Diabetes in the Americas

GUILLERMO LLANOS & INGRID LIBMAN

Diabetes mellitus is an important cause of disability and death throughout the Americas. Of the three main types (insulin-dependent, noninsulin-dependent, and malnutrition-related), virtually all cases in the Americas are either insulin-dependent (generally assessed in terms of incidence and usually occurring in subjects under 30) or noninsulin-dependent (generally assessed in terms of prevalence and usually occurring in subjects over 30).

Data on noninsulin-dependent diabetes mellitus (NIDDM) in various parts of the Americas point to prevalences ranging from 1.4% (among the Mapuche Indians in Chile) to 14.1% (among residents of Mexico City). However, the use of different methods and standards to gather and analyze these data renders comparison of the NIDDM situations in different countries uncertain.

A fair amount of comparable data on insulin-dependent diabetes mellitus (IDDM) have been gathered in various countries of the Region. These point to marked differences in annual incidence—ranging from 0.7 cases per 100,000 in Peru to 27 among males on Prince Edward Island, Canada—that have not been adequately explained, underlining the need for additional comparable data.

Considering the seriousness of the disease, it is important to know how many people have and develop diabetes, so as to be able to take preventive and therapeutic measures and guide public health actions. Hence, further cooperation directed at effective standardization of procedures and goals is indicated. Such cooperation, which should also come to include standardized national and hemispheric diabetes programs, must be achieved in accordance with the resources available to each country.

Diabetes was once considered a rare or even nonexistent disease in developing countries—including the developing countries of the Americas. However, during the last two decades it has been demonstrated that diabetes is a worldwide burden, one affecting millions of people in the Americas alone.

Diabetes mellitus is a chronic disease caused by something that prevents the body from producing or responding to insulin. As a result, high levels of glucose appear in the blood, a circumstance tending to create both short-term and long-term complications. Thus, compared to nondiabetics, people with diabetes are two to four times as likely to die from heart disease, two to six times as likely to suffer a stroke, and four times as likely to have peripheral arterial disease. In addition, diabetes is a major cause of neuropathy, renal failure, and blindness.

The WHO 1985 classification (1) refers to three main types of diabetes mellitus (Table 1): insulin-dependent diabetes mellitus (IDDM), noninsulin-dependent diabetes mellitus (NIDDM), and malnutrition-related diabetes mellitus (MRDM).

IDDM is generally characterized by abrupt onset of signs and symptoms (weight loss, excessive thirst, frequent urination), dependence on exogenous insulin to sus-
Table 1. WHO classification of diabetes mellitus and allied categories of glucose intolerance.

A. Clinical classes

Diabetes mellitus (DM)
- Insulin-dependent diabetes mellitus (IDDM)
- Noninsulin-dependent diabetes mellitus (NIDDM)
  (a) Nonobese
  (b) Obese
Malnutrition-related diabetes mellitus (MRDM)
Other types of diabetes associated with certain conditions and syndromes: (1) pancreatic disease, (2) diseases of hormonal etiology, (3) drug-induced or chemical-induced conditions, (4) abnormalities of insulin or its receptors, (5) certain genetic syndromes, and (6) miscellaneous

Impaired glucose tolerance (IGT)
- (a) Nonobese
- (b) Obese
- (c) Associated with certain conditions and syndromes

Gestational diabetes mellitus (GDM)

B. Statistical risk classes (subjects with normal glucose tolerance but substantially increased risk of developing diabetes)

- Previous abnormality of glucose tolerance
- Potential abnormality of glucose tolerance


...because of its different clinical characteristics and its apparently high prevalences in some tropical countries (1). Hugh-Jones (4) first described it in Jamaica in 1955, referring to it as “J-type” (for Jamaica) diabetes. The detected cases required high doses of insulin but were resistant to ketosis. That same year Zudeima (5) described another form of juvenile diabetes in Indonesia. Sometimes referred to as “z-type” diabetes, it was characterized by pancreatic calcification and fibrosis, insulin resistance, variable resistance to ketosis, and a history of childhood malnutrition. These reports and several subsequent ones from Africa, Asia, and Brazil led WHO to classify both of these two forms as malnutrition-related diabetes (1).

Population-based studies are needed in order to better determine the impact of this type of diabetes. As of today, however, on the basis of the information available, it appears that almost all cases of diabetes in the Americas are NIDDM or IDDM; therefore, the present article will deal only with data pertaining to these two types of the disease.

Because of diabetes’ seriousness, it is important to know how many people have and may develop the disease, so as to be in a good position to take appropriate preventive and therapeutic measures and to guide public health efforts. Many epidemiologic studies have been conducted around the world to address these questions. However, internationally standardized work has only been possible for the past 10–15 years, since it is only in this period that standardized criteria and approaches for defining and investigating diabetes have emerged. Until now, most of the standardized data have come from Europe and North America. However, it is also true that a number of Latin American and Caribbean countries have undertaken to develop data of this kind.

