Preventive Medicine Reports 35 (2023) 102315



Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr



Doctors' recommendations and healthy lifestyle behaviors among individuals with hypertension in Brazil

Kang Sun, Xiayu Summer Chen, Tonya Muzhylko, Flavia Cristina Drumond Andrade *

University of Illinois at Urbana-Champaign, United States

ARTICLE INFO

Keywords:
Hypertension
Diagnosis
Health behavior
Brazil
Physician-patient relations

ABSTRACT

Little is known about whether doctors' recommendations encourage healthy behaviors among individuals with hypertension in Brazil. This study examined the biological, social, and health factors related to doctor's recommendations and the associations between doctor's recommendations and healthy behaviors. The sample consisted of individuals with hypertension (N = 18,260) from Brazil's 2019 National Health Survey. The outcomes examined included smoking, drinking, diet, salt intake, physical activity, and doctor visits. Study findings indicated that more than 80% of people with hypertension in Brazil received doctors' recommendations to adhere to medical care and engage in healthy behaviors. Those who received recommendations were more likely to practice healthy eating and exercise regularly but also to be obese/overweight, smoke, and drink excessively. Nonetheless, the findings concerning diet and exercise suggest the value of doctors' recommendations for individuals with hypertension in Brazil.

1. Introduction

Hypertension is a leading risk factor for a host of fatal and debilitating conditions (Fuchs and Whelton, 2020), and people in low and middle-income countries are at particular risk (Chow et al., 2013). About 24% of Brazilian adults have hypertension (Malta et al., 2022), imposing an estimated Int$ 580 million adjusted for purchasing-power parity (~350 million U.S. dollars) health burden on the country (Curado et al., 2021).

From the early 2000 s to 2019, behaviors associated with hypertension increased in Brazil: eating the recommended levels of fruits and vegetables increased from 20% to 23%, being physically active increased from 30% to 39%, and smoking prevalence decreased from 16% to 10% (Brasil, 2021). However, unhealthy levels of alcohol consumption increased from 16% to 19% between 2006 and 2019 (Brasil, 2021). Likewise, sedentary lifestyles and unhealthy diets remain common (Szwarcwald et al., 2021). Among Brazilians with hypertension, 76% regularly consume processed foods, and 97.5% have sedentary lifestyles, although they are more likely than average to consume fruits and vegetables and have adequate salt consumption (Szwarcwald et al., 2021).

In Brazil, as elsewhere in Latin America, low socioeconomic status is associated with hypertension, lower therapeutic control, and irregular doctor visits (Chor et al., 2015; Lamelas et al., 2019). Private health insurance predicts regular exercise (Malta et al., 2018), whereas greater educational attainment predicts regular exercise in women, and lower attainment predicts regular exercise in men (Werneck et al., 2019).

Brazil's 2019 National Health Survey study (Pesquisa Nacional de Saude, PNS) shows that more than 80% of individuals reported that their doctor recommended they consume recommended levels of fruits and vegetables, maintain adequate weight, restrict salt consumption, be physically active, and have regular follow-ups (Szwarcwald et al., 2021). However, only 67% and 66%, respectively, reported being recommended not to smoke or drink heavily (Szwarcwald et al., 2021). Little is known about how such recommendations are associated with SES factors. Given the risks associated with low SES, this is a significant gap in the research.

Theoretically, scholars posit that medical diagnoses and health events constitute teachable moments (TMs). McBride et al. (2003) defined TM as "naturally occurring life transitions or health events [that motivate] individuals to spontaneously adopt risk-reducing health behaviors." According to the TM concept model, a hypertension diagnosis may increase people's risk perception and motivate behavioral change. Flocke and Stange (2004) argued that a diagnosis or health event creates an opportunity/opening for people to pay attention to doctors' recommendations. Stange (2018) further argued that a TM occurs when 1)

* Corresponding author at: 1010 W. Nevada Street | M/C 082, Urbana, IL 61801, United States.
E-mail addresses: kangsun2@illinois.edu (K. Sun), xiayuyc2@illinois.edu (X.S. Chen), am50@illinois.edu (T. Muzhylko), fandrade@illinois.edu (F.C.D. Andrade).

https://doi.org/10.1016/j.pmedr.2023.102315
Received 9 February 2023; Received in revised form 3 July 2023; Accepted 4 July 2023
Available online 12 July 2023
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communication about an unhealthy behavior becomes relevant, 2) a link between a patient's concern and health behavior is likely to motivate changes, and 3) a patient is willing to discuss behavioral changes (Stange, 2018).

