conditions - pneumonia/influenza, UTI/pyelonephritis, LRI (other) and the chronic condition - congestive heart failure. In that year, of all overnight emergency hospitalisations (among adults ≥16 years), the proportions that were in the 85+ years age group for these four conditions were 23%, 23%, 23% and 30% respectively. This is reflected in the population level rates in the oldest age groups being dramatically higher in than in the other age categories. The overnight emergency hospitalisation rate for ambulatory care sensitive medical conditions in 2017 in the 85+ years age was 8.1 times that observed in the total population (i.e. ≥16 years) and 2.7 times that observed in the 65-84 year age group. This disparity in burden was even more pronounced when bed days were examined, given the longer length of stay of the elderly. In 2017, of total bed days accounted for by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 23% were among adults aged 85+ years. Compared with the total population rate (aged 16 years and over) the overnight emergency hospitalisation rate for ambulatory care sensitive medical conditions was 12.2 times that observed in the total population (i.e. ≥16 years) and 3.6 times that observed in the 65-84 year age group. For the three acute conditions (LRI (other), pneumonia/influenza and UTI/ pyelonephritis), the difference between the rate in the age 85+ years age category and those in the general population was 16.2, 15.2 and 16.2 respectively.

Age-sex standardised rate of overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017

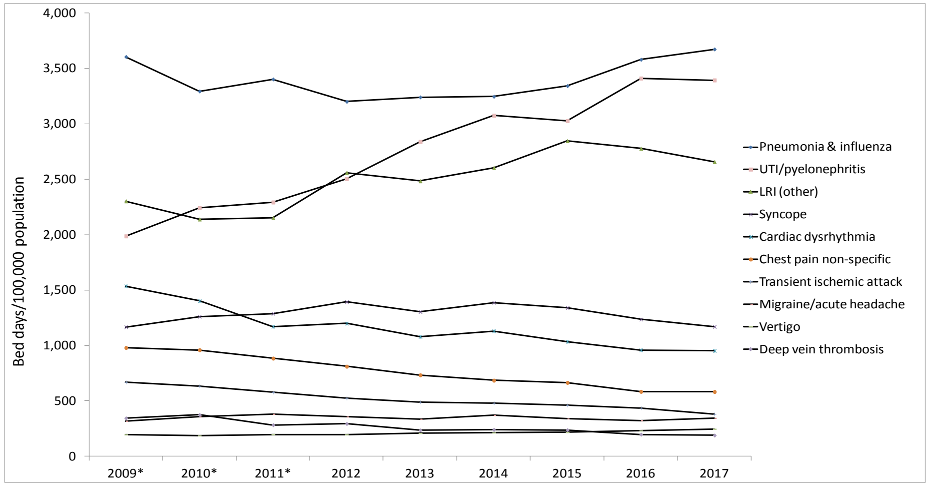
Acute conditions

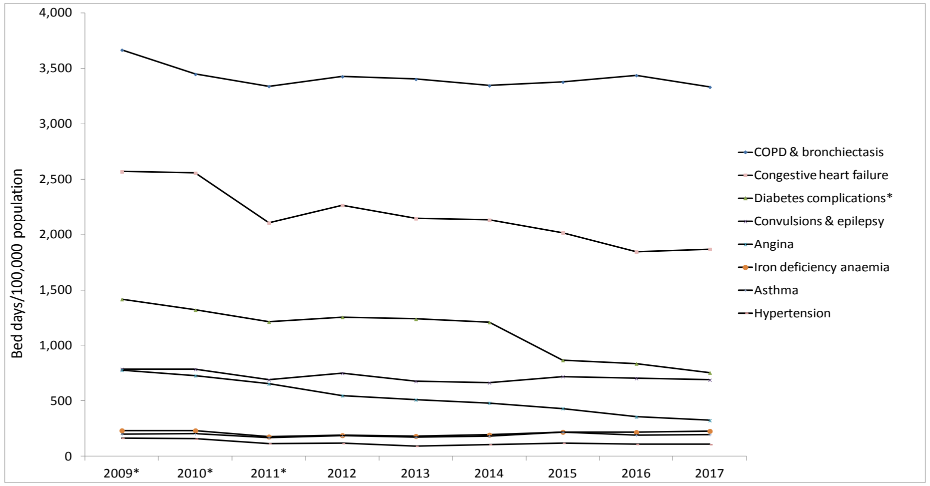


Chronic conditions



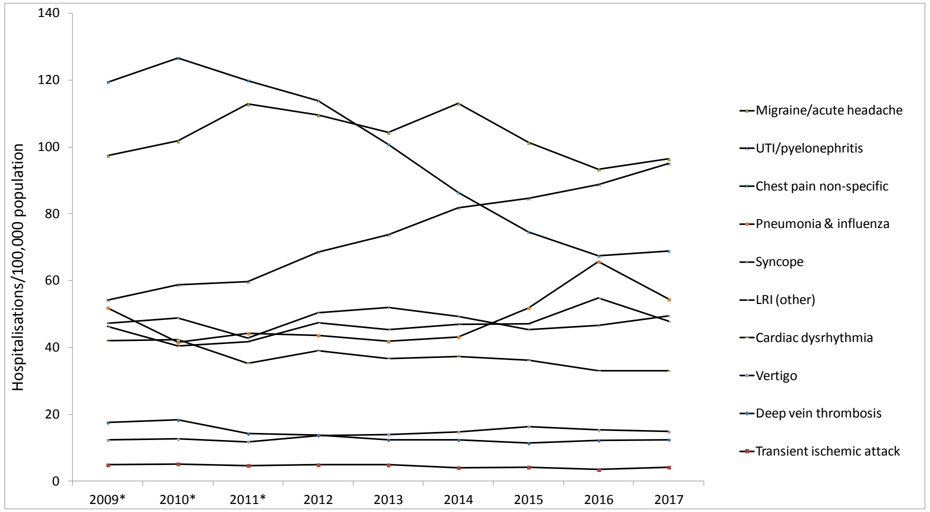
Age-sex standardised rate of bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, 2009-2017



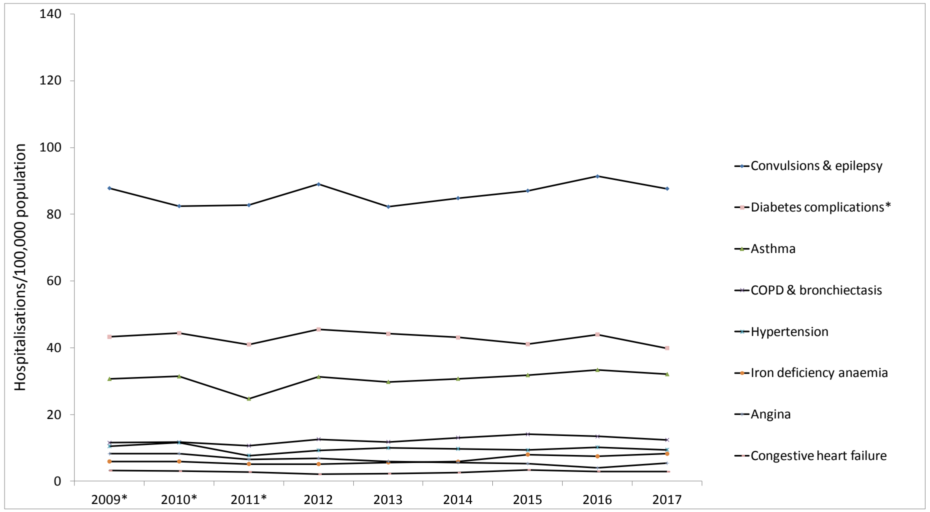


Overnight emergency hospitalisations for ambulatory care sensitive medical conditions/100,000 population, 2009-2017, 16-44 years