The purpose of this article is to review the data available in the socially, econom-
ically, culturally, and ethnically diverse countries of the Americas, with their more than 700 million inhabitants and over 22 million diabetics, and to briefly compare these data (6).

Figure 1 shows the overall variation in IDDM found in the Americas by a variety of studies. We will discuss each region separately below. The key point brought out by the figure is the extraordinary variation of IDDM incidence within the Region, the most marked being a 39- to 47-fold difference between incidences observed in Peru (0.7 cases per 100,000) and Mexico City (0.58 cases per 100,000) and that found among males on Canada's Prince Edward Island (27.0 cases per 100,000).

LATIN AMERICA

Some years ago, it was said that discussing the epidemiology of diabetes in South America brought out the lack of existing information rather than meaningful results (7). At the time, this remark applied equally well to the rest of Latin America. Things have changed, however, and the data presented below indicate that this situation has improved considerably over the past few years.

Figure 1. Incidences of insulin-dependent diabetes mellitus (IDDM, cases per 100,000) reported by various sources (see further details in the text, footnote 4, and references 9–12, 27, and 31–37).
Insulin-dependent Diabetes

The diabetes registration system now operating in the area provides a valuable tool for incidence studies (1). Specifically, population-based registries, which assess IDDM incidence in children younger than 15 years of age, have been developed or are being developed in 11 countries—first as part of the work of the Diabetes Epidemiology Research International Study Group (DERI) and more recently as part of the WHO Multinational Study on Childhood Diabetes (DIAMOND) (8). Table 2 presents IDDM incidence estimates for areas within seven Latin American countries where such estimates are now available. Additional information about these estimates, which apply to children 0–14 years of age, is as follows:

**Argentina:** A 1991 incidence of 8.00 IDDM cases per 100 000 inhabitants has been reported from the registry of Avellaneda in the Province of Buenos Aires; no confidence intervals were cited. The primary source used was a school survey, which was validated by contacting pediatric hospitals, pediatricians, and diabetologists. The rate of ascertainment (the percentage of the total actual cases that were detected in the study population) was greater than 90%.*

**Brazil:** The São Paulo registry found an incidence of 7.60 IDDM cases per 100 000 (95% confidence interval 5.6–9.7) for the period 1987–1991 with an ascertainment greater than 95%. Physician reports were used as the primary source of case identification and school surveys as the main secondary source (9).

**Chile:** The annual 1990–1991 IDDM incidences were determined in Santiago by a retrospective review of medical records—with validation from private physicians and records of the Chilean Juvenile Diabetes Foundation. The ascertainment was rated at over 95%. The registry reported an average incidence of 2.49 cases per 100 000 per year (no confidence limits were cited).5

**Cuba:** The 1991 IDDM incidence reported for Cuba was 4.2 cases per 100 000 (no confidence limits). Cases were identified by endocrinology consultants and then validated at pediatric clinics. The reported rate of ascertainment was 85%.6

**Mexico:** An IDDM registry was established in 1984 in Mexico City, and an IDDM incidence of 0.58 cases per 100 000 was subsequently reported for the 1984–1987 period. However, the work of this registry has not yet been completely validated, so this unusually low figure must be viewed with caution (10).

**Peru:** This country’s predominantly mestizo population was found to have a 1991 IDDM incidence of 0.7 cases per 100 000 (no confidence limits cited). Hospital records were used as the primary source, while the validation was made with lists obtained from the Peruvian Di-

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Table 2. Incidences of IDDM among children 0–14 years of age in seven Latin American countries in periods ranging from 1984–1987 to 1991.

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence (cases per 100 000)</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>0.58</td>
<td>1984–1987</td>
</tr>
<tr>
<td>Peru</td>
<td>0.7</td>
<td>1991</td>
</tr>
<tr>
<td>Chile</td>
<td>2.49</td>
<td>1990–1991</td>
</tr>
<tr>
<td>Cuba</td>
<td>4.2</td>
<td>1991</td>
</tr>
<tr>
<td>Brazil</td>
<td>7.60</td>
<td>1987–1991</td>
</tr>
<tr>
<td>Argentina</td>
<td>8.00</td>
<td>1991</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>10</td>
<td>1990</td>
</tr>
</tbody>
</table>

*Sources Ferreira et al (9), Diabetes Epidemiology Research International Group (10), and data presented at the meeting cited in footnote 4.

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*From data presented at the DIAMOND Session held during the VIII Latin American Diabetes Association and Argentine Diabetes Association Meeting in Mar del Plata, Argentina, in October 1992.

*Idem.

*Idem.
The reported degree of ascertainment was 90%.