Studies on the impact of TMs on health behaviors have addressed chronic disease diagnoses (Dimova et al., 2020; Xiang, 2016) and their impact on behavior such as smoking cessation, alcohol consumption, diet, and physical activity (Margolis, 2013; Newsom et al., 2012; Xiang, 2016). Those who have addressed hypertension include Rabel et al. (2019), who found that a hypertension diagnosis did not increase physical activity among Germans. Akbarpour et al. (2018) found being aware of their condition did not predict positive health behaviors among hypertensive Iranians. Hernandez et al. (2018) found that less than a third of Americans recently diagnosed with hypertension had made positive behavioral changes, except that over 80% reported antihypertensive medication use. In Canada, smoking cessation was the most common behavioral change following a hypertension diagnosis (Neutel and Campbell, 2008).

The National Program of Health Promotion in Brazil has implemented actions in primary care settings that make doctors responsible for providing recommendations for controlling chronic non-communicable diseases (Szwarcwald et al., 2021). Using nationally representative data from Brazil, this paper aims to 1) describe whether socioeconomic and health factors are associated with doctors' recommendations and 2) informed by TM, examine whether doctors' recommendations are associated with engaging in healthy behaviors and regular visits to the doctors among individuals with diagnosed hypertension in Brazil. We hypothesize a positive association between doctors' recommendations and patients' higher socioeconomic status and access to private health insurance. We also hypothesize that a doctor's recommendation is positively associated with the report of adopting health behaviors and visiting doctors regularly.

2. Methods

2.1. Data

This study analyzed 2019 microdata from the PNS, the national health survey conducted by the Brazilian Census Bureau (Instituto Brasileiro de Geografia e Estatistica, IBGE) in partnership with the Ministry of Health of Brazil (Stopa et al., 2020). The PNS-2019 is a nationally representative survey of residents living in private households.

PNS employs a three-stage conglomerate plan with primary sampling units (PSUs) stratification. In the first stage, PSUs were selected using the master sample, a set of census tracts or tract aggregates. In the second stage, households were randomly chosen from the tracts. In the final stage, one selected individual (15 years or older) was randomly chosen to respond to the complete questionnaire (Galvão and Roncalli, 2021). The response rate reached 93.6% (Souza Júnior et al., 2021).

The National Research Ethics Committee (Conselho Nacional de Ética em Pesquisa) of the National Health Council (Conselho Nacional de Saúde; No. 3.529.376) approved the PNS-2019 methodology (Stopa et al., 2020). Participation was voluntary and required consent to participate (Stopa et al., 2020). The PNS-2019 dataset and microdata are publicly available on the IBGE website (https://www.ibge.gov.br/estatisticas/downloads-estatisticas.html?caminho=PNS/2019/Microdados/Dados), and thus exempt from ethical compliance.

2.2. Participants

The PNS-2019 randomly selected 94,114 residents aged 15 and over to be interviewed. Of those respondents, 2,431 were below 18 years of age and, thus, excluded. Of the remaining 91,863, 88,531 had completed the interview (n = 3,153 either refused or were not located). Among those who completed the interview, a total of 63,043 reported they did not have hypertension and 23,819 reported they had hypertension (1,669 had missing data on hypertension status). Among those without hypertension, 764 had missing data on selected variables and available data was complete for 62,279 participants. Among those with hypertension, 4,743 had visited the doctor for their hypertension three or more years prior to the survey or had missing data on this variable, and 816 had missing data on select variables and were also excluded. The final analytical sample was thus comprised of 18,260 participants aged 18 and over from the PNS-2019 survey who had hypertension and complete data on selected variables. Those with hypertension who were excluded were younger than those included (p less than 0.001) and more likely to be female (p = 0.0128).

2.3. Measures

Health variables. PNS personnel interviewed the respondents with questions such as "Has a doctor given you a diagnosis of (hypertension/arthritis/diabetes/high cholesterol/heart disease/asthma/chronic lung diseases/cancer/kidney failure)?" Each disease was asked separately. Coding as having the condition was based on an affirmative answer. Individuals were categorized as having one, two, or three or more conditions. The multimorbidity variable consists of all chronic conditions except hypertension.

