



# Noncommunicable diseases and their common risk factors in Curitiba, Brazil: results of a cross-sectional, population-based study

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## ABSTRACT

**Objective.** To describe the estimated prevalence of noncommunicable diseases and their common risk factors among the adult population of Curitiba, Paraná, Brazil, based on results of the EPIdemiology of CURitiba: EvaluAtion of Noncommunicable diseases (EPICUREAN) study.

**Methods.** This was a cross-sectional, population-based survey of 1 103 residents of Curitiba, grouped by age (18 – 39 years of age, 40 – 59, and ≥ 60 years), conducted in August 2013 – August 2014. Household interviews, anthropometry, blood pressure measurements, and fasting capillary glycemia were performed during two visits to each participant. The analyses included frequency distribution and prevalence estimates of main outcomes. Prevalence estimates, weighted by age and sex, were presented as absolute numbers and percentages.

**Results.** Prevalence estimates for self-reported depression were 21.2%; hypertension, 31.2%; diabetes, 9.1%; self-reported dyslipidemia, 21.7%; obesity, 21.2%; current smoking, 16.1%; binge drinking, 23.4%; and insufficient physical activity, 35.1%. Prevalences of diabetes and hypertension were higher among individuals with less schooling and the elderly. Binge drinking and leisure-time physical activity were more prevalent in young adults. Men presented higher prevalences of overweight, current smoking, and harmful use of alcohol. Obesity and moderate-to-severe risk of depression were more frequent among women and those with lower income.

**Conclusions.** The prevalence of NCDs and common risk factors among the adult population of Curitiba are high and reveal a gradient of vulnerabilities by age, sex, education level, and income. To address health inequities and meet the needs of different population groups, the health system should monitor NCDs and risk factors and implement equitable public health policies.

## Keywords

Chronic disease, epidemiology; depression; diabetes mellitus; hypertension; risk factors; Brazil.

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In 2009, the Pan American Health Organization (PAHO) / World Health Organization (WHO) Country Office in Brazil launched the *Laboratório de Inovações em Atenção às Condições Crônicas* (Laboratory for Innovative Care for Chronic Conditions; LIACC), an initiative to generate evidence for good health care management within the *Sistema Único de Saúde* (Unified Health System; SUS) and to positively impact the management of noncommunicable diseases (NCDs) in Brazil. The LIACC was based on technical cooperation with the Ministry of Health (MoH) of Brazil, as well as other local, public institutions (1).

This initiative was clearly linked with the country's "Strategic Plan of Action for Controlling Noncommunicable Diseases in 2011 – 2022" (2). This plan, instituted by the MoH, aims to deter the advancement of the four principle NCDs (cancers, cardiovascular diseases, chronic respiratory disease, and diabetes) and to reduce their shared modifiable risk factors (tobacco use, harmful use of alcohol, physical inactivity, and unhealthy diet). In keeping with the PAHO "Regional Strategy and Plan of Action on an Integrated Approach to the Prevention and Control of Chronic Diseases" (3) and the WHO "Global Action Plan for the Prevention and Control of NCDs 2013 – 2020" (4), the Brazilian plan addresses strategies for surveillance, monitoring, evaluation, prevention, and health promotion, as well as management proposals for comprehensive health care (2).

Inequalities in NCDs and their common risk factors are well established and extensively connected with social inequalities (5 – 6). Identifying vulnerabilities and striving for health equity in all policies are core principles of the Commission on the Social Determinants of Health (7), placing inequality squarely on the political agendas of governments. In Curitiba, as in other large, Latin American cities, intra-urban social and health inequalities represent a challenge for public health managers.

Curitiba is the capital of the Paraná, a state in the southern part of Brazil. It has approximately 1.9 million inhabitants (8). Since 1999, the Municipal Secretariat of Health has organized Health Care Networks and has adopted chronic disease management programs in Curitiba. Based on the Chronic Conditions Care Model (CCCM), introduced by Mendes (9), the LIACC-Curitiba redesigned the

health care approach according to the prevalence and risk stratification of depression, diabetes, and hypertension. Interventions addressing each CCCM level took into account the social determinants of health and the presence of risk factors and chronic conditions. In addition, self-management support and group visits were launched (9). However, local, population-based, epidemiological studies to back these actions were lacking.

To generate data on NCD prevalence and risk factors among the adult population of Curitiba, the "EPIdemiology of CURitiba: EvaluAtion of Noncommunicable diseases" (EPICUREAN) study was designed. Its aim was to collect epidemiological information that would guide public health policies and help monitor and provide qualified care for adults, taking into account the specific vulnerabilities of various age groups (2 – 4). With this in mind, the objective of this study was to describe the EPICUREAN baseline results for estimated NCD prevalence and common risk factors among the adult population of Curitiba.

## MATERIALS AND METHODS

EPICUREAN was a cross-sectional, population-based study with a municipal scope, conducted from August 2013 – August 2014 in Curitiba, Paraná, Brazil.

### Study sample

The study population was composed of residents from private households in Curitiba, 18 years of age and older, not pregnant, with autonomy to answer the questionnaire, and who agreed to participate by completing an informed consent form. The sample size was calculated using the estimated population of three age groups of interest: 18 – 39 years of age, 40 – 59 years, and  $\geq 60$  years (8); the estimated mean frequency of the most prevalent health condition—hypertension, 30% (10); an acceptable margin of error of 5%; and a non-response rate of 20%. It totaled 1 161 participants (387 per age group).

