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REVIEW

Diabetes in Panama: Epidemiology, Risk Factors, and Clinical Management

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Abstract

OBJECTIVES To draw evidence-based conclusions about the epidemiology, drivers, and management of diabetes in Panama based on a literature review and original analyses of large databases.

METHODS A search about diabetes in Panama was conducted through PubMed. We used the final reports of 2 studies: the first Survey of Health and Life Quality, 2007, and the first Survey of Risk Factors Associated to Cardiovasular Diseases, 2010-2011, conducted in Panama and analyzed the databases. We reviewed the approach adopted by the Panamanian Social Security institution and the diabetes national guidelines published by the Panamanian Ministry of Health.

FINDINGS The prevalence of diabetes, as estimated in 1 database (ENSCAVI), was 5.4% (4.3% men; 6.0% women; OR = 1.41 [confidence interval 1.26-1.59]; $P < 0.0001$), with the highest prevalence in urbanized regions. In another database (PREFREC), prevalence was 9.5% (10.3% men and 9.1% women), again higher in urbanized regions, but also in males, older adults, and Afro-Panamanians. Obesity, abdominal obesity, physical inactivity, family history of diabetes, high blood pressure, and triglycerides $\geq$ 150 mg/dL were associated as risk factors for diabetes in both genders ($P < 0.0001$). Total cholesterol $\geq$ 200 mg/dL and high-density lipoprotein cholesterol $<$ 40 mg/dL were risk factors in men ($P < 0.0001$). In the last 5 years, diabetes was ranked between the sixth and fifth cause of death in Panama. In response, the Panamanian Social Security created the "Program for Prevention and Control of Diabetes" to strengthen primary health care.

CONCLUSIONS Diabetes is a serious national public health threat in Panama. To address this problem in a public health modality, information from large databases was analyzed and presented to the Panamanian Ministry of Health to prompt constructive policy change to enhance diabetes prevention.

KEY WORDS diabetes mellitus, Panama, diabetes risk factors, diabetes care, Latin America

INTRODUCTION

Diabetes mellitus (DM) is a global epidemic representing a considerable health and socioeconomic burden[1] and affecting 6%-8% of the world's population.[2] It is estimated that by the year 2030, there will be 552 million people affected by diabetes worldwide; this is an increase of 50.8% from the 366 million cases recorded in 2011.[3] On a global scale, approximately 7% of people with diabetes live in Latin America.[1] In the last decade, the number of people in Latin America with diabetes has

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been increasing as a result of urbanization and other risk factors.[1] In 2011, the diabetes adjusted prevalence in Latin America was 9.2% for adults between 20 and 79 years old, with the number of cases in 2030 expected to be higher in this region than in other regions.[4]

Panama is a Latin American nation located at the southernmost end of Central America (Fig. 1) and has been classified by the World Bank as a country with an upper middle income level.[5,6] In the last 3 decades, the per capita gross domestic product of Panama increased almost 5-fold, allowing the Panamanian economy to be the most vigorous of the region. At the same time, the percentage of people living in urban areas grew from 50% to 75%.[5,7,8] Economic growth in Panama, increased urbanization, and stimulated migration from rural and indigenous (ie, Indian reservations) areas toward larger cities produced noticeable behavioral changes in diet and lifestyle.[9-12] For instance, transitions in occupation, transportation modalities, and available technology, especially when directed at leisure activities at home, contributed to increased sedentary behaviors, decreased physical activity, and the development of overweight/obesity.[8,13-16]

Anthropometric factors, such as body mass index (BMI) $\geq$ 25 kg/m^2 and abdominal circumference $>$ 80 cm in women and $>$ 90 cm in men; clinical factors, such as arterial hypertension, triglycerides $\geq$ 150 mg/dL, high-density lipoprotein (HDL) cholesterol $<$ 40 mg/dL; and lifestyle factors, such as sedentary lifestyle ($<$150 minutes of physical activity per week), tobacco use, alcohol consumption, and excessive intake of calories, particularly when associated with an increased consumption of refined carbohydrates and fats, act in concert to increase the risk of diabetes in Panama.[16,17] Management of these risk factors can significantly diminish the likelihood of developing chronic complications related to sustained hyperglycemic states.[18,19]

An important biological risk factor for the development of diabetes in Panama is obesity.[20] The first Survey on Risk Factors Associated with Cardiovascular Disease (PREFREC; Spanish acronym), conducted in Panama from 2010 to 2011, estimated a prevalence of overweight of 34.7% (35.1% in men and 34.5% in women) and obesity of 27.1% (18.3% in men and 30.9% in women) in a sample of 3590 individuals 18 years old and over.[21] Since 1982, there has been a marked increase in the