Health behaviors. Participants indicated whether they currently smoked or whether they smoked in the past. Categories for current smoking included 1. yes, daily, 2. yes, less than daily, and 3. do not smoke currently. Categories for past smoking included yes and no. Participants were categorized as current smokers if they reported smoking daily or less than daily, past smokers if they answered affirmatively for past smoking, and never smokers if no past or current smoking was reported. Those who currently did not smoke were classified as engaging in healthy behavior. Two categories were created for alcohol consumption based on whether the respondent drink, how often they drink, and how many drinks are usually consumed. Healthy drinking was defined as not drinking or consuming fewer than eight doses of alcohol a week for women and fewer than 15 doses per week for men. Those drinking above these thresholds were considered to be drinking excessively, which was categorized as unhealthy drinking (Szwarcwald et al., 2021). Participants provided information on their perception of salt consumption by answering the item: "Considering freshly prepared and processed foods, do you think your salt intake is—"(very high, high, adequate, low, and very low)." Those with very low, low, and adequate consumption were classified as having adequate or low salt consumption. Participants self-reported their weight and height. BMI was calculated as weight (kg)/height (m^2), and BMI categories were created: underweight, less than18.5 kg/m^2; normal, 18.5 to 24.9 kg/m^2; overweight, 25.0 to 29.9 kg/m^2, and obese: $\geq$30.0 kg/m^2. Those who were normal or underweight were classified as having not high weight status, whereas those who were overweight or obese were categorized as having high weight status and engaging in unhealthy behavior. For physical activity, those who answered that having exercised or practiced a sport in the last three months were categorized as engaging in healthy behavior. Healthy eating was defined when participants reported eating fruits and vegetables at least five days a week. If participants did not want to answer any of the questions, they had the option to not respond, and thus, they were excluded from our analytical sample.

Doctor visits. Participants were asked, "Do you regularly visit the doctor/health service to monitor arterial hypertension (high blood pressure)?" Response categories were 1. yes, regularly, 2. no, only when I have a problem. 3. never go to the doctor for monitoring of high blood pressure. Those who reported three were excluded from the sample.

Doctor recommendations. PNS personnel asked the respondents, "In any of the visits for hypertension, has any doctor or other health professional given you any of these recommendations?" Recommendations were related to a) keeping a healthy diet, b) maintaining an adequate weight, c) reducing salt intake, d) regularly practicing physical activities, e) not smoking, f) not drinking excessively, and g) having regular

follow-ups with a health professional.

Demographic variables. Biological variables include age and sex. Age was included as a categorical variable in years (15–34, 35–49, 50–64, and 65 and over) and a dichotomous variable for females (male as the reference group).

Mental health. To evaluate mental health, which is often associated with health behaviors (May et al., 2022), we used the Brazilian version of the Patient Health Questionnaire, PHQ-9 (Santos et al., 2013). For each item, possible answers include not at all, less than half of the days, more than half of the days, and almost every day, with respective scores from 0 to 3. Total PHQ-9 scores were obtained by summing across all questions. A PHQ-9 score of 10 or higher indicated depression (Santos et al., 2013).

Social variables. Social variables included education, income, private insurance, marital status, urban vs. rural residency, and region of residence. Data on two derived variables created by IBGE were included in the analysis of education (level completed) and per-capita household income. Individuals were recategorized into four categories of education (no education or primary incomplete, primary/8th grade complete but not high school, complete high school or some college, college degree or more). The monthly gross income of all household members was included based on all sources of income to calculate per-capita household income. Per-capita household income brackets (in minimum wages) were obtained by dividing the average income of the household members by the Brazilian minimum monthly salary, which was $998 Brazilian reais (approximately $253.30 US dollars). The per-capita household was then categorized by its relationship to minimum wage (less than 1/4, 1/4 to 1/2, 1/2 to 1, 1 to 2, 2 or more). A dichotomous variable measured the presence of private health insurance (having private insurance vs. not). Marital status was categorized into three categories (married, divorced/separated/widowed, single). Finally, we included two variables that capture a broader socioeconomic context – a dichotomous variable for urban (urban vs. rural residence) and regions (North, Northeast, Midwest, Southeast, South).

2.4. Statistical analysis

Descriptive statistics for those with and without hypertension were calculated. We used logistic regressions to examine whether biological, social, and health factors are associated with doctor's recommendations after adjusting each variable for all variables included in the model. Similarly, we adjusted logistic regressions to explore whether doctors' recommendations are associated with adherence to healthy behaviors and medical visits. We present adjusted odds ratios and 95% confidence intervals.

The complex sample design of PNS-2019 was considered in the statistical analyses performed with the STATA package's survey data module (svy) using the appropriate sampling weights. All statistical analyses were done using STATA SE 16.1.

3. Results

Compared to those without hypertension, participants with hypertension were older, more likely to be female, have depressive symptoms, and have lower education levels. Still, they do not differ regarding having private health insurance or urban residency. Compared to those without hypertension, those with hypertension have higher prevalence rates of engaging in healthy behaviors, such as having low or adequate salt consumption and a healthy diet, except for physical activity and adequate weight (Table 1).