The strategy used to access participants included the following. First, four of the nine health districts were selected to represent the city's diversity: geographic distribution (East, West, and South health macro-region), population

profile (socioeconomic status, percentage of elderly, use of public and private health services), and the characteristics of health units (basic units and family health care units). Then, the total sample size was proportionally distributed in the health districts according to the size of the estimated population by age group, composing age-specific sample sizes. Then, 20 census tracts in each district were randomly selected from the *Geographic Operating Base 2010 Demographic Census* (8). From these tracts, blocks and the starting point of the block were randomly chosen. Field teams traveled these blocks in a clockwise direction to sequentially locate homes where a resident might be interviewed.

At eligible homes, the interviewer presented information on the research aims and identified all household adults. To avoid selection bias, only one consenting adult per household (within one of the three possible age groups) was selected to participate. The houses were visited in sequence until the required sample size for each age group was met. Interviews and physical exams were scheduled on days and times most convenient for the participants. Two visits per household were required.

### Study instrument and data collection

The staff interviewers (medical graduates and graduate students in health sciences) were trained in a 40-hour workshop that addressed research objectives; random selection of the blocks from the census tracts, routes, location of households, and selection of participants; conducting interviews; calibration of physical exam; and recording and delivering data. Additional training materials were made available on paper and in electronic format. Research supervisors monitored the work done in the field.

A pilot study was performed in August 2013 on two census tracts. This experience made it possible to adjust all of the interview procedures and instrument, as well as to solidify plans for each visit. The first visit was allotted 60 minutes, and the second, 20 minutes.

Interviews and measurements were performed at the participants' homes from August 2013 – August 2014. Data was registered on electronic devices with study-specific software.

Data collection followed the WHO STEPwise approach to noncommunicable disease risk factor surveillance (11), including Step 1 (questionnaire), Step 2 (physical measurements), and Step 3 (biochemical measurements), except for measurement of total cholesterol. Validated questionnaires (11 – 13) included information on socioeconomic status (occupation, schooling, family income, marital status, and work), lifestyle, health status, follow-up and treatment of NCDs, and health services utilization.

**Prevalence of chronic conditions.** Self-reported morbidity was registered based on reporting of a doctor's diagnosis of depression, diabetes, dyslipidemia (high cholesterol and/or triglycerides), and/or hypertension. The assessment of risk/severity of chronic diseases included self-rated health, risk of depression, and type 2 diabetes. Depression was assessed by the Brazilian version of the Patient Health Questionnaire (PHQ-9)—the depression module of the Primary Care Evaluation of Mental Disorders (14). A total score  $\geq 10$  on the PHQ-9 was considered a moderate-to-severe risk of depression (15).

Diabetes was assessed with the Finnish Diabetes Risk Score (FINDRISC; 16), the most commonly used scale for detecting undiagnosed diabetes. A total score of  $\geq 15$  was considered a high 10-year risk of developing diabetes. It included values for: age (45 – 54 years of age = 2; 55 – 64 = 3;  $\geq 65$  years of age = 4); less than 4 hours/week of physical activity = 2; daily consumption of fruits, berries, or vegetables = 1; use of antihypertensive medication = 2; family history of diabetes (first degree relative = 5, second degree relative = 3); measured body mass index (BMI; 25 – 29.9 kg/m<sup>2</sup> = 1 or  $\geq 30$  kg/m<sup>2</sup> = 3); waist circumference (WC; 80 – 88 cm for women or 94 – 102 cm for men = 3,  $\geq 88$  cm for women or 102 cm for men = 4); and informed (history of) or measured, raised blood glucose = 5 (16).

**Behavioral risk and protective factors.** The behavioral risk factors assessed were: current smoking; heavy drinking (weekly calculated drink consumption of  $\geq 8$  for women or  $\geq 15$  for men; 17); binge drinking (women  $\geq 4$  or for men  $\geq 5$  cans of beer, glasses of wine, or doses of cachaça, scotch, or distilled spirits on a single occasion in the past 30 days; 17);

regular intake of sodas and artificial juices ( $\geq 5$  days/week); sausage and luncheon meat intake ( $> 1$  day/week); high fat meat (meat with apparent fat and/or chicken with skin) intake ( $> 1$  day/week); whole milk intake ( $> 1$  day/week); insufficient physical activity ( $< 150$  minutes of mild/moderate or 75 minutes of intensive physical activity per week including leisure time, occupation, and transportation). Protective factors comprised recommended fruit and vegetable intake ( $\geq 5$  days/week in 5 portions/day—minimum of 1 portion of fruit/juice and 2 portions of vegetables/berries) and leisure-time physical activity ( $\geq 150$  minutes of moderate or 75 minutes of vigorous physical activity per week; 11 – 13).

**Physical exam.** The measured diseases and conditions included: nutritional status (overweight: BMI 25 – 30 kg/m<sup>2</sup>; obesity: BMI  $\geq 30$  kg/m<sup>2</sup>); central obesity (WC  $\geq 102$  cm in men and  $\geq 88$  cm in women); hypertension (mean systolic blood pressure [BP]  $\geq 140$  mmHg and/or diastolic BP  $\geq 90$  mmHg and/or currently taking prescribed antihypertensive medication); and diabetes (fasting capillary glycemia  $\geq 126$  mg/dL and/or prior diagnoses of diabetes).