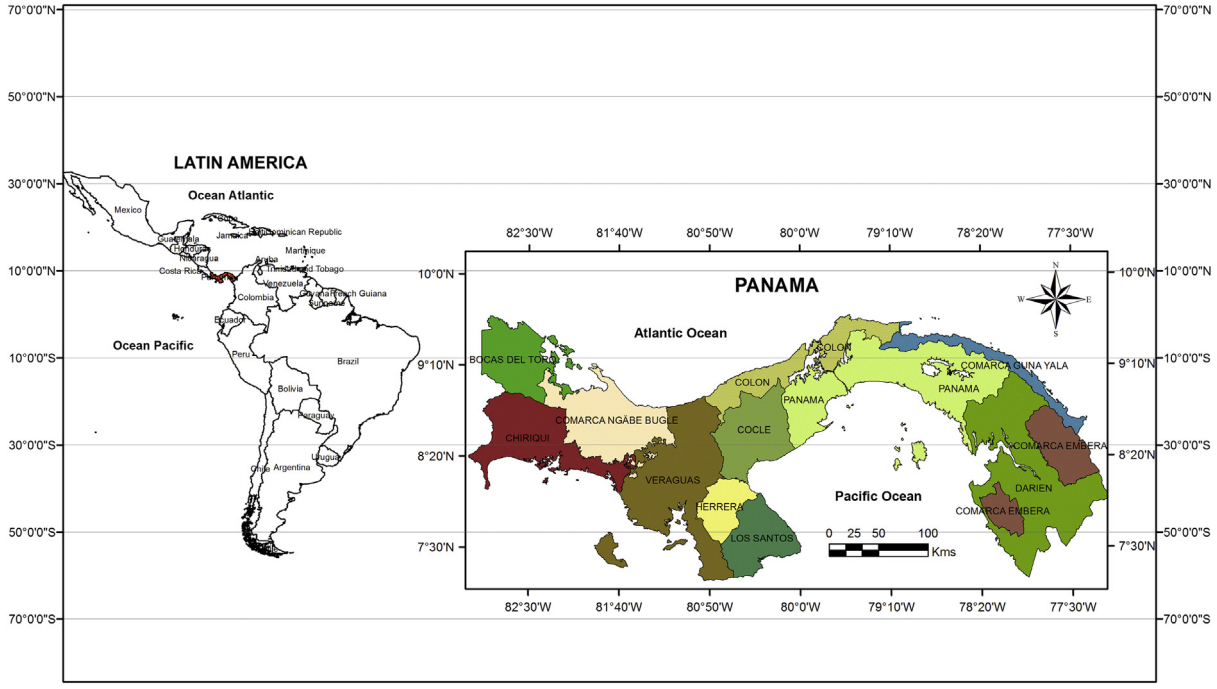

Figure 1. Panama in Latin America. (Source: Elaborated by the authors. Panama's cartographic shape, legally purchased from the National Institute of Statistics and Census. Each color represents a Panamanian province. Latin America's cartographic shape is included in World Arc View 3.2, legally acquired by our institution.)

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prevalence of obesity in Panama,[6] especially among women.[20]

Another main population study in Panama was the first National Health and Quality of Life Survey, 2007 (ENSCAVI; Spanish acronym). Both studies—PREFREC and ENSCAVI—conducted in national and subnational representative samples, demonstrated the epidemiological patterns and public health impact of diabetes in Panama.[21,22] Moreover, diabetes was found to be one of the principal causes of death in Panama,[20] ranking in the top 10 causes in the last 10 years.[23]

Given the tremendous impact that diabetes exerts on a public health system, the World Health Organization and the International Diabetes Federation (in their World Plan for 2011-2021) recommend that countries create programs to improve metabolic control of patients with diabetes and thus reduce complications from diabetes.[3] The Panamanian Social Security institution, concerned about the current status of insured patients with diabetes, decided to implement these recommendations, developing the "Program for Prevention and Control of Diabetes" through the creation of diabetes clinics in primary care at a national level.[24]

METHODS FOR THE ANALYSIS OF PANAMANIAN DATA

General Comments. This review provides an analysis of diabetes care in Panama based on relevant medical literature, particularly from the PREFREC and ENSCAVI studies, as well as seminal white papers, key gray literature data (from nontraditional academic/commercial publication sources), and primary data upon which some of these studies are based.

Published studies on diabetes in Panama over the last 10 years were identified through PubMed (National Library of Medicine, Bethesda, Maryland) search engines. The search terms "diabetes in Latin America," "diabetes in Panama," "diabetes prevalence in Panama," "diabetes and risk factors in Panama," and "diabetes mortality in Panama" were used. Four publications were related directly with diabetes in Panama (1 about mortality, 2 about prevalence, and 1 about diabetes as a risk factor for the development of cerebrovascular disease); and 2 publications were related to chronic diseases associated with diabetes in Panama: high blood pressure and obesity.

