BJPS

Brazilian Journal of Pharmaceutical Sciences

http://dx.doi.org/10.1590/s2175-97902022e20153

Article

# Industry workers with hypertension and diabetes mellitus, the prevalence of self-reported adherence, and disease control

**Priscila Ribeiro Castro[1,2*], Roberta Mendes Abreu[2], Clavdia Nicolaevna Kochergin[1], Danielle Souto de Medeiros[1,2], Daniela Arruda Soares[1,2], José Andrade Louzado[1], Kelle Oliveira Silva[1], Matheus Lopes Cortes[1], Sóstenes Mistro[1], Vanessa Moraes Bezerra[1,2], Welma Wildes Amorim[3], Márcio Galvão Oliveira[1,2]**

*[1]Multidisciplinary Health Institute, Federal University of Bahia, Vitória da Conquista, Bahia, Brazil, [2]Pos-graduate Program in Collective Health, Multidisciplinary Health Institute, Federal University of Bahia, Vitória da Conquista, Bahia, Brazil, [3]Medical School, State University of Southeast Bahia, Vitória da Conquista, Bahia, Brazil*

To evaluate the prevalence of self-reported drug adherence and factors associated, as well as clinical health outcomes, for industry workers with hypertension (HTN) and diabetes mellitus (DM). This was a cross-sectional study of 137 Brazilian industry workers with HTN and/or DM. Self-reported adherence was assessed, and the disease control was defined through blood pressure and capillary glycemia values. Data were descriptively analyzed and the factors associated with adherence were evaluated using the Poisson model with robust variance to calculate prevalence ratios. The prevalence of self-reported drug adherence was 79.6% and the prevalence of disease control was 53.8%. There was no statistically significant association between the two variables. In the controlled disease group, non-adherence was associated with being under 40 years of age, not having a partner, and having a risky alcohol consumption habit. In the uncontrolled disease group, adherence was highest for participants aged 40 years and older. The prevalence of self-reported drug adherence was high, but the prevalence of disease control was low and not associated with adherence, indicating that the self-reported adherence measure may be inaccurate. Our findings identify some factors that explain non-adherent behavior in the workforce.

**Keywords**: Drug adherence. Hypertension. Diabetes mellitus. Occupational health. workers. Brazil.

## INTRODUCTION

Noncommunicable diseases (NCDs) account for the majority of global morbidity and mortality, especially in low- and middle-income countries. The burden and impact of NCDs were considered some of the greatest challenges of the 21st century by the World Health Organisation (WHO) (Duncan *et al.*, 2012; WHO, 2019). In Brazil, NCDs accounted for 74% of the total 1.32 million deaths in 2016 (WHO, 2019). Hypertension (HTN) and diabetes mellitus (DM) account for most of these deaths (WHO, 2019) and their high prevalence and associated socioeconomic costs make them main causes of lower life expectancy and poorer quality of life in the world population (SBC, 2016; de Oliveira, 2017).

Despite increased knowledge about diagnosis and treatment, controlling these diseases remains a challenge due to several factors, including non-adherence to treatment, a common issue for chronic disease patients even in developed countries (Sabaté, 2003; Girotto *et al.*,

***Correspondence:** P. R. Castro. Instituto Multidisciplinar de Saúde. Universidade Federal da Bahia. Rua Hormindo Barros, 58, Quadra 17, Lote 58, Bairro Candeias, Vitória da Conquista Bahia, 45029-094, Brasil. Phone: 55 77 988333620. E-mail: priscilac@ufba.br. ORCID: 0000-0002-8455-6158

2013; Krass, Schieback, Dhippayom, 2015). A population-based household survey conducted in Brazil showed high prevalence of treatment non-adherence in DM patients (27%) (Meiners *et al*., 2017). A cross-sectional population-based study on hypertensive elderly patients in a Brazilian city reported that one-third showed low treatment adherence (Tavares *et al*., 2013).

These data are concerning because adherence is one of the main determinants of treatment effectiveness. Low adherence reduces clinical benefit, results in the worsening of symptoms and disease progression, increases expenses due to emergency consultations, hospitalisation, and drugs, and increases morbidity and mortality (Klein, Gonçalves, 2005).