Puerto Rico: A registry covering the southern and western parts of the island found an annual IDDM incidence of 10 cases per 100,000 for the period 1985-1989; no confidence limits were cited. Hospital records were used as the primary source and the government diabetic registry as the secondary source (11).

Besides this available information, data are currently being collected in Colombia, the Dominican Republic, Paraguay, and Venezuela. It is expected that IDDM incidence estimates will be available for these countries in the near future.

The causes of the observed IDDM variations observed in Latin America (as well as in the rest of the hemisphere) are not known. However, these differences do not appear due to methodology problems. The centers involved have been using standardized procedures to compile registry data that permit comparisons (12). All except one (in Mexico City) have validated their ascertainment with an independent data source.

Both genetic and environmental factors have been suggested. Studies focusing on the HLA (Human Leukocyte Antigen) DQB1 chain gene, which codes for the beta chain of the HLA-DQ molecule (13), have shown that the presence of DNA sequences coding for an amino acid other than aspartic acid at the 57th position (non-Asp-57) of this chain is highly associated with susceptibility to IDDM, whereas aspartic acid in this position (Asp-57) appears to confer resistance to the disease. Cross-national studies (13) examining the situation in China, Norway, Sardinia, and the United States of America have shown that population variations in the distribution of non-Asp-57 alleles may explain much of the geographic variation of IDDM. However, similar studies must now be developed for other parts of the world such as Latin America, where racial admixtures (primarily among natives, whites, and blacks) may be playing a key role in producing the different incidences.

No clear picture has emerged with regard to environmental influences. It is thought that viruses, milk substitutes, and various other factors are likely to be implicated (14). However, more studies are needed to relate the varying IDDM incidence patterns to these potential risk factors.

Noninsulin-dependent Diabetes

Application of the aforementioned 1985 recommendations of the WHO Study Group (1) and concurrent efforts to standardize worldwide prevalence data (15) have greatly improved the comparability of the available epidemiologic data on NIDDM. However, as will be seen, variations in methodology still make comparisons between different areas difficult.

Figure 2 shows NIDDM prevalences found in different places throughout the Americas. As with IDDM, though to a lesser degree, considerable regional variation has been found.

Among the first studies investigating the prevalence of diabetes using standardized criteria was one by West and Kalbfleish in 1966 (16). Data from more recent Latin American studies are presented in Table 3. Brief additional information about these studies is as follows:

Argentina: A study carried out in the city of Rosario, Santa Fe Province, before the new WHO diagnostic criteria were established, found a prevalence of 6.12% (17). A study conducted in Avellaneda, Buenos Aires Province, in 1976 but adjusted to the WHO diagnostic criteria found a prevalence of 8.05% (18), while...
Figure 2. Prevalences of noninsulin-dependent diabetes mellitus (NIDDM) reported by various sources (see further details in the text and references 15–22, 28–30, 33, 38, and 40–44).

![Map showing prevalence rates of NIDDM in various countries.]

Table 3. Prevalences of NIDDM in some Latin American countries. (FCG = fasting capillary glucose; OGTT = oral glucose tolerance test.)

<table>
<thead>
<tr>
<th>Country</th>
<th>Definition of diabetes</th>
<th>Age group (in years)</th>
<th>Survey method</th>
<th>Sample size</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosario</td>
<td>“diagnosed”</td>
<td>20–75</td>
<td>OGTT</td>
<td>22,351</td>
<td>6.12%</td>
</tr>
<tr>
<td>Avellaneda</td>
<td>WHO criteria</td>
<td>20–69</td>
<td>OGTT</td>
<td>596</td>
<td>8.05%</td>
</tr>
<tr>
<td>La Plata</td>
<td>“diagnosed”</td>
<td>20–74</td>
<td>OGTT</td>
<td>809</td>
<td>5.0%</td>
</tr>
<tr>
<td>Brazil</td>
<td>WHO criteria</td>
<td>30–69</td>
<td>FCG</td>
<td>21,847</td>
<td>7.5%</td>
</tr>
<tr>
<td>Chile:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mapuches</td>
<td>WHO criteria</td>
<td>&gt;20</td>
<td>OGTT</td>
<td>34/</td>
<td>0.0% (males)</td>
</tr>
<tr>
<td>Santiago</td>
<td>“diagnosed”</td>
<td>&gt;20</td>
<td>OGTT</td>
<td>1,100</td>
<td>6.5%</td>
</tr>
<tr>
<td></td>
<td>WHO criteria</td>
<td>&quot;</td>
<td>&quot;</td>
<td>5.3%</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>WHO criteria</td>
<td>&gt;30</td>
<td>OGTT</td>
<td>471</td>
<td>7.3% (males)</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>8.7% (females)</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>WHO criteria</td>
<td>35–64</td>
<td>&quot;</td>
<td>263</td>
<td>14.1%</td>
</tr>
</tbody>
</table>

Sources: 16–23
a more recent study carried out in La Plata, Buenos Aires Province, in 1982 found a lesser prevalence of 5.0% (19).

