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Prehypertension and hypertension among adults in a metropolitan area in Southern Brazil: population-based study

ABSTRACT

OBJECTIVE: To assess the prevalence and factors associated with prehypertension and hypertension among adults.

METHODS: Population-based cross-sectional study carried out with a sample of 1,720 adults in the city of Florianópolis, Southern Brazil, from September 2009 to January 2012. Information on demographic and socioeconomic factors, health-related behaviors, anthropometric measures, morbidities, and self-rated health was collected through household interviews. Systolic and diastolic blood pressure levels were also assessed as well as use of antihypertensive medications and medical diagnosis of hypertension. The dependent variable was categorized as normal blood pressure, prehypertension and hypertension. Polytomous multiple logistic regression analysis was performed with use of a multinomial logit model.

RESULTS: The overall prevalence of prehypertension and hypertension was 36.1% (95%CI 33.3;38.8) and 40.1% (95%CI 36.6, 43.5), respectively. The polytomous regression analysis showed that prehypertension was significantly associated with males, black skin, 50-59 years of age, leisure-time physical inactivity, and pre-obesity. Hypertension was associated with males, 40 years of age or more, intermediary tertile of *per capita* family income, less than 12 years of schooling, leisure-time physical inactivity, pre-obesity, obesity, abdominal obesity, and negative self-rated health.

CONCLUSIONS: It is pressing to introduce effective public health policies to control hypertension among adult population in Florianópolis, Southern Brazil.

DESCRIPTORS: Hypertension. Epidemiology. Risk Factors. Adult. Cross-Sectional Studies.

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INTRODUCTION

Hypertension (HT) is one of the most important risk factors in cardiovascular disease which causes early death in adults.[15] The prevalence of HT in the adult population varies from 5.2% to 70.7% throughout the world.[12,23] Immutable characteristics such as sex and skin colour/race, macro-structural determinants such as socio-economic status and degree of urbanisation and lifestyle factors capable of modification such as nutrition, physical activity and alcohol and tobacco consumption all affect blood pressure levels.[15,23]

A recent report from the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High BP (JNC-7) provided new guidelines for the prevention and detection of HT.[5] The detection of prehypertension (PreHT) is as important as the diagnosing of H, according to the JNC-7. PreHT is not an illness; however, those with prehypertension are at greater risk of developing HT and increase their risk of cardiovascular disease compared with normotensive individuals.[5]

Studies of the prevalence of HT in adults have reported values of 22% and 44% in Brazil. HT was more prevalent in older people, those with black skin, those with low socioeconomic status, those with a diet high in salt and those who were overweight.[23] Although it is relevant to public health to investigate the prevalence of HT and the associated factors, it is also necessary to analyse preHT. Diagnosing preHT is important so that campaigns to diminish the damage caused by HT and the cost of hospital admissions due to cardiovascular disease can begin earlier.[5] In 2005, in Brazil, these costs had an estimated value of US$ 2,250, 417, 514.00.[23]

The majority of studies of HT in Brazil have been carried out away from the state capitals, in cities and towns which have a more tranquil pace of life. Only one study on preHT was carried out with adults, and that was in a small town.[22] The prevalence and the consequences of high blood pressure are more evident in the big cities than in small towns, as a result of greater consumption of processed food, stress and physical inactivity.[23]

This study aims at estimating the prevalence and factors associated with preHT and HT in adults.

METHODS

This study is a health survey which took place between September 2009 and January 2010, part of the population based project "EpiFloripa Adultos 2009",[a] of adults in Florianópolis, SC.

Florianópolis, with a population of 421,203 inhabitants, had the best social and health indicators of all the state capitals in 2010, according to IBGE (Brazilian Institute of Geography and Statistics).[b]

The size of the sample was calculated in order to estimate the prevalence of each health outcome investigated, the reference population being 249,530 adults between the ages of 20 and 50, the confidence interval being 95%, sampling error 3.5 percentage points, design effect (*deff*) estimated at 2 due to cluster sampling and percentage losses estimated to be 10%. We interviewed 32 adults in each of the 63 census districts, increasing the sample size to 2016 individuals.

By considering the parameters of study power to be 80%, confidence intervals of 95% and number of subjects in each category of the independent variables, this study found, in unadjusted analysis, *odds ratio* of 1.3 and 0.7 as risk and protection factors respectively.

