Journal of Adolescent Health 59 (2016) 354–361

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Original article

Ethnic Minorities Are at Greater Risk for Childhood-Onset Type 2 Diabetes and Poorer Glycemic Control in England and Wales

Amal R. Khanolkar, Ph.D. [a,b,*], Rakesh Amin, M.D. [a], David Taylor-Robinson, Ph.D. [a,c], Russell Viner, Ph.D. [a], Justin Warner, M.D. [d,1], and Terence Stephenson, D.M. [a]

[a] *Institute of Child Health, University College London (UCL), London, United Kingdom*
[b] *Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden*
[c] *Department of Public Health and Policy, University of Liverpool, Liverpool, United Kingdom*
[d] *Department of Child Health, Children's Hospital for Wales, Cardiff, United Kingdom*

Article history: Received March 18, 2016; Accepted May 13, 2016
Keywords: Type 2 diabetes; Ethnicity; Glycemic control; HbA_{1c}; Childhood; Adolescence; Prevalence; England; Wales

A B S T R A C T

Purpose: Ethnic minority children are at a greater risk for type 2 diabetes (T2D). However, current prevalence of T2D among children and young people is unknown in England and Wales. In addition, little is known on glycemic control in pediatric T2D globally.
Methods: Using data from the National Paediatric Diabetes Audit for 2012–2013 with >98% coverage of diabetes cases, we estimated (1) the overall, gender- and ethnic-specific prevalence of T2D in children and young people <16 years and (2) whether ethnicity predicts glycemic control (measured by mean HbA_{1c}) in children and young people <19 years. Ethnicity was self-identified and categorized into white, Asian, black, mixed, other, and "not stated." Multivariable linear regression was used to estimate differences in glycemic control by ethnicity adjusting for socioeconomic status, age, diabetes duration, and gender.
Results: A total of 307 children and young people aged <16 years were identified with T2D in the National Paediatric Diabetes Audit for 2012–2013. Overall prevalence of T2D was 2.9/100,000. Females had a higher prevalence of T2D than males (4.3 vs. 1.5/100,000). The highest prevalence was found in Asian (12.2/100,000) followed by mixed ethnicity (4.4/100,000) females. Children of mixed ethnicity had significantly higher mean HbA_{1c} compared with white children (9.7% [83 mmol/mol] vs. 7.8% [62 mmol/mol], $p < .001$, and adjusted mean difference of 4.2% [22.3 mmol/mol], 95% confidence interval = 3.1%–5.2% [10.9–33.7 mmol/mol]), but there were no significant differences between the other ethnic minority groups.
Conclusions: Children of all ethnic minorities particularly females have an increased prevalence of T2D. Those belonging to mixed ethnic backgrounds are at increased risk for poorer glycemic control.

IMPLICATIONS AND CONTRIBUTION

This study found strong variation in type 2 diabetes prevalence in adolescents by gender and ethnicity, with Asian and Mixed ethnicity females particularly affected. In addition, mixed ethnicity children had the poorest diabetes control. Findings highlights significant health inequalities associated with childhood-onset type 2 diabetes, a growing global problem.

Type 2 diabetes (T2D) remains relatively rare in children and adolescents (between 1% and 2% of all diabetes cases) [1,2]. However, with the ongoing obesity epidemic in this group and its associated adverse metabolic consequences, there has been concern about increasing incidence/prevalence of T2D and its comorbidities including hypertension, dyslipidemia, and

Conflicts of Interest: The authors have no conflicts of interest to declare.

* Address correspondence to: Amal R. Khanolkar, Ph.D., Institute of Child Health, University College London (UCL), 30 Guildford Street, London, United Kingdom.
E-mail address: a.khanolkar@ucl.ac.uk (A.R. Khanolkar).

[1] On behalf of the National Paediatric Diabetes Audit (NPDA) and the research and policy division of the Royal College of Paediatrics and Child Health (RCPCH).

1054-139X/
http://dx.doi.org/10.1016/j.jadohealth.2016.05.012

impaired glucose intolerance leading to reduced life expectancy [1]. There is considerable variability in incidence rates for T2D. In some countries, 25%–40% of all new cases of diabetes in children are now diagnosed as obesity-related T2D with some studies reporting >85% of all children with T2D as overweight or obese [3]. This is a complex disease to manage for young patients, their families, and clinicians because of its comorbidities and requires significant lifestyle changes and consistent long-term management [4].

T2D is disproportionately more common among ethnic minority and low income children, which parallels similar disparities observed in obesity rates [1,2,5,6]. In adolescents, it is associated with elevated risk of future cardiovascular and other diabetes-related complications which is different from long-term complications often associated with type 1 diabetes [7–11]. These complications (such as dyslipidemia and hypertension) are more common in ethnic minority and low-income groups making them more vulnerable to increased morbidity and mortality in adulthood [2,12].

