Incidence and prevalence trends of youth-onset type 2 diabetes in a cohort of Canadian youth: 2002-2013

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ABSTRACT

Objective: Youth-onset type 2 diabetes is an emerging disease. We estimated incidence and prevalence trends of youth-onset type 2 diabetes between 2002 and 2013 in the Canadian province of British Columbia.

Methods: This population-based cohort study used a validated diabetes case-finding definition and algorithm to differentiate type 2 from type 1 diabetes to identify youth <20 years with type 2 diabetes within linked population-based administrative data. Age-standardized incidence and prevalence were calculated. JoinPoint regression and double exponential smooth modeling were used.

Results: From 2002/03-2012/13, the incidence of youth-onset type 2 diabetes increased from 3.45 (95% CI: 2,43, 4.80) to 5.16 (95% CI: 3.86, 6.78)/100,000. The annual percent change (APC) in incidence was 3.74 (95% CI: 1.61, 5.92; p=0.003) overall, while it was 5.94 (95% CI: 1.84, 10.20; p=0.009) and 0.53 (95% CI: -5.04, 6.43; p=0.837) in females and males, respectively. The prevalence increased from 0.009% (95% CI: 0.007, 0.011) in 2002/03 to 0.021% (95% CI: 0.018, 0.024) in 2012/13 with an APC of 7.89 (95% CI: 6.41, 9.40; p<0.0001). In females, it increased from 0.012% (95% CI: 0.009, 0.015) to 0.027% (95% CI: 0.023, 0.032) and in males from 0.007% (95% CI: 0.005, 0.009) to 0.015% (95% CI: 0.012, 0.019). By 2030, we forecast a prevalence of 0.046% [95% CI: 0.043, 0.048].

Conclusions: Youth-onset type 2 diabetes is increasing with higher rates in females versus males. If these rates continue, in 2030, the number of cases will increase by 5-fold. These data are needed to set priorities for diabetes prevention in youth.

MeSH Key Words: type 2 diabetes mellitus; epidemiology; incidence; prevalence; pediatrics

INTRODUCTION

Incidence rates of youth-onset type 2 diabetes vary worldwide. In the United States (2007), annual incidence rate was 9.0 cases per 100,000 youth 0-19 years of age per year, (1), while in Canada (2006-2008), the annual minimum incidence rate was 1.54 cases per 100,000 youth <18 years of age (2). The U.K and other European countries report much lower rates of youth-onset type 2 diabetes (3,4). Although the absolute number of cases of youth-onset type 2 diabetes appear inconsequential when compared to the number of cases in adults, the natural history of this emerging disease suggests youth-onset type 2 diabetes will significantly impact the health of children and youth today, and for generations to come.

Youth-onset type 2 diabetes is materializing to be a more severe disease than adult-onset type 2 diabetes. As shown by the TODAY Study Group that conducted a clinical trial in the U.S to maintain glycemic control in youth-onset type 2 diabetes, diabetes-related complications develop quickly (5,6) and are often present at diagnosis (2). SEARCH reported that, when compared to youth with type 1 diabetes, those with type 2 diabetes have a significantly increased higher odds of developing diabetic kidney disease, retinopathy, and peripheral neuropathy (7). Also, treatment of youth-onset type 2 diabetes with oral hypoglycemic agents is largely ineffective and almost 50% of cases require subcutaneous insulin because of metabolic decompensation (8). Mortality is also higher in those who develop type 2 diabetes at a young age where an inverse relationship between age of diabetes onset and standardized mortality ratio (SMR) has been reported with the highest SMR (3.4 [95% CI 2.7-4.2]) in those diagnosed with diabetes between 15 and 30 years of age (9).

Evidence suggests an increase in both incidence and prevalence of youth-onset type 2 diabetes, albeit at varying degrees depending on the population demographic. In the U.S., the overall prevalence of type 2 diabetes in youth <20 years increased by 30.5% between 2001 and 2009 (10), with predictions that the prevalence will increase by 178% by 2050 (11). Incidence rates are also on the rise in the U.S with an estimated relative increase of 4.8% (95% CI: 3.2, 6.4; $p<0.001$) per year between 2002/03 to 2011/12 (1).

In Canada, administrative health data have been used to describe epidemiological trends of diabetes in youth (12), however, type 1 and type 2 diabetes are for the most part reported separately and therefore trends are assumed to reflect type 1 diabetes, the most common form of childhood diabetes. We have developed a validated algorithm for differentiating between type 1 and type 2 diabetes in administrative datasets using demographic and drug utilization data (13) and have recently reported incidence and prevalence trends of childhood type 1 diabetes (14). The objective of this study was to describe trends in the incidence and prevalence of youth-onset type 2 diabetes in a population-based sample of Canadian youth <20 years of age.