Selection of the sample went through two stages. In the first stage, 420 census districts were stratified according to income of the head of the household (R$ 192.80 to R$ 13,209.50, equivalent to US$ 327.76 to US$ 22,456.15) and systematically randomly selected 60 sectors (sample fraction = 7), making six sectors in each decile. In the second stage, the sampling units were households. The number of houses in each randomly selected sector was updated by the supervisors of the study, who counted the number of dwellings in each of the selected sectors (the number of dwellings ranged from 61 to 810). The result of this process was sixty three census districts, totalling 16,755 eligible families, of which 1,134 were systematically selected. On average, 32 adults were selected from each census district.

Adults aged 20 to 59, who resided in the dwellings selected, were eligible for the study. Exclusion criteria were: being bedridden, amputees or those with limbs in plaster, neurological disorders which interfered with understanding of the interview questions. Pregnant women and those who had had a child in the six months previous to the study did not have their blood pressure or anthropometric measurements taken, as this would affect the values obtained.[23] If the selected individual was not encountered after at least four visits, including one during the weekend and one in the evening, this was considered a loss.

Face to face interviews were carried out with the adults living in the selected dwellings. There has been the selection of 35 five interviewers who had completed Secondary education and were available for the entire

[a] EpiFloripa: Health Conditions in Adult and the Elderly in Florianópolis. Florianópolis; 2009 [cited 2012 Nov11]. Available from: http://www.epifloripa.ufsc.br/

[b] Brazilian Institute of Geography and Statistics. Brazilian population. [cited 2009 Feb 10]. Available from: http://www.ibge.gov.br

period of the survey in order to carry out this field work. They used a Personal Digital Assistant (PDA) to record and store the data obtained, eliminating the need for inputting data later.

Quality control of the responses was conducted weekly by verifying 15% of the interviews carried out (n = 248), selected randomly for each sector. Key information was verified through telephone contact by the field supervisor. The value of Kappa varied from 0.6 to 1.0 in the concordance analysis.

Comprehension of the questions was tested beforehand by giving the questionnaire to 30 adults resident in an area covered by one of the municipality's health units. A pilot study, with around 100 people from two census districts randomly selected for the purpose, was carried out after the interviewers had received training. The results were not incorporated into the study.

Systolic and diastolic blood pressure (SBP and DBP) were measured twice and the average of the two values recorded. Resting time before and between the two measurements was approximately 15 minutes. Measurements were taken using the right arm, resting on a table at heart height, palm upwards. The individuals were seated, with both feet on the floor.[23] All of the interviewees were recommended not to smoke or drink coffee, mate (tea) or black tea and to empty the bladder before blood pressure was taken.[23] Electronic Sphygmomanometers with a digital display (Techline®), previously and adequately calibrated by Inmetro (National Institute of Metrology, Standardization and Industrial Quality) were used to measure blood pressure. Normal blood pressure was defined as when the individual reported that they were not taking any medication for high blood pressure, had not been diagnosed with high blood pressure and had SBP lower than 120 mmHg and DBP lower than 80 mmHg.[5] PreHT was defined when the individual reported that they were not taking any medication for high blood pressure, had not been diagnosed with high blood pressure and had SBP of 120-139 mmHg or DBP of 80-89 mmHg.[5] HT was defined as when the subjected reported being on medication for high blood pressure and/or had been diagnosed as having hypertension, and/or SBP of 140 mmHg or higher and/or DBP of 90 mmHg or higher.[5]

The independent variables were sex (masculine: feminine); age group (in full years: 20 to 29, 30 to 39, 40 to 49 and 50 to 59); self-reported skin colour (white, light- or dark-skinned black – those subjects who referred to their skin colour as yellow = 1.0% and indigenous = 1.2% were excluded from the tables due to being low frequency, although they were used in the association analysis); level of education (in years of study with passing successfully in the education system: 0 to 4 years, 5 to 8 years, 9 to 11 years and ≥ 12 years); household income *per capita* (in R$: (1º tercile = up to R$ 566.90; 2º tercile = R$ 567.00 to 1,300.00; and 3º tercile = R$ 1,300.10 to 33,333.00); private health plan (yes; no) and occupation. At time of collection the Brazilian classification of occupations was adopted, which was later adapted to the British classification according to Boing et al.[2] Occupations were classified as manual (III – specialised, IV – semi-specialised, V – unskilled) or non-manual (I – university graduates. II – administrative and technical, III – specialist professionals).