Additionally, the final reports, in book form, of the ENSCAVI and PREFREC studies, related to cardiovascular diseases in Panama, were diligently analyzed, as well as an analysis of Panamanian statistical data on mortality from the National Institute of Statistics and Census (INEC; Spanish acronym). Also, clinical guidelines for the treatment of diabetes published by the Pan-American Health Organization (PAHO) and the Panamanian Ministry of Health and Social Security Institution were reviewed.

The following data were excluded from the PREFREC database: pregnant women, individuals without weight and height values, those without blood pressure values, those without waist circumference values, and people with underweight values, resulting in a final sample size of 3497. For the original analysis of Panamanian data on diabetes and cardiometabolic risk factors, the prevalence estimates were calculated as percentages and the risk analyses (odds ratio [OR]) were performed with 95% confidence intervals (CI). OR and P values were calculated using 2×2 tables and a value of $P \leq 0.05$ was considered statistically significant.[25,26] The data were processed using SPSS Statistical Software (Version 19; IBM Corp., Armonk, NY, USA), Microsoft Excel 2010 (Microsoft, Redmond, WA, USA), and Epi info (Version 3.5.1; Centers for Disease Control and Prevention, Atlanta, GA, USA). The National Bioethics Committee of the Republic of Panama approved the studies.

Additional Details: ENSCAVI. ENSCAVI was a quali-quantitative and cross-sectional survey, conducted in 2007, of the Panamanian population focusing on disease prevalence and health/lifestyle perceptions. The study sample was 25,748 participants, 18 years old and over, derived through probabilistic, randomization, and stratification techniques taking into account geography, census blocks (ie, urban vs rural) and other descriptors (eg, indigenous vs nonindigenous). The validated questionnaire addressed self-perception of body size and type, physical activity, feelings of energy and vitality, personal quality of life, health services satisfaction and usage, and other general health measures.[22]

Additional details: PREFREC. PREFREC was a subnational, cross-sectional study performed between 2010 and 2011 in urban, rural, and indigenous Panamanian populations. According to the National Census of 2010, 60.4% of the Panamanian population of 18 years and more lived in these areas. PREFREC surveyed cardiovascular risk factors in 3590 adults and then a single-stage, probabilistic and randomized sampling strategy with a multivariate stratification was used. Anthropometric

measurements (eg, height, weight, and abdominal circumference) were obtained by licensed nutritionists. In order to obtain information about ethnic and socioeconomic variables, a structured questionnaire was used.[21]

In PREFREC, the excessive consumption of "high-fat foods" was defined as the intake of 2 or more daily fried foods or foods high in fat, such as tortilla, puff pastry, patty, chips, fried plantain, fried yucca, and pork crackling (typical Panamanian high-fat foods); as well as fried sausage, fried nuggets, fried chicken, fried meat, fried fish, fried pork, snacks ("kaprichitos," "doritos," and "taquitos"); and, last, the use of coconut milk or coconut oil for cooking. An excessive consumption of foods high in sugar was defined as an intake of foods or beverages with an equivalent of 6 teaspoons of sugar per day or more. Examples include sugared sodas, certain artificial drinks (eg, Tang®, Kool-Aid®, etc), milk chocolate, candy bars, and candies in quantities of 6 or more per day.

Physical activity was defined as any activity that requires energy expenditure under aerobic conditions, such as most sports and exercises. This variable was classified into 3 categories: no physical activity (<60 minutes per week), insufficient physical activity (60-149 minutes per week), and physically active (150 minutes or more per week).

The biological variables were family history of diabetes, nutritional status, abdominal obesity, hypertension, and lipid profile. Nutritional status was determined by BMI, where underweight is <18.5 kg/m^2, normal weight is 18.5-24.9 kg/m^2, overweight is 25-29.9 kg/m^2, and obesity is ≥30 kg/m^2.[21,27] Abdominal obesity was defined as a waist circumference >88 cm in women and >94 cm in men.[8] High blood pressure was classified in accordance with the JNC 7 High Blood Pressure Guidelines,[28] namely, hypertension as systolic blood pressure ≥ 140 mm Hg or diastolic pressure ≥ 90 mm Hg and prehypertension as systolic blood pressure 120-139 mm Hg or diastolic blood pressure 80-89 mm Hg. Abnormal lipid levels were triglycerides ≥ 150 mg/dL, low-density lipoprotein (LDL) cholesterol ≥ 100 mg/dL, total cholesterol values ≥ 200 mg/dL, and HDL < 50 mg/dL (men) or < 40 mg/dL (women), as sampled and performed by licensed medical laboratory scientists.[29]