METHODS

Data source:

We used four datasets that exist within a universal health care system in the Canadian province of British Columbia. These databases are linkable using an individual's personal health number (PHN) and include: (i) client registration information (Client Registry & Premium Billing); (ii) physician fee-for-service claims for outpatient services (Medical Services Plan – MSP); (iii) health claims for hospital admissions (Discharge Abstract Database – DAD); and (iv) provincial prescription dispensations (PharmaNet). To establish the Diabetes Database, a diabetes case-finding definition was applied to the linked data where an individual with any 1 of following within a 1-year period was included: 1 hospital discharge code for diabetes; 2 outpatient physician MSP claims coded for diabetes; 2 or more prescription dispensations for insulin; 2 or more prescription dispensations for an oral anti-diabetic medication (except metformin); or two of more of: 1 prescription dispensation for insulin, 1 prescription dispensation for an oral anti-diabetic medication, 2 prescriptions for metformin and 1 outpatient physician MSP claim coded as diabetes. Once individuals were included in the Diabetes Database, they remained in it until they moved out of the province or died. For the purpose of this study, data was retrieved on individuals <20 years of age within the Diabetes Database. The diabetes case-finding definition used to create the Diabetes Database has been shown to be highly sensitive (97%) in the <20 year old population when validated against a clinical database comprised of physician-diagnosed pediatric type 1 and type 2 diabetes (15).

Study population and period:

In this population-based study examining an average of 950,000 individuals <20 years of age each year, we included all individuals >1 year of age and <20 years of age in the Diabetes Database between April 1st, 2002 to March 31st, 2013 who were classified as having type 2 diabetes within the province of British Columbia. A case was classified as type 2 diabetes if they were 10 years of age or older, and their prescription dispensations within 2 years (730 days) of meeting the case-finding algorithm (the index date) included an oral anti-diabetic medication (i.e. metformin, sulfonylurea) alone or in combination with insulin, ± glucose strips. This diabetes differentiating algorithm was 83.2% sensitive and 97.5% specific in classifying cases of type 2 diabetes in individuals <20 years of age, with a positive predictive value of 73.7%, when compared to a gold standard clinical database of physician-diagnosed pediatric type 1 and type 2 diabetes (13). Individuals who did not show evidence of diabetes-related prescription dispensations within 2 years (730 days) of their index date were excluded from the analysis (Figure 1).

Definition of main outcomes:

We identified incident and prevalent cases for each fiscal year (April 1st to March 31st) from 2002 to 2013, based on the following definitions. Incident cases: (i) the individual met the conditions of the diabetes case-finding algorithm for the first time, and the date at which this occurred was the index date for diagnosis; and (ii) the individual met the conditions of the diabetes differentiating algorithm as a case of type 2 diabetes. Prevalent cases:

cases that existed at the beginning of that fiscal year that met the conditions of the diabetes differentiating algorithm as a case of type 2 diabetes, in addition to incident cases that were identified during that year.

Statistical analysis:

Age-standardized incidence (per 100,000) and prevalence rates (per 100) were calculated using 1990/91 Canadian population as the standard population and Census data (StatsCan) on the BC population <20 years of age. The JoinPoint regression analysis program (V4.3.1.0) was used to examine the trends in age-standardized incidence and prevalence rates, overall, and by gender. We used the permutation test (with 5000 randomly permuted datasets) method in the Joinpoint program that selects the best fitting piecewise continuous log-linear model (16) at a significance level of 0.05 to calculate the annual percent change (APC) with corresponding 95% confidence intervals. We also used double exponential smooth modeling in SAS [9.4] to project the number and prevalence rates of type 2 diabetes until 2030.

RESULTS

Incidence of youth-onset type 2 diabetes:

In 2002/03, 37 (62% female) new cases of youth-onset type 2 diabetes were identified increasing to 53 (68% female) new cases in 2012/13. Incidence was 3.45 (95% CI: 2.43, 4.80) per 100,000 in 2002/03 and 5.16 (95% CI: 3.86, 6.78) per 100,000 in 2012/13. During the same time period, incidence increased from 4.43 (95% CI: 2.81, 6.74) to 7.21 (95% CI: 5.05, 10.05) in females and from 2.53 (95% CI: 1.39, 4.36) to 3.23 (95% CI: 1.88, 5.24) in males (Table 1 - online). The sex differences in type 2 diabetes incidence widened after 2010 (Figure 2A).

