Increasing Incidence of IDDM in Austrian Children

A nationwide study 1979–1993

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OBJECTIVE — A nationwide population-based study was conducted to assess the insulin-dependent diabetes mellitus (IDDM) incidence in childhood over a 15-year period (1979–1993).

RESEARCH DESIGN AND METHODS — A questionnaire was sent to all Austrian pediatric departments and diabetologists. The secondary data source was based on patient organization lists and hospital administration data. The data from 1979–1987 were collected retrospectively, while from 1988 to 1993 the registration of cases was performed prospectively in the same network. Estimates of probability of ascertainment were calculated according to the capture-recapture method.

RESULTS — The achieved ascertainment was 94%. The overall annual incidence was 7.9/100,000 person-years in children 0–14 years old. During the observation period, the incidence rose by 2.4% annually.

CONCLUSIONS — The incidence of childhood IDDM in Austria, a European country with an intermediate risk for IDDM, showed a proportionally similar increase to that of Northern European countries over the past decade. The increase seems to be continuous, following mainly a linear trend with superimposed sudden outbreaks indicating environmental causative factors.

During the last decade, it has been frequently claimed that the incidence of childhood insulin-dependent diabetes mellitus (IDDM) is increasing (1,2). The evidence for the increase comes mostly from the high-risk populations in northern Europe. There, the incidence has increased over 50% during the last 20 years (3–8), whereas in some populations an increase has not been confirmed (2,9,10). Thus far, there are limited long-term data on the incidence of IDDM in the relatively low-risk areas of central and southern Europe (11). The purpose of this study was to describe the time trend in incidence of IDDM over a 15-year period in Austria.

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CI, confidence interval; IDDM, insulin-dependent diabetes mellitus.

RESEARCH DESIGN AND METHODS

Case definition and ascertainment

The primary source of case ascertainment was a network covering all pediatric hospitals, wards, and diabetologists. Altogether, 1,551 IDDM patients, 0–14 years of age and newly diagnosed from 1979 to 1993, were included in the study.

A questionnaire requested the child's initials, gender, date of birth, and date of first insulin injection. The data from 1979 to 1987 were collected retrospectively (12). Because of a lack of funding, data for 1985 were not collected. During 1988–1993, case ascertainment was otherwise the same but was updated prospectively every 6 months. During the retrospective period 1979–1984 and in 1989 and 1992, the secondary data source was the lists of summer camps (organized by the patient association). In 1990, hospital administration data could be used as a secondary source.

Estimates of probability of ascertainment were calculated according to the capture-recapture method (13) and reached 93–94% in the retrospective and 94–95% in the prospective study period.

Population at risk

The population denominator data by sex, calendar year, and each birth year (Table 1) were obtained from the Austrian Central Statistic Office in Vienna (National Census 1990).

Statistical analysis

For the incidence rates, confidence intervals (CIs) were estimated assuming the

Table 1—*At-risk population (in millions) <15 years of age during 1979–1993 in Austria*

	1979–1981	1982–1984	1986–1988	1989–1991	1992–1993
Boys	2.367	2.207	1.971	2.071	1.422
Girls	2.265	2.113	1.904	1.966	1.342
Total	4.632	4.328	3.894	4.038	2.764

Poisson distribution of the cases. The effects of the time period, age, and sex and their corresponding interactions were tested using the logistic regression model (SAS 6.08) (14). Because of the relatively low incidence, a logistic regression model yields virtually the same parameter estimates and standard errors as a Poisson regression model (15). The variable age-group was transformed into two binary variables indicating the risk of the 5- to 9- vs. the 0- to 4-year-old age-group and the 10- to 14- vs. the 0- to 4-year-old age-group, respectively. Because of the model's lack of fit where time was the only explanatory variable, an additional variable was generated by setting it equal to the sine of time and a period of 14 years. This new variable was used to detect whether the effect of time was linear or not.

Lack of fit of the model was tested by means of the deviance, i.e., the twofold difference in the log-likelihood between the fitted and the saturated model. The year 1985 was not included in the regression model because of missing data.