RESULTS

Diabetes Prevalence in Panama. In 2007, according to the ENSCAVI survey, the estimated prevalence of diabetes in Panama was 5.4%.[22] However, higher prevalence rates were located in the country's most urbanized health care regions: San Miguelito (8.0%), West Panama (6.3%), Chiriquí (6.2%), and Metropolitan Panama (6.0%); those with Afro-Panamanian ethnic groups: Colón (5.6%) and Coclé (6.0%); and those with a more elderly population: Herrera (7.3%) (Fig. 2).[22] The lowest prevalence rate of diabetes in Panama was in Guna's reservations (0.5%) (Fig. 2).[22] Prevalence rates were 6.4% in urban area (5.5% in men and 6.9% in women; OR = 1.27 [CI 1.09-1.47]; $P < 0.0001$), 5.0% in rural (3.8% in men and 5.9% in women; OR = 1.62 [CI 1.31-2.01]; $P < 0.0001$), and 1.7% in indigenous areas (1.4% in men and 1.9% in women).[22]

There was a higher risk probability of diabetes among women (OR = 1.41 [CI 1.26-1.59]; $P < 0.0001$). The prevalence of diabetes positively correlated with increasing age and was more prevalent among the elderly, especially those who were 50 years and older (OR = 5.08 [CI 4.5-5.7]; $P < 0.0001$) (Table 1). For all age groups, female diabetes prevalence was higher than that of males (Table 2).

As the level of education increased, the prevalence of diabetes diminished. Diabetes prevalence was highest among widows (14.6%, OR = 3.30 [CI 2.78-3.92], $P < 0.0001$), whereas the lowest prevalence was among singles (2.9%, OR = 0.47 [CI 0.40-0.55], $P < 0.0001$), compared with prevalence rates among married persons (Table 1).

In 2013, PREFREC results disclosed that 7.3% of 3590 participants had a previous diagnosis of diabetes, 5.7% had fasting blood glucose levels ≥ 126 mg/dl, and 4.3% had hemoglobin A1c (A1C) levels ≥ 6.5% (≥ 48 mmol/mol), which in aggregate estimated a prevalence of diabetes of 9.5% (CI 95% between 8.5%-10.5%). This prevalence is comparable with other studies of the region.[18]

Diabetes prevalence rates in PREFREC were higher in urban areas (10.5%) compared with rural (9.2%) and indigenous (5.7%; $P = 0.0038$) areas and higher in men (10.3%) than in women (9.1%). There was an epidemiological trend toward higher rates of diabetes with increasing age ($P < 0.05$). Prevalence was also higher among men than women younger than 50 years old, but at 50 years old and older, the prevalence was greater among women.[18]

The highest prevalence rates of diabetes were found among Afro-Panamanians (11.9%; $P < 0.05$), widowers (16.0%; $P < 0.05$), those earning US$600 or more per month (12.2%; $P < 0.05$),

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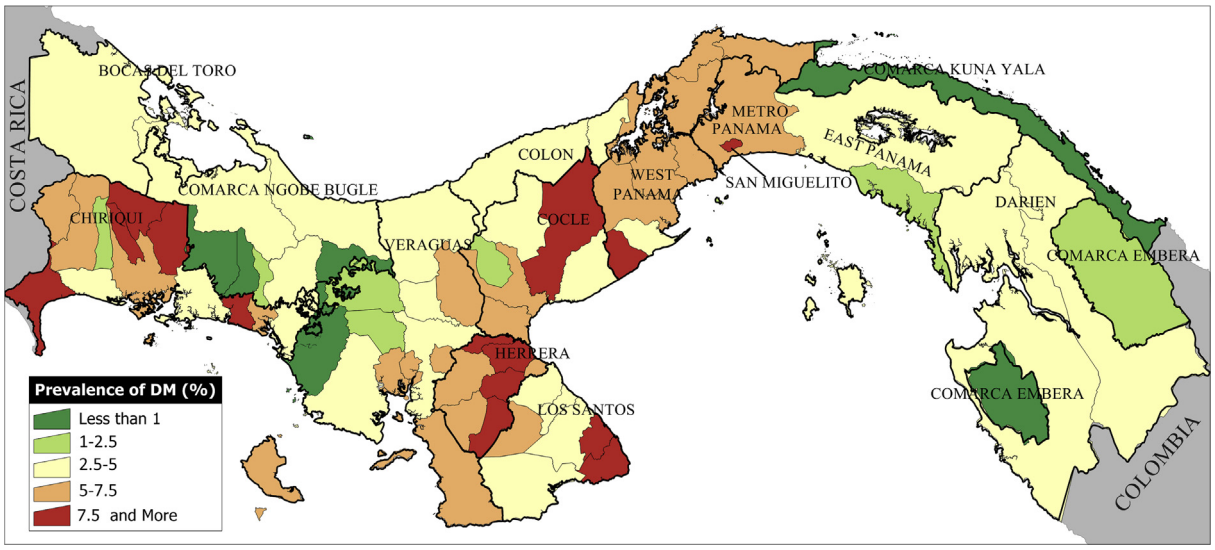