This is particularly relevant for the economically active population because the work environment contains several factors (e.g., risk exposure, organisation and working conditions) that can negatively impact the workers' health and physical integrity (Ferreira *et al*., 2018); emphasizing the importance of evaluating and monitoring workers from various employment sectors (Pohl *et al*., 2013), which is one of the tasks included in the list of primary care actions (WHO, 2007; Brasil, 2018). The incidence and management of HTN and DM affect the workplace (Brasil, 2018), specifically in cases resulting in leave due to illness (Cunha, Blank, Boing, 2009). In addition, some studies identified a higher prevalence of these conditions in workers from several sectors like industries (Breaux-Shropshire *et al*., 2014; Bosu, 2015). In Brazil, 15% and 2.6% of industry workers have HTN and DM, respectively (Garcia *et al*., 2014), although the general population showed higher prevalence (21.4% and 6.2%, respectively) in a national survey (IBGE, 2014). However, few studies have evaluated disease control and adherence to treatment in the context of occupational health (Breaux-Shropshire *et al*., 2012).

This study aimed to evaluate self-reported drug adherence and factors associated among Brazilian industry workers with self-reported diagnosis of HTN and DM and to evaluate clinical health outcome differences (blood pressure and blood glucose control) between adherents and non-adherents to drug treatment.

## MATERIAL AND METHODS

### Study design, participants, and data collection

This was a cross-sectional study using baseline information from the Health Rise Vitória da Conquista Project (Flor *et al*., 2020) which focused on screening and improving HTN and DM care. The original project was a longitudinal study aimed at analysing determinants of health for a population of industry workers using questionnaires and objective health measures.

The screening activities included in the project were conducted by the Industry Social Service, a non-profit private entity that is part of the Brazilian Industry Federation System, which represents the interests of industries in Brazil. HTN and DM screening occurred between August 2017 and July 2018. All employees of the registered industries that were age 18 years or older, living in the study city, and who attended routine consultations with the occupational health physician during this period were eligible to participate. After screening, 1,276 workers were interviewed, of which 137 had been previously diagnosed with HTN and/or DM. The workers with a diagnosis of HTN and/or DM were identified by "yes" in response to the questions "Has a physician ever diagnosed you with hypertension (high blood pressure)?" or "Has a physician ever diagnosed you with diabetes?", in addition to reporting the use of antihypertensive or antihyperglycemic drugs when asked about treatments used in the last two weeks.

In the screening stage, previously trained students collected data through individual interviews and clinical outcome measures (blood pressure, fasting or capillary glycemia, weight, and height).

Systolic (SBP) and diastolic blood pressure (DBP) values were obtained according to the guidelines established in the national clinical guideline (SBC, 2016), using an OMRON® 7113 digital automatic blood pressure monitor. This parameter was measured three times (once on each arm and the last measurement on the one with the highest BP value), with a minimum interval of one minute between measurements, and then the mean was calculated. Capillary glycemia was measured after a one-hour fasting period using an Accu-Chek Active® glycosometer.

### Study variables

The independent or explanatory variables were organized into the following groups: sociodemographic and economic, habits and behaviors, health status, and use of health services. As for socio-demographic and economic variables, the following were included: sex, age (according to the distribution of study subjects in the different age groups), self-reported race/color, education, marital status, family income, work shifts, and work position.

In the habits and behaviors group of variables, physical activity, tobacco consumption, and alcohol consumption were evaluated. In order to calculate physical activity levels, the four significant components comprising individual activity levels (leisure, occupation, housework, and transportation) in the International Physical Activity Questionnaire (IPAQ - short form) were considered. In this sense, the weekly frequency (days) was multiplied by the average duration (minutes) of moderate physical activity (defined as activity that produces a moderate increase in respiratory and heart rates, in addition to sweating for at least 10 minutes) and vigorous physical activity (defined as activity that produces vigorous increases in the same variables as moderate activity). The time spent on vigorous activities was multiplied by two (Hallal *et al*., 2003). Only activities which were performed for at least 10 continuous minutes were validated. Individuals who engaged in 150 minutes or more of physical activity per week were considered to be physically active (Hallal *et al*., 2003; Bezerra *et al*., 2015). Alcohol consumption was classified as risky (causing health-related and other issues) when consuming more than two daily doses in men and one daily dose in women, as recommended by the WHO (WHO, 2010).

