Increasing Incidence but Decreasing Awareness of Type 1 Diabetes in Sweden

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Diabetes Care 2017;40:e143–e144 | https://doi.org/10.2337/dc17-1175

In Finland, which has the highest incidence in the world of type 1 diabetes (T1D) among children, the incidence seems to level off. Sweden, which has the second highest incidence, is said to have an incidence leveling off at ~40–44 per 100,000 children per year (1). The environmental factors explaining the T1D increase (2) should have reached their maximum. Childhood obesity is no longer increasing in Sweden and a plateau of T1D incidence would fit the β-cell stress hypothesis; however, there could be other explanations.

To elucidate the situation data from the official annual reports from SWEDIABKIDS, the national register of children with newly diagnosed diabetes in Sweden (3), data have been analyzed regarding HbA_{1c} and ketoacidosis at onset, and to get the incidence of T1D in children <15 years of age. These data have been added to published data (1,4) to produce Fig. 1.

Figure 1 shows how incidence of T1D continued to increase in Sweden until 2015, the last complete year of registration. The incidence in those aged <15 years in 2014–2015 was 48.8. In the past 6 years, the incidence has decreased in very young children aged 0–4 years but has increased mainly in the 10- to 14-year-old age-group. Incidence decreases after 15 years of age. From 2012 to 2016, the mean HbA_{1c} at diagnosis increased from 91.7 to 94.3 mmol/mol, and the proportion of patients with ketoacidosis (pH <7.30) increased from 17.9% in 2009, 19.3% in 2012, and 21.0% in 2014 to 24.5% in 2016.

Delay in diagnosis could be illustrated by the number of cases where the diagnosis of diabetes in children has been inadequate, such as missed diagnosis, incorrect diagnosis, or delayed diagnosis. Thus, the incidence of T1D in Sweden in children <15 years of age is not leveling off but continuously increasing. The previous misjudgment was probably dependent on the following: *1*) the official Swedish incidence figures are based on those <18 years of age (as seen in Fig. 1, incidence decreases after the age of 15 years), and *2*) there is a delay in

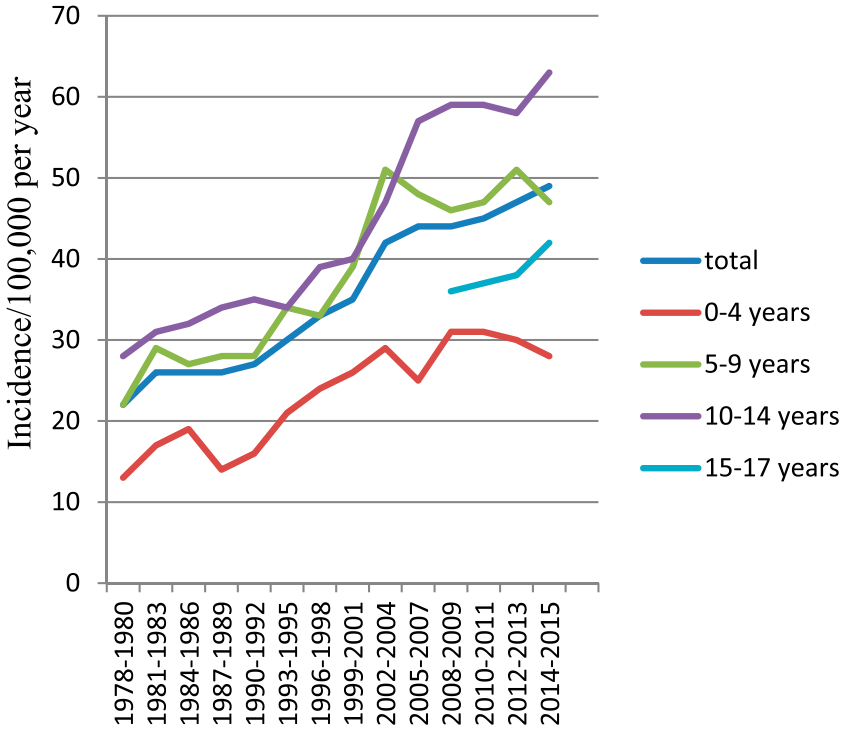

Figure 1—Data from Berhan et al. (1), Dahlquist et al. (4), and annual reports of SWEDIABKIDS show how incidence of T1D has increased in children <15 years of age without any sign of leveling off until 2015. The incidence in past 6 years has decreased in children <5 years of age but increased in teenagers.

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Received 16 June 2017 and accepted 13 July 2017.

reporting national registration data, which may have been incomplete in certain years. For example, according to the 2015 annual report from SWEDIABKIDS, the number of children with newly diagnosed T1D in 2015 was 784, but the annual report from SWEDIABKIDS 2016 gives the updated number of 901 for that same year.

Earlier it was published that the incidence decreased in individuals 15–30 years of age (4,5). The increase of incidence in those aged <15 years suggested a shift to a younger age at onset instead of a total increase. But the registration data was wrong (6); the incidence had actually also increased in young adults parallel to the increase in children aged <15 years. Furthermore, the incidence in the youngest age-group decreased in the past 6 years, while the incidence rose mainly among teenagers (Fig. 1).

In conclusion, Sweden has the world's highest incidence of T1D among children and adolescents next to Finland. The incidence continues to increase without any sign of plateau. Evidently, environmental and/or lifestyle factors are still getting worse. Furthermore, the diagnosis seems to be getting more delayed.

Acknowledgments. Barndiabetesfonden (The Swedish Child Diabetes Foundation) made the SWEDIABKIDS possible by initial important support to this national registration. The author is grateful to the people, not least Ulf Samuelsson, who have developed this register so well.

Duality of Interest. No potential conflicts of interest relevant to this article were reported.

Author Contributions. J.L. wrote the manuscript. J.L. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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