Figure 2. **Prevalence of DM in Panama according to Health Regions. (Source: Elaborated by the authors from ENSCAVI database. Panama's cartographic shape was legally purchased from the National Institute of Statistics and Census.**

and those holding postgraduate degrees (16.1%).[18] The lowest prevalence rates were recorded among native groups (Gunas Indians, 5.4%; $P < 0.05$).[18] Being Afro-Panamanian (OR = 1.42 [CI 1.09-1.85]; $P < 0.0001$) and 50 years or older (OR = 3.82 [CI 3.00-4.86]; $P < 0.0001$) were sociodemographic risk factors strongly associated with diabetes in Panama.[18]

Through multivariate analysis, using a logistic regression model, being a member of an indigenous

Table 1. **Prevalence of Diabetes in Panama According to Sociodemographic Variables***

Variables	Prevalence of Diabetes	%	OR and CI	*P*
Total	1378/25,748	5.4	NA	NA
Sex				
Women	931/15,461	6.0	1.41 (1.26-1.59)	<0.0001
Men	447/10,287	4.3	0.71 (0.63-0.80)	<0.0001
Age (y)				
18-29	86/7271	1.2	0.16 (0.13-0.20)	<0.0001
30-39	134/5878	2.3	0.34 (0.29-0.42)	<0.0001
40-49	230/4590	5.0	0.92 (0.79-1.06)	0.2565
50-59	291/3336	8.7	1.87 (1.63-2.14)	<0.0001
60 and older	637/4616	13.8	4.39 (3.93-4.91)	<0.0001
Schooling				
No schooling/elementary	678/10,457	6.5	1.49 (1.29-1.60)	<0.0001
High school	421/9427	4.5	0.75 (0.66-0.84)	<0.0001
University	268/5648	4.7	0.85 (0.74-0.97)	0.0321
Marital Status				
Single	170/5755	2.9	0.47 (0.40-0.55)	<0.0001
Free union/married	929/16,948	5.5	1.07 (0.95-1.20)	0.2556
Separated/divorced	108/1801	6.0	1.14 (0.93-1.39)	0.2372
Widowed	171/1172	14.6	3.30 (2.78-3.92)	<0.0001

CI, 95% confidence intervals; NA, not applicable; OR, odds ratio.
* For each category of the variables studied, OR and P values were calculated between total people with and without diabetes.
Adapted from ENSCAVI 2007.[22]

Table 2. Prevalence of Diabetes in Panama According to Age and Gender*

Variables	Women			Men		
	Prevalence of diabetes (%)	OR and CI	*P*	Prevalence of obesity (%)	OR and CI	*P*
Age (y)						
18-29	1.4 (62/4465)	0.16 (0.13-0.21)	<0.0001	0.85 (24/2806)	0.14 (0.09-0.22)	<0.0001
30-39	2.5 (92/3632)	0.34 (0.27-0.42)	<0.0001	1.9 (42/2246)	0.36 (0.26-0.49)	<0.0001
40-49	5.8 (160/2766)	0.95 (0.79-1.13)	0.5687	3.8 (70/1824)	0.85 (0.66-1.11)	0.2598
50-59	10.2 (203/1986)	1.99 (1.69-2.34)	<0.0001	6.5 (88/1350)	1.66 (1.31-2.11)	<0.0001
60 and older	16.1 (414/2574)	4.57 (3.99-5.24)	<0.0001	10.9 (223/2042)	4.38 (3.61-5.31)	<0.0001

CI, 95% confidence interval; NA, not applicable; OR, odds ratio.
* For each category of the variables studied, OR and *P* values were calculated between total people with and without diabetes.
Adapted from ENSCAVI 2007.[22]

population is a protective sociodemographic factor against the development of diabetes, compared with other ethnic groups (RR 0.54 [95% CI 0.35-0.84]).[30] Similarly, living in an indigenous reservation offers protection, compared with those living in urban and rural areas (RR 0.35 [95% CI 0.17-0.73]).[30] The authors concluded that being a native, female young adult (18-29 years old) and living in an indigenous area are sociodemographic variables related to a lower probability of having diabetes in Panama, whereas residing in urban areas, being a male older adult (≥60 years old), and being Afro-Panamanian are sociodemographic variables related to a higher probability of having diabetes in Panama.[30]

Summary of Risk Factors for DM in Panama. The risk factors that contribute with higher OR for the development of diabetes are: being 50 years and older, intake of 2 or more fried foods daily, having a family history of diabetes, and waist circumference measurements above the cut-off points for men and women (Table 3).