Brazil: A 1990 study performed in nine state capitals found a NIDDM prevalence of 7.5% in the 30–69 age group, with the highest rates being observed in the more industrialized cities (20). Data presented by King et al. (15) from São Paulo, adjusted to the world population, showed an age-adjusted prevalence of 7.0% (95% confidence limits 5.2–8.9) for men and 8.9% (95% confidence limits 7.1–10.7) for women in the 30–64 year age group.

Chile: A 1979 study carried out in the capital city of Santiago found a NIDDM prevalence of 6.5% when the WHO diagnostic criteria were not used and of 5.3% when they were adjusted for these criteria (21). Another study, this one of a Mapuche Indian community in Chile’s Region IX (22), indicated a prevalence of 0.0% in males and of 1.4% in females 30–64 years of age after the data were age-standardized by King et al. (15).

Colombia: Data from Santa Fe de Bogotá for 1988–1989, age-adjusted by King et al. (15), showed annual NIDDM prevalences in the 30–64 age group of 7.3% for men and 8.7% for women.

Mexico: A survey conducted in 1990 to compare the prevalences of diabetes in Mexico City and San Antonio, U.S.A., found a NIDDM prevalence of 14.1% in the Mexican capital (23). A 1988 report found that prevalences in Mexico varied from 6% to 10% (24). A considerably lower figure was reported that same year by Mexico’s National Health Survey (25), which found that only 1.2% of the whole population reported having diabetes—a low number perhaps ascribable to the country’s young age structure (26) and to the fact that the survey involved was self-reported, because self-reported studies tend to underestimate true prevalences.

Although there have been studies that used standardized methods and stand-

ardized the observed prevalences to the world population (16, 27), Table 3 shows that several problems remain in comparing observed NIDDM prevalences in different areas. First, the definition of diabetes used in different studies has been different. Results obtained using the definition of “diagnosed” diabetes tend to be quite different from those obtained when the WHO criteria are employed. Second, the age groups surveyed in different studies have varied considerably, raising a concern that different observed prevalences could be at least partly ascribable to different age structures. Third, both the sizes of the population samples studied and the approaches used to identify those samples have varied a good deal. Obviously, all else being equal, larger sample sizes will yield more precise estimates than smaller sample sizes; and, more critically, the fact that not all the studies were truly population-based (because some evaluated specific occupational groups and others were hampered by low participation rates) could have affected the results. Finally, the survey methods used were quite variable, ranging from the “gold standard” of oral glucose tolerance tests (OGTTs) performed on everyone in the population to use of screening followed by administration of OGTTs to only diagnosed cases. Overall, the ability of the methods used to detect undiagnosed cases varied considerably. In general, comparison of NIDDM prevalences across regions of Latin America (as well as other parts of the Americas) where standardized methodology has not been used still yields results that are at best very tentative.

THE WEST INDIES

This area is comprised of various islands including the polities of Anguilla, Antigua and Barbuda, the Bahamas, Barbados, Cayman Islands, Dominica, Gre-
nada, Haiti, Jamaica, Martinique, Montserrat, the Netherlands Antilles and Aruba, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, and the British and U.S. Virgin Islands. Efforts to map diabetes (IDDM and NIDDM) incidences and prevalences are currently underway in this area as part of the Caribbean-African Heritage Diabetes Studies (28).

**Insulin-dependent Diabetes**

A population-based registry has been established in the U.S. Virgin Islands, which consist of three main islands (St. Croix, St. Thomas, and St. John) and roughly 50 smaller uninhabited islands and cays. The average yearly IDDM incidence found for the 0–14 year age group throughout the 1979–1988 period was 7.5 cases per 100,000 (95% confidence interval 4.7–10.3) (29). Comparing Whites, Blacks, and Hispanics, the highest incidence (28.9 cases per 100,000) was found among Whites, the lowest incidence was found among Blacks (5.9 cases per 100,000), and a low intermediate incidence (7.2 cases per 100,000) was found among Hispanics.

An apparent epidemic in the year 1984 has been reported by Tull et al. (29), who found that nearly four times the number of diabetic subjects expected were identified. An acute infection could provide a possible explanation for this increase. More studies in the area will be needed in order to determine whether this epidemic pattern occurred on other islands.

Elsewhere in the area, new diabetes registries are being developed in Antigua, Barbados, the British Virgin Islands, and Saint Kitts.

**Noninsulin-dependent Diabetes**

A population survey using WHO criteria to identify adult diabetes patients was conducted on Trinidad between 1978 and 1985. This survey found a prevalence of 11.5% (30).

Another study, conducted on Tobago between 1976 and 1978, found a prevalence of 11.6% when a post-load value >180 mg/dl was used to identify diabetic patients, and a prevalence of 14.5% when fast blood sugar concentration was employed (31).