Smoking was evaluated using the following categories: non-smoker, ex-smoker, light smoker (< 10 cigarettes/day, moderate smoker (10 to 20 cigarettes/day) and heavy smoker (> 20 cigarettes/day). The last two categories were grouped together. The Alcohol Use Disorders Identification Test (AUDIT) was used to identify those who had problems with alcohol, using a cut-off point to classify individuals into either no (0-7) or yes (≥ 8).[16] Physical activity and nutrition were evaluated with a questionnaire used in the Vigitel system.[9,11] Those who did no physical activity in their free time, or had done so less than once a week in the three months previous to the interview were deemed inactive; those who had done some kind of physical activity in their free time at least once a week over the same period were deemed active.[9] nutrition was evaluated according to regular consumption of fruit and vegetables.[11]

The anthropometric measurements; body mass, height and waist circumference were evaluated according to standardised procedures.[17] Body mass Index (BMI) and waist circumference were categorised according to the literature.[26] BMI was categorised as obese (BMI ≥ 30 kg/m²), pre-obese/overweight (BMI of 25.0 to 29.9 kg/m²) and normal weight (IMC < 25 kg/m²). Underweight individuals were excluded from the tables due to low frequency (2.0%), although they were included in the association analysis. Waist circumference (WC) was analysed using cut off points according to the risk of developing metabolic complications, the categories were: very high risk (men ≥ 102 cm, women ≥ 88 cm), increased risk (men ≥ 94 cm, women ≥ 80 cm) and no risk men < 94 cm, women < 80 cm). Technical error of measurement (TEM) inter and intra evaluator was calculated according to the recommendations of Gore et al.[10] The maximum TEM value of inter (1.86%) and intra evaluators (1.18%) was for measuring waist circumference, which indicated an adequate level for the interviewers taking anthropometric measurements.

The subjects responded to the question of whether they had been diagnosed with diabetes (yes; no). Self-evaluation of health was measured in five categories and dichotomised into positive (very good and good) and negative (regular, bad and very bad) self-evaluations of health.[3]

We used values for the mean, absolute and relative frequency to describe the variables. Polytomous logistic

regression with the multinomial *Logit* model was carried out to determine factors associated with preHT and HT.

The variables were grouped into a hierarchical model from distal to proximal determinants.[24] The demographic variables (sex, age and skin colour) were in the distal block (level 1), followed by the socio-economic variables (level 2) (*per capita* income, level of education, private health plan and occupation), then health related behaviour (level 3) (tobacco and alcohol consumption, physical activity and nutrition), morbidities (level 4) (obesity, abdominal obesity and diabetes) with self-perception of health in the proximal level (level 5). The variables were included in the adjusted model, irrespective of the raw analysis p. The forward and backward methods showed similar results, and we opted for the backward method. We adjusted those variables at the same level and of higher levels which had results of more than $p \leq 0.20$ in the Wald test.

The analyses were stratified according to sex due to the nature of the outcome and the different prevalence of HT in men and women. However, on verifying factors which were associated with preHT and HT in both sexes, we observed that the same factors were repeated irrespective of sex, modifying the magnitude of the correlation, without changing its direction. We opted not to carry out analyses stratified by sex in order to increase the power of the statistical analyses. The analyses were carried out using *Stata* 11.0 software taking into consideration design effect and sample weight.

This study was approved by the Committee for Ethical Research on Humans of the Universidade Federal de Santa Catarina (nº 351/08). The subjects were informed of the aims of the study and signed consent forms.

RESULTS

The study counted on the participation of 1,720 adults (response rate 85.3%), with an average age of 38.1 (standard deviation = 11.6). Design effects were, respectively, 1.4 and 2.1 for exposure to preHT and HT.

The majority of the sample were female, with white skin, aged 20 to 29 with more than 12 years in the educational system, with private health plans and non-manual occupation. Approximately a fifth of the sample reported problems with alcohol and were smokers. More than half did no physical activity in their free time and did not regularly eat fruit and vegetables. The prevalence of obesity, abdominal obesity and diabetes was 16.1%, 16.2% and 6.7% respectively. Almost a fifth of the individuals evaluated their own health negatively (Table 1).

The average SBP and DBP was 133.0 mmHg (95%CI 132.0;133.9) and 85.0 mmHg (95%CI 84.3;85.6), respectively. The prevalence of preHT and HT

Table 1. Characteristics of adults participating in the study. Florianópolis, Southern Brazil, 2009-1010.