Most participants with hypertension were 50 years or older (78.6%), female (59.9%), had multiple chronic conditions (60.7%), had no or less than primary education (67.3%), were unmarried (54.9%), and lived in urban areas (86.8%). Less than a third (28.2%) had private health insurance. Most were non-smokers (89.3%) who consumed moderate amounts of alcohol (90.1%) and adequate or low levels of salt consumption (91%). Less than a third (28.3%) reported having a not high weight status (i.e., underweight or normal BMI). Well under half of the participants exercised regularly (34.7%) or had a healthy diet (40.2%). All participants visited a doctor in the last three years, and almost three-quarters of the individuals visit doctors regarding their hypertension regularly (73.4%) (Table 1).

Table 2 shows the adjusted odds ratios (aOR) for the logistic regressions that examine whether biological, social, and health factors are associated with reported doctors' recommendations. Men reported being more likely to be instructed not to drink excessively. Unmarried individuals were less likely to report receiving recommendations to engage in healthy behaviors, such as physical activity, keeping a not-

Table 1
Descriptive statistics (%) of adults in Brazil with and without hypertension (weighted estimates), Brazil, PNS-2019.

Variables	Without hypertension	With hypertension	p-value
Age (in years)			<0.001
18–34	32.8	3.6	
35–49	34.1	17.8	
50–64	22.2	37.7	
65 +	10.8	40.9	
Gender			<0.001
Female	50.6	59.9	
Male	49.4	40.1	
Depression			<0.001
No	90.6	85.0	
Yes	9.4	15.0	
Multimorbidity			<0.001
None	74.9	–	
1	19.2	39.3	
2	4.8	32.0	
3 or more	1.2	28.7	
Per Capita Household Income (in Brazilian minimum monthly wages)			<0.001
Less ¼	8.2	5.3	
1/4 to 1	13.5	9.5	
1/2 to 1	26.8	31.3	
1 to 2	27.9	30.1	
2 or more	23.6	23.8	
Education			<0.001
No or primary incomplete	31.0	55.5	
Primary	14.1	11.8	
Complete high school	36.1	21.2	
College or more	18.8	11.5	
Marital Status			<0.001
Married	41.1	45.1	
Divorced	14.7	31.2	
Single	44.2	23.7	
Health Insurance			0.9943
No	71.8	71.8	
Yes	28.2	28.2	
Residence Area			0.0948
Rural	13.8	13.2	
Urban	86.2	86.8	
Regions			<0.0001
North	7.8	5.3	
Northeast	26.2	24.9	
Midwest	7.8	6.8	
Southeast	42.8	47.8	
South	15.4	15.3	
Prevalence of health behaviors			
Adequate or low salt consumption	87.1	91.0	<0.0001
Current not smoker	86.1	89.3	<0.0001
Not drinking excessively	85.7	90.1	<0.0001
Exercise regularly	43.8	34.7	<0.0001
Not high weight status (underweight or normal BMI)	45.3	28.3	<0.0001
Healthy diet	32.2	40.2	<0.0001
Regular doctor visit	92.3	100.0	<0.0001
Doctor visit for hypertension	–	73.4	
Sample size	*62,279*	*18,260*	

Note: p-values were obtained using Pearson chi-square. BMI: body mass index.

Table 2
Estimated adjusted odds-ratios and 95% confidence intervals for the associations between demographic, social, and health factors among adults with reported doctor's recommendations, Brazil, PNS-2019.