Jamaican data, from a study performed in 1972, showed a prevalence of approximately 14.0% in the 45–64 age group (32).

Overall, the Caribbean area appears to exhibit quite high rates of diabetes. As the foregoing data suggest, more studies in the area will be needed simply to determine prevalence patterns and see whether different prevalences prevail in different areas. Beyond that, further studies in the area could well yield important clues about particular environmental factors that may be involved in the etiology of this disease.

**NORTH AMERICA**

There have been many studies of both IDDM and NIDDM in North America, especially in the United States. These have evaluated not only the White population but also Native Americans, Blacks, and Hispanics.

**Insulin-dependent Diabetes**

**Canada:** In Montreal, the overall annual incidence of IDDM found for the period 1971–1985 was 9.6 cases per 100,000 (95% confidence interval 8.8–10.5) among males <15 years of age and 10 cases per 100,000 (95% confidence interval 9.1–11.0) among females in this age range. Ascertainment was estimated as being 94% complete (12, 33).

Another IDDM incidence study, conducted on Prince Edward Island, showed
unusually high average annual incidences of 27.0 cases per 100 000 (95% confidence interval 20.4–35.6) among males <15 years old and 20.8 cases per 100 000 (95% confidence interval 14.8–28.4) among females <15 years old for the period 1975–1986 (12).

United States of America: Many studies have been done over a relatively long period. The registry in Pennsylvania’s Allegheny County provides data for one of the oldest ongoing studies, which began in 1965 and which has maintained a high ascertainment rate (>90%) (34). According to this registry’s data, the average annual IDDM incidence reported for the 0–14 year age group in the 1965–1985 period was 15.1 cases per 100 000 (95% confidence interval 13.9–16.4) among males and 16.0 cases per 100 000 (95% confidence interval 14.7–17.4) among females (12). An update of the study encompassing the 1985–1989 period showed an average annual IDDM incidence of 17.69 cases per 100 000 (95% confidence interval 15.77–19.85) (35). The age-standardized incidence per 100 000 was 18.04 cases among Whites and 15.31 cases among non-Whites (36).

Another study, in Alabama’s Jefferson County, found an average annual IDDM incidence of 12.1 cases per 100 000 (95% confidence interval 10.4–14.0) among people less than 20 years of age for the period 1979–1985. It also found a lower incidence among Blacks (7.0 cases per 100 000, 95% confidence interval 5.0–9.3) than among Whites (15.6 cases per 100 000, 95% confidence interval 13.1–18.4). Completeness of case ascertainment by the registry was estimated at 95% (37).

Other registries have focused on differences between children of Hispanic and non-Hispanic origin. The Colorado IDDM Registry found an average annual incidence of 8.7 cases per 100 000 (95% confidence interval 7.3–10.3) for Hispanic-origin children and young people under 18 years of age, versus an incidence of 15.5 cases per 100 000 (95% confidence interval 14.5–16.4) for non-Hispanic-origin children and young people in this age group over the period 1978–1988. The degree of case ascertainment was estimated at 93.3% (38). In a similar vein, data from a registry in San Diego, California, indicated an average annual IDDM incidence of 7.3 cases per 100 000 (no confidence interval cited) for the period 1978–1981 among children and young people 0–19 years old. A significant excess of cases among Caucasians, as compared to Hispanics of Mexican origin, Blacks, and Orientals was reported (39). Ascertainment for this registry was not documented.

Noninsulin-dependent Diabetes

Canada: A study published in 1991 reported that the overall prevalence of diabetes in Canada was 5%, twice the prevalence previously reported for 1985 (40). In addition, a very interesting study was carried out among the Inuit (Eskimo) and other indigenous peoples of Canada in 1987. The prevalence of diagnosed diabetes was determined for 76% of the members of these populations, cases being identified through the federal agency responsible for indigenous peoples’ health services. The prevalences found among the non-Eskimo natives ranged from a low of 0.8% among the natives of the Northwest Territories to 8.7% among those of the Atlantic region. The prevalence found among the Eskimos was 0.4% (41).

United States of America: The prevalence of NIDDM in the 20–74 year age group was evaluated by means of two national surveys conducted in 1982–1984 for Mexican-Americans and Puerto Ricans and in 1976–1980 for Blacks and Whites. An age-standardized prevalence of 6.2% was found in the White popu-
lation (42). However, far higher prevalences of NIDDM were found among certain minorities, these prevalences being 10.2% among Blacks, 13% among Mexican Americans, and 13.4% among Puerto Ricans (35, 42). Within the elderly 65-74 age group, 25% of the Blacks and 33-35% of the Hispanics were found to have diabetes, as compared to 17% of the Whites.

