IDDM in the Province of Pavia, Italy, From a Population-Based Registry

A descriptive study

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OBJECTIVE — To report the incidence of insulin-dependent diabetes mellitus (IDDM) in the Province of Pavia, Italy, in the 0- to 29-year-old age-group between 1988 and 1992. Urban versus rural residence, socioeconomic level, and family size of IDDM cases were also investigated.

RESEARCH DESIGN AND METHODS — A prospective register was established in 1988 to collect all newly diagnosed IDDM patients with onset before 30 years of age. The primary data source was based on notification of new cases by hospitals, out-patient clinics, family doctors, and pediatricians. The secondary and independent data source consisted of the registries of prescriptions for insulin syringes in the health districts of the province.

RESULTS — In 5 years (1988–1992), 66 cases of IDDM in the 0- to 29-year-old age-group were identified. The completeness of ascertainment was 100% for the combined sources. Age-adjusted (world-standardized) incidence rates per 100,000 (95% confidence interval) were 9.52 (6.42–13.61), 6.72 (4.68–9.34), and 8.27 (6.42–10.58), respectively, for the age-groups 0–14, 15–29, and 0–29. The rates were higher for residents in urban areas. The number of children in the families of IDDM patients was significantly higher than in the reference population.

CONCLUSIONS — Our data indicate the concordance of IDDM incidence rates with the North-Italian rates and a possible association of the disease with environmental factors. These factors might enhance the susceptibility to IDDM in genetically predisposed individuals.

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

The organization of regional registries for IDDM within the EURODIAB ACE Project provided some interesting points about the distribution of IDDM patients in different countries and ethnicities in Europe. In Italy, IDDM incidence, estimated for the years 1989–1990 in the 0- to 15-year-old age-group, varied from 6.5/100,000 in Lazio to 30.2/100,000 in Sardinia, showing a wide variation of rates even within one specific country (1).

A prospective IDDM registry (1988–1992) was recently organized in the Province of Pavia (Lombardy) for the 0- to 29-year-old age-group with the aim of accurately describing incidence rates and analyzing several potential host environmental risk factors in residents.

RESEARCH DESIGN AND METHODS

— The Province of Pavia's IDDM registry collects data with a standardized methodology (DERI Group) (2) and has contributed to the EURODIAB ACE Study in the Lombardy region (of Italy) since 1989 and to the WHO DIAMOND Project (3) since 1990. The registry covers an area of 2,965 km^2 in the Lombardy region (northern Italy). The 1991 census population (4) was 490,898 residents. The denominators have been obtained by the intercensal estimates (5) for the years 1988–1990 and 1992. The 0- to 29-year-old age-group consisted of 159,717 inhabitants, 81,951 males and 77,766 females. The primary data source for ascertaining IDDM patients was based on notification to our center of new cases by hospitals, out-patient clinics, family doctors, and pediatricians. The secondary source of cases consisted of the registries of insulin-syringe prescriptions from the health districts of the three local health units of the province. The criteria for diagnosing IDDM in children (0–14 years) and in the adult population (15–29 years) were those recognized for diabetes registries (2,3). Data recorded for each patient included name, date and place of birth, sex, address, date of diagnosis, age at di-

Table 1—*IDDM annual incidence rates (per 100,000) for the Province of Pavia (1988–1992)*

Age-group	Sex (M/F)	Population	Patients (*n*)	Incidence rate	95% CI
0–4	M	8,625	3	6.96	1.43–20.32
	F	8,187	1	2.44	0.06–13.59
5–9	M	9,255	4	8.64	2.35–22.19
	F	8,918	5	11.21	3.63–26.12
10–14	M	11,973	10	16.70	8.02–30.73
	F	11,262	8	14.21	6.12–27.99
0–14	M	29,853	17	11.39	6.64–18.22
	F	28,367	14	9.87	5.39–16.58
	M + F	58,220	31	10.65	7.19–15.23
15–19	M	15,073	3	3.98	0.82–11.62
	F	14,450	5	6.92	2.24–16.12
20–24	M	17,796	7	7.87	3.16–16.21
	F	16,844	4	4.75	1.29–12.16
25–29	M	19,229	8	8.32	3.59–16.39
	F	18,105	8	8.84	3.81–17.41
15–29	M	52,098	18	6.91	4.10–10.92
	F	49,399	17	6.88	4.01–11.01
	M + F	101,497	35	6.90	4.81–9.59
0–29	M + F	159,717	66	8.26	6.42–10.57

agnosis, date of first insulin injection, parents' educational level, house property, and number of children in the family. IDDM incidence rates were age-standardized (direct method) according to the world population (6). The 95% confidence interval (CI) was estimated assuming a Poisson distribution of the observed number of cases. The estimated completeness of ascertainment was computed with the capture-recapture method (7). The data regarding parents' educational level, house property, and number of children in IDDM families were compared with those of the general population of the same age for the Province of Pavia (Census 1991) (4). The average monthly temperature in Pavia was recorded by the Osservatorio Geofisico of Pavia from 1988 to 1992.