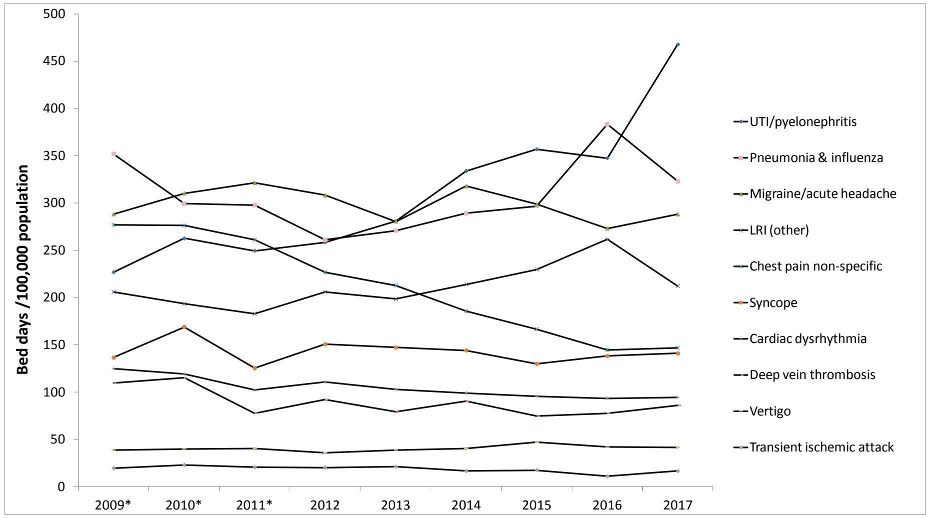
Acute conditions

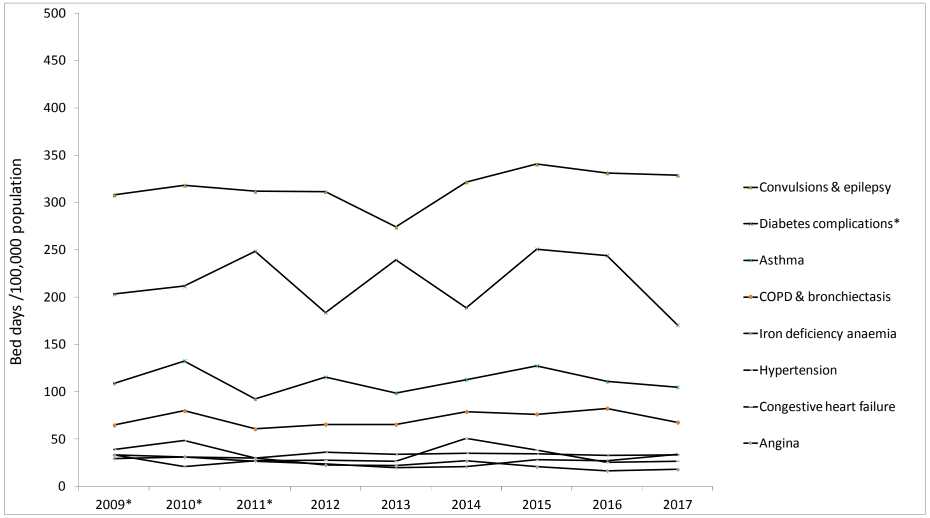


Chronic conditions



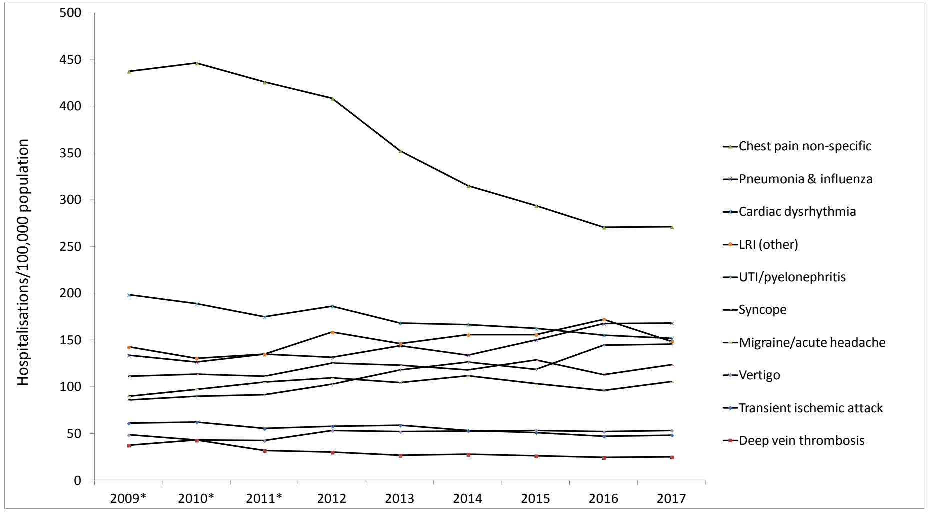
Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions/100,000 population, 2009-2017, 16-44 years



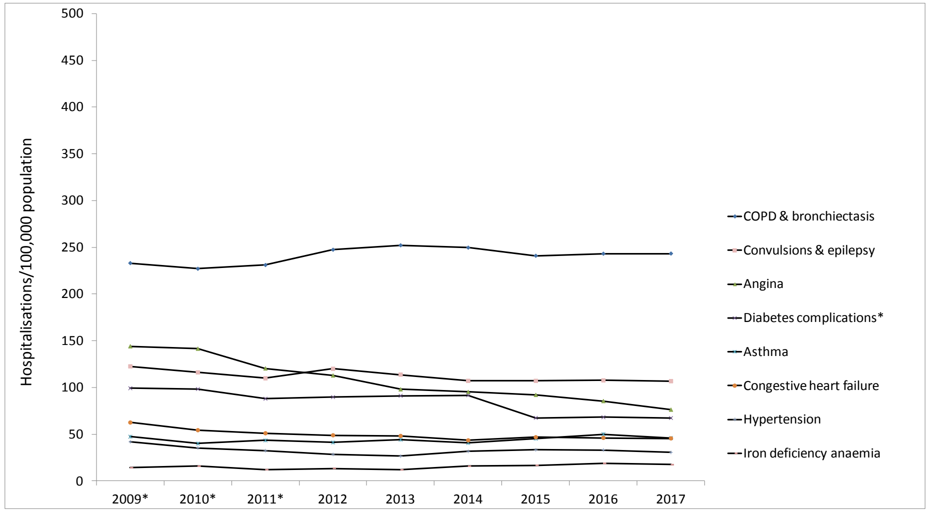


Overnight emergency hospitalisations for potentially avoidable medical admissions/100,000 population, 2009-2017, 45-64 years

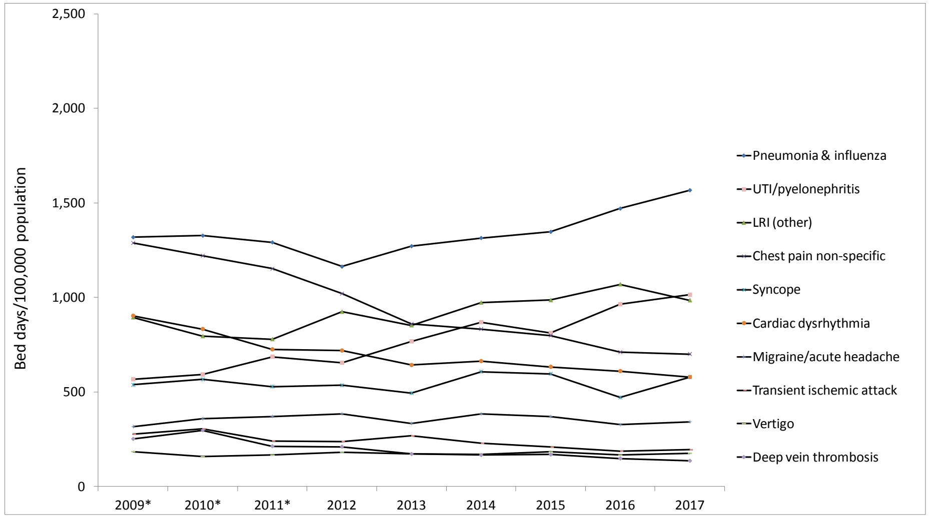
Acute

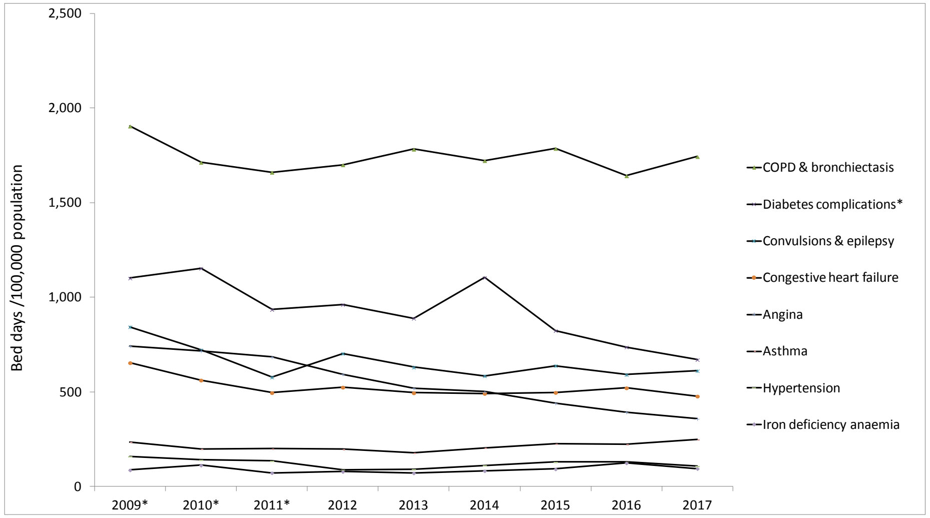


Chronic



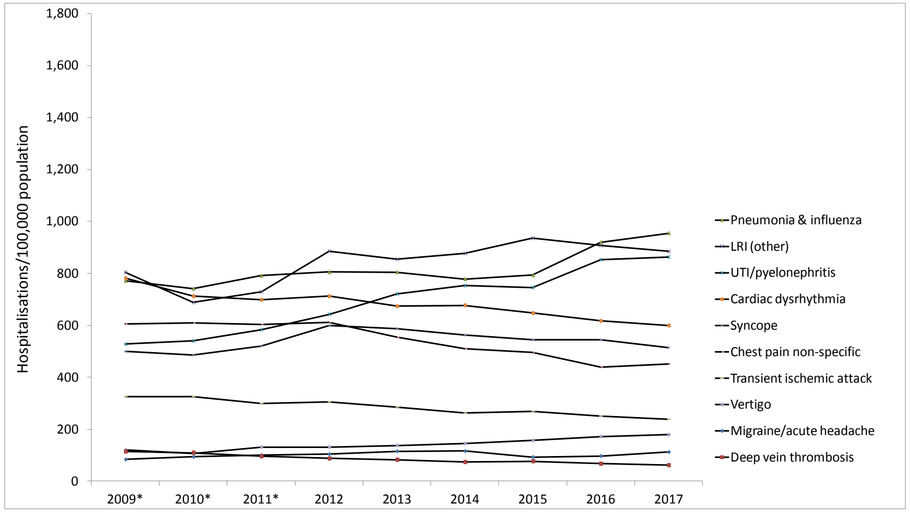
Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions/100,000 population, 2009-2017, 45-64 years



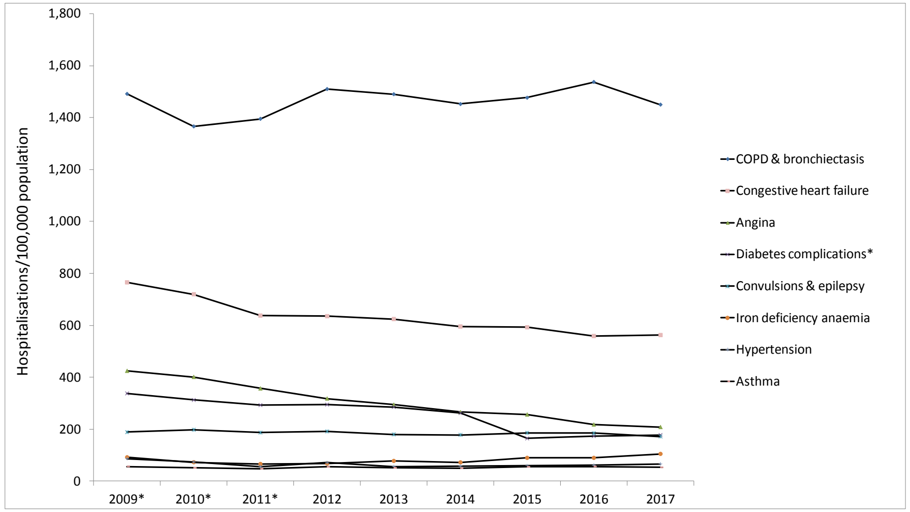


Overnight emergency hospitalisations for ambulatory care sensitive medical conditions /100,000 population, 2009-2017, 65-84 years