The APC in incidence was 3.74 (95% CI: 1.61, 5.92; p=0.003) overall, while it was 5.94 (95% CI: 1.84, 10.20; p=0.009) and 0.53 (95% CI: -5.04, 6.43; p=0.837) in females and males, respectively. While the overall APC did not increase in males, there was a marginally significant increase in the APC between 2002-2007 (APC: 11.95, 95% CI: 0.15, 25.14; p=0.048), and a marginally significant decrease between 2007-2012 (APC: -9.62, 95% CI: -18.7, 0.49; p=0.058). The APC in the overall population was the highest from 2002-2008 (APC: 6.35, 95% CI: 2.31, 10.55; p=0.008). Incidence was highest among females (Figure 3C) and youth aged 15-19 years (Figure 3D) where it increased from 10.57 (95% CI: 7.13, 15.09) in 2002/03 to 13.81 (95% CI: 9.82, 18.88) in 2012/13 (Table 1 - online).

Prevalence of youth-onset type 2 diabetes:

From 2002/03 to 2012/13, prevalent cases increased from 97 (63% female) to 219 (63% Female) and prevalence increased from 0.009% (95% CI: 0.007, 0.011) to 0.021% (95% CI: 0.018, 0.024) representing a 2.3-fold increase over a decade. In the same time period, prevalence increased from 0.012% (95% CI: 0.009, 0.015) to 0.027% (95% CI: 0.023, 0.032) in females, and from 0.007% (95% CI: 0.005, 0.009) to 0.015% (95% CI: 0.012, 0.019) in males (Table 2 -online).

The APC in the overall prevalence was 7.89 (95% CI: 6.41, 9.40; $p<0.0001$), while the same for females and males was 7.98 (95% CI: 6.94, 9.02; $p<0.0001$) and 7.77 (95% CI: 4.09, 11.57; $p=0.001$), respectively. Prevalence increased at a much higher rate from 2002-2008 (APC: 10.84, 95% CI: 8.64, 13.08, $p<0.0001$) followed by a slower increase thereafter (APC: 3.86, 95% CI: 0.80, 7.0, $p=0.021$). A significant increase in prevalence was also found among females aged 10-14 years.

Projections of youth-onset type 2 diabetes prevalence through 2020:

Assuming similar rates and APC, the projected total number of prevalent cases of youth-onset type 2 diabetes will increase to 350 (95% CI: 326, 374) in 2020, 421 (95% CI: 394, 447) in 2025 and 491 (95% CI: 462, 519) in 2030, representing more than a 5-fold increase in the number of prevalent cases of type 2 diabetes in children since 2002/03. The prevalence will increase to 0.046% (95% CI: 0.043, 0.048) by 2030 (Figure 4).

DISCUSSION

To our knowledge, this study is the first of its kind to use administrative health data to describe trends in youth-onset type 2 diabetes. We report an increasing trend in the incidence and prevalence of youth-onset type 2 diabetes over the last decade in a population-based sample of Canadian youth, with distinct sex differences where young females are affected more than males. The majority of the burden of youth-onset type 2 diabetes was in the 15-19 year age bracket although, an increasing trend in prevalence among females aged 10-14 years was also observed. If current rates continue, the prevalence of youth-onset type 2 diabetes will increase by 5-fold by the year 2030.

A similar increase in youth-onset type 2 diabetes has been reported in the U.S. and among First Nation youth in Canada. The SEARCH study reported that overall prevalence of youth-onset type 2 diabetes in the U.S rose from 0.034% in 2001 to 0.046% in 2009, representing a 35% relative increase when adjusted for differences in completeness of ascertainment (10). In the same U.S population, unadjusted incidence rate of youth-onset type 2 diabetes increased by 7.1% annually ($p<0.001$) from 2002/03 to 2011/12 (1). In Canadian First Nation youth <18 years of age, the incidence of type 2 diabetes doubled over a 5-year period (9.03 to 20.58 cases per 100,000 youth per year) (17). European data shows little or no increase in youth-onset type 2 diabetes (18) however, surveillance has typically excluded youth aged 15-19 years, the age bracket that faces the highest burden of disease. Austria recently reported a stable incidence of type 2 diabetes in youth ≤15 years of age from 1999 to 2015 (4).

The Canadian Diabetes Association first published clinical practice guidelines on the management of youth-onset type 2 diabetes in 2003 with updates in 2008 and 2013. Our data showed the highest incidence rate (5.85 cases per 100,000/year) in 2008 and the highest APC (6.35) from 2002-2008, suggesting that increased awareness of and screening for youth-onset type 2 diabetes has contributed to the increasing epidemiological trends. Rising rates of overweight and obesity also likely contribute to this finding. The prevalence of overweight and obesity doubled among Canadians aged 12-17 years over 25 years (1978/79-2004), and obesity alone tripled (19). In a study of Canadian youth with new-onset type 2 diabetes, 95% were obese and the remaining were overweight, confirming obesity as a key risk factor for youth-onset type 2 diabetes (2). Recent data suggest a decline in the prevalence of overweight and obesity in Canadian children from 30.7% to 27% ($p<0.001$) from 2009 to 2013 (20), which may translate into declining trends of youth-onset type 2 diabetes in the future. Recent data released by Statistics Canada comparing rates of childhood obesity in 2004 versus 2015 showed that in the province of British Columbia, obesity rates decreased more in males (16.8% in 2004 to 11.1% in 2015) than in females (11% in 2004 to 9.1% in 2015) (StatsCan - http://www5.statcan.gc.ca), possibly explaining the sex differences in incidence trends of youth-onset type 2 diabetes in our region.