Regarding the group of variables in health status, body mass index (BMI), presence of cardiovascular disease, disease (HAS and/or DM) control, and self-evaluation of health were described.

Finally, regarding the group of variables in use of health services, it was assessed whether the respondent had a medical or dental insurance plan (private, corporate, or public agency). Participants were also asked about the last time they saw a doctor and about their use of complementary and integrative practices (acupuncture, homeopathy, medicinal plants, and herbal medicine) in the last 12 months. The variable access to drugs in the Brazilian public health system was categorized by the following: no access (patient does not receive any medicine from the popular pharmacy program or public health service), partial access (patient receives some medicines from the popular pharmacy program or public health service), and full access (the patient obtains all medicines from the popular pharmacy program or public health service).

The dependent variable was self-reported adherence, evaluated by the answers to the following questionnaire questions: "Did you take any arterial hypertension (high blood pressure) drugs in the past two weeks?", "Did you take any diabetes drugs to lower your blood sugar in the past two weeks?", or "Did you use insulin because of diabetes in the past two weeks?". Patients who answered "yes" to any of the questions were considered adherent. If a patient was diagnosed with HTN and DM, then both questions about HTN and DM had to be answered positively to be considered adherent.

The controlled disease variable was defined as HTN patients who presented mean BP values below 140/90 mmHg, DM patients who presented capillary glycemia values below 160 mg/dL or fasting glycemia below 100 mg/dL, or HTN and DM patients who presented both outcome measures below these limits (SBC, 2016; de Oliveira, 2017).

### Data analysis

The data were descriptively analysed using absolute and relative frequencies and central tendency and dispersion measures. Factors associated with the analysed parameters were verified by bivariate analyses with prevalence ratio (PR) estimates, p-value calculations, and 95% confidence intervals using the Poisson model with robust variance. An association was considered statistically significant when the p-value was $\leq 0.05$. Stata 14 was used to analyse the data.

### Ethics approval

This study was approved by the Research Ethics Committee of the Multidisciplinary Health Institute,

Federal University of Bahia (technical opinion number 1.861.073), and all patients provided informed consent prior to participating.

## RESULTS AND DISCUSSION

This study evaluated data on 137 participants. Most were male (75.2%), aged 40 years or older (62.8%), not white (82.1%), living with a partner (73.7%), with family income lower than two minimal salaries (37.0%) (one salary in Brazil corresponds to US$ 265.00), and completed secondary or technical education (40.7%) (Table I).

Self-reported adherence was 79.6% in this study population. However, when asked about the name of the drugs used in the last 15 days, only 48.9% mentioned the name of antihypertensive or antihyperglycemic drugs. The bivariate analysis (Table I) showed that drug adherence was positively associated with being over 40 years of age, a family income greater or equal to two and lower than three salaries, and alcohol consumption not considered risky.

**TABLE I - C**haracteristics of the population of industry workers with hypertension and diabetes mellitus, prevalence of adherence and associated factors, 2017 to 2018