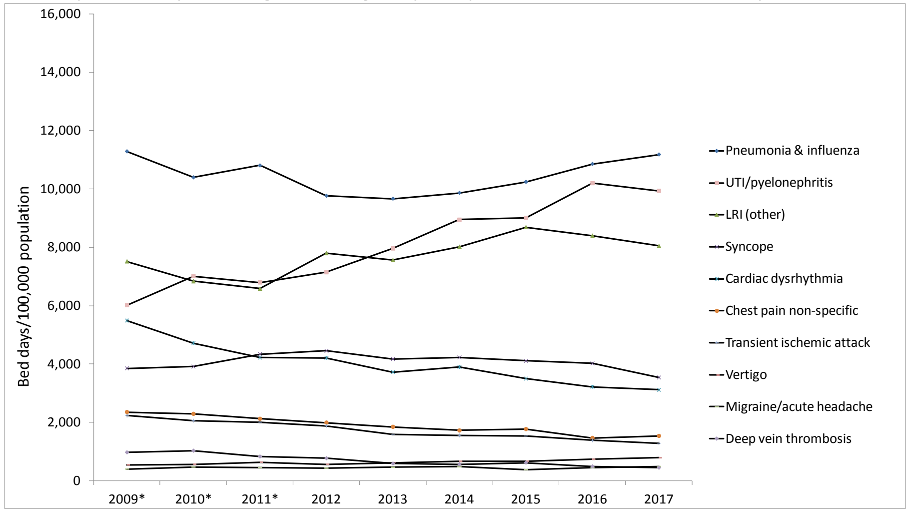
Acute

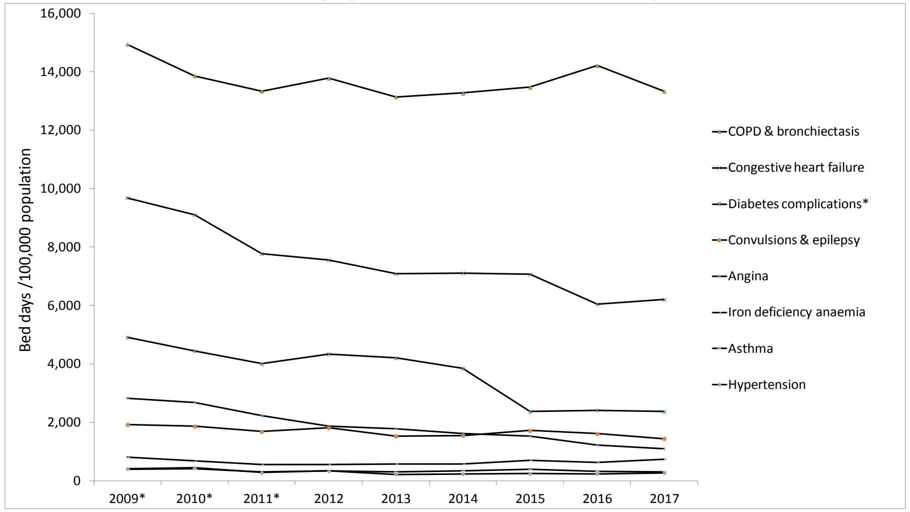


Chronic



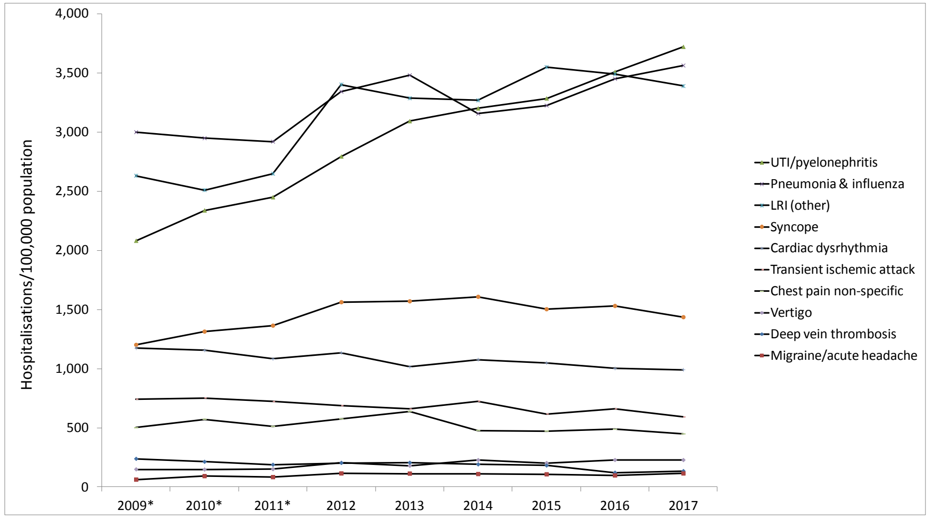
Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions/100,000 population, 2009-2017, 65-84 years



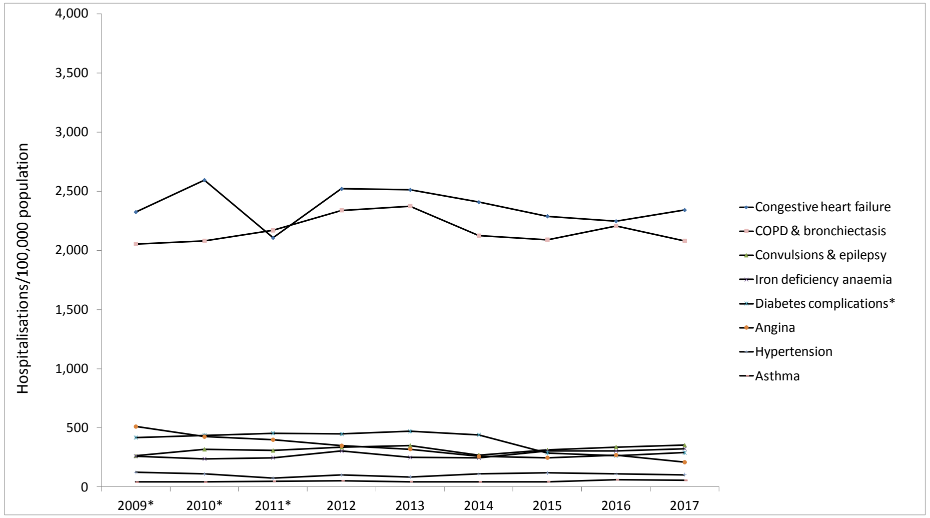


Overnight emergency hospitalisations for ambulatory care sensitive medical conditions /100,000 population, 2009-2017, 85+ years

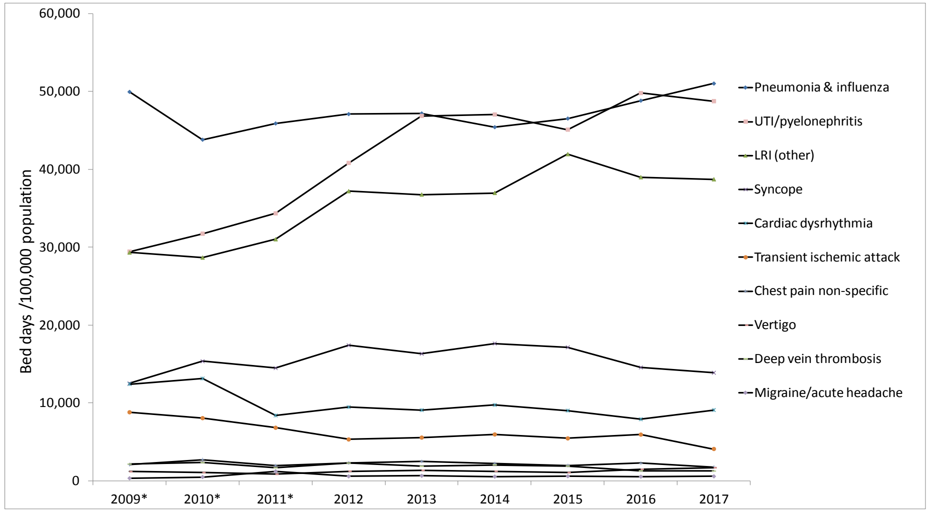
Acute

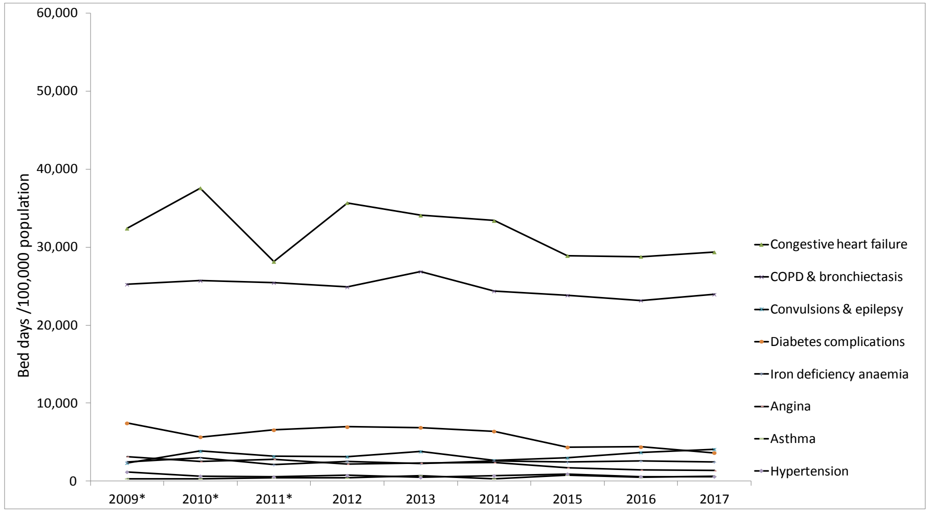


Chronic



Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions /100,000 population, 2009-2017, 85+ year





Overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and age-sex standardised rate/100,000 population, 2009-2017

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	6,953	6,698	6,446	6,890	6,544	6,761	6,691	6,528	6,553
	(238)	(224)	(212)	(221)	(206)	(207)	(199)	(190)	(185)
Chest pain non-specific	9,781	10,213	9,942	9,861	8,903	8,050	7,676	7,147	7,379
	(309)	(316)	(303)	(297)	(265)	(235)	(219)	(200)	(202)
Deep vein thrombosis	1,371	1,426	1,172	1,134	1,065	1,044	1,040	969	976
	(45)	(45)	(37)	(35)	(33)	(31)	(31)	(28)	(27)
LRI (other)	7,372	6,714	7,214	8,966	8,778	9,250	10,024	10,447	10,126
	(261)	(233)	(245)	(299)	(287)	(293)	(310)	(313)	(295)
Migraine/headache	3,291	3,510	3,834	3,860	3,775	4,054	3,650	3,477	3,796
	(92)	(99)	(108)	(109)	(106)	(113)	(101)	(95)	(102)
Pneumonia/influenza	7,449	7,182	7,716	8,179	8,548	8,357	9,067	10,646	11,010
	(264)	(251)	(262)	(273)	(280)	(265)	(279)	(317)	(319)
Syncope	4,950	5,107	5,254	6,174	6,247	6,194	6,235	6,259	6,357
	(169)	(170)	(174)	(201)	(199)	(193)	(189)	(185)	(182)
TIA	2,564	2,659	2,505	2,617	2,573	2,491	2,514	2,451	2,431
	(92)	(93)	(86)	(87)	(84)	(79)	(77)	(74)	(70)
UTI/pyelonephritis	5,435	5,882	6,313	7,237	8,224	8,909	9,126	10,488	11,101
	(190)	(203)	(214)	(241)	(270)	(284)	(284)	(318)	(328)
Vertigo	1,355	1,265	1,382	1,588	1,630	1,758	1,887	1,997	2,096
	(45)	(41)	(44)	(50)	(50)	(53)	(55)	(57)	(59)
Chronic Conditions									
Angina	3,776	3,692	3,300	3,091	2,851	2,701	2,676	2,447	2,337
	(129)	(123)	(107)	(98)	(88)	(81)	(78)	(69)	(64)
Asthma	1,373	1,297	1,195	1,345	1,327	1,318	1,436	1,561	1,490
	(41)	(38)	(35)	(39)	(38)	(37)	(40)	(43)	(41)
COPD/bronchiectasis	10,313	9,991	10,476	11,653	11,936	11,937	12,337	13,132	12,905
	(371)	(349)	(357)	(387)	(386)	(373)	(374)	(385)	(368)
Congestive heart failure	5,350	5,374	4,829	5,173	5,257	5,166	5,297	5,233	5,475
	(200)	(197)	(171)	(180)	(179)	(169)	(167)	(161)	(163)
Convulsions/epilepsy	4,000	3,925	3,836	4,133	3,924	3,892	4,062	4,229	4,155
	(119)	(118)	(114)	(122)	(115)	(112)	(115)	(118)	(114)

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Diabetes complications[2]	3,604	3,573	3,371	3,541	3,560	3,475	2,614	2,765	2,774
	(117)	(114)	(106)	(110)	(109)	(103)	(75)	(78)	(77)
Hypertension	1,086	995	798	888	811	904	943	988	990
	(36)	(32)	(25)	(28)	(25)	(27)	(28)	(28)	(28)
Iron def. anaemia	812	749	685	755	783	817	1,024	1,063	1,194
	(29)	(26)	(23)	(25)	(25)	(26)	(31)	(32)	(35)
ACS medical hospitalisations	80,835	80,252	80,268	87,088	86,740	87,078	88,299	91,827	93,144
(emergency)	(2,748)	(2,669)	(2,625)	(2,801)	(2,743)	(2,682)	(2,653)	(2,691)	(2,659)
All Med emergency hospitalisations	154,257	153,313	152,476	164,673	165,515	168,266	172,141	177,917	184,346
	(5,212)	(5,079)	(4,963)	(5,269)	(5,207)	(5,159)	(5,150)	(5,192)	(5,245)
Total emergency hospitalisations	243,709	240,342	235,956	247,058	246,421	248,617	252,546	259,586	267,065
	(7,927)	(7,703)	(7,459)	(7,710)	(7,585)	(7,488)	(7,444)	(7,483)	(7,521)

Source: Hospitalisations from HIPE 2009-2017. Emergency in-patient hospitalisations among adults aged 16 years and over in adult acute public hospitals with a minimum one night stay in hospital. Excludes hospitalisations of care transferred in from another acute hospital. Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).
OECD 2010 Standard population used in the estimation of age-sex standardised rates.

Notes.
1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and age-sex standardised rate/100,000 population, 2009-2017

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	42,733	39,933	34,421	36,029	33,295	35,725	33,754	32,123	32,910
	(1,536)	(1,402)	(1,171)	(1,200)	(1,080)	(1,130)	(1,035)	(959)	(953)
Chest pain non-specific	30,149	30,063	28,300	26,304	24,185	23,048	22,937	20,571	21,049
	(980)	(959)	(884)	(811)	(733)	(685)	(665)	(584)	(582)
Deep vein thrombosis	10,251	11,387	8,643	9,167	7,493	7,807	7,905	6,778	6,692
	(344)	(374)	(282)	(294)	(235)	(240)	(237)	(197)	(189)
LRI (other)	62,437	59,462	60,925	74,230	73,710	80,073	89,914	90,591	89,097
	(2,303)	(2,140)	(2,151)	(2,559)	(2,485)	(2,604)	(2,847)	(2,778)	(2,657)
Migraine and headache	11,010	12,295	13,042	12,496	11,704	13,106	12,248	11,783	12,722
	(318)	(357)	(380)	(357)	(335)	(370)	(340)	(323)	(344)
Pneumonia/influenza	97,579	91,869	97,160	93,380	96,592	100,222	106,612	117,877	124,701
	(3,606)	(3,295)	(3,404)	(3,201)	(3,242)	(3,247)	(3,344)	(3,581)	(3,675)
Syncope	32,068	35,750	36,925	40,799	39,225	42,688	42,604	40,380	39,586
	(1,167)	(1,261)	(1,288)	(1,394)	(1,304)	(1,388)	(1,340)	(1,236)	(1,170)
TIA	17,833	17,540	16,358	15,313	14,722	14,699	14,541	14,105	12,860
	(668)	(633)	(576)	(524)	(490)	(480)	(461)	(435)	(380)
UTI/pyelonephritis	52,972	61,317	64,228	71,374	82,538	92,427	94,185	108,438	112,309
	(1,987)	(2,242)	(2,293)	(2,504)	(2,840)	(3,076)	(3,028)	(3,412)	(3,395)
Vertigo	5,683	5,579	6,026	6,104	6,551	6,871	7,216	7,793	8,583
	(196)	(186)	(197)	(196)	(208)	(213)	(216)	(230)	(246)
Chronic Conditions									
Angina	22,366	21,609	19,895	17,175	16,441	15,954	14,680	12,536	11,736
	(778)	(728)	(653)	(547)	(511)	(481)	(431)	(356)	(324)
Asthma	6,450	6,740	5,564	6,163	5,721	6,333	7,508	6,773	7,100
	(199)	(202)	(169)	(184)	(171)	(183)	(216)	(191)	(196)
COPD/ bronchiectasis	100,521	97,179	96,421	101,666	103,456	105,390	110,130	115,668	115,464
	(3,668)	(3,449)	(3,339)	(3,428)	(3,403)	(3,346)	(3,378)	(3,438)	(3,333)
Congestive heart failure	67,829	69,026	58,856	64,448	62,532	64,720	63,542	59,786	62,478
	(2,570)	(2,557)	(2,107)	(2,266)	(2,146)	(2,133)	(2,019)	(1,846)	(1,870)
Convulsions/epilepsy	24,531	24,462	21,970	24,234	22,072	22,311	24,836	24,530	24,566
	(788)	(785)	(690)	(750)	(677)	(664)	(720)	(703)	(689)

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Diabetes complications2	41,009 (1,417)	39,595 (1,321)	37,368 (1,213)	39,135 (1,257)	39,626 (1,239)	39,848 (1,209)	29,595 (868)	29,512 (836)	27,265 (755)
Hypertension	4,845 (165)	4,801 (157)	3,608 (116)	3,675 (117)	3,014 (92)	3,542 (107)	3,980 (119)	3,797 (109)	3,808 (108)
Iron defic. anaemia	6,356 (233)	6,528 (233)	5,096 (177)	5,510 (189)	5,445 (182)	5,941 (193)	6,967 (219)	7,215 (218)	7,727 (228)
ACS medical hospitalisations (emergency)	636,622 (22,922)	635,135 (22,282)	614,806 (21,092)	647,202 (21,779)	648,322 (21,372)	680,705 (21,751)	693,154 (21,482)	710,256 (21,433)	720,653 (21,094)
All Med emergency hospitalisations	1,539,017 (54,745)	1,553,666 (53,999)	1,501,743 (50,949)	1,546,230 (51,453)	1,548,077 (50,506)	1,603,955 (50,816)	1,688,206 (51,874)	1,711,688 (51,178)	1,761,081 (51,108)
Total emergency hospitalisations	2,208,933 (76,869)	2,202,276 (75,068)	2,123,032 (70,835)	2,138,268 (69,988)	2,144,819 (68,952)	2,201,660 (68,860)	2,300,401 (69,928)	2,336,816 (69,199)	2,395,508 (68,924)

Source: Hospitalisations from HIPE 2009-2017 Emergency in-patient hospitalisations among adults aged 16 years and over in adult acute public hospitals with a minimum one night stay in hospital. Includes episodes of care transferred in from another acute hospital, which are excluded from the analysis of hospitalisation rates. Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019). OECD 2010 Standard population used in the estimation of age-sex standardised rates.