RESULTS — The overall mean annual incidence of IDDM per 100,000 person-years during the observation period 1979–1993 (Table 2) was similar for boys (8.1, 95% CI: 7.7–8.7) and girls (7.7, 95% CI: 7.1–8.2). The sex ratio 1.11 did not differ significantly from 1.04 in the background population.

We found a significant linear increase in incidence over the time ($P < 0.0001$) (Fig.1). Estimated from the linear trend model, the overall incidence rose by 2.4% annually.

In addition, we found nonlinear variation in incidence: a sine curve fitted significantly to the observed temporal pattern for both sexes ($P = 0.0032$). In a saturated model, neither sex nor the interaction between sex and time were significant. A model eliminating the sex-specific variables revealed a significant interaction between time and 10- to 14-year-old age-group ($P = 0.0273$). Therefore, the analysis was stratified by age (Table 3). In children aged 0–5 years, the time trend was not significant, whereas in children aged 5–10 and 10–14 years a significant increase in incidence was found. The goodness-of-fit tests showed no significant deviation from the observed data. The comparison of the observed and estimated age-specific incidence rates is given in Fig. 2.

CONCLUSIONS — Thus far, no long-term trend data have been available in European countries with an intermediate risk of IDDM. The present data from Austria covering a 15-year period demonstrate a marked increase of 36% in IDDM incidence in children aged 14 years and under. The increase in Austria seems to be continuous after a mainly linear trend with a superimposed cyclic pattern. The rise affects both sexes in a similar way. Despite the great differences in the baseline risk, the average annual increase of 2.4% is strikingly similar to the observed annual increase rates of 2.4% in Finland (5), 2.5% in Sweden (4), 2.8% in Norway (3), and 1.7% in the Netherlands (8).

Also, other incidence studies covering a continuous observation period of

Table 2—*Mean annual incidence (per 100,000 person-years), 95% CI, and number of cases (n) of IDDM diagnosed in Austrian children <15 years of age during 1979–1993*

	1979–1981	1982–1984	1986–1988	1989–1991	1992–1993
Boys					
Incidence (95% CI)	6.5 (5.5–7.6)	9.0 (7.8–10.4)	7.3 (6.2–8.6)	8.3 (7.1–9.6)	10.2 (8.6–11.9)
n	154	200	146	172	145
Girls					
Incidence (95% CI)	6.3 (5.3–7.4)	7.6 (6.4–8.8)	7.9 (6.7–9.3)	7.9 (6.7–9.2)	9.3 (7.8–11.1)
n	143	160	151	155	125
Total					
Incidence (95% CI)	6.4 (5.7–7.2)	8.3 (7.5–9.2)	7.6 (6.8–8.5)	8.1 (7.2–9.0)	9.8 (8.6–11.0)
n	297	360	297	327	270