| Variables | Study population (%) | 95% CI[a] | Adherence (%) | PR[b] | 95%CI | p-value |
|---|---|---|---|---|---|---|
| **Sociodemographic and economic variables** | | | | | | |
| **Sex** | | | | | | 0.82 |
| Male | 75.2 | 67.2 - 81.8 | 80.0 | 1.02 | 0.83 - 1.26 | |
| Female | 24.8 | 18.2 - 32.8 | 78.1 | 1 | | |
| **Age*** | | | | | | **< 0.05** |
| 18 to 39 years | 37.2 | 22.8 - 38.2 | 60.4 | 1 | | |
| 40 years or older | 62.8 | 54.3 - 70.5 | 90.5 | 1.5 | 1.18 - 1.90 | |
| **Race** | | | | | | 0.32 |
| Non-white | 82.1 | 74.6 - 87.8 | 78.5 | 0.90 | 0.75 - 1.08 | |
| White | 17.9 | 12.2 - 25.4 | 87.5 | 1 | | |
| **Education** | | | | | | 0.24 |
| High school/Technical school | 40.7 | 32.7 - 49.3 | 78.8 | 1.08 | 0.86 - 1.36 | |
| Incomplete superior education or more[β] | 26.7 | 19.8 - 34.9 | 88.2 | 1.21 | 0.97 - 1.51 | |
| Illiterate/Complete fundamental school II[α] | 32.6 | 25.1 - 41.0 | 72.7 | 1 | | |
| **Marital status** | | | | | | 0.08 |
| With partner | 73.7 | 65.6 - 80.5 | 83.0 | 1.21 | 0.94 - 1.55 | |
| Without partner | 26.3 | 19.5 - 34.4 | 68.8 | 1 | | |

**TABLE I - C**haracteristics of the population of industry workers with hypertension and diabetes mellitus, prevalence of adherence and associated factors, 2017 to 2018

| Variables | Study population (%) | 95% CI[a] | Adherence (%) | PR[b] | 95%CI | p-value |
|---|---|---|---|---|---|---|
| **Family income*** | | | | | | **<0.05** |
| 2 to <3 salaries[µ] | 23.0 | 16.6 - 30.9 | 65.5 | 0.74 | 0.56 - 0.98 | |
| <2 salaries | 37.0 | 29.2 - 45.6 | 77.6 | 0.88 | 0.73 - 1.05 | |
| >= 3 salaries | 40.0 | 32.0 - 48.6 | 88.5 | 1 | 0.95 - 1.37 | |
| **Work shifts** | | | | | | 0.85 |
| Day/Night | 80.9 | 73.3 - 86.7 | 80.8 | 1.02 | 0.83 - 1.26 | |
| Day | 19.1 | 13.3 - 26.7 | 79.0 | 1 | | |
| **Work position** | | | | | | 0.47 |
| Manual labour | 56.9 | 48.4 - 65.1 | 77.3 | 0.94 | 0.79 - 1.11 | |
| Non-manual labour | 43.1 | 34.9 - 51.6 | 82.5 | 1 | | |
| **Habit and behaviour variables** | | | | | | |
| **Physical activity** | | | | | | 0.86 |
| Active | 49.3 | 40.9 - 57.7 | 80.0 | 1.02 | 0.85 - 1.21 | |
| Inactive | 50.7 | 42.3 - 59.1 | 78.8 | 1 | | |
| **Tobacco consumption** | | | | | | 0.13 |
| Yes | 10.2 | 6.1 - 16.6 | 64.3 | 0.79 | 0.53 -1.18 | |
| No | 89.8 | 83.4 - 93.9 | 81.4 | 1 | | |
| **Risky alcohol consumption*** | | | | | | **<0.05** |
| No | 40.2 | 32.2 - 48.7 | 90.4 | 1.25 | 1.06 - 1.47 | |
| Yes | 59.8 | 51.3 - 67.8 | 72.5 | 1 | | |
| **Health status variables** | | | | | | |
| **BMI[c]** | | | | | | 0.99 |
| Overweight | 41.2 | 33.1 - 49.7 | 79.6 | 0.98 | 0.78 - 1.24 | |
| Obesity | 38.2 | 30.4 - 46.8 | 80.4 | 0.99 | 0.79 - 1.26 | |
| Low/Normal | 20.6 | 14.5 - 28.3 | 80.8 | 1 | | |

**TABLE I - C**haracteristics of the population of industry workers with hypertension and diabetes mellitus, prevalence of adherence and associated factors, 2017 to 2018

| Variables | Study population (%) | 95% CI[a] | Adherence (%) | PR[b] | 95%CI | p-value |
|---|---|---|---|---|---|---|
| **Presence of CVD[d] (angina, CHF[e] and infarction)** | | | | | | 0.25 |
| Yes | 3.6 | 1.5 - 8.6 | 100 | 1.27 | 1.16 - 1.39 | |
| No | 96.4 | 91.4 - 98.5 | 78.7 | 1 | | |
| **HAS and/or DM control** | | | | | | 0.82 |
| Yes | 53.8 | 45.1 - 62.2 | 80.3 | 1.02 | 0.86 - 1.22 | |
| No | 46.2 | 37.8 - 54.9 | 78.7 | 1 | | |
| **Self-evaluation of health** | | | | | | |
| Regular | 48.9 | 40.5 - 57.3 | 81.2 | 1.06 | 0.88 - 1.28 | 0.79 |
| Bad/Very Bad | 10.2 | 6.1 - 16.6 | 83.3 | 1.08 | 0.81 - 1.45 | |
| Good/Very Good | 40.9 | 32.9 - 49.4 | 76.8 | 1 | | |
| **Health service variables** | | | | | | |
| **Health insurance** | | | | | | 0.28 |
| Yes | 45.3 | 37.0 - 53.8 | 83.6 | 1.1 | 0.92 - 1.30 | |
| No | 54.7 | 46.2 - 63.0 | 76.1 | 1 | | |
| **Last medical consultation** | | | | | | |
| <1 year | 69.8 | 61.5 - 77.0 | 80.7 | 1 | | 0.58 |
| ≥1 year or never | 30.2 | 23.0 - 38.5 | 76.3 | 0.95 | 0.77 - 1.16 | |
| **Integrative practice user** | | | | | | 0.96 |
| No | 89.0 | 82.5 - 93.3 | 79.5 | 1 | | |
| Yes | 11.0 | 6.7 - 17.5 | 80.0 | 1.01 | 0.77 - 1.32 | |
| **Access to public health system drugs** | | | | | | |
| No | 50.9 | 41.3 - 60.5 | | | | |
| Partial | 16.1 | 10.1 - 24.4 | | | | |
| Full | 33.0 | 24.6 - 42.6 | | | | |

[a]CI = confidence interval; [b]PR = prevalence ratio; [c]BMI = body mass index; [d]CVD=cardiovascular disease; [e]CHF=congestive heart failure *Variables statistically significant at p<0.05; [β]Incomplete superior education or more = corresponds to college/university; [α] Illiterate/Incomplete fundamental school II = corresponds to elementary education; [μ]One salary in Brazil corresponds to US $ 265.00

The prevalence of disease control was 53.8%. When the study population was stratified into controlled and uncontrolled groups, adherence was 80.3% and 78.7%, respectively. Being over 40 years of age, having a partner, and alcohol consumption classified as not risky were positively associated with self-reported adherence in the controlled group. In the uncontrolled group, self-reported adherence was higher in participants over 40 years of age (Table II).

**TABLE II -** Prevalence of self-reported drug adherence in industry workers with controlled and uncontrolled hypertension and/or diabetes mellitus, 2017 to 2018

| Variables | Controlled | | p-value | Not controlled | | p-value |
|---|---|---|---|---|---|---|
| | Adherent (%) | Nonadherent (%) | | Adherent (%) | Nonadherent (%) | |
| **Socio-demographic and economic variables** | | | | | | |
| **Sex** | | | 0.62 | | | 0.83 |
| Male | 81.2 | 18.8 | | 77.8 | 22.2 | |
| Female | 71.4 | 28.6 | | 80.0 | 20.0 | |
| **Age*** | | | **<0.05** | | | **<0.05** |
| 18 to 39 years | 64.5 | 35.5 | | 52.9 | 47.1 | |
| 40 years or older | 92.5 | 7.5 | | 88.6 | 11.4 | |
| **Race** | | | 0.59 | | | 0.38 |
| Non-white | 79.4 | 20.6 | | 77.3 | 22.7 | |
| White | 87.5 | 12.5 | | 87.5 | 12.5 | |
| **Education** | | | 0.8 | | | 0.27 |
| High school/Technical school | 78.6 | 21.4 | | 79.2 | 20.8 | |
| Incomplete superior education or more[β] | 87.5 | 12.5 | | 66.7 | 33.3 | |
| Illiterate/Incomplete fundamental school II[α] | 76.9 | 23.1 | | 88.9 | 11.1 | |
| **Marital status** | | | **<0.05** | | | 0.68 |
| With partner | 85.4 | 14.6 | | 80.0 | 20.0 | |
| Without partner | 62.5 | 37.5 | | 75.0 | 25.0 | |
| **Family income*** | | | 0.06 | | | 0.21 |
| <2 salaries | 84.6 | 15.4 | | 69.6 | 30.4 | 0.24 |
| 2 to <3 salaries | 61.1 | 38.9 | | 72.7 | 27.3 | |
| > = 3 salaries | 88.9 | 11.1 | | 88.0 | 12.0 | |
| **Work shifts** | | | 0.41 | | | |
| Day/Night | 87.5 | 12.5 | | 70.0 | 30.0 | 0.48 |
| Day | 78.2 | 21.8 | | 80.0 | 20.0 | |