Variables	Adequate or low salt		No smoking		No excessive drinking		Physical activity		Not high weight status		Healthy Diet		Visit doctor regularly	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Age (ref = 18–34)														
35–49	0.88	0.57–1.37	0.97	0.72–1.30	1.22	0.90–1.66	1.1	0.74–1.61	0.99	0.67–1.47	0.96	0.62–1.49	1.3	0.87–1.94
50–64	0.79	0.53–1.18	0.98	0.74–1.28	1.03	0.77–1.37	0.86	0.60–1.25	0.84	0.58–1.22	0.79	0.52–1.20	1.02	0.69–1.49
65 +	0.67	0.44–1.04	0.64**	0.48–0.86	0.71*	0.53–0.96	0.52**	0.35–0.78	0.62*	0.43–0.91	0.67	0.43–1.04	0.89	0.60–1.34
Gender (ref = Female)														
Male	0.93	0.77–1.12	1.09	0.98–1.21	1.27***	1.15–1.42	0.89	0.78–1.01	0.87	0.76–1.01	0.93	0.80–1.08	0.89	0.77–1.02
Depression														
Yes	0.81*	0.66–0.99	0.94	0.82–1.09	0.91	0.78–1.05	0.71***	0.60–0.85	0.70***	0.58–0.84	0.66***	0.53–0.81	0.85	0.69–1.05
Multimorbidity (ref = 1)														
2	1.29*	1.06–1.56	1.11	0.98–1.25	1.1	0.98–1.25	1.18*	1.02–1.38	1.27**	1.09–1.49	1.20*	1.01–1.43	1.23*	1.05–1.45
3	1.37**	1.12–1.68	1.03	0.92–1.17	1.06	0.94–1.20	1.28**	1.09–1.50	1.60***	1.34–1.91	1.58***	1.31–1.91	1.49***	1.25–1.77
Income (ref = Less 1/4)														
1/4 to 1	1	0.69–1.45	1.09	0.86–1.38	0.91	0.71–1.17	0.99	0.72–1.37	0.87	0.64–1.18	1.08	0.74–1.59	1.04	0.77–1.41
1/2 to 1	1.1	0.79–1.54	1.02	0.80–1.29	0.95	0.75–1.21	1.22	0.88–1.69	0.93	0.68–1.27	1.09	0.74–1.60	1.11	0.84–1.46
1 to 2	1.1	0.77–1.57	1.06	0.84–1.34	1.03	0.81–1.30	1.43*	1.03–1.99	1.05	0.77–1.43	1.26	0.85–1.87	1.23	0.92–1.65
2 or more	1.12	0.77–1.64	1.22	0.94–1.58	1.16	0.89–1.53	1.60*	1.10–2.34	1.34	0.94–1.92	1.49	0.95–2.33	1.22	0.87–1.73
Education (ref = No Education)														
Primary	0.96	0.73–1.27	1.15	0.96–1.37	1.12	0.94–1.34	1.37**	1.09–1.72	1.22	0.95–1.57	1.12	0.85–1.47	1.1	0.87–1.39
Complete High School	0.94	0.73–1.21	1.24**	1.07–1.44	1.33***	1.15–1.54	1.55***	1.28–1.88	1.29*	1.04–1.59	1.15	0.92–1.44	1.07	0.88–1.29
College or more	0.99	0.72–1.36	1.08	0.88–1.33	1.17	0.95–1.45	1.83***	1.35–2.48	1.41*	1.05–1.88	1.13	0.81–1.58	1.46*	1.06–2.01
Marital status (ref = Married)														
Divorced	0.94	0.78–1.13	0.87*	0.76–0.98	0.91	0.81–1.03	0.78**	0.67–0.91	0.78**	0.66–0.93	0.94	0.78–1.13	0.92	0.78–1.09
Single	0.83	0.69–1.01	0.9	0.80–1.02	0.92	0.81–1.05	0.73***	0.63–0.86	0.77**	0.66–0.91	0.79**	0.67–0.94	0.74***	0.64–0.87
Insurance (ref = No)														
Yes	1.08	0.84–1.39	0.9	0.78–1.04	0.91	0.79–1.05	1.25*	1.03–1.51	1.09	0.90–1.33	1.13	0.90–1.42	1.16	0.95–1.44
Residence Area (ref = Rural)														
Urban	1.06	0.87–1.30	1.32***	1.15–1.52	1.37***	1.19–1.57	1.43***	1.23–1.65	1.32***	1.12–1.55	1.23*	1.03–1.47	1.34**	1.12–1.59
Regions (ref = North)														
Northeast	1.69***	1.34–2.14	1.36**	1.13–1.64	1.29**	1.08–1.55	1.56***	1.26–1.92	1.56***	1.22–1.99	1.51***	1.19–1.92	1.09	0.87–1.38
Midwest	1.56***	1.27–1.92	0.94	0.81–1.08	0.91	0.79–1.05	1.22*	1.04–1.45	1.24*	1.03–1.50	1.31*	1.06–1.61	0.99	0.82–1.21
Southeast	1.70***	1.27–2.27	1.09	0.87–1.36	1.08	0.85–1.37	1.41**	1.09–1.83	1.46**	1.14–1.88	1.53**	1.17–2.00	1.05	0.77–1.43
South	1.08	0.85–1.38	1.19	1.00–1.41	1.21*	1.02–1.44	0.99	0.81–1.20	1.22	0.99–1.49	0.92	0.73–1.15	0.84	0.67–1.05

Note: Results from adjusted logistic regressions, aOR for each variable is adjusted for all the variables included in the model. CI: Confidence Interval, aOR: Adjusted Odds-Ratios. Reference categories: age 18–34, female, no depression, one chronic condition, less than ¼ minimum wage, no education, married, no private health insurance, rural area, North region. * for p <.05, ** for p <.01, and *** for p <.001.

high weight status, having a healthy diet, and visiting a doctor regularly. Similarly, recommendations for physical activity, adequate weight status, and a healthy diet were less commonly reported among those with elevated depressive symptoms. However, individuals with multimorbid conditions were more likely to report receiving doctor recommendations regarding adequate salt intake, engaging in physical activity, keeping an adequate weight, having a healthy diet, and regularly visiting a doctor. Those living in urban areas were also more likely to report receiving doctor recommendations than those living in rural areas, except for salt consumption. The reported doctors' recommendations for physical activity followed a gradient for education and income, with those more educated and higher income reporting higher levels of receiving recommendations. Those with higher education, particularly those with college degrees, were more likely to report receiving recommendations for maintaining an adequate weight and visiting health care providers regularly.