The physical exam and capillary glycemia were performed at home according to standard technical recommendations. BMI was calculated by the ratio of weight in kilograms to height in meters squared (11, 18). Weight and height, and arm, neck, and waist circumference, were measured using a calibrated, portable, digital scale (Marte<sup>®</sup> LC/200PS, Marte Científica Inc., São Paulo, Brazil), a portable stadiometer (Altuxata<sup>®</sup>, Altuxata Inc., Belo Horizonte, Minas Gerais, Brazil), and a non-stretch tape measure (18). BP was measured after 5 minutes of rest, with the participant in a seated position, using a validated oscillometric device (Omron<sup>®</sup> HEM 7113, Omron Healthcare Inc., Kyoto, Japan) and appropriately sized arm cuff (Omron<sup>®</sup> adult small, medium, or large; Omron Healthcare Inc., Kyoto, Japan; 11). Three measurements were taken on the right arm after 2-minute intervals, and casual BP was calculated by the arithmetic mean of the last two results (19). A fasting capillary glycemia test (20, 21) was taken during the second visit, after an 8-hour fasting period, by photometry (Accu-chek<sup>®</sup> Active meter and Accu-chek<sup>®</sup>

test strips, Roche Diagnostics Inc., a F. Hoffmann La-Roche company, Mannheim, Germany), presenting a variation from 10 mg/dL – 600 mg/dL.

## Data analyses

Data processing and statistical analyses were performed using IBM SPSS Statistics software, version 20 (SPSS Inc., an IBM company, Chicago, Illinois, United States). Analyses included frequency distribution and prevalence estimates of main outcomes by age groups. Chi-squared tests were used to analyze associations between variables. An alternative weight approach was used to allow generalization of the results for the city population. For this, weighted prevalence estimates by age and sex were obtained by the ratio of the estimated total size of the population of a specific age group by sex per the sample size of the same, and were described as absolute numbers and percentages.

## Ethics

This study was approved by the Research Ethics Committee of the Pontifical Catholic University of Paraná (Curitiba, Paraná, Brazil; Protocol 362.266) and the Research Ethics Committee of the Municipal Secretariat of Health (Curitiba, Paraná, Brazil; Protocol 25/2013). Participants signed an informed consent, and to guarantee anonymity of the data, no identifiable individual data was published or shared.

## RESULTS

Considering the previously-calculated, age-specific sample size per health district, the total response rate was 95%. The final sample size analyzed was 1 103 participants. Of the original 1 161 participants, 58 did not complete the second visit (45 were not available, 12 refused to participate, and 1 died during the period between visits).

Participant characteristics are presented in Table 1. The majority were white (80.1%; 95% Confidence Interval [95%CI] = 77.7 – 82.5), currently working (51.3%; 95%CI = 48.4 – 54.2), and had a college education or higher ( $\geq 12$  years of study; 36.5%; 95%CI = 33.7 – 39.3).

Table 2 presents the crude prevalence of chronic conditions and risk and protective factors by age group. Except for

**TABLE 1. Sociodemographic characteristics, by sex, according to the Epidemiology of Curitiba: Evaluation of Noncommunicable Diseases (EPICUREAN) study, Curitiba, Paraná, Brazil, 2013 – 2014**

Characteristics	Overall (n = 1 103)		Women (n = 727)		Men (n = 376)		P value <sup>b</sup>
	%	95% CI <sup>a</sup>	%	95% CI	%	95% CI	
Age groups							0.45
18 – 39 years	32.9	30.1 – 35.7	31.6	28.3 – 35.0	35.4	30.5 – 40.2	
40 – 59 years	34.1	31.3 – 36.9	34.9	31.5 – 38.4	32.4	27.7 – 37.2	
≥ 60 years	33.0	30.2 – 35.8	33.4	30.0 – 36.9	32.2	27.5 – 36.9	
Skin color (self-declared)							0.51
White	80.1	77.7 – 82.5	81.2	78.4 – 84.1	77.9	73.7 – 82.1	
Brown (“pardo”)	15.1	13.0 – 17.2	14.6	12.0 – 17.2	16.0	12.3 – 19.7	
Black	3.5	2.4 – 4.6	3.0	1.8 – 4.3	4.5	2.4 – 6.6	
Yellow	1.2	0.6 – 1.8	1.1	0.3 – 1.9	1.3	0.2 – 2.5	
Native Indian	0.1	0.0 – 0.3	0.0	0.0 – 0.0	0.3	0.0 – 0.8	
Education level							< 0.001
Elementary or less	34.5	31.7 – 37.3	36.7	33.2 – 40.2	30.3	25.7 – 35.0	
Secondary	28.9	26.2 – 31.6	30.8	27.5 – 34.2	25.3	20.9 – 29.7	
College or above	36.5	33.7 – 39.3	32.5	29.1 – 35.9	44.4	39.4 – 49.4	
Married or partner	56.2	53.3 – 59.1	56.7	53.1 – 60.3	55.3	50.3 – 60.3	0.67
Work situation							< 0.001
Never worked	9.0	7.3 – 10.7	11.8	9.5 – 14.2	3.5	1.6 – 5.3	
Currently working	51.3	48.4 – 54.2	44.8	41.2 – 48.5	63.8	59.0 – 68.7	
Not currently working	17.9	15.6 – 20.2	23.5	20.4 – 26.6	6.9	4.4 – 9.5	
Retired/on leave	21.8	19.4 – 24.2	19.8	16.9 – 22.7	25.8	21.4 – 30.2	
Household monthly per capita income MW <sup>c</sup>							< 0.001
1st quintile	20.8	18.4 – 23.2	24.2	21.0 – 27.4	14.1	10.5 – 17.7	
2nd quintile	23.9	21.3 – 26.5	23.5	20.4 – 26.6	24.6	20.2 – 29.0	
3rd quintile	16.7	14.5 – 18.9	17.4	14.6 – 20.2	15.2	11.5 – 18.9	
4th quintile	19.3	16.9 – 21.7	18.8	15.9 – 21.7	20.2	16.1 – 24.3	
5th quintile	19.5	17.1 – 21.9	16.1	13.4 – 18.8	26.0	21.5 – 30.5	

<sup>a</sup> Confidence Interval.