Variables	Sample		
	n	%	(95%CI)
Total	1,720		
Sex			
Female	959	55.5	(53.4;57.7)
Male	761	44.5	(42.3;46.6)
Skin colour			
White	1,444	85.7	(82.2;89.2)
Lighter skinned black	147	9.1	(6.6;11.5)
Dark skinned black	87	5.2	(33.4;69.0)
Age (years)			
20 to 29	540	32.7	(28.1;37.2)
30 to 39	392	22.9	(20.2;25.5)
40 to 49	438	25.0	(21.8;28.1)
50 to 59	350	19.4	(16.9;21.9)
Family income *per capita* (R$)[a]			
> 1,300.00	559	32.6	(26.1;39.0)
566.80 to 1,300.00	562	33.3	(29.6;36.8)
0 to 566.70	564	34.1	(27.8;40.5)
Years completed and passed in the educational system			
≥ 12	737	43.9	(36.9;50.8)
9 to 11	568	33.4	(28.8;37.9)
5 to 8	253	14.0	(11.2;16.7)
0 to 4	158	8.7	(6.4;11.1)
Private health plan			
Yes	984	57.9	(52.9;63.1)
No	732	42.1	(36.9;47.0)
Occupation			
Non manual	1,111	70.3	(65.0;75.5)
Manual	490	29.7	(24.5;34.9)
Alcohol abuse			
No	1,403	81.5	(78.5;84.4)
Yes	317	18.5	(15.6;21.4)
Smoker			
Never smoked	926	54.7	(50.8;58.5)
Ex-smoker	449	26.1	(22.3;29.7)
Light smoker	158	9.0	(7.5;10.4)
Moderate/heavy smoker	178	10.2	(8.7;11.7)
Physical activity in leisure time			
Yes	806	46.9	(42.5;51.1)
No	912	53.1	(48.8;57.4)
Regular consumption of fruit and vegetables			
Yes	323	18.8	(15.9;21.6)
No	1,396	81.2	(78.3;84.0)

Continue

Table 1. Continuation

Body Mass Index (kg/m²)			
< 25.0	839	51.9	(48.3;55.4)
25.0 to 29.9	531	32.0	(29.6;34.4)
> 30.0	270	16.1	(13.5;18.6)
Waist circumference			
Normal	1,077	65.2	(61.5;68.7)
Increased risk	307	18.6	(16.3;20.8)
High risk	287	16.2	(13.8;18.6)
Diabetes			
No	1,655	96.3	(95.3;97.2)
Yes	63	6.7	(2.7;4.6)
Perception of own health			
Positive	1,373	81.2	(78.3;84.0)
Negative	347	18.8	(15.9;21.6)

[a] R$: Brazilian currency. 1R$ = 1.7US$ during data collection

was 36.1% (95%CI 33.3;38.8) and 40.1% (95%CI 36.6;43.5), respectively (Table 2).

Polytomous logistic regression in the raw analysis showed that the chances of the subjects having preHT and HT, when compared with normotensive individuals, were greater in individuals who were male, who had black skin, with a low level of education, with BMI > 25 kg/m² and with waist circumference values in the risk category. The chances of having HT were greater for people over 40, those in the intermediate tercile for income, those who had a manual occupation, those with alcohol abuse issues, those who smoked 10 or more cigarettes a day, those who were physically inactive in their free time, those with unsuitable nutrition, diabetics and those with a negative perception of their own health in the raw analysis (Table 3).

The chances of the subjects having preHT, when compared with normotensive individuals, were greater, in the adjusted analysis, in the following groups: male, black skin, over 50s, physically inactive and overweight. The chances of having HT, when compared with normotensive individuals, were greater for men, those with black skin, those over 40, those in the intermediate tercile for income, those who had spent < 12 years in the education system, those who were physically inactive, those who were overweight and obese, those with high values for waist circumference and those with a negative perception of their own health (Table 3).

DISCUSSION

The combined prevalence of preHT and HT (76.2%) was greater than that found in other studies[6,8] and lower than that found in a survey in China.[27] The analysis of the prevalence of HT alone in Florianópolis (41%) was higher than that of Italy,[25] Switzerland,[25] USA,[25] Canada,[25] Mexico,[20] Venezuela,[20] Chile,[20] Ecuador[20] and South Korea,[6] but was lower than that of Germany,[25] Finland,[25] Turkey,[8] Spain[25] and Cuba[20] and similar to that of England.[25]

PreHT and HT were strongly associated with being male, confirming previous studies.[22] However, other researchers have found that women had a greater prevalence to preHT and HT than men.[8] Gender in itself hardly seems to determine blood pressure levels. Habits affecting health may determine the magnitude with which HT is associated with sex.[7] The greater prevalence of preHT and HT in men may be related to risk factors present in men when compared to women.