Among the Native American populations in the United States, the Pima Indians have been found to possess the highest reported prevalence of NIDDM in the world, with 50% of the adult population being afflicted (43). Intensive studies have been done since 1954 (44), when it was discovered that diabetes was more common among this group than among the country's other Native Americans.

Data age-standardized by King et al. (15) from the NHANES II study (45) indicate a NIDDM prevalence of 5.0% (95% confidence limits 4.3–5.8) among non-Hispanic White men and of 7.2% (95% confidence limits 6.4–8.0) among non-Hispanic White women, both in the 30–64 year age range in the 1976–1980 period. Among non-Hispanic Black men the prevalence was found to be 8.5% (95% confidence limits 5.7–11.2), while among non-Hispanic Black women it was found to be 12.1% (95% confidence limits 9.4–14.9).

MORTALITY

Diabetes mellitus is among the first 10 causes of death in most countries of the Americas (46). The life expectancy of people with IDDM in developed countries is approximately 75% of that of nondiabetics. In developing countries, however, it may be only about half that of nondiabetics (1). For those with NIDDM, the average life-span is several years shorter in developed countries and many years shorter in developing ones (1).

Death registration (by means of death certificates) has been and still is the principal source of diabetes mortality data. Death certification has been standardized to a considerable degree through use of the WHO International Classification of Diseases (ICD). Unfortunately, there is also considerable underreporting of diabetes deaths, which leads to underestimation of diabetes' total impact. In some cases diabetes is not listed as the underlying cause of death because other more obvious causes were presented, even if these were direct or indirect consequences of diabetes. In this vein, numerous studies have found that diabetes is not listed on 30% or more of the death certificates of people with diabetes, and have also found considerable variability across time and geographic areas concerning coding practices (47).

Despite these limitations, death registration data have proved a useful source of information, especially because they provide indications about broad disease trends. Table 4 shows rates of diabetes mortality reported for most countries of the Americas (these data being the latest available and published by PAHO). Countries where diabetes is ranked among the six leading causes of death in the general population include the Bahamas, Barbados, Dominica, Guadeloupe, Jamaica, Martinique, Mexico, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Uruguay.8

FUTURE PROSPECTS

Both direct and indirect economic costs of the disease are high. Direct costs include expenditures for medical care and

8Idem.
Table 4. Age-adjusted mortality (per 100 000 population) from diabetes mellitus, by country (latest data available).

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Age-adjusted mortality (deaths per 100 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trinidad and Tobago</td>
<td>1986</td>
<td>52.2</td>
</tr>
<tr>
<td>Mexico</td>
<td>1986</td>
<td>29.9</td>
</tr>
<tr>
<td>Jamaica</td>
<td>1984</td>
<td>21.4</td>
</tr>
<tr>
<td>Suriname</td>
<td>1985</td>
<td>20.5</td>
</tr>
<tr>
<td>Bahamas</td>
<td>1987</td>
<td>20.4</td>
</tr>
<tr>
<td>Guyana</td>
<td>1984</td>
<td>17.4</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>1987</td>
<td>15.4</td>
</tr>
<tr>
<td>Venezuela</td>
<td>1987</td>
<td>13.5</td>
</tr>
<tr>
<td>Paraguay (area of info)</td>
<td>1986</td>
<td>12.6</td>
</tr>
<tr>
<td>Guadeloupe</td>
<td>1981</td>
<td>12.3</td>
</tr>
<tr>
<td>Belize</td>
<td>1986</td>
<td>12.1</td>
</tr>
<tr>
<td>Cuba</td>
<td>1988</td>
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<td>Dominica</td>
<td>1985</td>
<td>10.5</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>1985</td>
<td>10.2</td>
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<td>Brazil (area of info)</td>
<td>1986</td>
<td>9.2</td>
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<td>French Guiana</td>
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</tr>
<tr>
<td>Colombia</td>
<td>1984</td>
<td>7.7</td>
</tr>
<tr>
<td>Argentina</td>
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<td>7.3</td>
</tr>
<tr>
<td>El Salvador</td>
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</tr>
<tr>
<td>Martinique</td>
<td>1985</td>
<td>6.6</td>
</tr>
<tr>
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</tr>
<tr>
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<td>5.8</td>
</tr>
<tr>
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<tr>
<td>Canada</td>
<td>1988</td>
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</tr>
<tr>
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<td>(Curacão)</td>
<td>1981</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1984</td>
<td>4.7</td>
</tr>
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Source: Harris (42).

One result has been to produce a steadily increasing burden of noncommunicable diseases, one of the principal problems in this regard being diabetes. Throughout the hemisphere, certain risk factors associated with prevailing lifestyles are contributing to this pattern. All this suggests that if we are to stand any real chance of effectively controlling the diabetes problem throughout the hemisphere, an organized effort by all countries will be needed.

