Prevalence of Diabetes and Intermediate Hyperglycemia Among Adults From the First Multinational Study of Noncommunicable Diseases in Six Central American Countries

The Central America Diabetes Initiative (CAMDI)

OBJECTIVE — The increasing burdens of obesity and diabetes are two of the most prominent threats to the health of populations of developed and developing countries alike. The Central America Diabetes Initiative (CAMDI) is the first study to examine the prevalence of diabetes in Central America.

RESEARCH DESIGN AND METHODS — The CAMDI survey was a cross-sectional survey based on a probabilistic sample of the noninstitutionalized population of five Central American populations conducted between 2003 and 2006. The total sample population was 10,822, of whom 7,234 (67%) underwent anthropometry measurement and a fasting blood glucose or 2-h oral glucose tolerance test.

RESULTS — The total prevalence of diabetes was 8.5%, but was higher in Belize (12.9%) and lower in Honduras (5.4%). Of the screened population, 18.6% had impaired glucose tolerance/impaired fasting glucose.

CONCLUSIONS — As this population ages, the prevalence of diabetes is likely to continue to rise in a dramatic and devastating manner. Preventive strategies must be quickly introduced.

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appendent changes in access to cheap, energy-dense food, urbanization, and adoption of sedentary lifestyles in the countries of Central America have raised concerns about the rapid emergence of obesity and diabetes in the region. Diabetes and related chronic conditions in Central America have been largely neglected by epidemiologic and surveillance programs in recent decades, however, because other issues, such as under-nutrition, infectious diseases, and armed conflict, were regarded as much more pressing health threats.

The Central America Diabetes Initiative (CAMDI) is the first population-based multinational study to examine the prevalence of diabetes and risk factors in Central America. We report here the main findings from the multinational analyses of this survey.

RESEARCH DESIGN AND METHODS — The CAMDI survey was a cross-sectional survey based on a probabilistic, stratified, multistage, cluster sampling design of the noninstitutionalized population of five Central American sites. The survey sample included the entire national population in Belize; the overall metropolitan populations in San Jose, Costa Rica; Tegucigalpa, Honduras; and Managua, Nicaragua; and was restricted to the municipalities of Santa Tecla and Villa Nueva, which are part of the metropolitan

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areas of San Salvador and Guatemala City, respectively.

In each city, the primary sampling unit was a cluster of independent households within predetermined geographic areas. The primary sampling units were grouped into geographic strata (sectors and compact segments or blocks). The sample was allocated proportionally to the size of the population within each geographic stratum of each city. All eligible individuals aged 20 years or older in the randomly selected households were invited to participate. Data were weighted to account for differential selection probabilities and survey nonresponse, and weights were stratified to the adult population of each site based on age group and sex. The total sample population was 10,822, of whom 7,234 (66.8%) underwent anthropometry.

Site-based on age group and sex. The total diabetes (interview weights) and all participants with diagnosed diabetes were collected in sodium anhydrous glucose. The cold chain was maintained through a capillary blood sample (blood sample weights). This report is the ultimate intention of this issue merits further investigation of diabetes-related genetic and environmental risk factors, our data showed that the prevalence of obesity (BMI >29 kg/m²), a major risk factor for diabetes, was almost twice as high among Belizean women (44.1%) as among Belizean men (23.6%; data not shown in Table 1), was as high or higher than the most recent U.S. estimate of 35.5% among adult women (9).

The age-adjusted prevalence of diabetes was comparable among men and women in all sites except in Belize, where the prevalence of diagnosed and undiagnosed diabetes was more than twice as high among women (10.5% and 7.1%, respectively) than in men (4.7% and 3.6%, respectively). Although a full explanation of this issue merits further investigation of diabetes-related genetic and environmental risk factors, our data showed that the prevalence of obesity (BMI >29 kg/m²), a major risk factor for diabetes, was almost twice as high among Belizean women (44.1%) as among Belizean men (23.6%; data not shown in Table 1). In general, the prevalence of obesity was higher among women than in men across all CAMDI sites, but the sex difference in the prevalence of obesity observed in Belize was the greatest. In summary, the total prevalence of diabetes found in the combined Central America sample was greater than the prevalence reported in most Latin American countries and similar to that in the U.S. These findings are particularly noteworthy given the relatively young age of the population of Central America and the potential for a growing burden in future decades. These findings should be an

The total prevalence of diabetes across the six sites was 8.5%, but was notably higher in Belize (12.9%) and notably lower in Honduras (5.4%). Men and women had similar prevalence except in Belize, where women had a higher prevalence (17.6%) than men (8.8%). Overall, 40% of those with diabetes were undiagnosed, ranging from 53% in Honduras to 28% in Costa Rica. The prevalence of intermediate hyperglycemia varied more across the sites than diabetes. Of the screened population, 18.6% had intermediate hyperglycemia, with the highest prevalence reported in Guatemala (28.2%) and the lowest in Nicaragua (12.4%).