PreHT is strongly correlated with having black skin. Kurian & Cardarelli[14] demonstrated that HT and cardiovascular disease is more prevalent in those with black skin than those with white skin. The authors explain their findings based on social inequalities between the two segments of the population, which hinders access to diagnosis and treatment of HT. Those with black skin make up the segment of the Brazilian population which most feels the impact of social inequalities, a fact which can be explained historically, mainly due to slavery in Brazil in the nineteenth century.

Correlation was found between HT and age group, from the age of 40 onwards, and with preHT from the age of 50 onwards. On average, SBP is relatively stable in both men and women until the age of 45; afterwards, there is an increase of 5-8 mmHg/decade. DBP increases one mmHg/decade in men, whereas in women it starts to increase on reaching middle age and tends to decrease again after the age of 70.[21] Kotchen et al[13] report that increases in blood pressure is not an integral part of the ageing process. Primitive societies which have been analysed showed no increase in blood pressure with age and HT was practically unknown. Individuals in these societies consume little salt, there is the possibility that salt intake over the years is behind the apparent effect of ageing on blood pressure in industrialised societies.

Low levels of education and income *per capita* were associated with HT, as in other studies.[6,8] The high prevalence of HT in subjects of lower socio-economic status and education may be the result of other factors which affect blood pressure levels, such as stress, working conditions and unsuitable eating habits, being sedentary and the difficulty of accessing health services so as to HT being diagnosed and treated.[8]

PreHT and HT were directly correlated with physical inactivity in leisure time, even after adjusting for demographic and socio-economic variables and other habits which impact on health. Similar results have been found by other authors[4] Doing moderately intense physical

Table 2. Average values for systolic and diastolic blood pressure, prevalence of prehypertension and hypertension among adults, Florianópolis, Southern Brazil, 2009-2010.

Variables	SBP (mmHg)		DBP (mmHg)		Pre-hypertension		Hypertension	
	n	$\overline{X}$ (95%CI)	n	$\overline{X}$ (95%CI)	n	% (95%CI)	n	% (95%CI)
Total	1,679	133.0 (132.0;133.9)	1,682	85.0 (84.3;85.6)	606	36.1 (33.3;38.8)	680	40.1 (36.6;43.5)
Sex								
Female	927	127.5 (126.3;128.7)	928	81.9 (81.0;82.8)	317	33.8 (30.6;37.0)	286	30.5 (26.4;34.6)
Male	752	139.8 (138.4;141.1)	754	88.6 (87.6;89.7)	289	38.8 (34.9;42.6)	394	51.6 (47.5;55.7)
Skin colour								
White	1,406	132.4 (131.4;133.4)	1,409	84.9 (84.1;85.6)	504	35.5 (32.6;38.3)	569	40.1 (36.4;43.8)
Lighter skinned black	98	137.6 (133.7;141.5)	146	84.2 (81.6;86.8)	49	34.6 (28.5;40.7)	58	38.5 (31.9;45.1)
Dark skinned black	77	138.8 (134.1;143.5)	85	87.9 (84.9;90.8)	37	44.5 (28.7;60.2)	37	43.5 (29.1;57.8)
Age (years)								
20 to 29	521	129.8 (128.4;131.2)	522	81.5 (80.4;82.6)	221	42.3 (37.5;47.2)	166	31.0 (26.1;35.8)
30 to 39	381	130.1 (128.1;132.0)	381	83.6 (82.2;85.0)	130	34.8 (30.1;39.5)	138	36.0 (30.5;41.4)
40 to 49	433	133.8 (131.9;135.7)	435	86.7 (85.3;88.1)	139	31.8 (26.0;37.6)	195	44.8 (38.8;50.8)
50 to 59	344	139.8 (137.6;142.2)	344	89.3 (87.8;90.9)	116	32.5 (27.0;38.1)	181	53.5 (47.1;59.9)
Family income *per capita* (R$)[a]								
> 1,300.00	548	130.6 (129.0;132.2)	550	83.8 (82.7;84.9)	207	36.8 (31.8;41.7)	194	35.1 (30.6;39.4)
566.80 to 1,300.00	551	135.1 (133.5;136.8)	551	86.1 (84.9;87.3)	180	33.2 (28.2;38.2)	255	45.8 (39.2;52.4)
0 to 566.70	552	133.0 (131.4;134.6)	552	85.0 (83.7;86.2)	210	38.6 (33.9;43.4)	217	38.6 (34.0;43.2)
Years completed and passed in the educational system								
≥ 12	720	129.5 (128.2;130.9)	721	82.8 (81.9;83.8)	282	39.1 (34.7;43.4)	232	32.1 (28.1;36.0)
9 to 11	553	134.7 (133.1;136.4)	555	86.1 (84.9;87.3)	186	33.7 (30.0;37.6)	255	45.1 (40.3;49.7)
5 to 8	246	135.2 (132.6;137.7)	246	86.6 (84.9;88.4)	79	31.3 (25.7;36.9)	117	48.1 (43.1;53.1)
0 to 4	157	139.1 (135.7;142.5)	157	87.7 (85.2;90.1)	57	36.3 (27.5;45.2)	75	48.2 (39.0;57.4)
Private health plan								
Yes	962	131.7 (130.4;132.8)	963	83.9 (83.1;84.8)	351	36.6 (33.1;40.8)	367	37.9 (33.4;42.4)
No	715	134.7 (133.2;136.2)	717	86.2 (85.2;87.3)	254	35.3 (31.0;39.5)	312	42.8 (38.6;47.1)
Occupation								
Non manual	1,083	131.1 (130.0;132.3)	1,085	84.1 (83.2;84.9)	403	37.1 (33.4;40.6)	401	36.8 (33.2;40.3)
Manual	481	137.3 (135.4;139.1)	481	87.6 (86.2;88.9)	163	33.8 (29.1;38.6)	237	49.0 (43.7;54.2)

