Increasing Incidence of Type I Diabetes in The Netherlands

The second nationwide study among children under 20 years of age

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OBJECTIVE — A nationwide retrospective study was conducted to assess the incidence of type I diabetes in The Netherlands among children <20 years of age in 1988–1990. The first study with a similar design covered 1978–1980.

RESEARCH DESIGN AND METHODS — The capture-recapture census method was chosen for analysis of the data. A questionnaire was sent to all Dutch pediatricians and internists, and for the ascertainment, a similar questionnaire was sent out separately to members of the Dutch Diabetes Association, which is the national patient association.

RESULTS — The average achieved ascertainment rate was 81%. The ascertainment-adjusted annual incidence was 13.2/100,000 for 0- to 19-year-old children, indicating an increase of 23% compared with the 1978–1980 survey; for 0- to 14-year-olds, the increase amounted to 17%.

CONCLUSIONS — This study suggests a sustained increase of type I diabetes in The Netherlands because the cumulative incidence studied previously in the 1960–1970 birth cohorts of male army conscripts 18 years of age was also found to rise. In contrast to Northern European countries, an increase in incidence for the age category 0–4 years could not be found.

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DDA, Dutch Diabetes Association; CI, confidence interval.

During the past decades, an increase in incidence of type I diabetes has been found in several countries (1–6). A study among the 1960–1970 birth cohorts of 18-year-old male army conscripts revealed that the incidence of type I diabetes is also rising in The Netherlands (7). Our study offers an opportunity to assess recent changes in incidence of type I diabetes in The Netherlands in both sexes because this second nationwide study covering 1988–1990 had a design similar to the previous 1978–1980 study (8).

RESEARCH DESIGN AND METHODS — A questionnaire was sent in January 1991 to all pediatricians and internists to obtain data on children <20 years of age newly diagnosed with type I diabetes during the years 1988, 1989, or 1990. The questionnaire requested information on the child's initials, gender, date of birth, date of first insulin injection, and residence at that time.

As in the first study (8), the national Dutch Diabetes Association (DDA) was selected as a secondary source for validation. In April 1991, the DDA mailed a questionnaire to all members registered since 1988 and born since 1968. Registration and reporting by the specialists and DDA have not changed since the first study.

The ascertainment rate was defined as the proportion of responding patients from the DDA who also were reported by the specialists. The method used to estimate the incidence and its confidence intervals (CIs) is based on the capture-recapture census described by Hook et al. (9). The same formulas have been used to recalculate the incidence figures for 1978–1980. Changes in incidence estimates per 100,000/year were considered significant when the CIs did not overlap. For the 0- to 19- and 0- to 14-year-olds, the incidence rates were standardized to the age (5-year intervals) and sex distribution of the population during 1978–1980.

Table 1—*Cases of type I diabetes reported by specialists and members of the DDA according to type of specialist, age starting on insulin, and rate of ascertainment*

	Cases of type I diabetes (*n*)			Rate of ascertainment (%)	Significance of difference in ascertainment rate
	Specialists	DDA members	Both sources		
Type of specialist					
Pediatrician	840	570	520	91	$P < 0.001$
Internist	329	227	123	54	
Age starting on insulin (years)					
0–4	160	110	99	90	
5–9	292	204	181	89	$P < 0.001$
10–14	436	290	256	88	
15–19	281	195	107	55	

The sum of DDA members according to type of specialist (797) is not equal to the sum of members according to age starting on insulin (799) because two members were treated by general practitioners.

RESULTS— On 1 November 1991, 100 and 87% of the pediatricians and internists, respectively, did respond. The pediatricians reported 840 youngsters and the internists reported 329 youngsters 0–19 years of age in whom insulin treatment was initiated in 1988–1990. Of the DDA questionnaires received, 799 met the criteria. From the 1,169 patients reported by the specialists, 643 (55%) were also responding members of the DDA. Of the 156 DDA members not reported by the specialists, 36 were treated by non-responding specialists, 117 were treated by responding specialists who failed to report, and 3 were under treatment by doctors who were missing on the mailing list (two general practitioners and one pediatrician abroad).

No significant differences were found in ascertainment rates according to sex, month of first insulin injection, year of first insulin injection, and province of residence at that time (two-way χ^2 test; $P < 0.05$). Ascertainment by pediatricians (91%) was significantly higher than by internists (54%), and consequently, the overall decrease in ascertainment rate with age was significant (Table 1).