**RESULTS**—Sixty percent of participants were young adults (20–39 years), 31.6% were middle aged (40–64 years), and only 8.4% were elderly (≥65 years; Table 1). Respondents’ mean BMI was 27.1 ± 0.2 kg/m².

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**CONCLUSIONS**—This report is the first epidemiologic study of the prevalence of diabetes in Central America to be based on a representative geographic sample. We found a combined prevalence of diabetes of 8.5% for the six-country region. Almost half of the cases of diabetes were undiagnosed.

The combined crude prevalence of diabetes in participating sites was comparable to the prevalence of 9.6% reported in the U.S. (2) (estimates for 1988–2006) (3) and 8.4% in Mexico City (4) in 2000, and higher than the prevalence of 7.2% reported in four Bolivian cities in 1998 (5). The prevalence of diabetes in Belize was comparable to the 12.5% reported in Jamaica (6) in 1999 and New York in 2008 (7). The Cardiovascular Risk Factor Multiple Evaluation in Latin America (CARMELA) study reported the prevalence of diabetes was 4.4% in Lima and 8.9% in Mexico City (8). The proportion of cases of diagnosed diabetes in the combined sample (5%) was comparable to that reported in the U.S. (5%) in 2000 and in Bolivia (5.2%) in 1998. The proportion of undiagnosed cases of diabetes was higher in Belize and Managua than in the other sites.

These prevalence estimates are particularly worrisome given the relative youth of the population. The overall age-adjusted prevalence is equivalent to the most recent 9.6% estimate from the U.S. (1988–2006) (2), with site-specific prevalence ranging from 7% in Tegucigalpa to 15% in Belize. This increased prevalence may be related to a variety of characteristics, including genetic, demographic, and lifestyle factors, but the prevalence of obesity across the sites, and in particular among Belizean (44%) and Nicaraguan women (34%; data not shown in Table 1), was as high or higher than the most recent U.S. estimate of 35.5% among adult women (9).

The age-adjusted prevalence of diabetes was comparable among men and women in all sites except in Belize, where the prevalence of diagnosed and undiagnosed diabetes was more than twice as high among women (10.5% and 7.1%, respectively) than in men (4.7% and 3.6%, respectively). Although a full explanation of this issue merits further investigation of diabetes-related genetic and environmental risk factors, our data showed that the prevalence of obesity (BMI >29 kg/m²), a major risk factor for diabetes, was almost twice as high among Belizean women (44.1%) as among Belizean men (23.6%; data not shown in Table 1). In general, the prevalence of obesity was higher among women than in men across all CAMDI sites, but the sex difference in the prevalence of obesity observed in Belize was the greatest. In summary, the total prevalence of diabetes found in the combined Central America sample was greater than the prevalence reported in most Latin American countries and similar to that in the U.S. These findings are particularly noteworthy given the relatively young age of the population of Central America and the potential for a growing burden in future decades. These findings should be an
### Table 1—Sample characteristics and prevalence of diagnosed diabetes, newly diagnosed diabetes, and intermediate hyperglycemia (IGT/IFG) by sex and site

| Country     | Sample (n) | Weighted population | Female (%) | Mean age (years) | BMI (kg/m²) | Known DM (n) | New DM (n) | Total DM (n) | IGT/IFG (n) |
|-------------|------------|---------------------|------------|-----------------|-------------|--------------|------------|-------------|-------------|
| Belize      | 2,439      | 1,622 (99.5)        | 49.7       | 39.2 (0.18)     | 28.2 (0.2)  | 7.6 (6.1–6.2)| 5.3 (4.2–6.6)| 12.9 (10.9–15.2)| 16.5 (13.7–19.8)|
| Guatemala   | 1,477      | 1,146 (80.3)        | 51.4       | 39.2 (0.20)     | 28.2 (0.2)  | 10.5 (8.2–13.2)| 8.8 (6.3–11.7)| 19.3 (16.0–22.6)| 27.8 (23.1–32.8)|
| Honduras    | 1,280      | 901 (74.0)          | 49.7       | 39.2 (0.29)     | 27.7 (0.2)  | 8.7 (6.3–10.7)| 5.3 (4.3–6.9)| 14.0 (11.4–17.4)| 21.7 (17.9–25.4)|
| Nicaragua   | 452,780    | 1,231,720           | 45.6       | 39.2 (0.36)     | 27.7 (0.2)  | 5.8 (4.7–7.0)| 3.4 (2.3–4.8)| 9.1 (7.1–11.7)| 12.5 (10.6–14.5)|
| Total       | 2,017,147  | 5,452,780           | 50.2       | 39.2 (0.24)     | 27.7 (0.2)  | 12.9 (10.9–15.2)| 8.7 (6.3–11.7)| 21.6 (17.9–25.4)| 27.4 (23.1–32.8)|

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