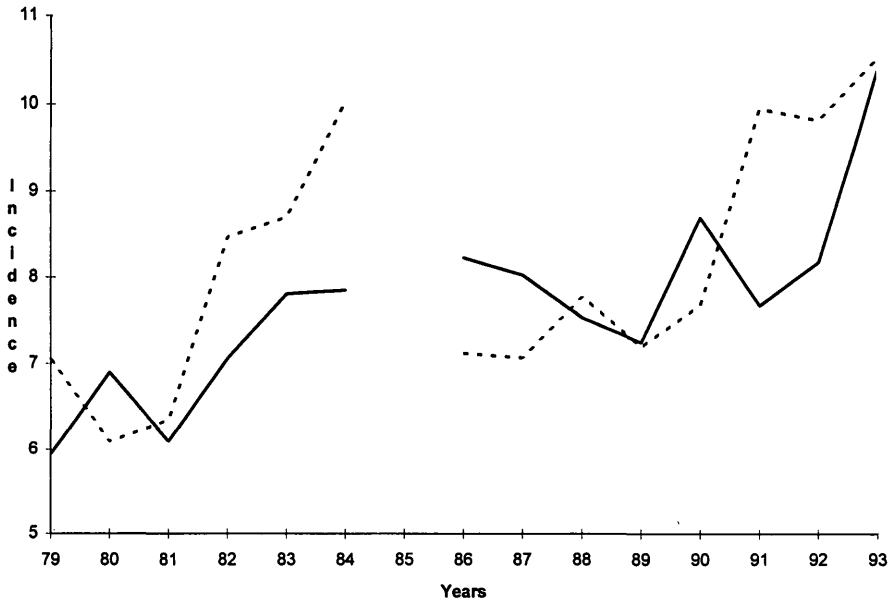

Figure 1—*Annual incidence of IDDM per 100,000 person-years in Austrian children 0–14 years old between 1979–1993.* ———, *boys;* – – – –, *girls.*

>10 years have found a cyclic pattern in incidence trend (4,5). Some investigators have postulated that epidemic outbreaks of IDDM incidence do occur, such as in the early 1980s (16–18). Our data give further support to this theory.

The consistency across the continent indicates that environmental agents that act periodically may play a role in triggering the manifestation of the disease, at least during the "epidemic" years.

The increase in incidence may not mean that the disease is becoming more common, but that the manifestation occurs at an earlier age (19). We found that the time trend had a greater impact in older age-groups than in younger age-groups. This contrasts with the findings in Sweden (4) and Finland (5), but is in accordance with a recent report from the Netherlands (8). Nevertheless, note that the increase in incidence in the 1960s and 1970s in Finland started in older children, but in the 1980s, a transition toward a younger age of onset has been observed (20).

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Table 3—*Regression results and test for lack of fit for the stratified analysis*

	0–4 year olds		5–9 year olds		10–14 year olds	
Parameter	Estimate	*P* value	Estimate	*P* value	Estimate	*P* value
Intercept	−10.1926	0.0001	−11.7833	0.0001	−12.3575	0.0001
Year	0.0041	0.7367	0.0271	0.0058	0.0367	0.0001
Deviance	19.7184	0.0726	17.2044	0.1420	10.5137	0.5709

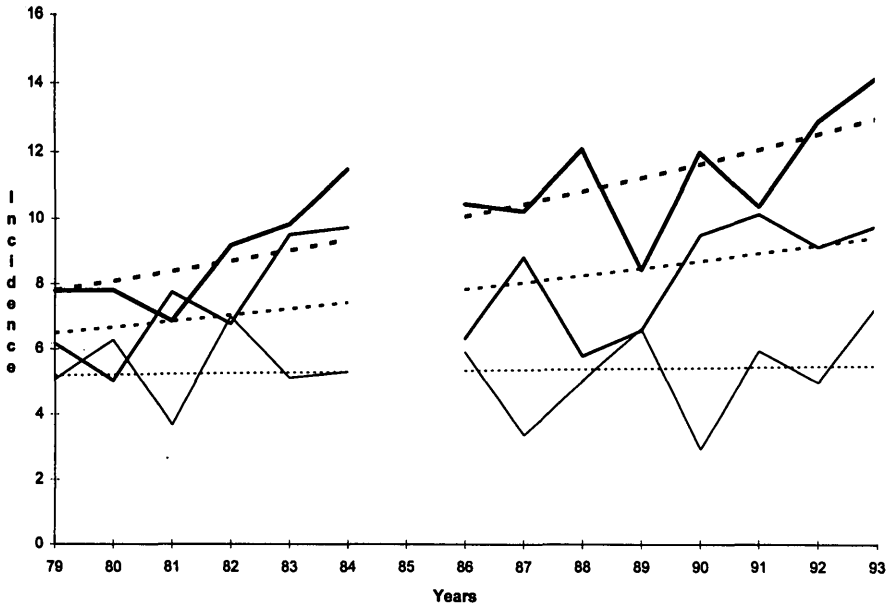

Figure 2—*Age-specific annual incidence of IDDM per 100,000 person-years in Austrian children 0–14 years old during 1979–1993. Comparison between observed (———) and estimated rates (– – – –) in the 0- to 4-year-old (bottom), 5- to 9-year-old (middle), and 10- to 14-year-old (top) age-groups.*

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