**TABLE II -** Prevalence of self-reported drug adherence in industry workers with controlled and uncontrolled hypertension and/or diabetes mellitus, 2017 to 2018

| Variables | Controlled | | p-value | Not controlled | | p-value |
|---|---|---|---|---|---|---|
| | Adherent (%) | Nonadherent (%) | | Adherent (%) | Nonadherent (%) | |
| **Work position** | | | 0.48 | | | 0.7 |
| Manual labour | 77.8 | 22.2 | | 76.7 | 23.3 | |
| Non-manual labour | 84.6 | 15.4 | | 80.6 | 19.4 | |
| **Habit and behaviour variables** | | | | | | |
| **Physical activity** | | | 0.77 | | | 0.56 |
| Active | 78.8 | 21.2 | | 81.2 | 18.8 | |
| Inactive | 81.6 | 18.4 | | 75.0 | 25.0 | |
| **Tobacco consumption** | | | 0.69 | | | 0.07 |
| Yes | 75.0 | 25.0 | | 50 | 50 | |
| No | 81.0 | 19.0 | | 81.8 | 18.2 | |
| **Risky alcohol consumption*** | | | **<0.05** | | | 0.22 |
| No | 93.1 | 6.9 | | 87.0 | 13.0 | |
| Yes | 71.4 | 28.6 | | 73.7 | 26.3 | |
| **Health status variables** | | | | | | |
| **BMI**[a] | | | 0.91 | | | 0.96 |
| Overweight | 79.3 | 20.7 | | 80.0 | 20.0 | |
| Obese | 84.0 | 16.0 | | 76.9 | 23.1 | |
| Low/Normal | 81.2 | 18.8 | | 80.0 | 20.0 | |
| **Presence of CVD**[b] **(angina, CHF**[c]**, and infarction)** | | | 0.48 | | | 0.36 |
| Yes | 100 | 0 | | 100 | 0 | |
| No | 79.7 | 20.3 | | 77.6 | 22.4 | |
| **Self-evaluation of health** | | | 0.22 | | | 0.51 |
| Regular | 88.2 | 11.8 | | 73.3 | 26.7 | |
| Bad/very bad | 80.0 | 20.0 | | 100 | 0 | |
| Good/very good | 70.4 | 29.6 | | 82.8 | 17.2 | |
| **Health service variables** | | | | | | |
| **Health insurance** | | | 0.17 | | | 0.91 |
| Yes | 87.5 | 12.5 | | 79.3 | 20.7 | |
| No | 74.4 | 25.6 | | 78.1 | 21.9 | |
| **Last medical consultation** | | | 0.35 | | | 0.86 |

**TABLE II -** Prevalence of self-reported drug adherence in industry workers with controlled and uncontrolled hypertension and/or diabetes mellitus, 2017 to 2018

| Variables | Controlled | | p-value | Not controlled | | p-value |
|---|---|---|---|---|---|---|
| | Adherent (%) | Nonadherent (%) | | Adherent (%) | Nonadherent (%) | |
| <1 year | 83.3 | 16.7 | | 77.8 | 22.2 | |
| ≥1 year or never | 73.9 | 26.1 | | 80.0 | 20.0 | |
| **Integrative practice user** | | | 0.38 | | | 0.42 |
| No | 81.5 | 18.5 | | 76.9 | 23.1 | |
| Yes | 66.7 | 33.3 | | 88.9 | 11.1 | |