Continua

Table 2. Continuation

Alcohol abuse								
No	1,365	132.1 (131.1;133.1)	1,367	84.5 (83.7;85.2)	503	36.7 (33.8;39.6)	523	38.0 (34.3;41.7)
Yes	314	136.6 (134.3;138.9)	315	87.1 (85.3;88.8)	103	33.3 (27.4;39.2)	157	48.8 (41.5;55.9)
Smoker								
Never smoked	901	131.9 (130.7;133.1)	903	84.0 (83.2;84.9)	343	38.0 (34.2;41.9)	344	37.9 (33.5;42.3)
Ex-smoker	441	133.5 (131.6;135.4)	442	85.2 (83.8;86.5)	154	33.9 (29.5;38.4)	185	42.1 (36.2;47.9)
Light smoker	156	130.3 (127.2;133.4)	156	83.7 (81.2;86.2)	53	35.6 (25.4;45.7)	55	31.1 (20.7;41.5)
Moderate/ heavy smoker	174	139.5 (136.1;142.8)	174	89.9 (87.5;92.4)	53	30.9 (23.5;38.2)	93	53.8 (47.1;60.5)
Physical activity in leisure time								
Yes	787	131.7 (130.4;133.1)	790	83.6 (82.6;84.6)	280	35.6 (32.0;39.2)	304	37.9 (33.6;42.2)
No	890	134.1 (132.7;135.4)	890	86.1 (85.2;87.0)	326	36.4 (33.0;39.9)	375	41.8 (37.7;45.9)
Regular consumption of fruit and vegetables								
Yes	313	130.6 (128.4;132.7)	314	84.3 (82.6;85.9)	118	36.8 (31.5;42.1)	109	34.2 (29.3;39.1)
No	1,365	133.4 (132.4;134.5)	1,367	85.1 (84.3;85.8)	488	35.9 (32.9;38.9)	570	41.3 (37.7; 44.8)
Body Mass Index (kg/m²)								
< 25.0	831	126.5 (125.3;127.6)	832	80.4 (79.6;81.3)	337	40.1 (36.0;44.1)	215	25.6 (21.8;29.4)
25.0 to 29.9	527	137.6 (135.9;139.2)	529	87.7 (86.6;88.9)	194	37.4 (32.7;42.1)	264	50.2 (45.3;55.0)
> 30.0	266	146.4 (144.0;148.9)	266	94.6 (92.8;96.5)	59	21.9 (16.5;27.4)	189	70.4 (64.6;76.3)
Waist circumference								
Normal	1,069	129.3 (128.3;130.4)	1,070	82.2 (81.4;83.0)	417	38.9 (35.4;42.4)	343	31.3 (27.9;34.8)
Increased risk	304	135.1 (133.0;137.2)	305	87.0 (85.5;88.6)	110	35.4 (29.7;41.2)	140	47.2 (41.1;53.4)
High risk	282	144.6 (142.2;147.2)	283	93.2 (91.4;94.9)	69	24.7 (19.4;29.9)	189	67.2 (60.6;73.7)
Diabetes								
No	1,617	132.6 (131.6;133.6)	1,620	84.8 (84.0;85.4)	592	36.6 (33.8;39.4)	639	39.0 (35.5;42.5)
Yes	61	140.8 (135.6;145.9)	61	90.0 (86.5;93.4)	14	21.6 (10.9;32.2)	40	66.0 (51.6;80.5)
Perception of own health								
Positive	1,341	131.5 (130.5;132.5)	1,344	84.1 (83.4;84.9)	496	36.8 (33.6;40.0)	511	37.9 (34.2;41.6)
Negative	338	138.6 (136.2;141.0)	338	88.1 (86.4;90.0)	110	32.6 (27.3;38.0)	169	49.3 (44.0;54.7)

