

# The Incidence of IDDM in Seoul From 1985 to 1988

KWANG W. KO, MD  
SEI W. YANG, MD  
NAM H. CHO, PHD

**OBJECTIVE**— To determine insulin-dependent diabetes mellitus (IDDM) incidence rates for the first time in Seoul, Korea, from 1985 to 1988.

**RESEARCH DESIGN AND METHODS**— A mail survey was conducted among all hospitals, a total of 136, with >80 beds in the Seoul area. Of these, 21 (15.4%) hospitals reported patients with newly diagnosed IDDM.

**RESULTS**— The average incidence rate of IDDM from 1985 to 1988 was 0.70/100,000 (95% confidence interval [CI]: 0.55–0.89). When stratified by gender, the average incidence rate in boys was 0.58/100,000 (95% CI: 0.42–0.9), and in girls it was 0.78/100,000 (95% CI: 0.56–1.07). The age at onset was similar to that reported in other countries, i.e., more than 50% of the cases were diagnosed between the ages of 10 and 14. The incidence of IDDM increased in parallel with the age-group (0–4 < 5–9 < 10–14 years). Onset seasonality was also similar to that in other reported countries with the most cases occurring during the winter months and the least number of cases during the summer months.

**CONCLUSIONS**— The incidence rate of IDDM in Seoul is the lowest reported in the world. This might be effectively considered a baseline incidence rate before exposure to environment or other risk factors. The similar pattern of onset characteristics in Korea to those in other countries suggests that the same etiological factors are operative.

Insulin-dependent diabetes mellitus (IDDM), as it is classically seen in the child and adolescent, is abrupt in onset with a prediagnostic clinical course characterized by polyuria, polydipsia, polyphagia, weight loss, fatigue, and, if the diagnosis is not made, eventual progression to diabetic ketoacidosis (DKA) (1). In 1984,

From the Department of Pediatrics (K.W.K., S.W.Y.), College of Medicine, Seoul National University, Seoul, Korea; and the Department of Medicine (N.H.C.), Center for Endocrinology, Metabolism, and Molecular Medicine, Northwestern University Medical School, Chicago, Illinois.

Address correspondence and reprint requests to Nam H. Cho, PhD, Ajou University School of Medicine, Department of Preventive Medicine, 5 Wonchon-Dong, Paldal-Gu, 442–749 Suwon, Korea.

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

Keen and Ekoe (2) claimed that IDDM “is characteristic of Caucasoid people and much less common in, or even absent from, some other ethnic groups.” Indeed, numerous reports based on population studies indicate that there are marked geographical differences in the incidence of IDDM in the world: high risk in Scandinavian countries, moderate risk in Europe and North America, and low risk in Asia (3,4).

The epidemiology of IDDM in Far East Asian countries (Japan, China, and Korea) is very important because they have similar dietary patterns, culture, customs, and geographical setting. The questions to be addressed in this study focus on the low incidence of IDDM among Far East Asians, specifically in Seoul.

## RESEARCH DESIGN AND METHODS

### Seoul IDDM registry

The Seoul IDDM registry, a population-based hospital survey, was established at the Children’s Hospital of Seoul National University in the winter of 1986. The following criteria were set for eligibility: 1) the patient must be a resident of Seoul at the time of diagnosis; 2) the age of the patient must be <15 years; 3) the hospital records must indicate the presence of DKA, new onset of diabetes at the time of hospital admission, or ketoacidotic death; and 4) the patient must have been discharged on a regimen of insulin administration. All reported cases of IDDM during 1985 and 1986 were derived from review of extant medical records at all major hospitals (i.e., ≥80 beds). Because the pediatricians’ recall of older cases was less reliable, only the cases identified in recent years (i.e., 1985 and 1986) were included in the registry. A total of 38 IDDM patients (19 boys and 19 girls) were identified in 1985 and 1986 from 13 different hospitals. Patients with IDDM identified in 1987 and 1988 were enrolled prospectively into the registry by returning pre-

stamped postcards at the time of diagnosis. The postcards contained the following questions: hospital name, chart number, patient name, date of birth, and sex. In 1987 and 1988, IDDM was newly diagnosed in 33 (13 boys and 20 girls) patients from 14 different hospitals (6 previously reported and 8 new). In addition, one death from DKA (a 2-year-old boy) occurred in 1987, and the case was included in the registry. By the end of 1988, a total of 21 hospitals reported 71 patients with newly diagnosed IDDM. Approximately 90% of the hospitals participated in the study by returning pres-tamped postcards at least once between 1985 and 1988.