Our data show a 3:1 female predominance for youth-onset type 2 diabetes in 2012/13, and a widening gap in incidence between males and females since 2005. These sex differences have been described in the literature, and across all ethnic groups (10,17,21). Interestingly, in adults, the opposite has been reported; globally, 15.6 million more men than women had diabetes in 2015 (22). There continues to be a considerable gap in knowledge on the complex interplay of hormones, genes, lifestyle and environment that might contribute to the sex differences in rates of youth-onset type 2 diabetes, and why this trend reverses in adulthood. Insulin resistance during puberty can be as much as 30% greater in girls compared to boys (23) and a recent study by Cooper *et al* showed that pubertal females have a 30-40% higher insulinaemic response to a high glycemic index meal compared to pubertal males (24). These sex differences may partly be explained by higher adiposity in pubertal females versus males (25,26). Increased prevalence of youth-onset type 2 diabetes in females 15 years of age and older may also be due to more frequent screening and/or recognition of type 2 diabetes as part of the pre-natal medical assessment. Lastly, our data may have inadvertently captured young females with polycystic ovarian syndrome treated with metformin where the physician incorrectly used a diabetes diagnostic code.

Higher rates of type 2 diabetes in females entering child-bearing age has significant implications and requires an immediate public health response. The TODAY trial reported on female youth with type 2 diabetes (mean diabetes duration of 3 years) who became pregnant (N=53 pregnancies). Among these pregnancies, almost 25% resulted in fetal loss and 2 ended in stillbirth. Of the pregnancies resulting in a live-born infant, 15% were preterm and 20% had a major congenital anomaly (27). There is also strong evidence supporting that fetal over-nutrition and a hyperglycemic intrauterine environment increases the risk of obesity and early-onset type 2 diabetes in the offspring, resulting in a vicious cycle that may be contributing to increasing rates of youth-onset type 2 diabetes (28). In Canada, incidence rates of both gestational and pre-gestational diabetes doubled from 1996-2010 in women aged 15-50 years (29). Rising rates of youth-onset type 2 diabetes will add to this increasing burden of diabetes in pregnancy.

This study has several strengths: it is population-based, includes 11 years of data, and is the first to differentiate between type 2 from type 1 diabetes in administrative data enabling the delineation of epidemiological trends for youth-onset type 2 diabetes at a population level. Limitations of our study include the inability to describe trends by ethnicity and the potential for misclassifying cases of type 2 diabetes as type 1 diabetes and vice versa. The absence of clinical information within administrative data such as pancreatic antibody levels makes classification of diabetes type more challenging. Also, in a validation study using a combination of electronic medical record (EMR) and administrative data to identify and classify youth with diabetes, 9% of youth with physician diagnosed type 1 diabetes used metformin and insulin (30). In our study, these children would be misclassified as type 2 diabetes, potentially overestimating our rates. However, in our previous validation research, algorithms to differentiate type 1 vs. type 2 diabetes that classified insulin plus metformin users as type 1 diabetes performed less favorably compared to algorithms that classified this drug utilization pattern as type 2 diabetes (13). Our algorithm also assumed that individuals under 10 years of age had type 1 diabetes, potentially underestimating type 2 diabetes rates because, although type 2 diabetes under 10 years of age is uncommon, in some studies, it has accounted for roughly 10% of youth-onset type 2 diabetes cases (2,17). Children with existing type 2 diabetes that moved to BC from another province would have been counted as an incident (rather than a prevalent) case because we do not have access to data from other Canadian provinces. Lastly, our forecasting model, although similar to our observed data, should be interpreted with caution as it is based on only 11 years of data, assumes no change in clinical practice that could result in the identification of more (or less) cases, and does not take into account the recent data indicating decreasing rates of overweight and obesity in Canadian children (StatsCan).