[a] R$: Brazilian currency. 1R$ = 1.7US$ during data collection
SBP: systolic arterial pressure; DBP: diastolic arterial pressure
$\overline{X}$: média

Table 3. *Odds ratio* and 95% confidence intervals for prehypertension and hypertension, compared with o grupo normotensive individuals, using polytomous logistic regression with the Multinomial Logit model among adults. Florianópolis, Southern Brazil, 2009-2010.

Variables	Prehypertension				hypertension			
	Crude analysis		Adjusted analysis[a]		Crude analysis		Adjusted analysis[a]	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Sex[b]								
Female	1		1		1		1	
Male	*4.30*	*3.10;5.95*	*4.46*	*3.12;6.36*	*6.33*	*4.56;8.77*	*7.21*	*5.05;10.31*
Skin colour[b]								
White	1		1		1		1	
Lighter skinned black	0.88	0.62;1.25	0.80	0.53;1.20	0.87	0.61;1.23	0.78	0.53;1.13
Dark skinned black	*2.55*	*1.13;5.77*	*2.47*	*1.07;5.69*	*2.21*	*1.06;4.58*	2.01	0.96;4.19
Age (years)[b]								
20 to 29	1		1		1		1	
30 to 39	0.74	0.52;1.06	0.83	0.57;1.20	1.05	0.71;1.56	1.14	0.72;1.81
40 to 49	0.85	0.57;1.26	0.99	0.62;1.57	*1.64*	*1.12;2.40*	*2.01*	*1.27;3.17*
50 to 59	1.47	0.94;2.28	*1.79*	*1.03;3.08*	*3.30*	*2.29;4.75*	*3.95*	*2.46;6.34*
Family income *per capita* (R$)[c,d]								
> 1,300.00	1		1		1		1	
566.80 to 1,300.00	1.20	0.83;1.74	1.28	0.87;1.89	*1.75*	*1.23;2.47*	*1.66*	*1.12;2.47*
0 to 566.70	1.30	0.88;1.90	1.40	0.86;2.26	1.36	0.95;1.95	1.29	0.79;2.10
Years completed and passed in the educational system[d]								
≥ 12	1		1		1		1	
9 to 11	1.17	0.84;1.64	1.06	0.74;1.54	*1.91*	*1.42;2.56*	*1.70*	*1.18;2.44*
5 to 8	1.13	0.72;1.75	0.91	0.56;1.49	*2.11*	*1.50;2.97*	*1.69*	*1.04;2.75*
0 to 4	*1.74*	*1.05;2.88*	1.25	0.63;2.46	*2.81*	*1.73;4.58*	*1.99*	*1.01;2.75*
Private health plan[d]								
Yes	1		1		1		1	
No	1.12	0.84;1.49	0.90	0.66;1.24	1.31	0.98;1.76	1.05	0.74;1.49
Occupation[d]								
Non manual	1		1		1		1	
Manual	1.38	1.00;2.00	1.01	0.64;1.58	*2.00*	*1.44;2.88*	1.32	0.80;2.14
Alcohol abuse[e]								
No	1		1		1		1	
Yes	1.27	0.85;1.90	1.04	0.67;1.63	*1.80*	*1.18;2.76*	1.57	0.98;2.52
Smoker[e]								
Never smoked	1		1		1		1	
Ex-smoker	0.89	0.64;1.23	0.85	0.61;1.19	1.11	0.79;1.56	0.86	0.60;1.25
Light smoker	0.67	0.39;1.16	0.58	0.32;1.03	0.59	0.32;1.06	0.45	0.23;1.00
Moderate/heavy smoker	1.27	0.70;2.29	0.91	0.49;1.66	*2.22*	*1.36;3.64*	1.05	0.63;1.74
Physical activity in leisure time[e]								
Yes	1		1		1		1	
No	1.24	0.95;0.62	*1.47*	*1.15;1.88*	*1.34*	*1.01;1.79*	*1.50*	*1.10;2.04*
Regular consumption of fruit and vegetables[e]								
Yes	1		1		1		1	
No	1.24	0.89;1.71	0.95	0.66;1.36	*1.52*	*1.15;2.03*	1.26	0.88;1.78

