The Incidence of Childhood Type 1 Diabetes in Ireland and the National Childhood Diabetes Register

Abstract:

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Abstract

The incidence of Type 1 diabetes (T1D) in childhood and adolescence is increasing globally with few exceptions. To date limited conflicting data has been available regarding diabetes epidemiology in Ireland. We sought to determine the incidence of T1D in those aged under 15 years in the ROI by establishing a prospective national register of incident cases (Irish Childhood Diabetes National Registry (ICDNR)) using a standardised protocol which includes a measure of case ascertainment using capture-recapture methodology. In the period, 489 new cases were identified. All paediatric centres nationally participated. The directly standardised incidence rate was 27.5 per 100,000 per year (95%CIs: 24.0, 30.9) and 26.0 (95%CIs: 22.7, 29.3) in 2008 and 2009 respectively. The ICDNR is widely acceptable, it has confirmed a high incidence of T1D and is vital to monitor changes in disease incidence, optimise resource utilisation and diabetes management in the Irish population.

Introduction

The aims of this study were to: explore the epidemiology of T1D in the Irish population aged under 15 years; determine if the ROI is an area of high disease incidence by establishing an Irish Childhood Diabetes National Register (ICDNR).

Methods

All 20 centres (1 private facility) nationally caring for children with T1D were identified and invited to participate in the study. Prospective notification of incident cases were made by Paediatricians and Diabetes Nurse Specialists nationally from Jan 1st 2008. The case definition employed was similar to the Diabetes Mondiale- Diamond Study (1991)[7] and national 1997 study[8], requiring that cases: were diagnosed by a physician with T1D before their fifteenth birthday; required daily insulin injections; and were resident in the ROI at diagnosis. Exclusion criteria were: age over 15 years and secondary or non-Type 1 diabetes. On notification of an index case, clinical and demographic data were obtained from the reporting centre for case verification, to exclude multiple reports and facilitate secondary ascertainment. Regular contact was maintained with reporting centres to ensure optimal reporting with a minimum of quarterly contacts with all centres. As some cases over the age of 14 years may present to adult services, adult Endocrinologists nationally were surveyed also. Ethical permission was obtained from the Joint Ethics Committee of the Federated Dublin Voluntary Hospitals. A secondary source of case identification was employed to enable estimation of completeness of ascertainment using capture-recapture methodology[8]. In the ROI, the State provides insulin therapy free to all who require it, independent of means, through a number of support schemes administered by the Primary Care Reimbursement Services (PCRS). Of these the Long-term Illness State-held computerised support scheme for those with diabetes was employed as the secondary source of case identification.

Information regarding new insulin prescriptions for the target group in the time period was requested but declined. Participants were enrolled in the National Register following signed informed consent. A Steering Group was established to oversee the Register. Data collection and management was conducted in line with the National Data Protection Legislation[9]. Crude and category specific incidence rates were calculated for age- and sex- category using revised intercensal estimates of population for 2008 and 2009, provided by the Central Statistics Office (CSO)[10]. The direct method of standardisation, using the common standard population, which assumes equal numbers in each age- and sex- category was employed to permit comparison of incidence rates internationally and across time[11].

Data was analysed using SPSS 16. Confidence intervals (CIâ s) for Crude and category-specific rates were derived from confidence intervals for Poisson counts using STATA Release 9 and for directly standardised rates were calculated using the normal approximation to the binomial using Microsoft Excel. Capture-recapture methodology was used to estimate the degree of completeness of ascertainment[7,8]. The Studentâ s t-test and Chi squared test were used where appropriate to compare groups.

Results

All 20 centres caring for children with diabetes participated and submitted data. The number of new patients identified nationally meeting the diagnostic criteria, were: 248 and 241 in 2008 and 2009 respectively (Table 1). Of these 241 (97.2%) consented to join the National register in 2008, as five migrated and two refused and 236 (97.9%) in 2009 where five patients declined. Minimal anonymous baseline data is available on all notified patients for calculation of incidence rates. Two additional cases, both 14 years old, were identified from Adult services in 2009, and none in 2008. The secondary source of case identification (Long-Term Illness notifications) identified 279 potential cases for 2008 and 226 for 2009 respectively, with 185 common to both sources in 2008 and 165 in 2009. Using capture-recapture methodology the estimated overall case ascertainment was 91.5% (95% CI 87.8-95.5%) for 2008 and 91.5% (95% CI 87.7-95.8%) for 2009, for both sources combined. The completeness of ascertainment of the ICDNR was estimated at 66.3% (95% CI 63.7-69.2%) in 2008 and 73.1% (95% CI 70.0 â 76.4%) in 2009.

Data is not available for ascertainment purposes for those who did not consent to join the ICDNR (n=12). National Incidence rates were calculated for the population. Crude and category specific incidence rates are shown in Table 2. The directly standardised incidence rates of T1D was 27.5 per 100,000 per year (95%CIs: 24.0, 30.9) in 2008 and 26.0 per 100,000 per year (95%CIs: 22.7, 29.3) in 2009 (Table 3). Poisson regression analysis was performed to investigate the effects of age, gender and year on the rate of diabetes. There was no evidence that the overall rate (controlling for age and gender) changed between 2008 and 2009. There was a significant relationship between age and incidence of diabetes (p<0.001) with the 5-9.99 year age group having an incident rate 1.55 (1.2, 1.9) times the 0-4.99 age group and the 10- 14.99 year age group having an incident rate 1.73 (1.4, 2.2) times the 0-4.99 age group. The mean age at diagnosis was 8.5 years (range 0.60 â 14.79) in 2008 and 7.91 years (range 0.88 â 14.81) in 2009 (Table 4). There was no significant difference in the average age at presentation in the two years (t=1.69,df=487,p=.09).