Notes.
1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 16-44 years

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	857	849	696	758	706	713	691	632	634
	(42)	(42)	(35)	(39)	(37)	(37)	(36)	(33)	(33)
Chest pain non-specific	2,437	2,536	2,363	2,213	1,939	1,652	1,424	1,290	1,322
	(119)	(127)	(120)	(114)	(101)	(86)	(74)	(67)	(69)
Deep vein thrombosis	358	367	280	268	238	236	217	233	239
	(18)	(18)	(14)	(14)	(12)	(12)	(11)	(12)	(12)
LRI (other)	944	812	822	921	874	898	899	1,050	918
	(46)	(41)	(42)	(47)	(45)	(47)	(47)	(55)	(48)
Migraine/headache	1,989	2,039	2,224	2,129	2,008	2,163	1,937	1,788	1,852
	(97)	(102)	(113)	(110)	(104)	(113)	(101)	(93)	(96)
Pneumonia/ influenza	1,059	832	872	849	805	826	991	1,258	1,045
	(52)	(42)	(44)	(44)	(42)	(43)	(52)	(66)	(54)
Syncope	965	979	843	980	999	944	867	892	949
	(47)	(49)	(43)	(50)	(52)	(49)	(45)	(47)	(49)
TIA	100	104	93	96	94	78	81	67	81
	(5)	(5)	(5)	(5)	(5)	(4)	(4)	(3)	(4)
UTI/pyelonephritis	1,107	1,177	1,176	1,333	1,420	1,565	1,617	1,700	1,824
	(54)	(59)	(60)	(69)	(74)	(82)	(85)	(89)	(95)
Vertigo	252	253	233	265	269	282	313	293	285
	(12)	(13)	(12)	(14)	(14)	(15)	(16)	(15)	(15)
Chronic Conditions									
Angina	168	166	128	134	115	108	101	76	104
	(8)	(8)	(6)	(7)	(6)	(6)	(5)	(4)	(5)
Asthma	626	630	488	608	573	588	608	639	616
	(31)	(31)	(25)	(31)	(30)	(31)	(32)	(33)	(32)
COPD/bronchiectasis	235	234	210	245	227	250	269	257	238
	(12)	(12)	(11)	(13)	(12)	(13)	(14)	(13)	(12)
Congestive heart failure	65	60	55	40	44	49	65	57	55

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
	(3)	(3)	(3)	(2)	(2)	(3)	(3)	(3)	(3)
Convulsions/epilepsy	1,792	1,652	1,631	1,729	1,583	1,623	1,664	1,749	1,683
	(88)	(82)	(83)	(89)	(82)	(85)	(87)	(91)	(88)
Diabetes complications[2]	883	889	808	884	850	824	785	842	766
	(43)	(44)	(41)	(45)	(44)	(43)	(41)	(44)	(40)
Hypertension	214	232	152	180	192	186	178	195	181
	(10)	(12)	(8)	(9)	(10)	(10)	(9)	(10)	(9)
Iron def. anaemia	121	119	102	100	109	112	153	143	158
	(6)	(6)	(5)	(5)	(6)	(6)	(8)	(7)	(8)
ACS medical hospitalisations (emergency)	14,172 (694)	13,930 (695)	13,176 (668)	13,732 (706)	13,045 (678)	13,097 (684)	12,860 (673)	13,161 (687)	12,950 (675)
All Med emergency hospitalisations	29,219 (1,432)	28,030 (1,399)	26,712 (1,355)	28,029 (1,442)	27,215 (1,414)	27,933 (1,460)	27,484 (1,438)	28,122 (1,468)	28,868 (1,504)
Total emergency hospitalisations	68,688 (3,365)	65,473 (3,267)	62,659 (3,178)	63,062 (3,245)	60,742 (3,156)	60,806 (3,178)	59,457 (3,110)	59,360 (3,100)	60,333 (3,142)

Source: Hospitalisations from HIPE 2009-2017 Emergency in-patient hospitalisations among adults aged 16-44 years in adult acute public hospitals with a minimum one night stay in hospital. Excludes hospitalisations of care transferred in from another acute hospital. Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).
OECD 2010 Standard population used in the estimation of age-sex standardised rates.

Notes.
1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 16-44 years

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	2,550	2,389	2,018	2,149	1,974	1,894	1,822	1,790	1,812
	(125)	(119)	(102)	(111)	(103)	(99)	(95)	(93)	(94)
Chest pain non-specific	5,651	5,534	5,151	4,406	4,095	3,548	3,183	2,769	2,820
	(277)	(276)	(261)	(227)	(213)	(185)	(167)	(145)	(147)
Deep vein thrombosis	2,233	2,308	1,530	1,791	1,518	1,731	1,426	1,483	1,647
	(109)	(115)	(78)	(92)	(79)	(90)	(75)	(77)	(86)
LRI (other)	4,203	3,874	3,607	4,003	3,819	4,093	4,392	5,007	4,074
	(206)	(193)	(183)	(206)	(198)	(214)	(230)	(261)	(212)
Migraine/headache	5,882	6,217	6,336	5,990	5,399	6,080	5,708	5,229	5,532
	(288)	(310)	(321)	(308)	(280)	(318)	(299)	(273)	(288)
Pneumonia/ influenza	7,184	5,998	5,870	5,071	5,213	5,533	5,675	7,341	6,199
	(352)	(299)	(298)	(261)	(271)	(289)	(297)	(383)	(323)
Syncope	2,785	3,386	2,468	2,926	2,832	2,756	2,481	2,645	2,705
	(136)	(169)	(125)	(151)	(147)	(144)	(130)	(138)	(141)
TIA	395	458	401	391	402	314	333	206	315
	(19)	(23)	(20)	(20)	(21)	(16)	(17)	(11)	(16)
UTI/pyelonephritis	4,628	5,261	4,919	5,024	5,403	6,389	6,821	6,655	8,980
	(227)	(263)	(249)	(259)	(281)	(334)	(357)	(348)	(468)
Vertigo	782	798	796	697	744	771	896	800	796
	(38)	(40)	(40)	(36)	(39)	(40)	(47)	(42)	(41)
Chronic Conditions									
Angina	677	626	584	434	424	512	393	313	342
	(33)	(31)	(30)	(22)	(22)	(27)	(21)	(16)	(18)
Asthma	2,222	2,657	1,819	2,242	1,898	2,159	2,432	2,122	2,011
	(109)	(133)	(92)	(115)	(99)	(113)	(127)	(111)	(105)
COPD/bronchiectasis	1,318	1,599	1,194	1,272	1,259	1,508	1,458	1,577	1,298
	(65)	(80)	(61)	(65)	(65)	(79)	(76)	(82)	(68)
Congestive heart failure	674	412	529	531	507	975	735	485	513
	(33)	(21)	(27)	(27)	(26)	(51)	(38)	(25)	(27)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Convulsions/epilepsy	6,288	6,378	6,149	6,058	5,276	6,158	6,511	6,346	6,319
	(308)	(318)	(312)	(312)	(274)	(322)	(341)	(331)	(329)
Diabetes complications[2]	4,146	4,240	4,902	3,572	4,603	3,615	4,791	4,672	3,272
	(203)	(212)	(249)	(184)	(239)	(189)	(251)	(244)	(170)
Hypertension	797	969	592	699	652	671	657	621	643
	(39)	(48)	(30)	(36)	(34)	(35)	(34)	(32)	(33)
Iron def. anaemia	599	620	524	454	377	394	538	521	650
	(29)	(31)	(27)	(23)	(20)	(21)	(28)	(27)	(34)
ACS medical hospitalisations (emergency)	53,014 (2,597)	53,724 (2,681)	49,389 (2,505)	47,710 (2,455)	46,395 (2,410)	49,101 (2,566)	50,252 (2,629)	50,582 (2,641)	49,928 (2,601)
All Med emergency hospitalisations	160,524 (7,865)	155,216 (7,745)	147,559 (7,484)	145,053 (7,464)	139,937 (7,270)	146,041 (7,632)	149,734 (7,833)	156,355 (8,164)	162,059 (8,441)
Total emergency hospitalisations	326,814 (16,012)	310,333 (15,486)	290,548 (14,737)	284,351 (14,631)	273,805 (14,225)	279,204 (14,591)	280,407 (14,668)	284,186 (14,839)	290,528 (15,132)

Source: Hospitalisations from HIPE 2009-2017 Emergency in-patient hospitalisations among adults aged 16-44 years in adult acute public hospitals with a minimum one night stay in hospital. Includes hospitalisations of care transferred in from another acute hospital. Population estimates were obtained from the Central Statistics Office (PEA11. Population estimates from 1926 by Single Year of Age, Sex and Year Accessed 1 February 2019).

Notes.
1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 45-64 years

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	1,987	1,934	1,814	1,964	1,797	1,807	1,791	1,751	1,751
	(198)	(189)	(175)	(186)	(168)	(167)	(162)	(155)	(152)
Chest pain non-specific	4,382	4,562	4,423	4,306	3,761	3,415	3,242	3,054	3,125
	(438)	(446)	(426)	(409)	(352)	(315)	(294)	(271)	(271)
Deep vein thrombosis	376	438	330	316	285	301	288	277	287
	(38)	(43)	(32)	(30)	(27)	(28)	(26)	(25)	(25)
LRI (other)	1,427	1,334	1,402	1,669	1,562	1,687	1,720	1,944	1,714
	(143)	(131)	(135)	(158)	(146)	(156)	(156)	(172)	(149)
Migraine/headache	898	992	1,088	1,155	1,115	1,214	1,139	1,081	1,215
	(90)	(97)	(105)	(110)	(104)	(112)	(103)	(96)	(105)
Pneumonia/ influenza	1,339	1,292	1,399	1,384	1,538	1,452	1,657	1,890	1,941
	(134)	(126)	(135)	(131)	(144)	(134)	(150)	(168)	(168)
Syncope	1,113	1,158	1,155	1,322	1,315	1,276	1,420	1,273	1,422
	(111)	(113)	(111)	(125)	(123)	(118)	(129)	(113)	(123)
TIA	612	637	573	610	628	579	563	531	557
	(61)	(62)	(55)	(58)	(59)	(53)	(51)	(47)	(48)
UTI/pyelonephritis	858	917	951	1,082	1,261	1,373	1,310	1,629	1,677
	(86)	(90)	(92)	(103)	(118)	(127)	(119)	(144)	(145)
Vertigo	486	442	439	559	553	571	590	585	615
	(49)	(43)	(42)	(53)	(52)	(53)	(53)	(52)	(53)
Chronic Conditions									
Angina	1,443	1,446	1,250	1,189	1,046	1,032	1,016	964	879
	(144)	(141)	(120)	(113)	(98)	(95)	(92)	(85)	(76)
Asthma	474	409	451	434	471	440	499	565	529
	(47)	(40)	(43)	(41)	(44)	(41)	(45)	(50)	(46)
COPD/bronchiectasis	2,334	2,320	2,399	2,607	2,691	2,706	2,659	2,743	2,805
	(233)	(227)	(231)	(247)	(252)	(250)	(241)	(243)	(243)
Congestive heart failure	626	555	530	515	514	471	516	520	525
	(63)	(54)	(51)	(49)	(48)	(43)	(47)	(46)	(46)