**Diabetes Monitoring**

Monitoring is extremely important—not only for understanding diabetes etiology and pathogenesis but also for being in a position to take effective public health measures. This is especially important because an apparent upsurge of both insulin-dependent and noninsulin-dependent diabetes appears to have occurred or to be in progress throughout the world (29). Within this context, establishment of adequate monitoring systems is a necessary first step in maintaining awareness of what is happening.

Through the WHO DIAMOND Project (8), population-based registries have been established for IDDM in many countries of the Americas. These registries are yielding information about geographic and temporal variations that can provide clues about the genetic and environmental factors responsible for the disease. Also, because IDDM is a very costly disease for both the afflicted and society, it is essential to monitor its cost for the purpose of assessing the relative worth of primary diabetes prevention measures and secondary prevention of complications.

There is also a critical need for NIDDM monitoring systems. As seems evident, it is now almost impossible to effectively compare NIDDM prevalences in different parts of the Americas because of the widely diverse methods used in different
places. In terms of such comparisons, un-
til adequate standardization occurs we
will not be able to effectively assess the
NIDDM problem in the Americas. Where-
ver the same methods are used, how-
ever, repeated population surveys over
time will provide important information
about the disease's changing patterns in
the areas surveyed.

Risk Factor Assessment

A basic principal of public health is that
all else being equal, prevention is better
than a cure. To be able to prevent a dis-
ease, however, we must know the risk
factors involved in its development. So
how can we apply what we know about
risk factors to diabetes?

NIDDM

Diabetes has a hereditary component,
but it is also a result of lifestyle factors.
Very little can be done to change genetic
susceptibility, but it is possible to reduce
risk factors related to lifestyles. In the
case of NIDDM, excess body weight (es-
specially involving large amounts of fat
with a central distribution) and lack of
exercise play an extremely important role
in development of the disease.

It is therefore critical to monitor not
only the disease itself but also these related
risk factors. For this reason, standardized
evaluations of obesity and inactivity for
different populations and different times
are needed throughout the Americas—
because different risk factor patterns at
different times and places could explain
differing disease patterns and might be
used to assess the future. This is all the
more important because we should not
intervene to change the factors involved
unless we possess data clearly indicating
that the intervention will be effective.

IDDM

In the case of IDDM, the situation is
more challenging. Highly susceptible
people can be detected by means of ge-
netic markers—which could be useful for
preventing the disease by means of im-
munosuppression in high-risk subjects or
by genetic manipulation, though it seems
unlikely that the latter will be available
in the near future. Alternatively, more
accurate genetic counseling could lead to
early treatment and potentially reduce the
risk of acute diabetes-related complica-
tions in new onset cases.

What actual environmental factors are
involved in development of IDDM is still
not very clear. Some viruses have been
implicated in development of the dis-
ease, but IDDM is not a common con-
sequence of viral infection. Some nutri-
tional factors (including breast milk,
certain milk substitutes, and nitrates-
mines) have also been implicated, but
there are no firm data linking diet to IDDM
disease incidence in humans. Epidemi-
ologic studies have shown that coffee con-
sumption is higher in populations with
high IDDM incidences (50). In general,
as with other noncommunicable dis-
eases, it will be important to determine
how changing IDDM incidence patterns
in the countries involved relate to poten-
tial risk factors, including particular com-
municable diseases.

Complications and Mortality

As already noted, diabetes is currently
one of the leading causes of morbidity
and mortality in many countries of the
Americas. Among other things, diabetes
is responsible for about 12% of the new
cases of legal blindness each year in the
United States, being a leading cause of
new cases of blindness in adults 25 to 74
years old (51). Twenty-five percent of new
cases of end-stage renal disease (cases
where the patient requires dialysis or a renal transplant) are also attributable to diabetes. Moreover, as compared to the nondiabetic population, people with diabetes are one and a half to two times as likely to have reported heart disease and two to six times as likely to suffer strokes (52).

In seeking to prevent such complications, we need first to develop accurate systems for monitoring them, and also for monitoring diabetes mortality, so as to effectively assess the risks confronted by a given individual with diabetes. Organized measures such as standardized development of blindness registries and systems for monitoring amputations, dialysis, transplants, and deaths will provide basic data about the magnitude of diabetes complications and mortality within populations at different times and places. Besides serving other purposes, such measures are needed to determine the effectiveness of particular public health actions. Within this context, the effectiveness of programs designed to help prevent blindness among diabetics is apt to be reduced sharply if there is no measure of the number of people with diabetes who become blind.

The main goal, of course, is to prevent complications. It has been proven that certain factors such as smoking and hypertension greatly increase the risk of complications (53, 54). Programs for evaluating these and other risk factors, as well as standardized intervention protocols, need to be established.

Glucose control is also important for preventing acute diabetes complications, especially in IDDM patients (55). However, the control of diabetic patients should be monitored as one index of care; and the emphasis has to be placed on patient education. Gagliardino et al., reporting on a very good program based on education of patients and their families in La Plata, Argentina, have found no differences between diabetic and nondiabetic workers with respect to days of absenteeism due to illnesses (49).