#### Validation of cases

Currently, no secondary ascertainment sources (i.e., medical insurance, school records, etc.) are available in Seoul. Therefore, to determine the completeness of the registry, we applied two epidemiological methods: a random reevaluation technique and death certificate validation. First, during the summers of 1987 and 1989, two of the investigators (S.W.Y., N.H.C.) visited all hospitals that had reported cases of IDDM and abstracted the medical records using a computerized system. Because all of these cases were derived from hospitals with >80 beds, we recognized the possibility of underreporting cases at other hospitals. Therefore, we selected ~28% of nonrespondent major ( $\geq 80$  beds;  $n = 34$ ) and 25% of nonqualified minor (<80 beds;  $n = 30$ ) hospitals by a stratified random sampling method. The investigator telephoned the pediatrics and medical records departments in these hospitals to validate that there were no newly diagnosed IDDM cases. Second, the computerized death registration for the city of Seoul was reviewed for any primary or secondary causes, such as cerebral edema, diabetes, or DKA and age <15 years. No additional cases of IDDM were identified by either of these two methods.

#### Statistical analysis

The 1990 census report was used for denominators to calculate the incidence rate (5), and the incidence rates were age-adjusted using the direct method (6). A 95% confidence interval (CI) was derived using a Poisson distribution (7). Because the 4-year incidence of IDDM in Seoul is limited, we applied polynomial models to best fit the seasonal onset pattern (8).

**RESULTS** — Seoul is the fourth largest city in the world and comprises ~25% of the Korean population. Of the city's 10,618,395 people, 24% (2,568,933) were <15 years of age according to the 1990 census report (5). Between 1985 and 1988, a total of 71 patients with IDDM were observed for an incidence of 0.7/100,000 (95% CI: 0.55–0.89). Of the 71 patients, 32 were boys (0.58/100,000; 95% CI: 0.42–0.9), and 39 were girls (0.78/100,000; 95% CI 0.56–1.09). The mean age at onset was  $9.13 \pm 4.25$  and  $8.95 \pm 4.0$  years for boys and girls, respectively. There appears to be no sex differences in the overall incidence of IDDM because the 95% CIs for boys and girls overlap.

A seasonal pattern of IDDM onset was also evaluated in this study, and the majority of cases of IDDM were diagnosed during the winter months (November through March) in both sexes. The seasonal onset patterns for onset of IDDM in either sex was virtually superimposable when data were further analyzed by quartic-fitted polynomial curves.

**CONCLUSIONS** — The average incidence rate of IDDM in Seoul, Korea, from 1985 to 1988 was 0.7/100,000 (0.55–0.89); this rate is significantly lower than the rate reported in Japan and 49-fold lower than that in Finland. Although secondary ascertainment sources are not available to strengthen this finding, we believe that it is unlikely that the low incidence of IDDM in Seoul is due to incomplete ascertainment for several reasons. First, because IDDM is rare in Korean children, pediatricians from par-

ticipating hospitals were likely to remember all patients and their admission histories. Second, new onset IDDM demands immediate, in-depth medical care, so that all patients are brought to medical attention. The patients are also apt to be rapidly referred from community or small hospitals to a major health center for special care because of the life-threatening nature of the disease. Although referring patients with diagnosed IDDM from doctors' offices to a hospital is not mandated, patients with communicable diseases, rare diseases, or any illness requiring laboratory tests and/or hospitalization are commonly referred to major hospitals. There are no medical laboratory facilities outside of hospitals in the Korean medical system. Finally, there were no additional cases of IDDM in a random reevaluation and a review of death certificates for DKA. This confirms that the small number of IDDM cases in the Korean population is genuine. It is possible that some cases of sudden onset death before hospitalization were missed. However, we do not believe that a significant number of such incidents occurred because major medical facilities are readily accessible and 75% of the population benefited from the governmental medical security system at the time of the study (9). The possibility still remains that patients with an unusually mild, nonketotic presentation may have escaped our registry criteria. However, it is generally accepted that younger-onset patients experience a more acute onset. Because our study focused on those with IDDM onset at <15 years of age, exclusion of mild cases is not likely to be the reason for the low rate in Korea.

The pattern of onset characteristics in Seoul was very similar to that in the studies reported from other countries. Seasonality and age at onset of IDDM in Seoul appear to be similar to those reported from Asia, Europe, and North America (10–14). This similarity in the pattern of onset characteristics suggests that the same etiological factors operate in Korea as elsewhere.

Finally, despite the similarity in

environmental and cultural factors in Japan and Korea, there is a threefold difference in incidence of IDDM between the two countries. We speculate that these differences may be due to genetics. For example, Koreans are monomorphic (new Mongoloids) (15), whereas Japanese are both monomorphic (old or new Mongoloids) and dimorphic (mixture of old and new Mongoloids) (3). Perhaps genetic homogeneity decreases the susceptibility to IDDM, as has been postulated in a previous publication (3).

In conclusion, the incidence of IDDM in Seoul is the lowest in the world despite the fact that Koreans continue their westernization and industrialization. These findings strengthen and support other reports of the low incidence of IDDM in Far East Asia (3,4). This rate might be considered a baseline incidence rate (i.e., genetic susceptibility) before exposure to environmental risk factors or genetic-environmental interactions.

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