Letters

RESEARCH LETTER

Incidence of Type 1 Diabetes in Finland

The incidence of type 1 diabetes (T1D), one of the most prevalent chronic disease in children, has increased worldwide.[1] The highest recorded incidence in children younger than 15 years was 64.2 per 100 000 person-years in Finland in 2005.[2] We examined the incidence rates between 2006 and 2011 in Finnish children younger than 15 years as well as the 32-year trend (1980-2011).

Methods | All children with newly diagnosed T1D were ascertained using several nationwide registers as previously described.[2] Age-standardized and age-specific annual incidence rates for age groups 0-4, 5-9, and 10-14 years were calculated.

Changes in trends between 1980 and 2011 were identified using the Joinpoint Regression Program version 4.0.1 (National Cancer Institute; http://surveillance.cancer.gov/joinpoint). The study was approved by the ethics committee of the National Institute for Health and Welfare, Finland, as a part of the FinDM II database studies. A waiver of informed consent is not required for register-based studies in Finland.

Results | A total of 14 069 children (7695 boys and 6374 girls) were diagnosed with T1D between 1980 and 2011, of whom 3332 were new cases between 2006 and 2011. The peak incidence of 64.9 (95% CI, 59.7-70.3) per 100 000 person-years was observed in 2006 (**Table**), whereas the mean incidence was 62.5 (95% CI, 60.2-64.4) per 100 000 person-years between 2006 and 2011, 68.4 (95% CI, 65.7-71.9) per 100 000 person-years for boys and 55.4 (95% CI, 52.7-58.4) per 100 000 person-years for girls.

The mean age-specific incidences were 55.0 (95% CI, 51.6-58.6) per 100 000 person-years for children aged 0-4 years, 71.5 (95% CI, 67.5-75.6) per 100 000 person-years for 5-9 years, and

Table. Age- and Sex-Specific Incidence Rates of Type 1 Diabetes in Finland Between 2006 and 2011

	Incidence Rate of Type 1 Diabetes in Finland per 100 000 Person-Years (95% CI)		
Age Group, y	Boys	Girls	Total
0-4			
2006	57.1 (45.5-70.7)	57.5 (45.6-71.4)	57.3 (48.9-66.7)
2007	65.1 (52.8-79.5)	51.2 (40.1-64.3)	58.3 (49.9-67.7)
2008	68.3 (55.7-82.8)	56.9 (45.2-70.6)	62.7 (54.0-72.4)
2009	44.0 (34.1-55.9)	45.9 (35.6-58.3)	44.9 (37.7-53.2)
2010	60.3 (48.7-73.9)	48.2 (37.6-60.8)	54.4 (46.4-63.4)
2011	64.6 (52.5-78.5)	40.5 (30.9-52.1)	52.8 (44.9-61.7)
5-9			
2006	87.4 (72.9-103.8)	73.5 (60.0-89.0)	80.6 (70.5-91.6)
2007	81.9 (67.9-98.0)	74.4 (60.8-90.1)	78.3 (68.3-89.2)
2008	64.8 (52.4-79.2)	65.7 (52.9-80.5)	65.2 (56.2-75.2)
2009	72.6 (59.5-87.7)	66.9 (54.1-81.9)	69.8 (60.5-80.2)
2010	62.2 (50.2-76.3)	61.5 (49.2-75.8)	61.9 (53.1-71.6)
2011	80.8 (67.1-96.6)	64.9 (52.3-79.5)	73.0 (63.6-83.5)
10-14			
2006	65.4 (53.6-79.0)	50.4 (40.0-62.7)	58.1 (50.1-67.0)
2007	62.6 (51.0-76.1)	46.3 (36.2-58.3)	54.6 (46.8-63.4)
2008	68.5 (56.2-82.7)	49.4 (38.9-62.0)	59.2 (50.9-68.4)
2009	80.4 (66.9-95.8)	43.2 (33.3-55.2)	62.2 (53.6-71.7)
2010	69.3 (56.7-83.9)	53.7 (42.5-67.1)	61.7 (53.1-71.3)
2011	83.6 (69.6-99.6)	53.0 (41.8-66.4)	68.6 (59.5-78.8)
Total (0-14)			
2006	69.4 (62.0-77.4)	60.3 (53.3-68.0)	64.9 (59.7-70.3)
2007	69.7 (62.2-77.7)	57.0 (50.2-64.6)	63.5 (58.4-68.9)
2008	67.2 (59.9-75.2)	57.3 (50.5-64.9)	62.4 (57.3-67.8)
2009	64.7 (58.4-73.6)	51.7 (45.2-59.0)	58.3 (53.3-63.4)
2010	63.8 (56.8-71.7)	54.2 (47.7-61.8)	59.1 (52.0-62.1)
2011	75.8 (68.4-84.6)	52.2 (46.1-59.9)	64.3 (59.5-70.2)