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Convulsions/epilepsy	1,228 (123)	1,187 (116)	1,141 (110)	1,265 (120)	1,214 (114)	1,161 (107)	1,182 (107)	1,214 (108)	1,230 (107)
Dab. complications2	993 (99)	1,005 (98)	913 (88)	945 (90)	973 (91)	994 (92)	745 (68)	769 (68)	776 (67)
Hypertension	419 (42)	362 (35)	336 (32)	300 (28)	283 (27)	343 (32)	367 (33)	374 (33)	352 (31)
Iron def. anaemia	142 (14)	163 (16)	126 (12)	142 (13)	127 (12)	171 (16)	184 (17)	211 (19)	201 (17)
ACS medical hospitalisations (emergency)	21,137 (2,111)	21,153 (2,070)	20,720 (1,996)	21,764 (2,065)	21,134 (1,980)	20,993 (1,937)	20,888 (1,893)	21,375 (1,895)	21,601 (1,874)
All Med emergency hospitalisations	40,531 (4,048)	40,394 (3,953)	39,804 (3,833)	41,904 (3,977)	41,348 (3,874)	41,758 (3,853)	42,256 (3,829)	43,405 (3,848)	44,182 (3,833)
Total emergency hospitalisations	63,713 (6,363)	63,249 (6,189)	61,728 (5,945)	63,850 (6,059)	62,843 (5,889)	63,276 (5,838)	64,086 (5,807)	66,001 (5,851)	67,089 (5,820)

Source: Hospitalisations from HIPE 2009-2017

1. Under-reporting of activity from smaller hospital in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 45-64 years

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	9,049	8,517	7,537	7,584	6,862	7,195	6,991	6,890	6,680
	(904)	(833)	(726)	(720)	(643)	(664)	(633)	(611)	(579)
Chest pain non-specific	12,904	12,476	11,962	10,755	9,182	9,034	8,821	8,024	8,083
	(1,289)	(1,221)	(1,152)	(1,021)	(860)	(833)	(799)	(711)	(701)
Deep vein thrombosis	2,525	3,047	2,217	2,224	1,838	1,806	1,869	1,676	1,570
	(252)	(298)	(214)	(211)	(172)	(167)	(169)	(149)	(136)
LRI (other)	8,964	8,131	8,097	9,741	9,105	10,554	10,886	12,070	11,360
	(895)	(796)	(780)	(924)	(853)	(974)	(986)	(1,070)	(985)
Migraine/headache	3,175	3,657	3,852	4,061	3,570	4,163	4,091	3,685	3,954
	(317)	(358)	(371)	(385)	(335)	(384)	(371)	(327)	(343)
Pneumonia/ influenza	13,205	13,562	13,412	12,258	13,570	14,251	14,868	16,587	18,066
	(1,319)	(1,327)	(1,292)	(1,163)	(1,272)	(1,315)	(1,347)	(1,470)	(1,567)
Syncope	5,387	5,795	5,491	5,645	5,277	6,590	6,584	5,318	6,683
	(538)	(567)	(529)	(536)	(494)	(608)	(597)	(471)	(580)
TIA	2,772	3,117	2,513	2,513	2,862	2,477	2,302	2,117	2,242
	(277)	(305)	(242)	(238)	(268)	(229)	(209)	(188)	(194)
UTI/pyelonephritis	5,682	6,061	7,134	6,902	8,198	9,426	8,963	10,882	11,693
	(567)	(593)	(687)	(655)	(768)	(870)	(812)	(965)	(1,014)
Vertigo	1,849	1,611	1,729	1,916	1,859	1,844	2,024	1,879	2,031
	(185)	(158)	(167)	(182)	(174)	(170)	(183)	(167)	(176)
Chronic Conditions									
Angina	7,444	7,322	7,115	6,260	5,550	5,436	4,866	4,440	4,135
	(743)	(716)	(685)	(594)	(520)	(502)	(441)	(394)	(359)
Asthma	2,360	2,034	2,077	2,081	1,901	2,220	2,495	2,525	2,871
	(236)	(199)	(200)	(197)	(178)	(205)	(226)	(224)	(249)
COPD/bronchiectasis	19,078	17,509	17,248	17,922	19,028	18,673	19,721	18,529	20,105
	(1,905)	(1,713)	(1,661)	(1,701)	(1,783)	(1,723)	(1,787)	(1,643)	(1,744)
Congestive heart failure	6,556	5,753	5,156	5,537	5,290	5,338	5,493	5,888	5,513
	(655)	(563)	(497)	(525)	(496)	(492)	(498)	(522)	(478)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Convulsions/epilepsy	8,456	7,384	6,008	7,416	6,733	6,348	7,055	6,677	7,059
	(844)	(723)	(579)	(704)	(631)	(586)	(639)	(592)	(612)
Dab. complications2	11,031	11,788	9,713	10,136	9,490	11,975	9,096	8,320	7,734
	(1,102)	(1,153)	(935)	(962)	(889)	(1,105)	(824)	(738)	(671)
Hypertension	1,604	1,440	1,408	932	980	1,216	1,430	1,471	1,246
	(160)	(141)	(136)	(88)	(92)	(112)	(130)	(130)	(108)
Iron def. anaemia	880	1,157	758	836	769	905	1,028	1,410	1,098
	(88)	(113)	(73)	(79)	(72)	(83)	(93)	(125)	(95)
ACS medical hospitalisations (emergency)	122,921 (12,276)	120,361 (11,778)	113,427 (10,924)	114,719 (10,887)	112,064 (10,501)	119,451 (11,021)	118,583 (10,745)	118,388 (10,495)	122,123 (10,594)
All Med emergency hospitalisations	322,873 (32,244)	313,871 (30,713)	302,144 (29,099)	307,680 (29,198)	301,199 (28,223)	307,719 (28,390)	330,007 (29,903)	330,888 (29,333)	338,645 (29,378)
Total emergency hospitalisations	497,787	483,162	463,223	465,262	455,820	464,400	494,788	497,082	509,035
	(49,712)	(47,279)	(44,612)	(44,153)	(42,711)	(42,845)	(44,834)	(44,066)	(44,159)

Source: Hospitalisations from HIPE 2009-2017

1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 65-84 years

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	3,476	3,267	3,306	3,490	3,425	3,567	3,529	3,471	3,478
	(781)	(712)	(698)	(712)	(674)	(677)	(647)	(617)	(599)
Chest pain non-specific	2,692	2,794	2,858	2,998	2,815	2,684	2,704	2,475	2,620
	(605)	(609)	(604)	(612)	(554)	(509)	(496)	(440)	(452)
Deep vein thrombosis	509	502	453	429	418	388	418	378	357
	(114)	(109)	(96)	(88)	(82)	(74)	(77)	(67)	(62)
LRI (other)	3,581	3,159	3,448	4,341	4,346	4,617	5,101	5,103	5,132
	(805)	(688)	(728)	(885)	(855)	(876)	(935)	(907)	(885)
Migraine/headache	371	428	474	508	584	609	505	543	650
	(83)	(93)	(100)	(104)	(115)	(116)	(93)	(97)	(112)
Pneumonia/ influenza	3,432	3,403	3,745	3,947	4,091	4,102	4,326	5,175	5,541
	(771)	(742)	(791)	(805)	(805)	(779)	(793)	(920)	(955)
Syncope	2,224	2,233	2,462	2,938	2,980	2,967	2,973	3,064	2,986
	(500)	(487)	(520)	(599)	(586)	(563)	(545)	(545)	(515)
TIA	1,452	1,496	1,419	1,500	1,451	1,380	1,470	1,409	1,381
	(326)	(326)	(300)	(306)	(285)	(262)	(270)	(250)	(238)
UTI/pyelonephritis	2,347	2,476	2,760	3,151	3,665	3,966	4,067	4,797	5,007
	(528)	(540)	(583)	(643)	(721)	(753)	(746)	(853)	(863)
Vertigo	537	488	623	642	700	763	853	966	1,038
	(121)	(106)	(132)	(131)	(138)	(145)	(156)	(172)	(179)
Chronic Conditions									
Angina	1,890	1,842	1,690	1,560	1,496	1,400	1,399	1,226	1,209
	(425)	(401)	(357)	(318)	(294)	(266)	(257)	(218)	(208)
Asthma	251	235	229	272	260	264	300	317	307
	(56)	(51)	(48)	(55)	(51)	(50)	(55)	(56)	(53)
COPD/bronchiectasis	6,635	6,269	6,604	7,402	7,576	7,650	8,052	8,647	8,412
	(1,491)	(1,366)	(1,395)	(1,510)	(1,490)	(1,452)	(1,476)	(1,537)	(1,450)
Congestive heart failure	3,405	3,303	3,018	3,114	3,174	3,138	3,231	3,144	3,264
	(765)	(720)	(638)	(635)	(624)	(596)	(592)	(559)	(563)

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Convulsions/epilepsy	839	908	885	939	915	939	1,014	1,039	997
	(189)	(198)	(187)	(192)	(180)	(178)	(186)	(185)	(172)
Diabetes complications[2]	1,503	1,434	1,386	1,445	1,452	1,381	897	976	1,031
	(338)	(312)	(293)	(295)	(286)	(262)	(164)	(174)	(178)
Hypertension	387	340	267	348	285	307	322	346	385
	(87)	(74)	(56)	(71)	(56)	(58)	(59)	(62)	(66)
Iron def. anaemia	409	334	313	332	396	381	489	504	609
	(92)	(73)	(66)	(68)	(78)	(72)	(90)	(90)	(105)
ACS medical hospitalisations	35,940	34,911	35,940	39,356	40,029	40,503	41,650	43,580	44,404
(emergency)	(8,078)	(7,607)	(7,593)	(8,028)	(7,873)	(7,688)	(7,637)	(7,747)	(7,653)
All Med emergency	66,492	65,939	66,709	72,650	74,014	75,548	78,250	81,033	84,549
hospitalisations	(14,944)	(14,369)	(14,094)	(14,819)	(14,557)	(14,340)	(14,348)	(14,406)	(14,573)
Total emergency hospitalisations	88,315	87,582	87,424	93,246	94,948	96,626	99,950	103,596	107,552
	(19,849)	(19,085)	(18,470)	(19,020)	(18,674)	(18,341)	(18,327)	(18,417)	(18,538)

Source: Hospitalisations from HIPE 2009-2017

1. Under-reporting of activity from smaller hospital in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 65-84 years

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	24,428	21,650	19,976	20,631	18,943	20,530	19,087	18,114	18,080
	(5,490)	(4,718)	(4,220)	(4,208)	(3,726)	(3,897)	(3,500)	(3,220)	(3,116)
Chest pain non-specific	10,473	10,518	10,044	9,767	9,392	9,073	9,652	8,251	8,908
	(2,354)	(2,292)	(2,122)	(1,992)	(1,847)	(1,722)	(1,770)	(1,467)	(1,535)
Deep vein thrombosis	4,328	4,722	3,927	3,782	2,997	2,980	3,381	2,751	2,600
	(973)	(1,029)	(830)	(771)	(589)	(566)	(620)	(489)	(448)
LRI (other)	33,447	31,364	31,151	38,235	38,457	42,259	47,405	47,260	46,675
	(7,517)	(6,834)	(6,581)	(7,799)	(7,564)	(8,021)	(8,692)	(8,402)	(8,045)
Migraine/headache	1,772	2,143	2,136	2,101	2,341	2,523	2,063	2,508	2,832
	(398)	(467)	(451)	(429)	(460)	(479)	(378)	(446)	(488)
Pneumonia/ influenza	50,231	47,717	51,149	47,881	49,156	51,982	55,870	61,078	64,880
	(11,290)	(10,398)	(10,806)	(9,767)	(9,668)	(9,867)	(10,245)	(10,858)	(11,183)
Syncope	17,140	17,949	20,535	21,816	21,206	22,289	22,406	22,615	20,526
	(3,852)	(3,911)	(4,338)	(4,450)	(4,171)	(4,231)	(4,108)	(4,020)	(3,538)
TIA	9,912	9,444	9,472	9,229	8,084	8,173	8,367	7,784	7,450
	(2,228)	(2,058)	(2,001)	(1,883)	(1,590)	(1,551)	(1,534)	(1,384)	(1,284)
UTI/pyelonephritis	26,770	32,180	32,171	35,028	40,473	47,136	49,126	57,371	57,659
	(6,017)	(7,012)	(6,797)	(7,145)	(7,960)	(8,947)	(9,008)	(10,199)	(9,938)
Vertigo	2,410	2,574	3,010	2,749	3,136	3,483	3,604	4,116	4,577
	(542)	(561)	(636)	(561)	(617)	(661)	(661)	(732)	(789)
Chronic Conditions									
Angina	12,552	12,258	10,568	9,168	9,057	8,514	8,311	6,828	6,325
	(2,821)	(2,671)	(2,233)	(1,870)	(1,781)	(1,616)	(1,524)	(1,214)	(1,090)
Asthma	1,699	1,879	1,420	1,604	1,498	1,769	2,083	1,814	1,782
	(382)	(409)	(300)	(327)	(295)	(336)	(382)	(322)	(307)
COPD/bronchiectasis	66,512	63,651	63,169	67,593	66,854	69,949	73,486	79,969	77,377
	(14,949)	(13,870)	(13,346)	(13,788)	(13,149)	(13,277)	(13,475)	(14,216)	(13,337)
Congestive heart failure	43,110	41,759	36,776	37,032	36,030	37,480	38,549	34,025	35,982
	(9,689)	(9,100)	(7,770)	(7,554)	(7,086)	(7,114)	(7,069)	(6,049)	(6,202)

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Convulsions/epilepsy	8,535	8,545	7,969	8,893	7,761	8,143	9,344	9,038	8,347
	(1,918)	(1,862)	(1,684)	(1,814)	(1,526)	(1,546)	(1,713)	(1,607)	(1,439)
Diabetes complications[2]	21,820	20,390	18,934	21,269	21,361	20,254	12,888	13,569	13,730
	(4,904)	(4,443)	(4,000)	(4,338)	(4,201)	(3,845)	(2,363)	(2,412)	(2,366)
Hypertension	1,812	2,030	1,291	1,608	1,097	1,217	1,300	1,318	1,514
	(407)	(442)	(273)	(328)	(216)	(231)	(238)	(234)	(261)
Iron def. anaemia	3,555	3,083	2,595	2,709	2,928	3,007	3,833	3,543	4,266
	(799)	(672)	(548)	(553)	(576)	(571)	(703)	(630)	(735)
ACS medical hospitalisations (emergency)	340,506 (76,531)	333,856 (72,749)	326,293 (68,937)	341,095 (69,577)	340,771 (67,022)	360,761 (68,478)	370,755 (67,984)	381,952 (67,901)	383,510 (66,101)
All Med emergency hospitalisations	781,915 (175,740)	797,596 (173,801)	770,816 (162,853)	785,881 (160,305)	784,018 (154,199)	820,963 (155,832)	867,326 (159,038)	878,681 (156,206)	900,417 (155,195)
Total emergency hospitalisations	1,042,184 (234,237)	1,050,133 (228,831)	1,017,820 (215,038)	1,015,023 (207,046)	1,023,145 (201,229)	1,061,109 (201,416)	1,115,136 (204,477)	1,136,933 (202,116)	1,163,854 (200,601)

Source: Hospitalisations from HIPE 2009-2017

1. Under-reporting of activity from smaller hospital in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 85+ years

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	633	648	630	678	616	674	680	674	690
	(1,173)	(1,154)	(1,082)	(1,133)	(1,014)	(1,076)	(1,048)	(1,001)	(990)
Chest pain non-specific	270	321	298	344	388	299	306	328	312
	(500)	(572)	(512)	(575)	(639)	(477)	(471)	(487)	(448)
Deep vein thrombosis	128	119	109	121	124	119	117	81	93
	(237)	(212)	(187)	(202)	(204)	(190)	(180)	(120)	(133)
LRI (other)	1,420	1,409	1,542	2,035	1,996	2,048	2,304	2,350	2,362
	(2,631)	(2,510)	(2,648)	(3,402)	(3,286)	(3,268)	(3,549)	(3,490)	(3,389)
Migraine/headache	33	51	48	68	68	68	69	65	79
	(61)	(91)	(82)	(114)	(112)	(109)	(106)	(97)	(113)
Pneumonia/ influenza	1,619	1,655	1,700	1,999	2,114	1,977	2,093	2,323	2,483
	(3,000)	(2,948)	(2,919)	(3,342)	(3,480)	(3,155)	(3,224)	(3,450)	(3,563)
Syncope	648	737	794	934	953	1,007	975	1,030	1,000
	(1,201)	(1,313)	(1,363)	(1,561)	(1,569)	(1,607)	(1,502)	(1,530)	(1,435)
TIA	400	422	420	411	400	454	400	444	412
	(741)	(752)	(721)	(687)	(659)	(725)	(616)	(659)	(591)
UTI/pyelonephritis	1,123	1,312	1,426	1,671	1,878	2,005	2,132	2,362	2,593
	(2,081)	(2,337)	(2,448)	(2,794)	(3,092)	(3,200)	(3,284)	(3,508)	(3,721)
Vertigo	80	82	87	122	108	142	131	153	158
	(148)	(146)	(149)	(204)	(178)	(227)	(202)	(227)	(227)
Chronic Conditions									
Angina	275	238	232	208	194	161	160	181	145
	(510)	(424)	(398)	(348)	(319)	(257)	(246)	(269)	(208)
Asthma	22	23	27	31	27	26	29	40	38
	(41)	(41)	(46)	(52)	(44)	(41)	(45)	(59)	(55)
COPD/bronchiectasis	1,109	1,168	1,263	1,399	1,442	1,331	1,357	1,485	1,450
	(2,055)	(2,081)	(2,169)	(2,339)	(2,374)	(2,124)	(2,091)	(2,205)	(2,081)
Congestive heart failure	1,254	1,456	1,226	1,507	1,525	1,508	1,485	1,512	1,631
	(2,323)	(2,594)	(2,105)	(2,519)	(2,511)	(2,,407)	(2,288)	(2,246)	(2,340)

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Convulsions/epilepsy	141 (261)	178 (317)	179 (307)	200 (334)	212 (349)	169 (270)	202 (311)	227 (337)	245 (352)
Diabetes complications[2]	225 (417)	245 (436)	264 (453)	267 (446)	285 (469)	276 (440)	187 (288)	178 (264)	201 (288)
Hypertension	66 (122)	61 (109)	43 (74)	60 (100)	51 (84)	68 (109)	76 (117)	73 (108)	72 (103)
Iron def. anaemia	140 (259)	133 (237)	144 (247)	181 (303)	151 (249)	153 (244)	198 (305)	205 (304)	225 (323)
ACS medical hospitalisations (emergency)	9,586 (17,760)	10,258 (18,272)	10,432 (17,911)	12,236 (20,456)	12,532 (20,633)	12,485 (19,925)	12,901 (19,875)	13,711 (20,363)	14,189 (20,359)
All Med emergency hospitalisations	18,015 (33,377)	18,950 (33,755)	19,229 (33,016)	22,090 (36,929)	22,938 (37,765)	23,027 (36,749)	24,151 (37,206)	25,357 (37,659)	26,747 (38,378)
Total emergency hospitalisations	22,993 (42,600)	24,038 (42,818)	24,089 (41,360)	26,900 (44,970)	27,888 (45,914)	27,909 (44,540)	29,053 (44,758)	30,629 (45,489)	32,091 (46,046)