<sup>b</sup> Chi-squared test.

<sup>c</sup> Minimum Wage: total gross household monthly income divided by the total number of family members. Brazilian MW in January 2014 was R\$ 724.00 (US\$ 300.17).

**Source:** Prepared by the authors based on the EPICUREAN study results.

depression, the prevalence of chronic conditions was higher among the elderly, as was the 10-year high-risk of developing diabetes (FINDRISC  $\geq 15$ ) and central obesity. More than one-half (56.3%; 95%CI = 51.2 – 61.4) of these participants were not achieving sufficient weekly physical activity. Despite this, harmful alcohol consumption and poor diet (fatty meat, sausage/luncheon meat, and sweet beverages) were less prevalent in this group when compared to young adults (18 – 39 years of age).

Weighted prevalence estimates by sex and age group are shown in Table 3. Men reported lower recommended weekly intake of fruits and vegetables (28.8%; 95%CI = 24.9 – 32.7 vs. 37.2%; 95%CI = 33.3 – 41.1) and higher consumption of fatty meat (40.1%; 95%CI = 35.9 – 44.3 vs. 24.7%; 95%CI = 21.2 – 28.2) and sausage and luncheon meat (66.1%; 95%CI = 62.0 – 70.2 vs. 46.9%; 95%CI = 42.9 – 50.9).

In addition, binge drinking (37.4%; 95%CI = 33.2 – 41.6% vs. 11.1%; 95%CI = 8.6 – 13.6) and current smoking (19.6%; 95%CI = 16.2 – 23.0 vs. 12.9%; 95%CI = 10.2 – 15.6) were more frequent among men. Women, however, presented lower prevalence of sufficient leisure-time physical activity (25.6%; 95%CI = 22.1 – 29.1 vs. 40.2%; 95%CI = 36.0 – 44.5).

Overall, the prevalences of diabetes and hypertension were 9.1% (95%CI = 7.4 – 10.8) and 31.2% (95%CI = 28.5 – 33.9), respectively. Prior diagnosis of dyslipidemia was reported by 21.7% of the participants (95%CI = 19.3 – 24.1). More than one-fifth of the adults were considered obese (21.2%; 95%CI = 18.8 – 23.6), with higher prevalence among women (24.6%; 95%CI = 21.1 – 28.1).

Compared to men, women reported a higher frequency of previously diagnosed depression (28.8%; 95%CI = 25.1 – 32.5 vs. 12.5%; 95%CI = 9.6 – 15.4), as

well as moderate-to-severe risk of depression according to their PHQ-9 scores (12.8%; 95%CI = 10.1 – 15.5 vs. 6.5%; 95%CI = 4.4 – 8.6).

Figure 1 shows the prevalence of selected chronic conditions and risk and protective factors according to education level and monthly per capita household income. Current smoking, diabetes, hypertension, and obesity were more frequent among individuals with only an elementary education ( $\leq 5^{\text{th}}$  grade). Obesity and moderate-to-severe risk of depression were more prevalent among participants in the lowest household income quintile than among those in the highest.

## DISCUSSION

EPICUREAN is the first population-based study of a representative sample for NCDs in Curitiba. Not only



**TABLE 2. Prevalence of chronic conditions and risk and protective factors, by age group, according to the Epidemiology of Curitiba: Evaluation of Noncommunicable Diseases (EPICUREAN) study, Curitiba, Paraná, Brazil, 2013 – 2014**

Variable	18 – 39 years of age (n = 363)		40 – 59 years of age (n = 376)		≥ 60 years of age (n = 364)		P value <sup>b</sup>
	%	95%CI <sup>a</sup>	%	95%CI	%	95%CI	
Recommended fruit and vegetable intake	28.4	23.8 – 33.0	38.3	33.4 – 43.2	44.5	39.4 – 49.6	< 0.001
Regular intake of soda and artificial juices	39.7	34.7 – 44.7	30.3	25.7 – 34.9	18.4	14.4 – 22.4	< 0.001
Whole milk intake	56.5	51.4 – 61.6	58.8	53.8 – 63.8	53.0	47.9 – 58.1	0.284
High fat meat intake	31.7	26.9 – 36.5	31.1	26.4 – 35.8	22.3	18.0 – 26.6	0.007
Sausage and luncheon meat intake	62.0	57.0 – 67.0	47.9	42.9 – 52.9	38.5	33.5 – 43.5	< 0.001
Binge drinking	27.5	22.9 – 32.1	14.6	11.0 – 18.2	8.0	5.2 – 10.8	< 0.001
Heavy drinking	12.4	9.0 – 15.8	5.1	2.9 – 7.3	3.3	1.5 – 5.1	< 0.001
Current smoking	15.2	11.5 – 18.9	17.3	13.5 – 21.1	11.0	7.8 – 14.2	0.047
Sufficient leisure-time physical activity	36.9	31.9 – 41.9	25.0	20.6 – 29.4	22.3	18.0 – 26.6	< 0.001
Insufficient physical activity	29.8	25.1 – 34.5	38.3	33.4 – 43.2	56.3	51.2 – 61.4	< 0.001
Poor self-rated health	6.9	4.3 – 9.5	9.6	6.6 – 12.6	8.5	5.6 – 11.4	0.413
High risk of diabetes (FINDRISC <sup>c</sup> ≥ 15)	7.6	4.8 – 10.4	27.1	22.3 – 31.6	47.7	41.7 – 53.7	< 0.001
Moderate to severe risk of depression (PHQ-9 <sup>d</sup> score ≥ 10)	11.0	7.8 – 14.2	11.7	8.5 – 14.9	6.9	4.3 – 9.5	0.060
Overweight	29.2	24.5 – 33.9	38.0	33.1 – 42.9	44.8	39.7 – 49.9	< 0.001
Obesity	16.3	12.5 – 20.1	28.0	23.5 – 32.5	28.0	23.4 – 32.6	< 0.001
Central obesity	35.3	30.4 – 40.2	54.4	49.1 – 59.4	69.0	64.2 – 73.8	< 0.001
Dyslipidemia (self-reported)	11.3	8.0 – 14.6	30.9	26.2 – 35.6	37.6	32.6 – 42.6	< 0.001
Depression (self-reported)	21.2	17.0 – 25.4	26.3	21.8 – 30.8	22.3	18.0 – 26.6	0.482
Hypertension	9.7	6.6 – 12.8	40.6	35.6 – 45.6	75.5	71.1 – 79.9	< 0.001
Diabetes	2.8	1.1 – 4.5	10.7	7.6 – 13.8	28.1	23.5 – 32.7	< 0.001