Clinical Aspects of Diabetes Care in Panama. Overall, in Panama, 1 in every 5 persons with diabetes is unaware of their condition.[18] This level of unawareness is comparable to other countries in the region but lower than the global estimate of 50% reported by the International Diabetes Federation.[18] Glucose control remains a major focus in the management of individuals with diabetes[19] because it delays the micro- and macrovascular complications. Diabetes was found in 22.2% of patients with cerebrovascular disease.[31] In PREFREC, 60.0% of patients with diabetes were receiving treatment and 40.0% were not. Only 53.4% of the patients being treated for diabetes were controlled (A1C < 7%; < 53 mmol/mol).[18]

The Panamanian Social Security developed the Program for Prevention and Control of Diabetes to strengthen primary health care across 32 diabetes clinics by implementing a comprehensive plan involving structured self-monitoring of blood glucose at home, a registration system of electronic information, diabetes education and nutrition counseling for patients, continuous medical education for diabetes clinical staff, and a strong plan for disclosure and community participation. Each patient in the program is provided with a home-use glucose meter, under warranty, with semiannual maintenance arranged and change of batteries included. Test strips, lancets, and lancet device are also provided to accommodate the frequency of daily blood glucose monitoring recommended by the treating (specialist or family medicine) physician. The frequency is as follows: for patients with type 2 diabetes (T2D) with oral medications— only once a day; for patients with T2D with oral medication and insulin to conventional doses—up to 3 times a day; for patients with T2D with intensive insulinization—up to 5 times a day; and for adult or pediatric patients with type 1 diabetes—3-7 times a day.

Each clinic is equipped with computers loaded with specialized software that connects to a central server that integrates the patient's information. This software downloads blood glucose readings contained in the patient's personal glucose meter and collects data for reporting. This information is printed and/or sent each month to the patient's electronic health record and received by the treating physician and the multidisciplinary team. These data, presented as averages, graphics, and trends can be reviewed for clinical decision making and serve as a self-management support tool.

Each patient receives a structured plan of continuous education on proper technique and use of the glucose meter and interpretation of results for decision making and self-management. Additionally, patients participate in continuous individual and

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Table 3. Prevalence of Risk Factors Associated with Diabetes in Panama*

Variables	Frequency of Diabetes	%	OR and CI	*P*
Total	330/3497	9.5	NA	NA
Sex				
Women	222/2441	9.1	1.14 (0.89-1.45)	0.3237
Men	108/1056	10.2	1.03 (0.81-1.32)	0.3237
Age (y)				
18-29	10/699	1.4	0.11 (0.06-0.22)	<0.0001
30-39	34/674	5.0	0.45 (0.31-0.66)	<0.0001
40-49	57/704	8.1	0.81 (0.60-1.11)	0.1975
50-59	100/649	15.4	2.07 (1.60-2.69)	<0.0001
60 and older	129/771	16.7	2.52 (1.98-3.22)	<0.0001
Intake of Fatty Foods				
≥2 fried food daily	2941/3217	91.4	2.55 (1.85-3.51)	<0.0001
<2 fried food daily	226/280	80.7	0.39 (0.28-0.54)	<0.0001
Intake of Beverages / Foods Rich in Sugars				
≥2 teaspoons per day	2107/2296	91.8	1.48 (1.18-1.87)	0.0009
<2 teaspoons per day	1060/1201	88.3	0.67 (0.54-0.85)	0.0009
Physical Activity				
Physically active	116/1605	7.2	0.61 (0.48-0.77)	0.0001
Insufficient physical activity	61/586	10.4	1.14 (0.85-1.53)	0.4205
Physically inactive	153/1306	11.7	1.51 (1.20-1.90)	0.0005
Family History of Diabetes				
Yes	218/1512	14.4	2.82 (2.22-3.58)	<0.0001
No	108/1738	5.9	0.40 (0.31-0.51)	<0.0001
Do not know / no response	4/139	2.9	NA	NA
Waist Circumference				
>94 cm (men)	72/417	17.3	3.50 (2.29-5.33)	<0.0001
>88 cm (women)	183/1570	11.7	2.81 (1.97-4.02)	<0.0001
Body Mass Index				
Normal	68/1219	5.6	0.44 (0.33-0.58)	<0.0001
Overweight	122/1197	10.2	1.12 (0.88-1.42)	0.3745
Obese	131/947	13.8	1.88 (1.48-2.38)	<0.0001
High Blood Pressure (JNC 7)				
Hypertension class 1 & class 2	123/852	14.4	1.99 (1.56-2.52)	<0.0001
Prehypertension	105/1154	9.1	0.94 (0.74-1.20)	0.6758
Normal	102/1491	6.8	0.57 (0.45-0.73)	<0.0001
Triglycerides				
≥150 mg/dL	171/1231	13.9	2.14 (1.70-2.69)	<0.0001
<150 mg/dL	159/2266	7.0	0.47 (0.37-0.59)	<0.0001
Total Cholesterol				
≥200 mg/dL	155/1426	10.9	1.32 (1.05-1.65)	0.0190
<200 mg/dL	175/2071	8.5	0.75 (0.60-0.95)	0.0190
LDL-Cholesterol				
≥100 mg/dL	224/2319	9.7	1.08 (0.85-1.38)	0.5681
<100 mg/dL	106/1178	9.0	0.92 (0.73-1.18)	0.5681
HDL-Cholesterol				
<40 mg/dL (Men)	84/727	11.6	1.66 (1.03-2.67)	0.0449
<50 mg/dL (Women)	192/2052	9.4	1.23 (0.83-1.84)	0.3482