Table 3 displays the results of adjusted logistic regressions that examine whether doctors' recommendations are associated with patients engaging in healthy behaviors, net of demographic, health, and social factors. There was a positive adjusted odds of receiving a doctor's recommendation among those who reported smoking, drinking excessively, or being high weight status. However, doctors' recommendations were positively associated with reporting exercising regularly, having a healthy diet, and visiting a doctor regularly. Participants with more income, higher education, private insurance, and urban residents were more likely to report exercising and having a healthy diet. Higher education, income, and private insurance were positively associated with reporting regular doctor visits. However, those who reported depression were less likely to report engaging in healthy behaviors, but there were no differences between those with and without depression related to drinking, not high weight status, and visiting doctors regularly. Single and divorced individuals had lower odds of reporting engaging in healthy behaviors related to smoking, drinking, and a healthy diet. Those who were single were also less likely to report engaging in physical activity than those who were married. However, single people were more likely to report having no high weight status. Older people seemed less likely to exercise, but the odds were higher for them to report having a healthy diet, drinking moderately, and visiting doctors regularly.

4. Discussion

Brazil has recently improved its surveillance systems for non-communicable diseases and invested in programs to improve diagnosis and treatment access (Bertoldi et al., 2013). Nowadays, 97% of diagnosed patients receive medical treatment (Lamelas et al., 2019), but only 37% effectively control it (Lamelas et al., 2019), highlighting the need to improve the management of the disease and promotion of health behaviors. We find that doctors often provide recommendations related to health behaviors and disease management. Recommendations reached more than 80% in most cases, except for not smoking or drinking excessively. Results indicated that reporting receiving a doctor's recommendation was associated with positive health-related behaviors such as physical activity, healthy diet, and regular doctor visits. However, the results also show that patients with hypertension need more than just a recommendation in order to change behaviors such as smoking, drinking, and maintaining a healthy weight. In fact, attempts to maintain healthy behaviors need to consider the social context in which individuals live as the adoption and maintenance of healthy behaviors can be difficult (Bouton, 2014). Our results illustrated not only the presence of social and economic differences that affect the extent to which individuals report receiving advice from healthcare providers but also how the social context is associated with the reports of health behaviors.

Older adults are more likely to report having regular doctor visits. Among individuals with hypertension, men were more likely than women to report receiving a recommendation to stop drinking excessively, perhaps because excessive drinking is more prevalent among men than women. Besides engaging in physical activity and not having high weight status, men with hypertension are less likely to report engaging in all healthy behaviors than women, even though, for most cases, there were no statistical differences across gender in reporting receiving doctors' recommendations.

Among individuals with hypertension, those with higher, compared to lower incomes were more likely to report receiving a doctor's recommendation for physical activity. Results also showed that recommendation receipt is lower among single and divorced people, who often have lower SES, than married people. In contrast with past research in Brazil (Szwarcwald et al., 2021), our study finds that those with private insurance were more likely to receive recommendations to engage in physical activity. These recommendations, in turn, led to a greater propensity to report exercising.

Meanwhile, people with depressive symptoms are less likely to report receiving doctors' recommendations to engage in most healthy behaviors and also less likely to engage in most of them. These results may indicate that depressive symptoms complicate interactions between doctors and patients, in line with a U.S. study of patient–provider communications (Finney Rutten et al., 2006).

Patients with hypertension are more likely to engage in a healthy diet and exercise regularly following doctor recommendations. Doctors' recommendations to visit a doctor regularly are also positively associated with having regular follow-ups. Individuals who reported smoking, drinking excessively, or being overweight/obese were more likely to report receiving a doctor's recommendation. Specifically, for drinking and smoking, doctors focused on those with higher needs – recommendations for not drinking excessively increased from 65% among those who drink moderately to 76% among those who reported excessive drinking. Similarly, doctors' recommendations for not smoking increased from 66% among non-smokers to 81% among current smokers. Nonetheless, less than a third of Brazilians reported adequate access to obesity care in primary health units, and less than 8% of the units had adequate structure to manage obesity (Lopes et al., 2021).