<sup>a</sup> Confidence Interval.<sup>b</sup> Chi-squared test.<sup>c</sup> Finnish Diabetes Risk Score, only for non-diabetic individuals.<sup>d</sup> Patient Health Questionnaire-9.**Source:** Prepared by the authors based on the EPICUREAN study results.

does it estimate prevalence of chronic conditions, such as hypertension, diabetes, and depression, it also portrays the status of risk and protective factors among the adult population. Global, regional, and national recommendations point to the need for developing NCD action plans that are based on local data, ones that make evaluation and monitoring possible through indicators and targets (2 – 4).

The Brazilian NCD plan (2), concomitantly with PAHO (3) and WHO action plans (4), puts into place a set of targets to be reached by 2022. One of the targets is to reduce obesity among adults (2). This seems improbable for Brazil and Curitiba, since according to Vigitel (12)—a national telephone interview system that investigates NCDs and risk factors among adults living in Brazil's state capitals—obesity prevalence increased respectively from 11.8% (Brazil) and 12.6% (Curitiba) in 2006 to 18.9% (for both) in 2016. The findings of the present study showed overall obesity prevalence (21.2%) to be similar to the Vigitel data,

with higher frequency among women and those with less schooling and income. Although national targets regarding protective factors (2), such as leisure-time physical activity (22.0%) and consumption of fruits and vegetables (24.3%), were surpassed by the city, lower prevalence was seen among those with less schooling, revealing disparities in either risk or protective factors.

Concerning smoking prevalence, Vigitel 2016 documented an annual average decline of 0.62 percentage points in 10 years (15.7% – 10.2%), resulting from strong tobacco control in Brazil (12). However, the high frequency of current smokers (16.1%) found by EPICUREAN was similar to the National Health Survey (NHS; 13) estimates for Paraná (18.1%; 95%CI = 15.6 – 20.8), leaving both the city and the state far from the Brazilian plan's target of 9.1% (2). Economic and cultural factors may play a role in Curitiba's high smoking prevalence: tobacco production and processing are important economic activities in Paraná, and Curitiba is mostly inhabited by

descendants of Europe where smoking prevalence is known to be high (13, 22).

The inverse relationship between smoking prevalence and lower income in Latin America and the Caribbean was evidenced by a recent review (23). Although our results did not confirm this fact, EPICUREAN did concur with the NHS (13) on the highest frequencies of smoking being among the younger age-groups and those with a lower level of education (12, 13, 22).

Binge drinking is another municipal challenge. In EPICUREAN, its occurrence (23.4%) was higher in relation to NHS (13.7%; 95%CI = 13.1 – 14.2) and Vigitel (19.1%; 95%CI = 18.3 – 19.8) and far from the national target of 12% as well (2, 13, 14). The higher prevalences found among men, young adults (18 – 39 years of age), and individuals with a higher education were consistent with national patterns (12, 13, 24). In 2016, Brazil was ranked 6th in the Region of the Americas for estimated alcohol consumption per capita (25). Free market prices and social acceptance may be facilitating access to

**TABLE 3. Weighted prevalence by sex and age group of chronic conditions and risk and protective factors in population ≥ 18 years age of according to the Epidemiology of Curitiba: Evaluation of Noncommunicable Diseases (EPICUREAN) study, Curitiba, Paraná, Brazil, 2013 – 2014**