CI, 95% confidence interval; HDL, high-density lipoprotein; LDL, low-density lipoprotein; NA, not applicable; OR, odds ratio.
* For each category of the variables studied, OR and *P* values were calculated between total people with and without diabetes.
Adapted from PREFREC 2010-2011.[21]

group nutritional counseling on issues related to meal planning and how to best prepare food, such as cooking workshops taught by nutritionists with training in diabetes.

This care plan involves continuous health care staff education, through the development of a university-endorsed academic program using multidisciplinary and primary health care staff specializing in diabetes in order to improve the student's skills on patient education, various clinical issues, and prevention of diabetes complications. This academic program, taught in national and international centers, emphasizes 2 key aspects: overall patient health education and diabetes self-management.

DM Mortality in Panama. In Panama, diabetes accounted for 6.2% (1102/17767) of the total number of registered deaths in 2013.[32] In the last 5 years, diabetes was ranked between the sixth and fifth cause of death in the country.[20] The age-adjusted mortality for DM did not show any upward trend for men or women.[20] The 2 Panamanian provinces with the highest mortality rate related to DM were Colon and Bocas del Toro.[20] Moreover, women showed a higher mortality rate related to diabetes, a faster increase in adjusted diabetes-related death rate than males as they age, and the highest median age of death (75 years; $P = 0.001$).[20] The biological and socioeconomic risk factors with the strongest correlations to mortality from diabetes were overweight ($r = 0.96$, $P < 0.001$) and a monthly income of less than US$100.00 ($r = 0.6$, $P < 0.001$), respectively.[20]

DISCUSSION

General Comments. The estimated diabetes prevalence in the earlier ENSCAVI study was based on the case definition of diabetes and just included the medical diagnosis of diabetes. However, in the later PREFREC study, the case definition for diabetes included the medical diagnosis of diabetes, as well as glucose levels $\geq$ 126 mg/dL and/or A1C $\geq$ 6.5% ($\geq$ 48 mmol/mol). This difference in case definition accounts, in part, for the increase in the diabetes prevalence from 5.8% to 9.5% in the same area of study.

According to ENSCAVI and PREFREC, the highest prevalence of diabetes was found in urbanized and economically active areas,[5,7] which present specific challenges in diet and lifestyle (eg, less physical activity, westernized diet)[18] contributing to the overweight and obese state.[6] On the contrary, lower prevalence rates of diabetes were found in Indian reservations, where opposite behaviors are observed: more physical activity, less processed foods, and among all residents, a richer natural diet. Additionally, for women and men, an epidemiological trend toward a higher prevalence of diabetes was observed with increasing age, boosting the risk in people 50 years old and older.[18] This supports public health policies by the government to prevent diabetes starting with young adults, especially those younger than age 40 years.

In ENSCAVI, the prevalence of diabetes in women was higher than that of men for all age groups. These results differ from those in PREFREC, in which before 50 years of age the prevalence of diabetes was higher for men, and from 50 years of age and older, the prevalence was higher for women.[18] This could be explained by the fact that in Panama, it is women who seek out more medical attention and therefore are more likely to attend health facilities compared with men.

For both studies, there was a higher prevalence of diabetes among widows, twice as high than in divorced or separated and free union or married individuals.[18] The former could be related to the fact that 8 out of 10 widows are older than 60 years of age (effect of age), in addition to the effects of loneliness, emotional tension, and depression, which lead to neglect in self-care and a lack of desire to live.[18]

The scientific evidence produced by these studies has been presented to the Panamanian Ministry of Health for the development of plans, programs, and activities to prevent diabetes and promote healthy lifestyles. This evidence should be incorporated in future updates of guidelines and protocols to narrow the gap between science and policymaking.