Continue

Table 3. Continuation

Body Mass Index (kg/m²)[f]								
< 25.0	1		1		1		1	
25.0 to 29.9	*2.58*	*1.78;3.72*	*1.87*	*1.18;2.98*	*5.41*	*3.85;7.60*	*3.42*	*2.25;5.20*
> 30.0	*2.50*	*1.41;4.44*	1.37	0.4;3.80	*12.5*	*7.77;20.23*	*5.25*	*2.19;12.59*
Waist circumference[f]								
Normal	1		1		1		1	
Increased risk	*1.57*	*1.07;2.29*	1.30	0.75;2.25	*2.60*	*1.73;3.89*	1.35	0.77;2.36
High risk	*2.34*	*1.46;3.75*	2.17	0.89;5.27	*7.89*	*4.87;12.77*	*3.23*	*1.28;8.17*
Diabetes[f]								
No	1		1		1		1	
Yes	1.16	0.44;3.09	1.26	0.42;3.73	*3.35*	*1.24;9.04*	2.08	0.61;7.08
Perception of own health[g]								
Positive	1		1		1		1	
Negative	1.24	0.89;1.74	1.26	0.83;1.90	*1.83*	*1.39;2.40*	*1.57*	*1.05;2.34*

[a] Adjusted analysis: All the variables were introduced into the adjusted model irrespective of the p values in the crude analysis. Variables with $p \leq 0.20$ remained in the adjusted model
[b] Variables included in the first level
[c] R$: Brazilian currency, 1R$ = 1.7 US$ during the data collection
[d] Variables included in the second level
[e] Variables included in the third level
[f] Variables included in the fourth level
[g] Variables included in the fifth level
Italic: Variables with $p \leq 0.05$

activity regularly results in hemodynamic changes that promote lowering blood pressure, such as a reduction in cardiac output and decreased systemic vascular resistance.[19] Physical activity could be an important tool in preventing and treating HT.

Levels of abdominal fat and body fat are strongly associated with HT. Obesity is considered the main risk factor in developing HT.[23] In this study, 25.6% and 31.3% of hypertensive individuals had normal values for BMI and WC, respectively. This shows that obesity is a serious public health issue in Florianópolis. It is necessary to encourage active life styles to reduce weight and promote suitable blood pressure levels.

Negative self-evaluations of health are associated with poor quality of life and the presence of morbidities such as HT.[1] In this study, HT was associated with negative self-evaluations of health even after adjusting for other variables. HT has an important impact on perceptions of health, above all because it results in consequences for the organism. If not controlled, it may lead to problems such as arteriosclerosis, heart failure and loss of vision.[5,12,15]

This study is the first to be population based an investigate prevalence of preHT and HT in a Brazilian state capital. Previous studies in Brazilian state capital have investigated only the prevalence of HT. Analysing preHT may be useful in the implementation of public health policies aimed at preventing HT and the health problems associated with this illness.

One of the limitations of this study was the transversal design, which did not allow us to state whether or not the associated factors determine, or are determined by, blood pressure. However, the possibility of reverse causality cannot be ruled out. Another limitation is that the study did not include genetic or hereditary variables. In spite of these limitations, the results have external validity for the adult population resident in the urban area of Florianópolis. The uniform distribution of the losses in family income deciles and the distribution by sex and age group similar to that found in the estimates of the IBGE for the adult population of the municipality in 2009 contribute to this framework of inferences.

The prevalence of preHT and HT in Florianópolis was high. Demographic and socio-economic factors, morbidities and perceptions of own health were associated with preHT and HT. Knowledge about the distribution of HT in the population contributes to the planning of more efficient measures for reducing this public health problem. However, in order to propose effective actions it is necessary to understand that, although factors associated with preHT and HT such as level of physical

activity, being overweight and obesity are considered as modifiable, different levels of action are used to reverse this situation. This study identified factors which necessitate the diffusion of knowledge and specific actions in the population and, at the same time, distal factors in the chain of determination such as socio-economic status, level of education and skin colour which require restructuring the country's social policies.

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