Youth-onset type 2 diabetes is increasing at an alarming rate and if prevention efforts are not given priority among public health officials, the number of cases in British Columbia, Canada will increase by 5-fold by the year 2030. British Columbia has some of the lowest rates of childhood obesity and overweight in Canada, and therefore, rates in other provinces are likely at least similar, if not higher than what is reported here. The greatest burden of youth-onset type 2 diabetes is in older youth aged 15-19 years who likely access primary, rather than pediatric care. Therefore, increasing awareness of youth-onset type 2 diabetes among primary care practitioners is critical to ensure early identification and initiation of management so as to prevent serious diabetes-related complications and early mortality. The female predominance is particularly concerning considering the impact of maternal obesity and diabetes during pregnancy on the metabolic health of future offspring. Our findings will inform resource allocation for health services and public health, and ongoing surveillance will help to assess the impact of diabetes prevention initiatives designed for youth. Further research is needed to examine factors contributing to rising rates of youth-onset type 2 diabetes, as well as the pathophysiological and environmental mechanisms leading to the observed sex differences.

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Author contributions: S.A. designed the study, researched/interpreted the data and wrote the manuscript. K.R and J.S mined and analyzed the data, contributed to the discussion and reviewed/edited the manuscript. N.I conducted trend analyses and forecasting, contributed to the discussion and reviewed/edited the manuscript. This study did not receive funding. An honorarium, grant, or other form of payment was not provided to any author to produce the manuscript.

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Figure 1: Classification of Prevalent Cases of Diabetes in Individuals <20 years (2012/13)

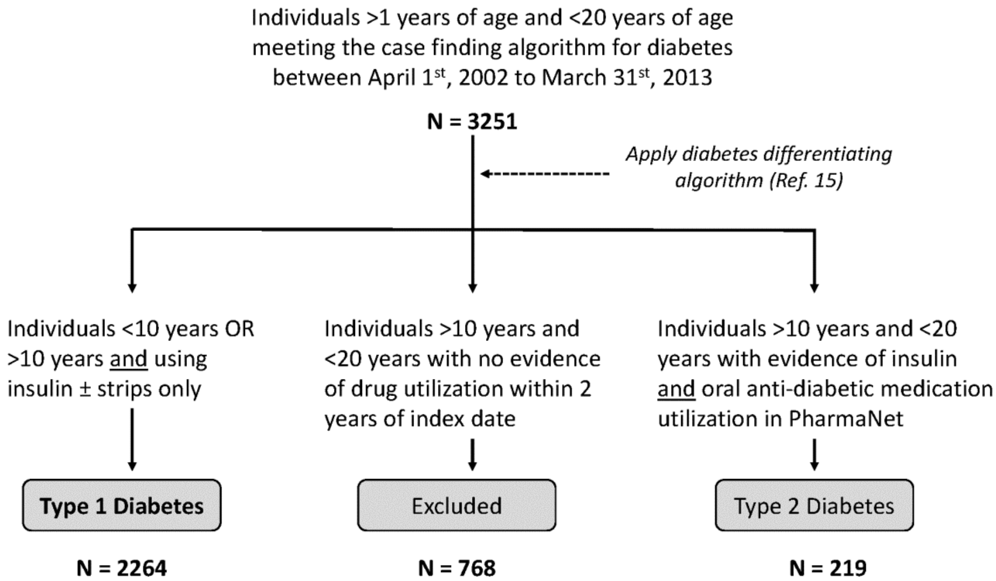

Figure 2: Age standardized incidence (A) and prevalence (B) rates by sex and year

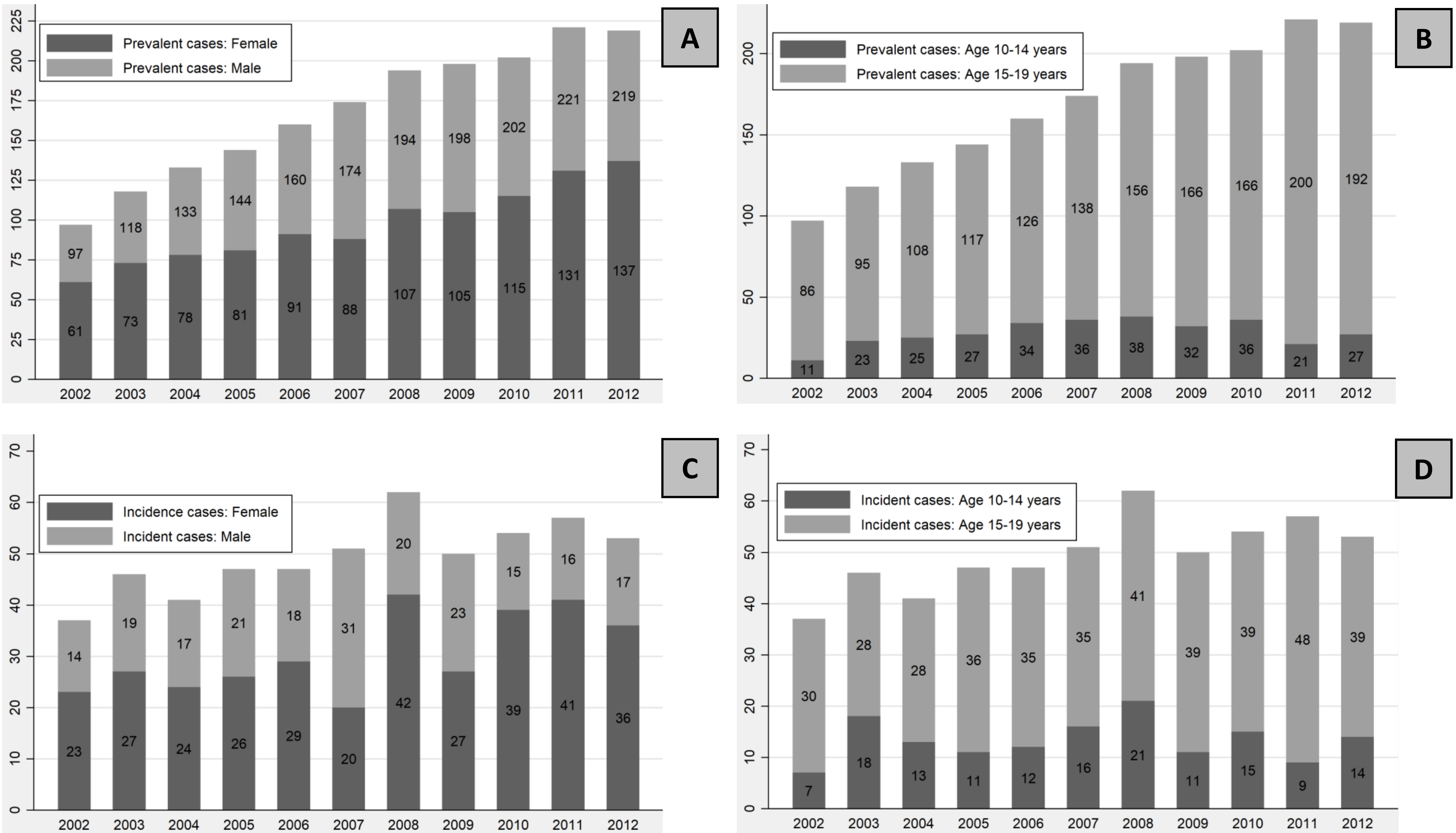

Figure 3: Incident and prevalent cases by sex and age group

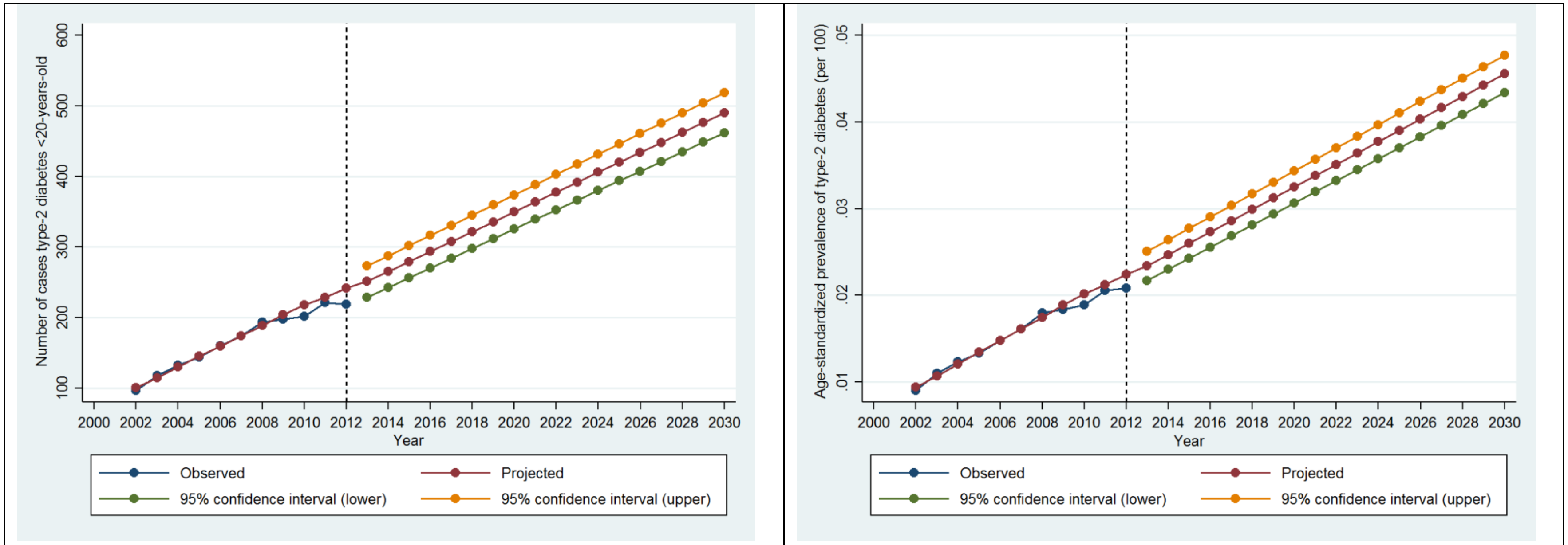

Figure 4: Projections of youth-onset type 2 diabetes prevalence through 2030

<u>*Supplementary Materials*</u>

Table 1; online only: Age-Standardized and Age-Specific Incidence Rates (per 100,000 [95% CI]) of T2D in youth 10-19 years of age

	2002/03	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**
All youth											
n	37	46	41	47	47	51	62	50	54	57	53
Population	963,702	958,746	952,680	950,240	946,336	944,855	943,889	941,654	941,102	937,895	932,268
Total Incidence	3.45 [2.43-4.80]	4.32 [3.17-5.81]	3.84 [2.75-5.25]	4.36 [3.20-5.84]	4.36 [3.21-5.85]	4.77 [3.55-6.31]	5.84 [4.48-7.53]	4.67 [3.47-6.20]	5.14 [3.86-6.74]	5.37 [4.06-6.99]	5.16 [3.86-6.78]
Incidence by age											
10-14 years	2.61 [1.05-5.38]	6.72 [3.98-10.62]	4.87 [2.59-8.33]	4.13 [2.06-7.40]	4.56 [2.36-7.96]	6.16 [3.52-10.01]	8.23 [5.09-12.58]	4.41 [2.20-7.89]	6.15 [3.44-10.14]	3.75 [1.71-7.12]	5.92 [3.24-9.93]
15-19 years	10.57 [7.13-15.09]	9.81 [6.52-14.18]	9.79 [6.50-14.14]	12.51 [8.77-17.33]	12.11 [8.43-16.84]	12.05 [8.39-16.76]	14.11 [10.13-19.14]	13.43 [9.55-18.36]	13.48 [9.58-18.42]	16.75 [12.35-22.21]	13.81 [9.82-18.88]
Females											
n	23	27	24	26	29	20	42	27	39	41	36
Population	468,690	466,038	463,355	462,186	460,276	459,304	458,858	457,844	457,359	456,062	453,124
Total Incidence	4.43 [2.81-6.74]	5.21 [3.43-7.68]	4.63 [2.97-6.99]	4.93 [3.22-7.33]	5.49 [3.67-7.98]	3.87 [2.36-6.07]	8.08 [5.82-11.00]	5.20 [3.43-7.65]	7.52 [5.35-10.36]	7.95 [5.70-10.85]	7.21 [5.05-10.05]
Incidence by age											
10-14 years	3.83 [1.24-8.94]	6.91 [2.16-13.11]	6.18 [2.67-12.17]	3.10 [0.84-7.94]	3.14 [0.85-8.03]	5.56 [2.24-11.46]	8.88 [4.43-15.89]	4.95 [1.82-10.77]	5.89 [2.37-12.13]	5.13 [1.88-11.16]	7.81 [3.57-14.83]
15-19 years	13.07 [7.75-20.66]	13.00 [7.71-20.55]	11.51 [6.58-18.69]	15.73 [9.86-23.82]	17.81 [11.52-26.29]	9.22 [4.91-15.77]	21.99 [14.94-31.22]	14.92 [9.24-22.81]	22.84 [15.62-32.34]	25.22 [17.56-35.07]	19.74 [13.01-28.73]
Males											
n	14	19	17	21	18	31	20	23	15	16	17
Population	494,993	492,694	489,312	488,041	486,050	485,543	485,024	483,806	483,740	481,830	479,142
Total Incidence	2.53 [1.39-4.36]	3.49 [2.10-5.55]	3.09 [1.80-5.05]	3.82 [2.36-5.93]	3.30 [1.96-5.31]	5.61 [3.81-8.05]	3.74 [2.28-5.85]	4.17 [2.64-6.34]	2.90 [1.62-4.84]	2.94 [1.68-4.86]	3.23 [1.88-5.24]
Incidence by age											
10-14 years	1.45 [0.18-5.25]	6.54 [2.99-12.42]	3.64 [1.18-8.50]	5.11 [2.05-10.52]	5.89 [2.54-11.61]	6.73 [3.08-12.77]	7.61 [3.65-14.00]	3.90 [1.27-9.11]	6.40 [2.76-12.60]	2.44 [0.50-7.12]	4.12 [1.34-9.61]
15-19 years	8.22 [4.25-14.36]	6.81 [3.26-12.51]	8.16 [4.21-14.25]	9.47 [5.18-15.89]	6.73 [3.23-12.37]	14.71 [9.22-22.28]	6.68 [3.21-12.29]	12.03 [7.13-19.01]	4.69 [1.89-9.66]	8.80 [4.68-15.04]	8.24 [4.26-14.39]