The ascertainment-adjusted incidence rate was 13.2/100,000 (95% CI 12.7–13.7) per year for the 0- to 19-year-olds and 12.4/100,000 (95% CI 12.1–12.7) per year for 0- to 14-year-olds. For boys and girls, the ascertainment-adjusted incidence increased with the first three 5-year age categories, after which a decline was observed in the age category 15–19 years (Table 2).

When comparing our data with the ascertainment-adjusted annual incidence rates for 1978–1980 (10.9/100,000 [95% CI 10.5–11.4] for 0- to 19-year-olds; 11.1/100,000 [95% CI 10.7–11.5] for 0- to 14-year-olds), a significant increase of 21 and 12% was apparent for the age-ranges 0–19 and 0–14 years, respectively. The standardized ascertainment-adjusted incidence in 1988–1990 was 13.5/100,000 (95% CI 13.0–14.0) per year for 0- to 19-year-olds and 12.9/100,000 (95% CI 12.6–13.2) per year for 0- to 14-year-olds, indicating an even larger increase of 23 and nearly 17%, respectively. Table 3 shows the ascertainment-adjusted incidence rates for both periods according to age. With the exception of the age category 0–4 years, the incidence increased significantly.

Table 2—*Ascertainment-adjusted 3-year incidence of type I diabetes and the annual incidence per 100,000 according to age and sex*

Age (years)	Ascertainment-adjusted number (1988–1990)	Mean population over the 3 years	Ascertainment-adjusted incidence per 100,000/year	95% CI
Boys				
0–4	96	470,081	6.8	6.3–7.2
5–9	159	453,269	11.7	11.0–12.4
10–14	259	465,841	18.5	17.9–19.1
15–19	287	578,051	16.6	14.3–18.9
Girls				
0–4	83	450,499	6.1	5.9–6.3
5–9	173	433,872	13.3	12.9–13.7
10–14	235	444,098	17.7	16.9–18.4
15–19	221	554,671	13.3	11.5–15.1

Table 3—*Ascertainment-adjusted annual incidence of type I diabetes per 100,000 with its CIs according to age in 1978–1980 and 1988–1990*

	1978–1980		1988–1990	
Age (years)	Incidence per 100,000/year	95% CI	Incidence per 100,000/year	95% CI
0–4	6.8	6.6–7.1	6.4	6.2–6.7
5–9	11.0	10.3–11.6	12.4	12.0–12.7
10–14	14.3	13.4–15.3	18.1	17.6–18.6
15–19	10.4	9.3–11.6	15.0	13.5–16.5

CONCLUSIONS — This study is the first one in which the change in incidence over time has been estimated by the capture-recapture census method (9). Comparing the standardized results of this study (1988–1990) with the first nationwide study (1978–1980), a significant increase in incidence of type I diabetes was found in 23 and 17% for the age-ranges 0–19 and 0–14 years, respectively. This increase could not be attributed to factors leading to a spurious rise, such as improvement of diagnosis, changes in case definition, or declining disease-specific mortality (10). Especially in the 0- to 14-year age category with high ascertainment rates, the increase could not be attributed to underreporting.

Drykoningen et al. (7) studied the cumulative incidence of type I diabetes in male army conscripts 18 years of age in The Netherlands over a 10-year period. A significant nonlinear increase in the birth cohorts of 1960–1970 was found (on the average 4.4% with each annual birth cohort). Although the cumulative incidences for birth cohorts are not directly comparable to the incidences found in the current study, both studies suggest a sustained significant increase in incidence of type I diabetes in The Netherlands.

The Diabetes Epidemiology Research International Group reported an annual increase in incidence ranging from 10.1% in New Zealand to 2.8% in Norway (3). Although the rise established in our study is lower than in those countries, it is a substantial increase. In our study the absence of increase in the 0- to 4-year-olds is striking. This contrasts with the findings in Sweden and Finland (4,5). In Leicestershire the most prominent increase could even be found in the youngest age categories (3). In both our studies, a north-south gradient was not present in our small but densely populated country.

The causes of the increasing incidence, as observed in several countries, are unknown. It is unlikely that it can be attributed to changes in genetic susceptibility (11,12). Although etiologically important factors in the environment have not been identified with certainty, observed differences in incidence over time and between countries may be helpful in the search for environmental determinants of type I diabetes.

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