[a]BMI = body mass index; [b]CVD=cardiovascular disease; [c]CHF=congestive heart failure; *Variables statistically significant at p<0.05; [β]Incomplete superior education or more = corresponds to college/university; [α] Illiterate/Incomplete fundamental school II = corresponds to elementary education; [µ]One salary in Brazil corresponds to US $ 265.00

In the present study, the prevalence of self-reported adherence to drug treatment was similar to the prevalence found in studies with HTN public sector workers in Finland (78%) (Oksanen *et al.*, 2011) – which used measures involving analysis of secondary data - but higher than the prevalence found in health workers in a Brazilian hospital (20.4%) (Tizato *et al.*, 2018), when using the 4-item Morisky Medication Adherence Scale (MMAS-4), another subjective measure of adherence. In another study involving HTN patients not focused on occupational health, and that used similar questioning, the prevalence of adherence ranged from 78.4 to 97.6% depending on the age group (Mengue *et al.*, 2016). The prevalence of disease control was lower than the one found in a previous study (75.0%) (Tizato *et al.*, 2018). On the other hand, compared to research with HTN firefighters, our proportion of controlled cases was higher (26.0% versus 53.8%, respectively) (Soteriades *et al.*, 2003). Different adherence and control levels may be due to different work profiles, sample sizes, and adherence measurement methods in each study, making it difficult to compare them.

In addition, contrary to what was expected (Leite, Vasconcellos, 2003), in this study there was no statistically significant association between treatment adherence and disease control (controlled workers were only 2.0% more likely to be adherent than the uncontrolled), which is different from what was found in other studies (Tizato *et al.*, 2018; Lulebo *et al.*, 2015).

There are several strategies to measure adherence behaviour, none of which are considered the "gold standard" (Sabaté, 2003). The lack of association between adherence and disease control found in the current study raises doubts about the validity of self-reported adherence measures, with possible concerns related to subjectivity of the measure or the possibility of intentional or accidental false information provided by the patients (Lam, Fresco, 2015). However, the self-reported adherence measure showed good sensitivity and accuracy in other studies (Bulgiba *et al.*, 2013). In a study that compared the accuracy of adherence measures rather in inflammatory bowel disease clinics, self-reported adherence was consistent with thiopurine metabolites, in patients using thiopurine (Selinger *et al.*, 2019). Self-reported adherence measurement is widely used in population surveys of the Brazilian government because it is easy to use and it is low cost (Meiners *et al*, 2017; IBGE, 2014; Costa *et al.*, 2017; Mengue *et al.*, 2016). One study showed adherence proportions of 81.4% and 80.2% in HTN and DM respondents, respectively (IBGE, 2014).

In our study, less than 50.0% of the respondents mentioned antihypertensive and/or antihyperglycemic drugs among those used in the past two weeks, which was lower than the adherence proportion. This supports

the hypothesis that factors such as subjectivity, mistakes caused by memory, and false data provided by patients may overestimate the prevalence of treatment adherence. In turn, this may affect the sensitivity and specificity of the self-reported adherence measure (Lam, Fresco, 2015).

Our data showed that being over 40 years of age was associated with treatment adherence. Although age has been found to inconsistently affect adherence (Sabaté, 2003), research involving patients with HTN, DM, and other chronic diseases indicated that older age is associated with better adherence (Girotto *et al.*, 2013; Tavares *et al.*, 2016a). When investigating the reasons for non-use of prescriptions, a Brazilian survey also reported higher non-adherence levels in the age group including individuals who were 18 to 44 years old (Costa *et al.*, 2017). This can be explained by a higher prevalence of chronic diseases with advancing age and longer disease duration, resulting in greater health care awareness in older age groups (SBC, 2016; Girotto *et al.*, 2013).