T2D among children in Europe and the United Kingdom is relatively less common when compared with the United States of America, Canada, Mexico, Brazil, Australia, and India [1,13]. However, studies to date suggest an increase in T2D incidence in many European countries including the United Kingdom [14,15]. In addition, the composition and proportion of ethnic minority groups vary significantly between different countries because of historical, geographical, and political reasons and patterns of immigration. This might affect both the overall- and ethnic-specific prevalence estimates of T2D in different high-income and multicultural countries. There has been little evidence in recent years to document ethnic differences in prevalence of T2D among children in England and Wales using nationally representative data [15]. In addition, not much is known on ethnic differences in glycemic control in children with T2D globally. The main aims of this study are to document ethnic differences in the prevalence of T2D in children and young people in England and Wales in 2012–2013 and to investigate any differences in glycemic control between ethnic groups. Estimation of ethnic-specific prevalence of T2D will help in framing future public health policies which might have to be more sensitive to the needs of particular ethnic minority groups.

Research Design and Methods

Design, setting, and data source

Data for this cross-sectional study were obtained from the National Paediatric Diabetes Audit (NPDA) for England and Wales [16]. The NPDA was started in 2002 and reached near 100% participation covering all 178 pediatric diabetes units in 2012. It includes demographic and outcome data on almost all children with all forms of diabetes <19 years old and treated at a specialist pediatric clinic. This study was based on the 2012–2013 audit year (first April 2012–March 31, 2013). Inclusion criteria comprised a diagnosis of T2D, <19 years old on the first day of the audit, a minimum of one visit to a clinic during the audit year, and valid information on ethnicity and postcode of residence. As per recommendations from the National Institute of Health and Care Excellence, a patient with diabetes is offered integrated health care by a multidisciplinary team at a clinic four times/year. HbA_{1c} levels, height, and weight are recorded at each visit. All demographical and clinical parameters are recorded systematically across clinics enabling comparison. The analysis was conducted in two parts: (1) estimation of prevalence of T2D by gender and ethnicity in all children aged <16 years and (2) a regression analysis analyzing association between ethnicity and glycemic control (HbA_{1c}) in all children aged <19 years.

Prevalence calculation

The analysis on prevalence of T2D was restricted to those children aged <16 years as some patients transfer to adult services at this time, potentially underestimating prevalence rates 16- to 18-year-olds. The numerator for analysis on prevalence included all cases of T2D prevalent in 2012–2013 and <16 years of age with valid data on gender and ethnicity (Figure 1). Patients (or their parents) self-reported their ethnicity using one of the 15 categories as recommended by the Information Standards Board for Health and Social Care. Participants were also given the option to decline identifying their ethnicity ("Not Stated" option). The 15 ethnic categories were collapsed into six broader groups (listed in Supplementary Table 2): white (British, Irish and any other white background), Asian (comprising subjects of mostly South Asian origin), black (subjects of Caribbean and African origin), mixed (any form of mixed ethnic background), other (including Chinese and any other ethnic background not listed previously), and "Not Stated." We excluded the "Not-Stated" ethnic group from the analysis on prevalence of T2D by ethnicity as the national census does not include this category and we were unable to estimate the prevalence for this group. The denominators for the analysis on prevalence were obtained from 2011 National Census (the most recent census).

All prevalence rates were expressed as cases per 100,000 children aged 0–15.99 years.

Regression analysis

Outcome and independent variables. HbA_{1c} was used as a measure of overall T2D (glycemic) control and the main outcome of interest. HbA_{1c} values recorded as percentages were converted to mmol/mol using the formula: (HbA_{1c} value in percentage $-$ 2.15) $\times$ 10.929. Where more than one HbA_{1c} was recorded in the year, the mean was calculated for each individual. Independent variables included age, gender, diabetes duration, ethnicity, and socioeconomic status (SES). Both age at diagnosis and age at clinic visit were calculated by subtracting the date of diagnosis from date of birth and date of clinic visit from date of birth, respectively. Duration of diabetes was calculated by subtracting the date at first visit in the audit year from the date of diabetes diagnosis. The first recorded entry for ethnicity in the audit year was used in the analysis. Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared. Overweight and obesity in children were determined by using age- and sex-specific cutoffs proposed by the International Obesity Task Force [17]. Age- and sex-appropriate BMI standard deviation scores or *z* scores were calculated as proposed by Cole et al. [18]. SES was derived from postcode using Indices of Multiple Deprivation (IMD) 2010 for England and the Welsh Indices of Multiple Deprivation 2008 for Wales [19]. Although these two countries use slightly differing indices to define deprivation, adjustment can be made to align the two techniques [20]. The IMD is a multidimensional index, and scores are derived