The male to female ratio of cases at 1.19:1 in 2008 showed a slight but not significant excess of males compared to the general population (1.05:1) (X2=1.03, df=1, p=0.32) and at (1.04:1) in 2009 is similar to that of the general population in 2009 (1.05:1). There were no significant differences between the proportions of males and females in the two years (X2=0.71, df=1, p-0.4).

Discussion

Establishing a national childhood diabetes register is complex and time consuming. The ICDNR is valued by patients, families, nurse specialists and doctors caring for children with T1D. 100% of centres participate and consistently return data. There is a high participation rate among parents and young children at over

97%. The main reason for non-participation was migration. This study utilised a comprehensive methodology and would be expected to capture the majority of new cases. In Ireland, children are admitted at diagnosis and cared for by a limited number of paediatricians. The ICDNR maintained regular contact with these centres, undertook multiple crosschecks of data returns and systematically contacted each centre a minimum of 4 times per year to optimise and verify case reporting. Adult centres were surveyed also. The ascertainment levels at 66.3% and 73.1% for the ICDNR appear under-estimated given the comprehensive methodology employed.

A number of limitations and misclassifications were identified in the secondary ascertainment source which would result in an under-estimated ascertainment level for the ICDNR. Non-participants (n=12) in the ICDNR would appear in the PCRS dataset and cases who were registered late with the PCRS would not appear in the incident year resulting in a falsely low ascertainment rate. A number of misclassifications were identified but the researchers were not permitted to validate these cases identified by the secondary source alone to protect patient confidentiality and so ascertainment rates could not be further refined. Had information regarding new insulin prescriptions been made available this would have improved the accuracy of the secondary or re-capture source. In an effort to improve the accuracy of the LTI data provided from the PCRS information was sought from the Local Health Offices, who receive the initial signed notification from clinicians and provide the information to the PCRS. The majority of the Local Health Offices declined to provide data but 4 Local Health Offices covering different geographical regions did participate, acting as a secondary source of case identification at a more local level.

These 4 regions reported fewer incident cases (n = 77) than were identified by the ICDNR (n=80), yielding an ascertainment level of 92.2% for the ICDNR and 99.1% overall for both sources combined. This confirms the authorsâ suspicion that the level of ascertainment by the ICDNR was higher than it would appear from the PCRS data. However, the PCRS data is becoming more reliable and refined through our collaboration. Secondary case ascertainment for those with T1D in Ireland is challenging. A number of potential secondary sources were evaluated. The PCRS data set provides national coverage, is the only computerised system and despite its limitations remains the best source of secondary ascertainment currently available and the most amenable for the application of capture-recapture methodology. The authors are grateful to the PCRS who are collaborating closely to further refine the accuracy of the secondary capture data which is improving with time, increasing from 66.3% in 2008 to 73.1% in 2009.

This study confirms Ireland has a high incidence of T1D in those under 15 years as reported in the 1997 national study[4] Comparing the Irish 2008 directly standardised incidence rate of T1D with European data from 16 Eurodiab centres from 14 countries, who provide complete data for both time periods 1994-8 and 2004-2008, confirms that the IR of ROI remains in the top quartile for Europe[5,6]. The incidence of T1D in the Irish population has increased substantially between 1997 and 2008. from 16.3 to 27.5/100,000/year, Most other areas of Europe have also reported increased incidence in T1D in the time period[5,6]. A number of studies have described the greatest increase in diabetes in children under five[13,14]. We found no evidence that the growth rate was different for each of the genders or age groups. We found the increased incidence of diabetes in all age groups and gender with a significant relationship between age and incidence of diabetes. The Australian National Register also found the mean incidence increased with age, although they reported significantly higher incidence in boys aged 0-4 and 10-14 years[15]. North West Saudi Arabia also reported an increased incidence in the older age groups[16]. In the Irish population there is no statistical evidence to suggest that the average age at diagnosis is decreasing. In the ROI the increased IR is noted with increasing age category, being highest in the 10-14.99 age category, this could possibly reflect an environmental effect 5-10 years previously affecting the older age groups more.

Perhaps, the slight though not significant reduction in IR in 2009 may reflect a stabilisation in the Irish population. It may be that the Irish childhood population has experienced increased environmental pressure on those predisposed to the development of Type 1 diabetes in the recent past and are now approaching incidence rates of our European neighbours. Thus, the Republic of Ireland is confirmed as a high incidence area of Type 1 diabetes. The incidence has risen substantially since 1997 and further monitoring is required to determine if the rate of increase in T1D is stabilising in this population. The ICDNR is acceptable with a high participation rate and provides an important mechanism to monitor future trends in diabetes epidemiology in the Irish population. The ICDNR provides for the first time robust data for health planning and audit purposes. Understanding the cause of Type 1 diabetes and the â environmental agent (s)â that is causing this disease to occur more frequently and at an earlier age in some populations is crucial to ultimately prevent this disease. National disease registries are essential for the provision of reliable information to enable better understanding of this process and the allocation of appropriate resources to manage this important disease.

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Comments: