Diabetes, Metabolic Syndrome and Obesity

Dovepress
Taylor & Francis Group

Open Access Full Text Article

REVIEW

The Rise and Rise of Type 1 and Type 2 Diabetes in Youth

Mark D DeBoer

Division of Pediatric Endocrinology and Center for Diabetes Technology, University of Virginia, Charlottesville, VA, USA

Correspondence: Mark D DeBoer, Email deboer@virginia.edu

Abstract: Despite having very different underlying etiologies, an unfortunate similarity between Type 1 diabetes (T1D) and Type 2 diabetes (T2D) is the ongoing increase in incidence and prevalence in youth in both types of diabetes over the past several decades. This mini-review highlights recent studies documenting the increases in T1D and T2D in the US and worldwide. These trends underscore the need for healthcare providers and families to have a low index of suspicion for diabetes, as well as the ongoing need for improved means of preventing and treating diabetes in youth.

Keywords: type 1 diabetes, type 2 diabetes, childhood, adolescence, incidence

Introduction

Despite having very different underlying etiologies, an unfortunate similarity between Type 1 diabetes (T1D) and Type 2 diabetes (T2D) is the ongoing increase in incidence and prevalence in youth that we have seen in both types of diabetes over the past several decades. T1D is an autoimmune disease that occurs in individuals who have inherited a genetic predisposition toward T-cell-mediated destruction of beta cells in the pancreas, with still unclear delineation of environmental triggers such as viral infections that might initiate this process.[1] T2D, by contrast, is centered around insulin resistance, frequently with underlying genetic limitations on optimal beta cell functioning.[2] For T2D, the ongoing obesity epidemic has fueled increases in adults with T2D globally.[3] With such different causes, it would not be expected that both diseases would increase so steadily in pediatric populations. However, these trends continue to be highlighted by recent publications of carefully-compiled data from before and during the COVID-19 epidemic. This mini-review highlights these updates and their implications for the medical world at large.

On-Going Pre-Pandemic Rise in Both T1D and T2D

In the US, the SEARCH for Diabetes in Youth study between 2002–2018 assessed the incidence of T1D and T2D among children and adolescents aged <20 years.[4] Surveillance areas included all or parts of seven states across areas that resemble the overall demographics of the US population, and the study was powered to assess differences in incidence between T1D and T2D, as well as by sex and race/ethnicity. Over this time period they noted a steady 2.1% increase per year in T1D incidence, from 19.5 cases per 100,000 person-years in 2002–2003 to 22.2 cases in 2017–2018—and without clear signs of stabilizing (Figure 1). While non-Hispanic Whites remained the racial/ethnic group most represented, the rates of increase in T1D were highest in non-White populations.

Over this same time period, incidence of T2D increased more dramatically, from 9.0 cases per 100,000 person-years in 2002–2003 to 17.9 in 2017–2018—an increase in incidence of 5.31% per year and again without sign of slowing (Figure 1).[4] These increases in incidence were particularly dramatic among American Indian and non-Hispanic Black children and adolescents, who experienced more than a quadrupling in incidence over this time period, to 48 cases per 100,000 person years by 2017–2018. Importantly, by 2017–2018, T2D incidence exceeded T1D incidence among these US adolescents aged 15–19 years.

Received: 18 November 2025
Accepted: 6 December 2025
Published: 20 December 2025

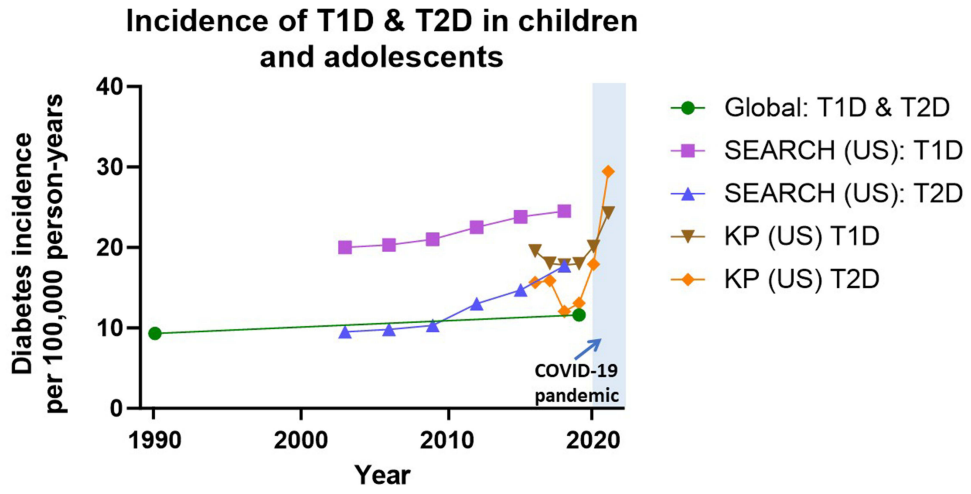

Figure 1 Incidence of diabetes in youth over time. Data shown are from (1) the Global Burden of Diseases;[5] (2) the SEARCH for Diabetes (US);[4] and (3) Kaiser Permanente (KP) Southern California.[6]

These increases in incidence are not confined to the US. A publication earlier this year from the SWEET registry covered data from centers across the globe but with approximately 50% of centers in Europe and 25% in Asia/Middle East.[7] Due to the study design, this group was not able to provide incidence rates but was able to subdivide registry participants into T1D vs T2D over time. They documented that, in all regions, there was a steady 9% increase in the proportion of registrants with T2D from 2012 to 2021. In 2018/2019, this increased proportion of T2D was notably higher in North America and Australia/New Zealand vs Europe, at approximately 9% vs 3% of participants. These data again re-orient us to the need to reduce T2D incidence—which likely has more prevention opportunities currently than does T1D.

Finally, a publication from the Global Burden of Diseases study assessed worldwide incidence of diabetes, combining Type 1 and Type 2 diabetes.[5] Given lower rates of diabetes in developing vs developed areas of the world and the greater population of children in developing regions, it is perhaps not surprising that the incidence of diabetes worldwide was lower than that found in SEARCH, with an overall incidence of 11.7 cases of T1D and T2D per 100,000 person years in 2019 (vs 22.2 of T1D and 17.9 of T2D in 2017–2018 according to SEARCH).[4] This global analysis did reveal a slow increase in pediatric diabetes worldwide between 1990 and 2019 (Figure 1), including in areas with a low socio-demographic index, a measure of local resources. This rise was particularly seen among children aged 5–9 and 10–14 years, and incidence rates of approximately 14.3 per 100,000 person years were identified—that is, still well below overall US incidence. Offering an encouraging ray of hope, the number of deaths attributed to diabetes dropped steadily in all age groups from 2000 onwards, as did disability-adjusted life-years, a measure of disease burden.

Changes in T1D and T2D Incidence During the COVID-19 Pandemic

The SARS-Co-V-2 pandemic from 2020–2022 represented a seismic change in lifestyle for many across the globe, where shelter-in-place orders disrupted routines of going to school and work as well as a loss of workout facilities and amateur sports participation. These changes overall resulted in more sedentary time and time at home near food sources. Moreover, infections with SARS-Co-V-2 resulted in inflammatory reactions with potential implications for systemic processes, including autoimmunity.[8] In addition, the SARS-Co-V-2 virus has effects on beta cells, with potential to influence both T1D and T2D risk.[9] Finally, individuals concerned with exposure in many cases avoided attending medical facilities, contributing to more severe presentations of illness when they did seek medical attention.

As a result of all of these potential intersections between SARS-Co-V-2, there has been ongoing interest into how both T1D and T2D incidence may have been affected during the pandemic. Reports during and since the pandemic focused on a potential increase in the prevalence of DKA at diabetes diagnosis. This finding was well-documented in a Korean report published this year, which assessed data from 2017–2022.[10] These investigators reported that DKA at

presentation increased by 37% for T1D and 107% for T2D during the pandemic. But it remained unclear if there was also an overall increase in incidence of disease.

A recent article evaluated this among members of the Kaiser Permanente Southern California health system in the US, assessing data on approximately 4.8 million individuals.[6] These investigators reported that incidence of T1D increased from 19.6 cases per 100,000 person years in 2016 to 24.3 cases per 100,000 person years in 2021. T2D increased much more dramatically, from 15.7 cases per 100,000 person years in 2016 to 29.4 cases per 100,000 person years in 2021 (Figure 1). The rise in T2D was dramatic among adolescents aged 10–19 years in that, on a quarterly basis, it jumped from 14 cases per 100,000 person years in the second quarter of 2020 (which was below its prior baseline, possibly from a decrease in in-person care) to over 60 cases per 100,000 person years by the fourth quarter of 2020, where it remained for a year before falling again in the last quarter of 2021. The rise in T1D by quarter was not as dramatic—and given its more modest rise, there is still a possibility that the increase in T1D incidence was largely due to pushing individuals who had already begun developing diabetes to present earlier, due to lifestyle changes or to SARS-Co-V-2 infections producing inflammation and worsened hyperglycemia. This may have been true for some with T2D, with pandemic-related changes causing a presentation of cases that would have developed eventually over the coming years. In this sense, it is possible that there will be a temporary decrease in incidence in the years following the pandemic.

Summary of Changes in Incidence of Diabetes in Youth

Overall, results from multiple carefully-compiled data all carry a similar message: the incidence and prevalence of pediatric diabetes, both Type 1 diabetes and Type 2 diabetes, continues to increase. Figure 1 summarizes data from three recent studies, revealing: (1) that US incidence rates for T1D and T2D individually are higher than the global diabetes incidence rate (combined T1D and T2D); (2) T1D incidence in the US overall remains higher than that of T2D; (3) there has been a more rapid rise in T2D vs T1D over the 10 years from 2008 to 2019; and (4) there appears to be a spike in diagnoses of both T1D and T2D in the Kaiser Permanente database (which, curiously, followed what appeared to be a drop in both T1D and T2D incidence in the Kaiser Permanente system in 2018 and 2019). There is now a need for data on what has happened since the pandemic, acknowledging that these careful studies take time, to help clarify whether these incidence rates will continue their gradual ascent.

Implications of This Increased Incidence

The rise in incidence and prevalence of T1D means that data on the prevention and management of T1D and T2D in youth is increasingly relevant. The practical applications of these data include the following:

1. Practitioners and families need to increasingly have diabetes on their radar, as early recognition can reduce morbidity at diagnosis and afterwards.[11,12]
2. We need to focus, when possible, on prevention, that is, on lifestyle changes in youth at risk for T2D.[13] Interventions such as teplizumab among children and adolescents with early signs of beta-cell autoimmunity and loss of function also need to be considered,[14] and further investigation into why these trends continue is required.
3. The field continues to need new approaches to effective treatment, which will be needed to treat a widening base of children and adolescents with diabetes. These include improving medications for T2D treatment[15] and improvements in automated insulin delivery in T1D.[16]

Finally, the reduced disability-adjusted life years reported on the global pediatric diabetes front[5] raises the most potent goal of diabetes research—that even with an increasing incidence of T1D and T2D, our care of diabetic patients needs to improve to the point where overall burden is reduced. Discovering ways to reduce diabetes incidence and reduce the burden of care can be parallel goals in ongoing efforts for this field going forward.

Data Sharing Statement

Data sharing is not applicable as no datasets were generated or analyzed in this review.

Funding

National Institutes of Health: DK124886.

Disclosure

The author has no conflicts of interest to declare.