Risk Factors Associated with DM in Panama. Consistent with other studies,[33,34] this analysis demonstrates that consuming 2 or more fried foods per day, 2 or more foods rich in sugar per day, and being physically inactive are risk factors for the development of increased visceral fat, overweight and obesity, and prediabetes or diabetes. Furthermore, excess visceral fat may lead to immunologic invasion of this tissue, resulting in inflammation, which might propagate in an overall systemic inflammation that causes an overproduction of biologically active metabolites, such as free fatty acids and proinflammatory mediators, thus developing features of the metabolic syndrome: insulin resistance, dyslipidemia, and hypertension.[35] Not surprisingly, there was a strong risk association among diabetes and hypertension, triglycerides $\geq$ 150 mg/dL, total cholesterol $\geq$ 200 mg/dL, and, in men, HDL values $<$ 40 mg/dL.[21]

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Clinical Management of DM. Treatment of diabetes at the Panamanian Social Security institution is aimed at improving the control of blood sugar levels, improving the quality of life, preventing the occurrence of acute and chronic complications, and preventing death. This effort involves an interdisciplinary health team (doctor, nurse, dietitian, social worker, physical therapist, pharmacist, lab technician, psychologist, etc) that must be committed, integrated, and constantly up to date in their knowledge, skills, and competencies.

Comprehensive treatment at the Panamanian Social Security institution integrates pharmacological and nonpharmacological intervention, such as a balanced meal plan, weight loss, physical activity, and a strong component of individual and group education measures. This approach also requires a degree of patient engagement and acquisition of self-management skills.

Given that the Panamanian Social Security Institution has 2.8 million policyholders, it is estimated that number includes approximately 260,000 people with diabetes. According to the latest study conducted by the Social Security institution in 2011, the average annual cost of comprehensive care for uncomplicated diabetes per person is around US$1200 (including clinical visits, medicines, and laboratory studies). This cost increases logarithmically as the disease progresses and as patients develop chronic complications, which increase the demand for health services. Although there are no studies of the indirect costs and hospitalizations of people with diabetes in Panama, these costs are probably significantly higher than those incurred by people without the disease.

According to the International Diabetic Foot Consensus of 2011,[36] which includes studies dating back to 2005, the average cost of major amputation (above the ankle) for diabetic foot was between US$19,052 (hospitalization costs only) and US$67,000 (factoring in postoperative management, rehabilitation, and prosthesis). These figures account for neither personal nor familial emotional suffering, nor the subsequent costs of permanent disability in terms of lost wages or years of productive work before retirement. Such losses in productivity as a result of permanent disability increase pension costs. Data supplied by 5 secondary and tertiary hospitals from the Panamanian Social Security in 2011 and 2012 indicated that there were 196 and 164, respectively, major amputations for diabetic foot.[36] These figures remain impressive, in spite of a 16% decrease in the number of major amputations as a result of diabetes.[36] Such a decrease could be due to improved development of preventive strategies (patient education on foot care in diabetes clinics, timely treatment of any wounds in clinics, and creation of an outpatient diabetic foot unit at the hospital level).

Terminal chronic kidney disease associated with diabetes is a leading cause of patient admissions to hemodialysis units in the world; about 45% of cases are associated with diabetes.[37] In 2014, the number of patients receiving hemodialysis in the institution was 1059.[37] The annual cost per patient for hemodialysis is approximately US$26,900.[37] This increased need for hemodialysis has led to increase the number of dialysis units to 15 nationwide.

Given the impact of diabetes on Panamanian quality of life, morbidity, mortality, and finance, the Social Security institution concludes that despite great efforts, more is needed to prevent and control diabetes. For instance, self-monitoring of blood glucose is needed for patients to achieve good metabolic control of the disease and enable good decision making about diet and medication adjustments. Also, home glucose data are an extremely valuable tool for the doctor and the health team when evaluating the success or failure of comprehensive therapy.

Also, the program allows the development of a structured plan to disseminate information about the benefits to the community on a larger scale. The program covers issues related to the prevention of diabetes and its risk factors and complications. Self-monitoring and patient education are presented as pillars of comprehensive treatment of the disease, and the importance of metabolic control and continuing care with the treating physician and health team is highlighted. In addition, participation of institutions and companies in public fairs and tours in the community allows further education on blood glucose testing and calculation of BMI to identify new individuals at risk for disease.

This program has benefited 30,000 nationally insured patients with diabetes who attended clinics located in 32 Social Security health care facilities throughout the country over the course of 3 years. In 2014 there were 10,000 patients enrolled, and in 2015 this number increased to more than 19,450 patients.

CONCLUSIONS

Diabetes is a global public health threat and clinically challenging disease that in Panama is a product of vigorous and constant urbanization and stress. Patients with diabetes exhibit a constellation of

interconnected biological, clinical, metabolic, social, and physiological factors that directly increase the risk of cardiovascular disease and, consequently, mortality. To improve the clinical management of diabetes and prevent its complications in patients with Social Insurance in Panama, a "game-changing" public health policy has been implemented. Eighty percent of the Panamanian population with diabetes benefit from a well-structured self-monitoring of blood glucose, a system of electronic information, patient education, and health promotion in the community.

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