## Behavioral Correlates of Metabolic Control in People With IDDM in Taipei

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The incidence of insulin-dependent diabetes mellitus (IDDM) in Taipei is between 1.3 and 2.0/100,000 per year during the period 1984–1993. Direct evaluation of most of these identified individuals documented that metabolic control was poor with three-quarters of them having $HbA_{1c}$ values in excess of 7%. A study was undertaken to identify the interrelationships between metabolic control of diabetes and several behavioral variables including psychological factors and adjustment, family attitudes about and knowledge of diabetes, and self-management strategies. One hundred thirty subjects were recruited from the survey project of the Taipei IDDM Registry and from the Kang-Tai IDDM Association. Statistical analysis applied to the data included analysis of variance tests, simple correlation, and multiple regression statistics. Results demonstrated that the psychological factors and knowledge about IDDM were directly related to self-management strategies, and that knowledge and self-management approaches had direct effects on $HbA_{1c}$ levels. Using a stepwise multiple regression analysis, self-management was found to explain 35% of the $HbA_{1c}$ variance and, when combined with diabetes knowledge, would account for 47% of variance. Somewhat surprisingly, it was found that self-management activities of primary school students were superior to those of junior and senior high school students. This study confirms the importance of diabetes knowledge and self-management skills in terms of diabetes control.

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## IDDM Incidence in Children 0–14 Years of Age in Piedmont, Italy

In Italy, a national population-based register on diabetes is lacking, and only recently, some investigations have been conducted in different areas. According to these studies, insulin-dependent diabetes mellitus (IDDM) incidence in children <15 years old shows a variation, with the highest reported difference between the Island of Sardinia and the rest of Italy (1). We would like to report the results of a survey on IDDM incidence in the pediatric population (0–14 years of age = 585,201 people) living in Piedmont (northwest of Italy), conducted with the collaboration of the 45 pediatric departments of our region and of the main pediatric-diabetology centers of the neighboring counties.

In Piedmont, medical care for diabetes is well developed, and most patients, especially those of a pediatric age, are admitted to public hospitals at the onset of the disease.

Data collected during 1 January 1989–31 December 1990 have been validated through the regional computerized file of diabetic patients and the regional discharges database. The estimated completeness of the primary data source, computed with the capture-recapture method according to the Chapman Estimator (2), was 91%, whereas the completeness of the whole system of data collection was 99%.

During the study period, 120 new cases of type I diabetes were identified in Piedmont, and the overall observed incidence rate, age-standardized on the world population, was 9.44/100,000 people per year, placing our area among those of intermediate IDDM incidence, such as Belgium, Netherlands, Spain, Austria, and France (1).

Compared with other Italian regions, our data show an IDDM incidence in Piedmont lower than in Sardinia and similar to the one reported during the same period in eastern Sicily, Lombardia, Lazio, and the city of Turin (1,3).

As reported in other studies, IDDM incidence varies with age. In our report, the lowest rate was observed in the 0–4 year age-group (4.6/100,000 people per year), and the highest rate in the 5–9 year age-group (12.8/100,000 people per year) similar to that observed in the 10–14 year age-group (12.2/100,000 people per year).

A slight predominance in the incidence of type I diabetes was observed in females. This finding is in accordance with data from the Diabetes Epidemiology Research International Group, which reported a male preponderance in populations with high incidence rates, but a female predominance in those with low-intermediate rates similar to our population (4).

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In conclusion, our study shows a good coherence with national and international findings about IDDM and adds interesting data to better understand the epidemiology of IDDM in Italy.

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# Resuspension of Intermediate-Acting Insulin as a Source of Error in Insulin Dosing

Correct measurement of the prescribed insulin dose is a sine qua non of glycemic control. Recent studies have shown large relative errors in injected volumes when measuring small doses of insulin (1–3). Another potential source of error is the incomplete resuspension of intermediate-acting insulin (IAI). An extensive literature search revealed no information on the degree to which patients comply with the few simple steps required to obtain a homogenous suspension of particles before withdrawing IAI. We examined this aspect of diabetes self-care in a camp for diabetic children where injection technique can be objectively monitored in a relaxed atmosphere, approximating that of home. Twenty subjects aged 8–15 years were examined, most on two separate occasions. They all had received instruction, at three university-based clinics, that resuspension is an integral part of the injecting technique, and the children were encouraged to perform resuspension at home under parental supervision. Resuspension was reinforced in the routine teaching activities of the camp without special emphasis.

IAI samples were obtained by one observer (S.L.) immediately after insulin withdrawal by the patient as follows: while the vial was still in the inverted position, the observer would immobilize it gently but firmly, explaining that the vial needed to be checked without specifying why. The study did not require informed consent, and only the two investigators were aware of its purpose. Ten units (0.01 ml) were then quickly drawn, to sample the IAI as mixed by the subject, followed by a paired control sample after thoroughly mixing the same vial by four vertical inversions. Particulate matter in the samples was measured based on protein content, using the Bio-Rad reagent (Richmond, CA) against a serial dilution of IAI of the same brand. The clear supernatant had no measurable protein, and absorbance was linear in the range of dilutions tested. The value of the sample as mixed by the subject was expressed as a percentage of the paired, completely mixed, control.

The mean absolute difference between these two samples was found to be 12.6%, compared with a 3.2% difference between duplicates of the same sample ($P < 0.001$ by the Pittman permutation test). The dose, as withdrawn by the patient, was within 10% of intended in 21 of 36 instances (58.3%). In four of the remaining instances (11.1%), the discrepancy was >20%, the worst cases being 51 and 198% of intended. Overdosing was as likely as underdosing, presumably depending on the position of the unsuspended particle clump at the time of sampling. Because our sampling procedure could only have promoted resuspension, we, if anything, underestimated the errors.

Our results point to incomplete IAI resuspension as a significant and relatively frequent source of insulin-dosing errors. Because several instances of >10% error involved patients in the 14- to 15-year-old group who were regularly injecting themselves at home, we suspect that the problem is not confined to children injecting in a camp. Similar studies in clinics for adults are needed to estimate the magnitude of the problem in that population. We submit that this aspect of injecting technique must not be taken for granted and must be better stressed during teaching of diabetes self-care and its subsequent reinforcement.

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