Statistical analysis concerning Student *t* test, χ^2 test, and correlation was made by SPSS/PC+.

RESULTS — In 5 years (1988–1992), 66 cases of IDDM in the 0- to 29-year-old age-group were identified. The estimated number of incident cases according to the capture-recapture method was 66 (95% CI 65–67) equal to 100% of ascertainment for the combined sources. Table 1 illustrates the number of IDDM cases, incidence rates, and respective 95% CIs for 5-year age-groups from 0 to 29 years in both sexes. The mean annual incidence rate for the 0- to 29-year-old age-group was 8.26/100,000 (males: 8.54/100,000, females: 7.97/100,000). In the 0- to 14-year-old age-group, the incidence rate was 10.65/100,000 (males: 11.39/100,000, females: 9.87/100,000). Age-adjusted (world-standardized) incidence rates per 100,000 were 9.52 (95% CI 6.42–13.61), 6.72 (95% CI 4.68–9.34), and 8.27 (95% CI 6.42–10.58), respectively, for the age-groups 0–14, 15–29, and 0–29 years. The male-to-female ratios in the 0- to 14-, 15- to 29-, and 0- to 29-year-old age-groups were 1.21, 1.06, and 1.13, respectively. A significantly higher number of IDDM patients younger than age 14 was diagnosed from September to February than from March to August ($P < 0.05$). However, no correlation was found among the monthly number of cases and the average outdoor temperature. IDDM annual incidence rates for residents in urban areas (>20,000 inhabitants) were 8.27/100,000 (95% CI 5.54–11.90) and for residents in rural areas, 6.7/100,000 (95% CI 4.78–9.11).

Higher educational level in parents (≥9 years of education) was not significantly higher (33.9%, 95% CI 24.2–46.1) in IDDM families compared with the same-age general population (28%) of the Province of Pavia (4). House property was also higher (64.5%, 95% CI 46.1–87.7), albeit not significantly, in parents of probands in comparison with the general population (56.8%). The number of children in the family of IDDM patients was significantly higher ($P < 0.001$) than in the families of the reference population, where only families with parents 20–64 years of age were considered (Table 2).

CONCLUSIONS — The annual incidence of IDDM in the population of the Province of Pavia (0–29 years) for 1988–1992 was 8.26/100,000. The completeness of ascertainment by the capture-recapture method (7) was 100%. Bruno and coworkers (7), measuring the prevalence of non-insulin-dependent diabetes and IDDM, reported that three data sources are necessary to avoid ascertainment bias; Pavia's IDDM registry, where incident cases are very homogeneous for type of diabetes and age, should make the ascertainment by only two independent sources sufficiently reliable. The age-corrected annual incidence (8.27/100,000) was higher than that registered in Lombardy (6.2/100,000) for the same age-group in 1989–1990 (9). The difference is more evident in the 0- to 14-year-old age-group, being 9.52/100,000 (95% CI 6.42–13.61) in Pavia and 6.8/100,000 (95% CI 5.8–7.8) in Lombardy (1). The rates in this age-group are more similar to those reported by Arpi et al. (10) in the district of Catania (1989–1991) (10.2/100,000). A possible reason for the higher rates could be the com-

Table 2—*Family size for IDDM and reference population (Pavia Province)*

Children	IDDM cases	Reference population (families)
1	20 (29)	43,993 (58)
2	33 (51)	26,900 (35)
3	7 (11)	4,248 (6)
4+	6 (9)	869 (1)
Total	66 (100)	76,010 (100)

Data are *n* (%).

pleteness of ascertainment in limited-size population registries. Urban areas showed higher incidence of IDDM than rural areas in the Province of Pavia, as Bruno et al. (11) described in the Province of Turin. Seasonal variations in 66 cases do not allow conclusive results, although a clustering of cases were diagnosed in September and in January. This phenomenon seems independent of outdoor temperature and might rather be related to the resumption of school attendance after summer and winter vacations. However, the influence of climatic factors on the occurrence of IDDM is not yet clear and might vary in different populations (9,12,13). According to Marmot (14), parents' educational level and house property can be considered as indicators of socioeconomic level. Our data indicated that the socioeconomic level in IDDM patients was not significantly higher than in the general population of the same age. The number of children in IDDM families appears to be higher than in the Pavia province population (4). A higher reproductive performance in parents of IDDM cases has previously been described (15).

The registration of IDDM cases during 5 years in the Province of Pavia and the collection of environmental and personal data provided the opportunity to conduct descriptive analyses and make comparisons with the general population of the same area. These results mostly confirmed results obtained in other studies and might be suggestive of new hypotheses concerning further environmental susceptibility factors of the disease. In fact, the described associations are indicative of exposure to one or more infectious agents present at the community level, which could play the role of promotors/triggers in genetically susceptible individuals. Immunogenetic data, collected for IDDM patients in the 0- to 14-year-old group, will contribute to a more complete description of IDDM in the Province of Pavia.

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