Cooperation and Standardization

To change the current situation will require cooperative action. In the Americas, until now our public health systems have been targeted predominantly against communicable diseases. Hence, we need to begin considering seriously how to incorporate substantial noncommunicable disease monitoring and disease prevention into the public health system. As seen in the case of NIDDM data, lack of effective hemispheric cooperation and standardized methods has meant that comparisons between populations in different places are not always possible. Despite the hemisphere's wide variety of socioeconomic and cultural conditions, however, there seems good reason to believe that specific standardized approaches can be implemented across the Region that would yield desirable results.

One possible approach is offered by the European model. In 1989 a meeting was organized by WHO Europe and the European Region of the International Diabetes Federation in order to set targets for dealing with diabetes. This produced a set of recommendations in the Saint Vincent Declaration, which gives a short description of the problem caused by diabetes and stresses that governments can create conditions in which reductions can be made in the ill health and mortality caused by the disease (56). It is also worth noting that in 1991 representatives of several Latin American countries signed the Declaration of Costa Rica, which set goals regarding diabetes education (57). Along these lines, we should consider developing a broad declaration on diabetes for the Americas. Standardization could be achieved through PAHO and collaborat-
ing groups in order to develop operating manuals and specific target goals.

Recently, the Eastern Mediterranean Region of the World Health Organization began establishing guidelines for the development of national and regional diabetes programs (58). These guidelines, which are intended for implementation through national ministries of health, provide a basis for targeted prevention and control of diabetes and its complications. There appears merit in the suggestion that we in the Americas also begin discussions about developing national guidelines for dealing with diabetes (59).

A first logical step in this direction would be to organize a meeting on diabetes in the Americas that would be attended by appropriate physicians, scientists, and representatives of lay organizations and governments. The mission of such a meeting would be to present a coherent overview of what is known; to assign to task forces the job of setting standards for data collection, health care, and technology; and to establish quantifiable goals, such as a 5% reduction of blindness due to diabetic retinopathy by the year 2000, as well as guidelines indicating ways in which these goals can be accomplished and setting forth specific standards for evaluation.

It is important to realize that such development of hemispheric standards, goals, and monitoring systems need not be expensive, and indeed seems destined to save money. At present the Americas has an uncoordinated approach toward diabetes research and care, with resources often being allocated without any genuinely firm and rational basis. Good data, attainable through a unified approach, will tell where the greatest needs are and will help health care planners and regulators make resource allocation decisions capable of yielding the greatest benefits for the most people.

It also seems evident that diabetes care should be a part of primary health care programs. In essence, basic diabetes care must include diagnosis and treatment, health care, social and professional rehabilitation, and diabetes education—the latter including not only the patient but also the patient’s family (59). International organizations such as PAHO and the International Diabetes Federation, working with government task forces, can help to evaluate the conditions in each country and to implement procedures for achieving the best results.

Within this context, epidemiologic research is of fundamental importance. Specifically, it is essential to monitor the incidence and prevalence of diabetes and its complications in order to have a baseline for evaluating the effectiveness of treatments and public health interventions. In this area procedures established through the WHO DIAMOND project and the recent WHO initiative to monitor NIDDM prevalences have been setting the stage for future across-country initiatives and standardization.

As we all know, diabetes can affect anyone; it does not respect age, sex, ethnic group, or nationality; and it is only through standardized information and increased awareness at all levels that strong progress can be achieved. Therefore, there is good reason to think that cooperation throughout the hemisphere should be enhanced; so that instead of hindering the understanding of diabetes, our different languages, cultures, customs, and conditions can serve as a bridge to its control.

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Winner of 1994 Soper Award

The Fred L. Soper Award for 1994 has been given to Dr. Maria da Glória Lima Cruz Teixeira and her collaborators for their article “Epidemia de gastroenterite na área da barragem de Itaparica, Bahia,” published in Portuguese in the Boletín de la Oficina Sanitaria Panamericana 114(6), 1993, and in English in the Bulletin of PAHO 27(3), 1993 (“Gastroenteritis Epidemic in the Area of the Itaparica Dam, Bahia, Brazil”).

The Soper Award is presented annually to the author or authors of an original scientific contribution in the field of public health that has special relevance to Latin America or the Caribbean and was published during the previous calendar year in a qualifying journal. It is administered by the Pan American Health and Education Foundation (PAHEF), and the winner(s) are selected by the PAHEF Board of Trustees. For further information on the award and the nomination procedures for 1995, see the announcement on p. 210 of the Bulletin of PAHO 28(3), 1994, or contact the Executive Secretary, PAHEF, 525 23rd Street, N.W., Washington, D.C. 20037.