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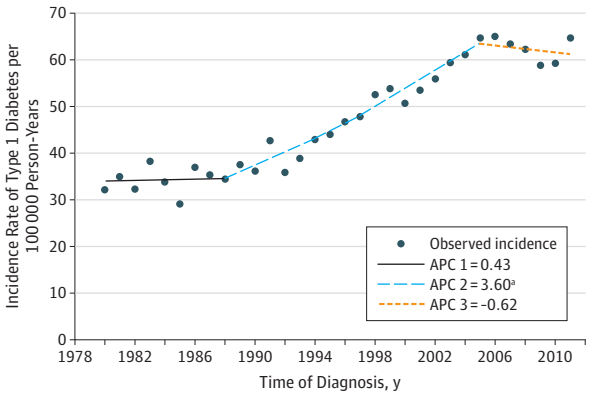
Figure. Trend in the Incidence Rate of Type 1 Diabetes With 2 Joinpoints in Children Younger Than 15 Years in Finland Between 1980 and 2011



APC indicates annual percentage change and it shows trend in incidence over time.
[a]Indicates that the trend is statistically significant.

60.6 (95% CI, 57.1-64.3) per 100 000 person-years for 10-14 years. Joinpoint regression highlighted 2 significant changes in the longer-term trend (**Figure**). After a modest increase until 1988, the incidence increased annually by 3.6% (95% CI, 2.9%-4.3%; $P<.001$) until 2005, followed by a plateau until the end of 2011.

Discussion | The encouraging observation in this study is that the incidence of T1D in Finnish children younger than 15 years has ceased to increase after a period of accelerated increase. This may be due to changes in the environment,[3] such as vitamin D intake. The amount of vitamin D recommended for supplementation in infants had been reduced to one-tenth since the 1950s, during which time the incidence of T1D increased 5-fold. The fortification of dairy products with vitamin D after 2003 may have contributed to the leveling off of T1D incidence.[3]

The increased prevalence of overweight and obesity also has been suggested to contribute to the increasing incidence of T1D. Overweight and obesity in children have increased in Finland during the past 2 decades; however, there is no evidence of a decrease in this risk factor since 2005.[4] Enteroviruses are possibly involved in the pathogenesis of T1D. The number of severe enterovirus infections in Finland increased 10-fold from 2006 to 2010 and it is likely that milder infections increased as well[5]; however, the incidence of T1D did not increase during the same period.

The main limitation of this study is that we were not able to compare the changes in temporal incidence in children with older age groups. Therefore, we cannot determine whether the clinical manifestation is only shifted to older ages. The results should be interpreted with caution because it is possible that this is only a temporary phenomenon. Longer follow-up and studies that extend the coverage to older ages are warranted. Studies are also needed in other countries because the observations from Finland may not be generalizable. However, Sweden has also reported a similar plateau in incidence during 2005-2007.[6]

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Author Contributions: Drs Harjutsalo and Sund had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Harjutsalo, Sund, Knip, Groop.
Acquisition of data: Harjutsalo, Sund, Knip.
Analysis and interpretation of data: Harjutsalo, Sund, Knip, Groop.
Drafting of the manuscript: Harjutsalo, Groop.
Critical revision of the manuscript for important intellectual content: Harjutsalo, Sund, Knip, Groop.
Statistical analysis: Harjutsalo, Sund.
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COMMENT & RESPONSE

Mortality Trends in Critical Access Hospitals

To the Editor Dr Joynt and colleagues[1] compared mortality trends in critical access hospitals (CAHs) and non-CAHs. Their analysis raises a number of concerns in addition to those raised by

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