Variable	Overall (n = 1103)		Women (n = 588)		Men (n = 515)		P value <sup>b</sup>
	%	95% CI <sup>a</sup>	%	95% CI	%	95% CI	
Recommended fruit and vegetable intake	33.3	30.5 – 36.1	37.2	33.3 – 41.1	28.8	24.9 – 32.7	0.003
Regular intake of soda and artificial juices	33.7	30.9 – 36.5	31.6	27.8 – 35.4	36.0	31.9 – 40.1	0.127
Whole milk intake	57.3	54.4 – 60.2	55.2	51.2 – 59.2	59.6	55.4 – 63.8	0.137
High fat meat intake	31.9	29.1 – 34.7	24.7	21.2 – 28.2	40.1	35.9 – 44.3	< 0.001
Sausage and luncheon meat intake	55.8	52.9 – 58.7	46.9	42.9 – 50.9	66.1	62.0 – 70.2	< 0.001
Binge drinking	23.4	20.9 – 25.9	11.1	8.6 – 13.6	37.4	33.2 – 41.6	< 0.001
Heavy drinking	9.3	7.6 – 11.0	6.1	4.2 – 8.0	13.0	10.1 – 15.9	< 0.001
Current smoking	16.1	13.9 – 18.3	12.9	10.2 – 15.6	19.6	16.2 – 23.0	0.002
Sufficient leisure – time physical activity	32.4	29.6 – 35.2	25.6	22.1 – 29.1	40.2	36.0 – 44.5	< 0.001
Insufficient physical activity	35.1	32.3 – 37.9	41.2	37.2 – 45.2	28.2	24.3 – 32.1	< 0.001
Poor self – rated health	8.0	6.4 – 9.6	8.1	5.9 – 10.3	7.8	5.5 – 10.1	0.822
High risk of diabetes (FINDRISC ≥15) <sup>c</sup>	18.1	15.7 – 20.5	21.9	18.4 – 25.4	13.9	10.8 – 17.0	< 0.001
Moderate-to-severe risk of depression (PHQ-9 <sup>d</sup> score ≥10)	9.9	8.1 – 11.7	12.8	10.1 – 15.5	6.5	4.4 – 8.6	< 0.001
Overweight	36.0	33.2 – 38.8	31.1	27.4 – 34.8	41.6	37.3 – 45.9	0.002
Obesity	21.2	18.8 – 23.6	24.6	21.1 – 28.1	17.3	14.0 – 20.6	0.003
Central obesity	43.1	40.2 – 46.0	58.2	54.2 – 62.2	25.9	22.1 – 29.7	< 0.001
Dyslipidemia (self-reported)	21.7	19.3 – 24.1	23.0	19.6 – 26.4	20.2	16.7 – 23.7	0.443
Depression (self-reported)	21.2	18.8 – 23.6	28.8	25.1 – 32.5	12.5	9.6 – 15.4	< 0.001
Hypertension	31.2	28.5 – 33.9	28.2	24.6 – 31.8	34.6	30.5 – 38.7	0.021
Diabetes	9.1	7.4 – 10.8	10.1	7.7 – 12.5	8.0	5.7 – 10.3	0.236

<sup>a</sup> Confidence Interval.

<sup>b</sup> Chi-squared test.

<sup>c</sup> Finnish Diabetes Risk Score, only for non-diabetic individuals.

<sup>d</sup> Patient Health Questionnaire-9 (15).

**Source:** Prepared by the authors based on the EPICUREAN study results.

alcohol beverages and encouraging consumption (24).

Halting the rise of diabetes in adults is a major challenge worldwide, especially in low- and middle-income countries where prevalence increased faster (26, 27). By 2014, approximately 15% of adults living with diabetes were in the Americas, 2.8% in Brazil (26, 27). By 2016, diabetes had become the 3rd leading cause of Disability-Adjusted Life-Years (DALYs) in Latin America and the Caribbean (excluding high-income countries) and the 8th in Brazil (28). In 2006 – 2016, the frequency of self-reported diabetes increased about 62% in Brazil (from 5.5% to 8.9%) and 96% in Curitiba (from 4.9% to 9.6%), according to Vigitel (12). Our results showed a similar overall prevalence (9.1%), with higher frequencies observed among the elderly and individuals with less schooling (12). Awareness of diabetes (78%) was higher than in most countries of Latin America and the Caribbean (50%), as was glycemic control (84.1%) (29). About one-quarter

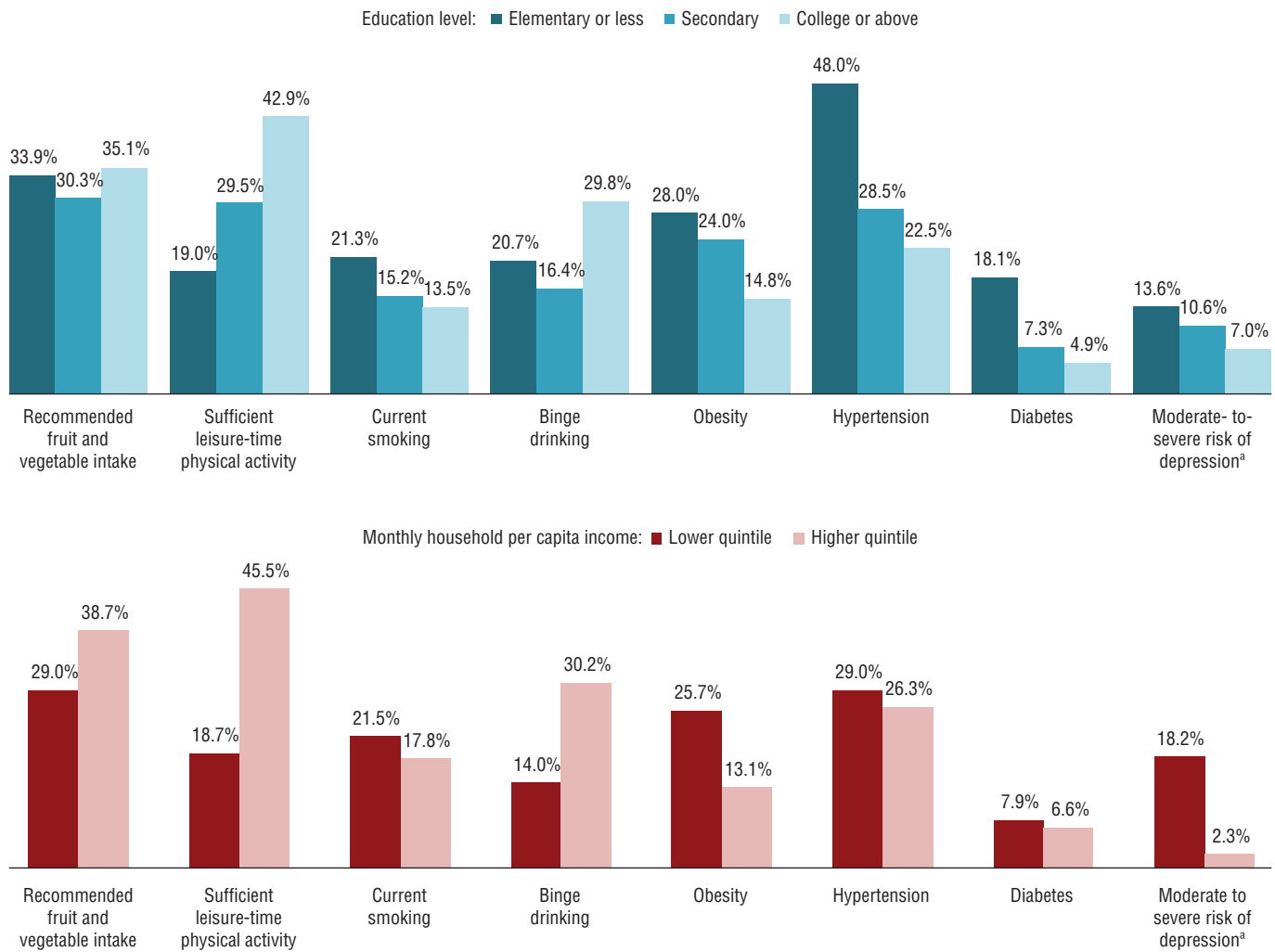
(22.9%) of individuals presented a high 10-year risk of diabetes according to the FINDRISC.