An income greater or equal to two and lower than three minimum salaries was also associated with a lower probability of treatment adherence in our study. The association between a higher income and a greater proportion of adherence is widely investigated and reported in previous studies, mainly involving chronic diseases (DiMatteo, 2004). Even in developed countries – where worse social positions are associated with worse health conditions – income affects people's health opportunities (access to information, services, and health products), increasing biomedical, environmental, behavioural, and psychosocial risks (Sabaté, 2003; Santos, 2011). On the other hand, national research on drug use in Brazil reported that economic class was not associated with treatment adherence for chronic disease, although drug cost (a factor that is influenced by income) was associated with adherence, so patients who had to pay part of their treatment showed lower treatment adherence than the patients who had free access to all of the necessary chronic disease drugs (Tavares *et al.*, 2016a).

In Brazil, free access to essential drug is guaranteed in the public health system, but some drugs are not always available in some regions of the country (Tavares *et al.*, 2016b). The inability to pay for treatment in the private sector may prevent users from adhering to the prescribed treatment. Our study did not collect information on access to drugs in the population analysed, so we were unable to evaluate the impact of this factor on adherence (Tavares *et al.*, 2016a).

As for the association between adherence and not reporting risky alcohol consumption, similar results were found in a study with HTN patients in primary care settings, where patients who did not consume alcohol regularly (alcohol ingestion at least three days a week, regardless of the quantity consumed) showed better treatment adherence (Girotto *et al.*, 2013). It is worth noting that in our study the population was characterised by low frequency of tobacco consumption, a deleterious health behaviour strongly associated with alcohol consumption (SBC, 2016). Although the association between tobacco consumption and treatment adherence was not statistically significant, the adoption of protective health behaviours may lead to improved control of chronic diseases, such as HTN and DM (Girotto *et al.*, 2013).

After stratifying the studied population into two groups, controlled and uncontrolled, age, risky alcohol consumption, and marital status were significantly associated with adherence in the controlled group. In the uncontrolled group, age was the only variable significantly associated with adherence.

In the controlled group, the association of non-adherence with being under 40 years of age and reporting risky alcohol consumption can be understood from the discussion previously made in this article, as well as the association between being over 40 years and adherence, in the non-controlled group. On the other hand, this study also reported that controlled workers who did not have a partner were twice as likely to be non-adherent when compared to those with partners. A review of the literature showed that being married has a protective effect on health outcomes, possibly due to increased adherence to medical evaluations, drug treatments, and screening programs, besides having access to healthier meals, better sleep, less stress, more financial benefits, and better mood (Manfredini *et al.*, 2017).

As for the study limitations, most of the information was obtained via self-report, which may

led to overestimation of treatment adherence due to poor memory and false reporting. Also, for the variable disease control we measured blood pressure and capillary blood glucose only once during the study, in addition to the latter lower ability to predict diabetes control compared to other less accessible tests available. Another limitation of this study was the lack of access to further information about the participants, such as medical history, past drugs used, and current prescriptions, which would have provided additional information on whether poor disease control was influenced by suboptimal treatments.

Our study found high self-reported treatment adherence, although the clinical health outcomes did not corroborate this finding, indicating a possible concern regarding the validity of the adherence measure that was used.

Being over 40 years of age, family income greater or equal to two and lower than three minimum salaries, and not presenting with risky alcohol consumption were associated with adherence. Being under 40 years of age, not having a partner, and reporting risky alcohol consumption behaviour were associated with non-adherence in the controlled group, while being over 40 years of age was associated with adherence in the uncontrolled group.

This study highlights the importance of the performance of primary health care, the gateway to the health service network, and serving workers with diverse work ties who may present forms of illness and work-related demands such as the DCNs. It is essential to be prepared to identify, solve, and monitor these problems for comprehensive care. For example, the uncontrolled disease group presented with a high frequency of physical inactivity, being overweight and obese, and a lack of regular health self-assessment, showing the need for improved primary health care.

In addition, companies can contribute, through programs aimed at well-being and health at work, to maintain the health of these individuals, thus avoiding the complications and disabilities resulting from these diseases.

## ACKNOWLEDGEMENTS

We would like to thank all of the students who assisted us with the patient interviews. This research has been conducted as part of the HealthRise project, led by Abt Associates and the Institute for Health Metrics and Evaluation. This study was funded by the Medtronic Foundation and also was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

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Received for publication on 20th April 2020
Accepted for publication on 04th July 2021