



## Associations between noncommunicable disease risk factors, race, education, and health insurance status among women of reproductive age in Brazil – 2011☆☆

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### ABSTRACT

**Background.** Noncommunicable disease (NCD) risk factors increase the risk of adverse reproductive health outcomes and are becoming increasingly common in Brazil.

**Methods.** We analyzed VIGITEL 2011 telephone survey data for 13,745 Brazilian women aged 18–44 years in a probabilistic sample from 26 Brazilian state capitals and the Federal District. We examined associations between NCD risk factors (fruit and vegetable intake, leisure time physical activity, alcohol consumption, smoking status, BMI and hypertension status) and race, education, and insurance using chi-square tests and multivariable logistic regression models, estimating the average marginal effects to produce adjusted relative risk ratios (aRRs). Analyses were conducted using SAS 9.3 survey procedures and weighted to reflect population estimates.

**Results.** Women with less than a college education were more likely to report physical inactivity (adjusted relative risk (aRR) and 95% confidence interval = 1.1 (1.1–1.2)), smoking (aRR = 1.7 (1.3–2.2)), and self-reported diagnoses of hypertension (aRR = 2.0 (1.6–2.5)) compared to women with a college education or greater. Similarly, women without health insurance were more likely to report physical inactivity (aRR = 1.1 (1.1–1.2)), smoking (aRR = 1.4 (1.1–1.8)), and self-reported diagnoses of hypertension aRR = 1.4 (1.1–1.7)) compared to women with health insurance. Less variation was found by race and NCD risk factors.

**Conclusion.** Targeted public health strategies and policies are needed to increase healthcare access and decrease educational and racial disparities in NCD risk factors among women of reproductive age in Brazil.

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### 1. Introduction

Noncommunicable diseases (NCDs), defined as cardiovascular disease, cancer, chronic respiratory diseases, and diabetes, are major causes of morbidity and mortality in low- and middle-income countries (Alwan et al., 2011; Hunter and Reddy, 2013; Roura and Arulkumaran,

2014). In recent reports, the World Health Organization estimates that approximately 42% (16 million) of NCD deaths annually are premature, deaths occurring before age 70. Of the 16 million premature NCD deaths, 82% occur in low- to middle-income countries (World Health Organization, 2013, 2015). In 2007, approximately 72% of all deaths in Brazil were attributable to NCDs, and racial and ethnic minority groups were disproportionately affected (Schmidt et al., 2011). Rapid increases in urbanization, industrialization, and income over the past several decades in Brazil have contributed to increasing prevalence of NCDs and their risk factors (referred to as NCD risk factors hereafter) (Schmidt et al., 2011).

NCD risk factors include tobacco use, physical inactivity, an unhealthy diet, alcohol abuse, obesity, and hypertension (World Health Organization, 2013). NCD risk factors are shaped by race, economic status, and education, which indirectly shape NCD morbidity and mortality (do Carmo et al., 2005; Linetzky et al., 2013). Additionally, women with NCD risk factors are at higher risk for adverse reproductive health

\* The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

☆☆ The following study is not being considered for publication elsewhere and has not been published previously.

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outcomes for themselves and their infants, such as gestational diabetes (Bombard et al., 2012), gestational hypertension (Bombard et al., 2012; Ferrer et al., 2000), pre-eclampsia (Duckitt and Harrington, 2005; Livingston et al., 2003), and increased risk of macrosomia and other negative birth outcomes (Arendas et al., 2008; Begum et al., 2011; Leddy et al., 2008; Roura and Arulkumaran, 2014). Such adverse reproductive health outcomes may also adversely affect offspring later in life (Barker et al., 1989; Bloomfield, 2011; Eriksson, 2005; Roura and Arulkumaran, 2014; Vieau, 2011) and contribute to premature mortality and major cardiovascular events for mothers later in life (Charach et al., 2015; Lee and Tubby, 2015; Lee et al., 2015). The contribution of race and socioeconomic factors such as economic status and education on NCD risk can also influence infant and maternal reproductive health outcomes by patterning access to healthcare and health resources for women of reproductive age (Nagahawatte and Goldenberg, 2008). Little to no research has examined associations between NCD risk factors, race and socioeconomic factors among non-pregnant women of reproductive age in Brazil.

Because of an increasing burden of NCD risk factors in Brazil and their associations with adverse reproductive health outcomes, surveillance is needed to examine characteristics associated with NCD risk factors among non-pregnant women of reproductive age in Brazil (do Carmo et al., 2005). Our objective was to estimate the prevalence of NCD risk factors and their associations with race, education, and health insurance status among non-pregnant women of reproductive age in Brazil.