In 2016, high blood pressure was one of the three leading risk factors in terms of attributable DALYs at the global level (30). While WHO targeted (4) a 25% reduction in its prevalence, the Government of Brazil (2) adopted population strategies and targets, such as reduction of dietary salt and sedentary lifestyle, as well as early detection and treatment of hypertension. Countries in Latin America and the Caribbean had the highest hypertension prevalence estimates (39.1%) across low- and middle-income countries (32.3%); (31). Our findings were consistent with these results and with estimates of high blood pressure, not considering current medication, in Brazil (22.4% in EPICUREAN; 22.8% in NHS). Likewise, the prevalence was higher among men and the elderly, and was inversely proportional to educational level, resulting in a downward socioeconomic gradient (31, 32).

By 2016, Depressive Disorders were the 9th leading cause of DALYs worldwide (28). In the presence of comorbidities, such as diabetes, dyslipidemia, and hypertension, depression is associated with lower drug compliance and poorer prognoses (33). The frequency of diagnosis of depression at some point in life reported by our study (21.2%; 95%CI = 18.8 – 23.6) is in line with those estimated by the World Health Survey (34) for Brazil (19.2%). However, the NHS (13) showed a self-reported depression prevalence of 7.6% (95%CI = 7.2 – 8.1) for Brazil and 12.6% (95%CI = 11.2 – 13.9) in its South region. Nearly 1 in 10 individuals presented moderate-to-severe risk of depression by the PHQ-9 in EPICUREAN. High risk of depression was more frequent among women and among adults at the lowest levels of education and income.

The presence of risk factors and chronic conditions shown by EPICUREAN allow for the categorizing of the 5 CCCM levels in Curitiba (9). At Level 1,

**FIGURE 1. Weighted prevalence by sex and age group of selected chronic conditions and risk and protective factors, by education level and monthly household per-capita income, according to the Epidemiology of Curitiba: Evaluation of Noncommunicable Diseases (EPICUREAN) study, Curitiba, Paraná, Brazil, 2013 – 2014**



<sup>a</sup> Risk of depression based on a Patient Health Questionnaire-9 score  $\geq 10$ .  
**Source:** Prepared by the authors based on the EPICUREAN study results.

interventions should focus on intermediate social determinants of health (living and working conditions) reaching the entire municipal population. At Level 2, interventions should be directed to proximal determinants (smoking, overweight, insufficient physical activity, unhealthy eating, and excessive alcohol use) and may occur in macro-, middle-, and/or micro-level environments. Disease management of established conditions (depression, diabetes, hypertension, and obesity) characterizes interventions for Level 3 – Level 5, based on risk stratification (presence of complications, comorbidity, and unfavorable socioeconomic condition). At Level 5, case

management is usually required (9). At all levels, strategies that take into account vulnerable populations should be considered (7).

### Limitations

EPICUREAN had some limitations. Selecting four of the nine geographic areas within Paraná limited the equal probability of participation by the adult population. Although the study included a higher percentage of women, this fact was minimized by weighting the results in the analysis. A comparative analysis of selected sociodemographic data (schooling, income, and race), weighted by sex

and age groups, confirmed the representativeness and external validity of the sample in accordance with the Brazilian census (8). Fieldwork timing may also be considered a limitation since 12 months were required to complete data collection; but despite possible seasonal influences, results were consistent with other Brazilian surveys (12, 13). Moreover, it is well known that self-reporting is subject to bias, though widely used even in national health surveys (12, 13). Regarding diabetes diagnosis, although the gold standard method (plasma glycemia) was not used, the capillary glycemia method has produced similar results for prevalence at the population level (21).