Results indicate that, for the most part, doctors provide lifestyle recommendations to those with hypertension; however, it is ultimately up to the individual within their social context to implement and follow these guidelines. The results of this paper showed that reporting unhealthy behaviors, especially regarding physical inactivity, unhealthy eating, and high weight status, is high. Furthermore, current results pointed out significant social inequalities and recommendation gaps.

Thus, strategies targeted at different social groups may have better results, given that there are different reactions to doctors' advice, depending on health literacy, cultural customs, and financial and logistic obstacles. We also recommend further incorporating doctor communication into the medical training curriculum, including training on how social inequalities influence health behaviors and outcomes. In addition, policies should improve the structure and organization of primary health units nationwide (Lopes et al., 2021). Efforts should include educational campaigns, increasing availability and access to fresh fruits and vegetables, and promoting healthy behaviors (Moriguchi Watanabe et al., 2022).

This study has a few limitations. First, self-reported hypertension diagnoses may be subject to bias and diagnosis avoidance (Burgard and Chen, 2014). Second, self-report accuracy may vary depending on socioeconomic characteristics, such as educational level and access to health insurance (Burgard and Chen, 2014). Similarly, self-reported healthy habits are subject to memory bias and influenced by social desirability bias. Also, patients' recollections of the doctors' recommendations may be inaccurate due to memory bias or misunderstandings. Additionally, we do not have insight into how doctors recommendations were presented to patients. Research suggests that patients are more likely to take action if the recommendations are framed as treatments instead of merely providing advice for behavior change (Bergen, 2020). Moreover, the PNS-2019 survey only allowed us to report whether fruits and vegetables were consumed rather than the amount consumed per day. Similarly, clinical measurements of sodium

Table 3
Estimated adjusted odds-ratios and 95% confidence intervals examining the associations between doctor's recommendations and reports of engaging in healthy behaviors among adults, Brazil, PNS-2019.