Table 2; online only: Age-Standardized and Age-Specific Prevalence (per 100) [95% CI] of T2D in youth 10-19 years of age

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
All youth											
n	97	118	133	144	160	174	194	198	202	221	219
Population	963,762	958,818	952,772	950,337	946,449	944,978	944,021	941,802	941,250	938,059	932,434
Total Prevalence	0.009 [0.007-0.011]	0.011 [0.009-0.013]	0.012 [0.010-0.015]	0.013 [0.011-0.016]	0.015 [0.013-0.017]	0.016 [0.014-0.019]	0.018 [0.016-0.021]	0.018 [0.016-0.021]	0.019 [0.016-0.022]	0.021 [0.018-0.024]	0.021 [0.018-0.024]
Prevalence by age											
10-14 years	0.004 [0.002-0.007]	0.009 [0.005-0.013]	0.009 [0.006-0.014]	0.010 [0.007-0.015]	0.013 [0.009-0.018]	0.014 [0.010-0.019]	0.015 [0.011-0.020]	0.013 [0.009-0.018]	0.015 [0.010-0.020]	0.009 [0.005-0.013]	0.011 [0.008-0.017]
15-19 years	0.030 [0.024-0.037]	0.033 [0.027-0.041]	0.038 [0.031-0.046]	0.041 [0.034-0.049]	0.044 [0.036-0.052]	0.047 [0.040-0.056]	0.054 [0.046-0.063]	0.057 [0.049-0.067]	0.057 [0.049-0.067]	0.070 [0.060-0.080]	0.068 [0.059-0.078]
Females											
N	61	73	78	81	91	88	107	105	115	131	137
Population	468,728	466,084	463,409	462,241	460,338	459,372	458,923	457,922	457,435	456,152	453,225
Total Prevalence	0.012 [0.009-0.015]	0.014 [0.011-0.018]	0.015 [0.012-0.019]	0.015 [0.012-0.019]	0.017 [0.014-0.021]	0.017 [0.013-0.021]	0.020 [0.017-0.025]	0.020 [0.016-0.024]	0.022 [0.018-0.027]	0.025 [0.021-0.030]	0.027 [0.023-0.032]
Prevalence by age											
10-14 years	0.005 [0.002-0.011]	0.009 [0.005-0.016]	0.010 [0.005-0.017]	0.010 [0.005-0.017]	0.013 [0.007-0.020]	0.013 [0.007-0.021]	0.015 [0.009-0.024]	0.016 [0.009-0.024]	0.018 [0.011-0.027]	0.012 [0.007-0.020]	0.015 [0.009-0.024]
15-19 years	0.039 [0.029-0.051]	0.044 [0.034-0.057]	0.047 [0.036-0.060]	0.049 [0.038-0.062]	0.053 [0.042-0.067]	0.051 [0.040-0.064]	0.062 [0.050-0.077]	0.061 [0.049-0.075]	0.067 [0.054-0.082]	0.084 [0.070-0.101]	0.088 [0.073-0.105]
Males											
N	36	45	55	63	69	86	87	93	87	90	82
Population	495,015	492,720	489,350	488,083	486,101	485,598	485,091	483,876	483,812	481,904	479,207
Total Prevalence	0.007 [0.005-0.009]	0.008 [0.006-0.011]	0.010 [0.007-0.013]	0.011 [0.009-0.015]	0.012 [0.010-0.016]	0.015 [0.012-0.019]	0.016 [0.013-0.019]	0.017 [0.013-0.020]	0.016 [0.013-0.020]	0.016 [0.013-0.020]	0.015 [0.012-0.019]
Prevalence by age											
10-14 years	0.003 [0.001-0.007]	0.008 [0.004-0.014]	0.009 [0.005-0.015]	0.010 [0.006-0.017]	0.013 [0.008-0.021]	0.015 [0.009-0.023]	0.014 [0.009-0.023]	0.010 [0.005-0.017]	0.012 [0.007-0.020]	0.006 [0.002-0.012]	0.008 [0.004-0.015]
15-19 years	0.022 [0.015-0.031]	0.023 [0.016-0.032]	0.029 [0.021-0.039]	0.033 [0.025-0.044]	0.034 [0.026-0.045]	0.044 [0.034-0.056]	0.045 [0.035-0.058]	0.053 [0.042-0.067]	0.048 [0.038-0.061]	0.056 [0.045-0.070]	0.049 [0.039-0.062]