## Conclusions

In conclusion, EPICUREAN baseline results indicate that the prevalence of NCDs and common risk factors is high among the adult population of Curitiba. The results also reveal a gradient of vulnerabilities by age, sex, education, and income. This population-based information and its representativeness for Curitiba should allow comparisons in health behaviors and morbidity for the three target age groups. This information can support policy and decisionmaking for NCD control at the municipal level. In order to address health inequalities and meet the needs of the

various population groups, health systems at the local level should monitor NCDs and risk factors with sound epidemiological information and develop and implement equitable public health policies.

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## RESUMEN

### Enfermedades no transmisibles y sus factores de riesgo comunes en Curitiba, Brasil: resultados de un estudio transversal basado en la población

**Objetivo.** Describir la prevalencia estimada de las enfermedades no transmisibles (ENT) y sus factores de riesgo comunes en los habitantes adultos de Curitiba (Paraná, Brasil), con base en los resultados del estudio sobre las características epidemiológicas de Curitiba en el que se evaluaron las ENT (conocido como EPICUREAN por su acrónimo en inglés).

**Métodos.** Encuesta transversal, basada en la población, de 1 103 habitantes de Curitiba, agrupados por edades (de 18 a 39 años, de 40 a 59 años y de 60 años en adelante), efectuada entre agosto del 2013 y agosto del 2014. Se realizaron entrevistas domiciliarias, antropometría y mediciones de presión arterial y glucemia capilar en ayunas en dos visitas a cada participante. Los análisis incluyeron distribución de frecuencias y cálculos de prevalencia de los principales resultados. Los cálculos de prevalencia, ponderados por edad y sexo, se presentaron como números absolutos y porcentajes.

**Resultados.** Las cifras de prevalencia de la depresión autonotificada fueron de 21,2%; hipertensión, 31,2%; diabetes, 9,1%; dislipidemia autonotificada, 21,7%; obesidad, 21,2%; consumo actual de tabaco, 16,1%; consumo compulsivo de bebidas alcohólicas, 23,4%; y actividad física insuficiente, 35,1%. La prevalencia de la diabetes y la hipertensión fue mayor en las personas con menor escolaridad y las de edad avanzada. El consumo compulsivo de bebidas alcohólicas y la actividad física en el tiempo libre fueron más prevalentes en los adultos jóvenes. Los hombres presentaron prevalencias más altas de consumo de tabaco, sobrepeso y consumo nocivo de alcohol. La obesidad y el riesgo de moderado a grave de depresión fueron más frecuentes en las mujeres y las personas de menores ingresos.

**Conclusiones.** La prevalencia de las ENT y los factores de riesgo comunes entre los habitantes adultos de Curitiba es alta y muestra un gradiente de vulnerabilidad por edad, sexo, nivel educativo e ingresos. Para abordar las inequidades en materia de salud y satisfacer las necesidades de diferentes grupos de población, el sistema de salud debe vigilar las ENT y sus factores de riesgo, y ejecutar políticas de salud pública equitativas.

## Palabras clave

Enfermedad crónica, epidemiología; depresión; diabetes mellitus; hipertensión; factores de riesgo; Brasil.

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**Doenças não transmissíveis e principais fatores de risco associados em Curitiba, Brasil: resultados de estudo transversal de base populacional**

**RESUMO**

**Objetivo.** Descrever a prevalência estimada de doenças não transmissíveis e principais fatores de risco associados na população adulta da cidade de Curitiba (PR), Brasil, de acordo com os resultados do estudo EPIdemiology of CURitiba: EvaluAtion of Noncommunicable diseases (EPICUREAN).

**Métodos.** Foi realizado estudo transversal de base populacional com 1.103 residentes da cidade de Curitiba, por faixas etárias (18–39, 40–59 e ≥60 anos), em agosto de 2013 a agosto 2014. Foram conduzidas entrevistas domiciliares com medidas antropométricas e de pressão arterial e teste da glicemia capilar de jejum em duas visitas a cada participante. Foi analisada a distribuição da frequência e estimada a prevalência dos principais desfechos. As estimativas de prevalência, ponderadas por idade e sexo, foram apresentadas como números absolutos e porcentagens.

**Resultados.** Foram obtidas as seguintes estimativas de prevalência: 21,2% para depressão autorreferida, 31,2% para hipertensão, 9,1% para diabetes, 21,7% para dislipidemia autorreferida, 21,2% para obesidade, 16,1% para tabagismo atual, 23,4% para uso excessivo de álcool e 35,1% para nível insuficiente de atividade física. A prevalência de diabetes e hipertensão foi maior nos indivíduos com menor escolaridade e idosos. O uso excessivo de álcool e atividade física no lazer foram mais prevalentes em jovens adultos. Os indivíduos do sexo masculino apresentaram prevalência mais elevada de sobrepeso, tabagismo atual e uso prejudicial de álcool. Obesidade e risco moderado a grave de depressão foram mais frequentes no sexo feminino e em indivíduos de baixa renda.

**Conclusões.** Existe alta prevalência de doenças não transmissíveis e dos principais fatores de risco na população adulta de Curitiba, demonstrando um gradiente de vulnerabilidade por idade, sexo, nível de escolaridade e renda. Para abordar as iniquidades em saúde e suprir as necessidades dos diferentes grupos populacionais, o sistema de saúde deve monitorar as doenças não transmissíveis e os fatores de risco e implementar políticas de saúde pública equitativas.

**Palavras-chave**

Doença crônica, epidemiologia; depressão; diabetes mellitus; hipertensão; fatores de risco; Brasil.

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