Variables	Adequate or low salt		No smoking		No Excessive Drinking		Regular physical Activity		Not high weight status		Healthy Diet		Regular doctor's visits	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Doctor recommendation	1.01	0.76–1.33	0.44***	0.37–0.53	0.65***	0.54,0.79	2.47***	2.09–2.91	0.63***	0.55–0.73	1.22**	1.05–1.42	2.94***	2.54–3.39
Age (ref = 18–34)														
35–49	1.38	0.96–1.99	1.38	0.91–2.09	0.93	0.65,1.32	0.98	0.70–1.37	0.75	0.54–1.03	1.83***	1.28–2.61	1.66***	1.26–2.19
50–64	2.35***	1.66–3.32	0.88	0.60–1.28	1.48*	1.04,2.09	0.73*	0.56–0.95	1.15	0.85–1.57	2.14***	1.54–2.98	2.44***	1.87–3.19
65 +	2.96***	2.02–4.33	1.80**	1.18–2.76	2.68***	1.82,3.94	0.51***	0.38–0.67	2.06***	1.51–2.82	2.91***	2.08–4.09	2.62***	1.98–3.45
Gender (ref = Female)														
Male	0.74***	0.62–0.88	0.63***	0.54–0.74	1.72***	1.38,2.14	1.06	0.94–1.19	0.92	0.82–1.03	0.55***	0.49–0.63	0.85*	0.75–0.97
Depression														
Yes	0.72**	0.58–0.88	0.67***	0.54–0.83	1.1	0.85,1.41	0.62***	0.53–0.73	1.05	0.90–1.24	0.75***	0.65–0.88	0.99	0.83–1.18
Multimorbidity (ref = 1)														
2	0.98	0.80–1.19	1.17	0.97–1.40	1.14	0.94,1.40	1.03	0.91–1.16	0.99	0.88–1.11	0.97	0.87–1.10	1.15*	1.01–1.30
3	1	0.80–1.25	1.18	0.96–1.44	1.21	0.95,1.54	0.9	0.79–1.03	0.77***	0.67–0.88	1.12	0.99–1.27	1.86***	1.61–2.14
Income (ref = Less 1/4)														
1/4 to 1	0.77	0.51–1.17	1.33	0.93–1.91	1.06	0.70,1.62	1.11	0.88–1.42	0.99	0.76–1.29	1.48**	1.10–1.99	1.19	0.95–1.48
1/2 to 1	0.89	0.61–1.31	1.56*	1.09–2.23	1.03	0.69,1.54	1.31*	1.03–1.66	1.08	0.86–1.37	1.70***	1.27–2.27	1.09	0.86–1.37
1 to 2	0.65*	0.44–0.95	1.66**	1.16–2.38	0.79	0.53,1.19	1.65***	1.31–2.08	0.96	0.74–1.25	2.18***	1.66–2.88	1.12	0.90–1.40
2 or more	0.81	0.54–1.20	2.13***	1.40–3.24	0.73	0.48,1.11	1.95***	1.47–2.60	0.91	0.68–1.22	2.90***	2.10–4.02	1.38*	1.06–1.80
Education (ref = No Education)														
Primary	0.99	0.76–1.30	1.11	0.87–1.40	0.69**	0.52,0.91	1.23*	1.03–1.48	0.88	0.74–1.04	1.17	0.98–1.39	0.99	0.83–1.19
Complete High School	0.95	0.75–1.19	1.35**	1.08–1.70	0.65**	0.50,0.85	1.42***	1.23–1.64	0.95	0.81–1.11	1.32**	1.11–1.57	1.07	0.92–1.25
College or more	0.73*	0.54–0.99	1.16	0.83–1.62	0.61**	0.45,0.82	2.15***	1.72–2.69	0.89	0.72–1.10	1.45***	1.17–1.81	1.37**	1.09–1.72
Marital status (ref = Married)														
Divorced	1.16	0.93–1.46	0.59***	0.48–0.73	0.77*	0.62,0.96	0.91	0.78–1.05	1.12	0.99–1.28	0.83**	0.74–0.94	0.94	0.82–1.08
Single	0.91	0.75–1.11	0.47***	0.39–0.56	0.54***	0.44,0.65	0.77***	0.68–0.89	1.18*	1.03–1.36	0.77***	0.67–0.88	0.89	0.77–1.02
Insurance (ref = No)														
Yes	1.11	0.88–1.39	1.38**	1.10–1.74	0.97	0.77,1.24	1.22**	1.05–1.41	0.96	0.84–1.10	1.28***	1.13–1.45	1.50***	1.24–1.82
Residence Area (ref = Rural)														
Urban	0.76*	0.58–0.98	1.03	0.87–1.21	0.78*	0.61,0.99	1.53***	1.32–1.77	0.77***	0.68–0.86	1.38***	1.20–1.58	0.91	0.79–1.03
Regions (ref = North)														
Northeast	1.21	0.94–1.55	1.92***	1.52–2.44	1.90***	1.50,2.40	0.97	0.81–1.16	1.07	0.91–1.26	0.61***	0.52–0.72	0.74***	0.62–0.88
Midwest	1.55***	1.25–1.92	1.47***	1.22–1.78	1.28*	1.06,1.55	1.23**	1.06–1.42	1.13	0.99–1.29	0.77***	0.68–0.88	0.86	0.74–1.01
Southeast	1.27	0.98–1.63	1.17	0.91–1.49	1.05	0.82,1.34	0.96	0.79–1.18	1.03	0.87–1.22	0.83*	0.70–0.98	0.83	0.69–1.01
South	0.59***	0.47–0.74	0.9	0.73–1.12	1.49***	1.20,1.85	0.91	0.77–1.07	0.80**	0.68–0.93	1.28***	1.11–1.47	0.88	0.74–1.04

Note: Results from adjusted logistic regressions, aOR for each variable is adjusted for all the variables included in the model. CI: Confidence Interval, aOR: Adjusted Odds-Ratios. Reference categories: age 18–34, female, no depression, one chronic condition, less than ¼ minimum wage, no education, married, no private health insurance, rural area, North region. * for p <.05, ** for p <.01, and *** for p <.001.

levels in the blood are unavailable. Another limitation is the lack of definition of the term 'regularly' to refer to the frequency of doctor visits which can lead to varied interpretations. Finally, the cross-sectional design limits our understanding of how doctors' recommendations influence the change in health behaviors.

5. Conclusions

This study makes a novel contribution to the relationships between characteristics of people with hypertension, doctor's recommendations, and patients' reports of healthy behaviors. As Brazilian policies promote healthy behaviors, doctors' recommendations are uniquely positioned to reinforce TMs. Thus, it is particularly concerning that the inequality in the reports of offered recommendations aligns with socioeconomic disparities and thus can exacerbate them. Further research into the contexts in which doctors' recommendations operate could help improve the influence of such recommendations along with tackling healthcare problems and social and economic inequalities.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data are publicly available. Code and final data can be shared by request.

Acknowledgments

We want to thank EpsteinWords for providing proofreading services.

Authors' statement

Flavia C. D. Andrade led the conception, planning, design, and preparation of the article, made all statistical analyses and interpretation of the data, drafted the article, and revised it. Kang Sun was responsible for the theoretical framework and assisted in drafting the article. Xiayu Summer Chen substantially drafted the manuscript, revised it critically, and helped with organization and interpretation. Tonya Muzhylko assisted in drafting the manuscript. All authors revised and gave final approval.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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