References

1. Ilonen J, Lempainen J, Veijola R. The heterogeneous pathogenesis of type 1 diabetes mellitus. *Nat Rev Endocrinol*. 2019;15(11):635–650. doi:10.1038/s41574-019-0254-y
2. DeForest N, Majithia AR. Genetics of Type 2 Diabetes: implications from Large-Scale Studies. *Curr Diab Rep*. 2022;22(5):227–235. doi:10.1007/s11892-022-01462-3
3. Collaborators GD. Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet*. 2023;402(10397):203–234. doi:10.1016/S0140-6736(23)01301-6
4. Wagenknecht LE, Lawrence JM, Isom S, et al. Trends in incidence of youth-onset type 1 and type 2 diabetes in the USA, 2002–2018: results from the population-based SEARCH for Diabetes in Youth study. *Lancet Diabetes Endocrinol*. 2023;11(4):242–250. doi:10.1016/S2213-8587(23)00025-6
5. Zhang K, Kan C, Han F, et al. Global, Regional, and National Epidemiology of Diabetes in Children From 1990 to 2019. *JAMA Pediatr*. 2023;177(8):837–846. doi:10.1001/jamapediatrics.2023.2029
6. Mefford MT, Wei R, Lustigova E, Martin JP, Reynolds K. Incidence of Diabetes Among Youth Before and During the COVID-19 Pandemic. *JAMA Network Open*. 2023;6(9):e2334953. doi:10.1001/jamanetworkopen.2023.34953
7. Gesuita R, Eckert AJ, Besançon S, et al. Frequency and clinical characteristics of children and young people with type 2 diabetes at diagnosis from five world regions between 2012 and 2021: data from the SWEET Registry. *Diabetologia*. 2025;68(1):82–93. doi:10.1007/s00125-024-06283-5
8. Knight JS, Caricchio R, Casanova JL, et al. The intersection of COVID-19 and autoimmunity. *J Clin Invest*. 2021;131(24):1. doi:10.1172/JCI154886
9. Müller JA, Groß R, Conzelmann C, et al. SARS-CoV-2 infects and replicates in cells of the human endocrine and exocrine pancreas. *Nat Metab*. 2021;3(2):149–165. doi:10.1038/s42255-021-00347-1
10. Lee DH, Kim HY, Park JY, Kim J, Park JH. New-Onset Type 1 and Type 2 Diabetes Among Korean Youths During the COVID-19 Pandemic. *JAMA Pediatr*. 2025;179(2):155–162. doi:10.1001/jamapediatrics.2024.5068
11. Jonas DE, Crotty K, Yun JDY, et al. Screening for Prediabetes and Type 2 Diabetes: updated Evidence Report and Systematic Review for the US Preventive Services Task Force. *JAMA*. 2021;326(8):744–760. doi:10.1001/jama.2021.10403
12. ElSayed NA, McCoy RG, Aleppo G, Committee ADAPP. Prevention or Delay of Diabetes and Associated Comorbidities: standards of Care in Diabetes-2025. *Diabetes Care*. 2025;48(Suppl 1):S50–S58. doi:10.2337/dc25-S003
13. ElSayed NA, McCoy RG, Aleppo G, Committee ADAPP. Children and Adolescents: standards of Care in Diabetes-2025. *Diabetes Care*. 2025;48(Suppl 1):S283–S305. doi:10.2337/dc25-S014
14. Herold KC, Bundy BN, Long SA, et al. An Anti-CD3 Antibody, Teplizumab, in Relatives at Risk for Type 1 Diabetes. *N Engl J Med*. 2019;381(7):603–613. doi:10.1056/NEJMoa1902226
15. Mingrone G, Castagneto-Gissey L, Bornstein SR. New Horizons: emerging Antidiabetic Medications. *J Clin Endocrinol Metab*. 2022;107(12):e4333–e4340. doi:10.1210/clinem/dgac499
16. Schoelwer MJ, DeBoer MD, Breton MD. Use of diabetes technology in children. *Diabetologia*. 2024;67(10):2075–2084. doi:10.1007/s00125-024-06218-0