Source: Hospitalisations from HIPE 2009-2017

1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Bed days used by overnight emergency hospitalisations for ambulatory care sensitive medical conditions, count and (rate/100,000 population), 2009-2017, 85+ years

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
Acute Conditions									
Cardiac dysrhythmia	6,706	7,377	4,890	5,665	5,516	6,106	5,854	5,329	6,338
	(12,425)	(13,140)	(8,396)	(9,471)	(9,081)	(9,745)	(9,019)	(7,914)	(9,094)
Chest pain non-specific	1,121	1,535	1,143	1,376	1,516	1,393	1,281	1,527	1,238
	(2,077)	(2,734)	(1,963)	(2,300)	(2,496)	(2,223)	(1,973)	(2,268)	(1,776)
Deep vein thrombosis	1,165	1,310	969	1,370	1,140	1,290	1,229	868	875
	(2,158)	(2,333)	(1,664)	(2,290)	(1,877)	(2,059)	(1,893)	(1,289)	(1,256)
LRI (other)	15,823	16,093	18,070	22,251	22,329	23,167	27,231	26,254	26,988
	(29,316)	(28,666)	(31,026)	(37,198)	(36,762)	(36,973)	(41,951)	(38,991)	(38,724)
Migraine/headache	181	278	718	344	394	340	386	361	404
	(335)	(495)	(1,233)	(575)	(649)	(543)	(595)	(536)	(580)
Pneumonia/ influenza	26,959	24,592	26,729	28,170	28,653	28,456	30,199	32,871	35,556
	(49,948)	(43,805)	(45,893)	(47,094)	(47,174)	(45,413)	(46,524)	(48,819)	(51,018)
Syncope	6,756	8,620	8,431	10,412	9,910	11,053	11,133	9,802	9,672
	(12,517)	(15,354)	(14,476)	(17,406)	(16,316)	(17,640)	(17,151)	(14,557)	(13,878)
TIA	4,754	4,521	3,972	3,180	3,374	3,735	3,539	3,998	2,853
	(8,808)	(8,053)	(6,820)	(5,316)	(5,555)	(5,961)	(5,452)	(5,938)	(4,094)
UTI/pyelonephritis	15,892	17,815	20,004	24,420	28,464	29,476	29,275	33,530	33,977
	(29,444)	(31,733)	(34,346)	(40,825)	(46,863)	(47,041)	(45,100)	(49,797)	(48,752)
Vertigo	642	596	491	742	812	773	692	998	1,179
	(1,189)	(1,062)	(843)	(1,240)	(1,337)	(1,234)	(1,066)	(1,482)	(1,692)
Chronic Conditions									
Angina	1,693	1,403	1,628	1,313	1,410	1,492	1,110	955	934
	(3,137)	(2,499)	(2,795)	(2,195)	(2,321)	(2,381)	(1,710)	(1,418)	(1,340)
Asthma	169	170	248	236	424	185	498	312	436
	(313)	(303)	(426)	(395)	(698)	(295)	(767)	(463)	(626)
COPD/bronchiectasis	13,613	14,420	14,810	14,879	16,315	15,260	15,465	15,593	16,684
	(25,221)	(25,686)	(25,428)	(24,874)	(26,861)	(24,354)	(23,825)	(23,158)	(23,939)
Congestive heart failure	17,489	21,102	16,395	21,348	20,705	20,927	18,765	19,388	20,470
	(32,403)	(37,588)	(28,150)	(35,689)	(34,088)	(33,398)	(28,909)	(28,794)	(29,372)
Convulsions/epilepsy	1,252	2,155	1,844	1,867	2,302	1,662	1,926	2,469	2,841

	2009[1]	2010[1]	2011[1]	2012	2013	2014	2015	2016	2017
	(2,320)	(3,839)	(3,166)	(3,121)	(3,790)	(2,652)	(2,967)	(3,667)	(4,076)
Diabetes complications[2]	4,012	3,177	3,819	4,158	4,172	4,004	2,820	2,951	2,529
	(7,433)	(5,659)	(6,557)	(6,951)	(6,869)	(6,390)	(4,344)	(4,383)	(3,629)
Hypertension	632	362	317	436	285	438	593	387	405
	(1,171)	(645)	(544)	(729)	(469)	(699)	(914)	(575)	(581)
Iron def. anaemia	1,322	1,668	1,219	1,511	1,371	1,635	1,568	1,741	1,713
	(2,449)	(2,971)	(2,093)	(2,526)	(2,257)	(2,609)	(2,416)	(2,586)	(2,458)
ACS medical hospitalisations	120,181	127,194	125,697	143,678	149,092	151,392	153,564	159,334	165,092
(emergency)	(222,665)	(226,566)	(215,818)	(240,196)	(245,463)	(241,609)	(236,576)	(236,636)	(236,885)
All Med emergency hospitalisations	273,705	286,983	281,224	307,616	322,923	329,232	341,139	345,764	359,960
	(507,105)	(511,192)	(482,854)	(514,262)	(531,657)	(525,426)	(525,549)	(513,513)	(516,494)
Total emergency hospitalisations	342,148	358,648	351,441	373,632	392,049	396,947	410,070	418,615	432,091
	(633,913)	(638,846)	(603,415)	(624,625)	(645,465)	(633,493)	(631,742)	(621,709)	(619,992)

Source: Hospitalisations from HIPE 2009-2017

1. Under-reporting of activity from smaller hospitals in earlier years.
2. Re-coding of diabetes complications; pre-2015 cannot be compared with post 2015.

Abbreviations. ACS: ambulatory care sensitive; Med: Medicine; LRI: lower respiratory infection; TIA: transient ischaemic attack; UTI: urinary tract infection

Appendix 7.1 Topic guide for acute medicine physicians working in the AMAU

1. Firstly, can you tell me what your current role is and how long you have worked in it?

2. Do you know when the AMAU actually opened here in [site name]?

A. OPERATION OF THE UNIT

3. On a typical day in the Unit, what type of patients do you see here, and is it what you expect?

PROBES

- If not, why not?
- Any protocol for who should/should not be seen? Who uses the 'protocol'? Is the protocol adhered to?

4. Broadly speaking what aspects of the AMAU here are working well? And not working well?

PROBES

- How is staffing affecting the ability of the AMAU to operate?
- Senior decision maker present? (who is classed as a SDM)

B. INTERACTION OF THE AMAU WITH THE BROADER SYSTEM

(AMAU and ED)

5. Can you describe how the AMAU integrates with the ED?

PROBES

- How are patients actually referred to the AMAU from the ED, and who makes this decision and where (front door streaming)? Are appropriate patients (conditions, acuity) streamed to the Unit, and if not, why?
- Have there been any challenges in this regard and how have these been addressed?
- Do all patients go through the ED? Direct from ambulance?

(AMAU and wider hospital services)

6. In terms of the way AM physicians practice medicine, how do you integrate this with the General Internal Medicine Service?

7. From the perspective of the workings of the AMAU how would you describe the availability of outpatient appointments and rapid access clinics in the hospital for patients

seen in the AMAU?

8. Similarly what about access to same day diagnostics and laboratory service?

PROBES

- Are there specific clinical conditions whereby improved access to same day diagnostics would mitigate need to admit a patient?

9. A major focus of the Programme was on the HSE's integrated discharge planning standards and initiative such as nurse-facilitated discharge, charting estimated date of discharge, discharge planner to achieve these standards. Are you familiar with these standards?

10. Can you describe the impact of any of these on the working of the AMAU and flow of medical patients through the hospital in general?

11. Are there any ambulatory care pathways in the AMAU? How do they work in the AMAU?

(AMAU and GP)

12. What about GPs in the vicinity of [site name]. How would you describe the relationship between GPs and the AMAU?

PROBES

- Refer directly in to the Unit? With a referral letter? If not/why not? Changed recently?
- Is there a GP liaison committee? What's its role?
- Are GPs able to telephone and speak to a medical consultant about a patient they have concerns about? How does that work?

13. What type of patients do GPs refer into the AMAU, and why? (if direct referral is available to them)

PROBES

- What the options are for local GPs, if they have a concern about a medical patient in their practice?
- Rapid access clinics, outpatient appointments (rapid access OPD for new patients), access to diagnostics?
- Liaison between GP and the case manager to choose appropriate pathway for AM patient?

- How do these options (or lack thereof) influence the working of the Unit?

(AMAU and community services)

14. What is your experience of the community services available in this region? How does this affect the work of the Unit and the management of medical patients in general?

C. IMPACT OF THE UNIT ON PATIENT CARE

15. How has the AMAU had an impact on medical patients here?

PROBES

- What is it about the AMAU that improves care for AM patients?
- Does it work equally well for everyone?
- Are these the patients that you are seeing in this AMAU, and if not why not?

16. Do you think there is a better way than the AMAU of improving care for medical patients presenting to this hospital?

D. IMPLEMENTATION AND SUSTAINABILITY

17. How have hospital management supported the Programme? When an issue arises, how have you found the response from hospital management? Can you provide examples?

18. What about your medical colleagues? How have you found their role in implementing the AMAU?

19. How does the work of the national team influence what you do here?

PROBES

- Supportive?
- Assisting with starting up -funding, resources, and consultant posts?
- Feedback given during the site visits to make changes?
- Data shared?
- Continual process and performance data fed back to sites in terms of NQAIS Clinical, usefulness of it?

20. How good a learning environment is the AMAU, say for new Advanced Nurse Practitioners?

21. What about the AM governance committee? Do you have one? How have you found their role in implementing the AMAU?

22. Do you think Acute Medicine should be a separate discipline, like it is in the UK? How would that change the workings of the Unit?

23. What do you find most challenging about your role as lead AMAU physician/Acute Medicine Physician/CNM?

24. How sustainable is the current model of consultant cover for the AMAU? If not, why not?

25. Do you think the NAMP programme and the AMAU is a 'priority' in your hospital? How can you tell?

PROBES

- What are you competing with for management attention?
- How has this changed over the time you have been here?

26. If another M3/M4 hospital were going to adopt the Programme and introduce an AMAU into their setting, what would be the three key pieces of advice you would give to the team establishing it?