## 2. Methods

We used 2011 data from Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases, or VIGITEL) (Moura et al., 2006). VIGITEL uses probabilistic samples of the adult population ( $\geq 18$  years of age) selected from residential listings of households with telephones in each capital of the 26 Brazilian states and the Federal District. Respondents gave verbal consent at the time of the telephone call. VIGITEL was approved by the National Ethics Committee on Human Research of the Ministry of Health of Brazil (protocol number 355.590/2013). Of 83,401 telephone lines eligible in 2011, approximately 54,000 interviews were performed, for a response rate of 65%. For this analysis, we restricted the sample to women aged 18–44 years who were not currently pregnant ( $N = 15,301$ ). We excluded 1556 (12.1%) women who responded ‘don't know’ or refused to answer questions about racial/ethnic group, education, health insurance status, covariates, or body mass index. Our final study sample consisted of 13,745 women.

The dependent variables, NCD risk factors, were categorized as behavioral or biological. Behavioral NCD risk factors were current smoking (women who answered yes to the question, “Do you smoke?” were considered to be smokers independent of frequency and duration of smoking habit); insufficient leisure time physical activity ( $<150$  min/week of moderate physical activity or  $<75$  min/week of vigorous physical activity over the last 3 months); binge drinking (consuming  $\geq 4$  alcoholic beverages on the same occasion in the past 30 days); and inadequate intake of fruit, legumes, and vegetables (eating  $<5$  servings/day on  $\geq 5$  days/week). Biological NCD risk factors were obesity (body mass index [BMI]  $\geq 30$  kg/m<sup>2</sup>) and self-reported previous medical diagnosis of hypertension. Independent variables were self-reported racial group (white, black, Asian, mixed race, or Native Brazilian), educational level ( $<$ college or university education,  $\geq$ college or university education), and health insurance status (uninsured: government free, public national health system only (Sistema Único de Saúde, SUS), insured:  $\geq 1$  private insurance plans). Private insurance plans include private health insurance, prepaid group practice, medical cooperatives and company health plans. Covariates were age in years (18–19, 20–24, 25–29,

30–34, 35–39, 40–44), marital status (unmarried, married), and employment status (unemployed/not worked over past 3 months, employed).

### 2.1. Statistical analysis

Analyses were conducted using SAS 9.3 survey procedures and weighted to reflect population estimates. We calculated weighted prevalence and 95% confidence intervals (CIs) for all demographic characteristics and for behavioral and biological NCD risk factors overall and by racial group and examined associations using chi-squared tests. Additionally, we calculated weighted prevalence and 95% CIs for behavioral and biological NCD risk factors by educational level and health insurance status and examined associations using chi-squared tests. Finally, we examined associations between behavioral and biological NCD risk factors and racial group, education level, and health insurance status in logistic regression models with the average marginal effect statement to produce adjusted relative risk ratios (aRRs) and 95% CIs. We examined associations between racial group, education level and health insurance in a single model to gain clarity on the association of each with NCD risk factors while controlling for the others. All models were adjusted for age, marital status, and employment status. For all analyses, significance was set at  $P < 0.05$ . This study was approved by the National Commission for Ethics in Human Research, Brasilia, Federal District, Brazil.

## 3. Results

Of the 13,745 women in the final sample, the majority were unmarried (68.3%), had less than a college or university education (66.2%), and were uninsured (51.4%) (Table 1). About one-third (30.6%) were unemployed or had not worked over the previous 3 months. We found significant differences across racial groups for all demographic characteristics except employment status (Table 1). Mixed-race women had the highest prevalence of less than a college or university education (75.9%; 95% CI 74.0–77.7), while white women had the lowest prevalence (56.6%; 95% CI 54.0–59.1). Black women had the highest prevalence of being uninsured (64.3%; 95% CI 59.6–69.1), while white women had the lowest (41.6%; 95% CI 49.8–53.1).

For the behavioral NCD risk factors, most women had inadequate weekly intake of fruit, legumes, and vegetables (77.3%) and insufficient weekly leisure time physical activity (73.7%). Less than 10% of women were current smokers, and 12% reported binge drinking in the past 30 days (Table 1). Native Brazilian women had the highest prevalence of inadequate intake of fruit, legumes, and vegetables (84.7%; 95% CI 77.5–91.8), while white women had the lowest (75.5%; 95% CI 73.3–77.6). Black women had the highest prevalence of binge drinking (18.1%; 95% CI 13.9–22.3) and Native Brazilian women had the lowest (9.1%; 95% CI 3.3–15.0). For biological NCD risk factors, 11.7% of women were obese, and 11.5% had self-reported diagnosed hypertension. There were no significant differences across racial groups for obesity and self-reported diagnosed hypertension.

There were significant differences among all behavioral and biological NCD risk factors by education level and insurance status, except binge drinking (Table 2). Compared to their counterparts, women with less than a college or university education and uninsured women had higher prevalence estimates of inadequate intake of fruit, legumes, and vegetables, insufficient leisure time physical activity, current smoking, obesity, and self-reported diagnosis of hypertension (Table 2).

In the multivariate logistic regression model, the aRR for binge drinking was 1.6 times higher among black women than white women (Table 3). Women without a college or university education were significantly more likely than women with a college or university education or greater to have inadequate fruit, legume, and vegetable intake (aRR 1.1; 95% CI 1.1–1.1), insufficient leisure time

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