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Factors associated with the onset of hypertension in women of 50 years of age or more in a city in Southeastern Brazil

Fatores associados à taxa acumulada de ocorrência de hipertensão em mulheres com 50 anos ou mais num município do sudeste brasileiro

Keywords

Hypertension
Aging
Menopause
Obesity

Palavras-chave

Hipertensão
Envelhecimento
Menopausa
Obesidade

Abstract

PURPOSE: To evaluate factors associated with hypertension in Brazilian women of 50 years of age or more. **METHODS:** A cross-sectional population based study using self-reports. A total of 622 women were included. The association between sociodemographic, clinical and behavioral factors and the woman's age at the onset of hypertension was evaluated. Data were analyzed according to cumulative continuation rates without hypertension, using the life-table method and considering annual intervals. Next, a Cox multiple regression analysis model was adjusted to analyze the occurrence rates of hypertension according to various predictor variables. Significance level was pre-established at 5% (95% confidence level) and the sampling plan (primary sampling unit) was taken into consideration. **RESULTS:** Median age at onset of hypertension was 64.3 years. Cumulative continuation rate without hypertension at 90 years was 20%. Higher body mass index (BMI) at 20–30 years of age was associated with a higher cumulative occurrence rate of hypertension over time (coefficient=0.078; $p<0.001$). Being white was associated with a lower cumulative occurrence rate of hypertension over time (coefficient=-0.439; $p=0.003$), while smoking >15 cigarettes/day was associated with a higher rate over time (coefficient=0.485; $p=0.004$). **CONCLUSION:** The results of the present study highlight the importance of weight control in young adulthood and of avoiding smoking in preventing hypertension in women aged ≥ 50 years.

Resumo

OBJETIVO: Avaliar os fatores associados com a taxa de ocorrência de hipertensão arterial sistêmica (HAS) em mulheres brasileiras com 50 anos ou mais. **MÉTODOS:** Trata-se de um estudo transversal de base populacional usando autorrelato de doenças. Foi avaliada a associação entre os fatores sociodemográficos, clínicos e comportamentais com a idade da ocorrência de hipertensão. Os dados foram analisados com uso das taxas acumuladas de continuação para hipertensão utilizando o método de tabela de vida, com intervalos anuais. Em seguida, foi ajustado modelo de regressão múltipla de Cox, para a análise de diversas variáveis preditoras, possivelmente associadas à taxa acumulada de ocorrência de hipertensão. O nível de significância foi pré-estabelecido em 5% (Intervalo de confiança de 95%) e o plano de amostragem (unidade primária da amostra) foi levado em consideração. **RESULTADOS:** A mediana da ocorrência da hipertensão das mulheres da amostra foi de 64,3 anos. A taxa acumulada de continuação sem hipertensão, aos 90 anos, foi de 20%. Quanto maior o índice de massa corpórea entre os 20 e 30 anos, maior foi a taxa acumulada de ocorrência de HAS ao longo do tempo (coef=0,078; $p<0,001$); ter cor da pele branca esteve associada à menor taxa acumulada de ocorrência de HAS ao longo do tempo (coef=-0,4; $p=0,003$) e fumar mais de 15 cigarros por dia esteve associado ao aumento da taxa acumulada de ocorrência de HAS ao longo do tempo (coef=0,4; $p=0,004$). **CONCLUSÃO:** Os resultados do presente estudo evidenciam a importância de controlar o peso na adulta jovem e evitar o tabagismo para prevenir a ocorrência de hipertensão em mulheres com 50 anos ou mais.

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Introduction

It has been estimated that the prevalence of systemic arterial hypertension (SAH) will have increased by 60% by the year 2025, particularly in women. This way, hypertension will be affecting 29.2% of all adults, 29.0% of men and 29.5% of women. Nevertheless, taking in account the fast changes in lifestyle and the increase in risk factors for arterial hypertension, some experts believe that these predictions are underestimated and the number of individuals with hypertension will indeed be much greater¹. In Brazil, as in the rest of the world, arterial hypertension is the most common chronic condition. Its incidence increases with age, mainly in women, with 41% of postmenopausal women becoming hypertensive^{2,3}.

Hypertension is a major risk factor for the early development of heart disease, stroke and heart and kidney failure. The risk of a heart attack or kidney failure increases four-fold in individuals with SAH > 160 mmHg compared to normotensive individuals; and the risk of heart failure doubles after 40 years of age^{4,5}.

This high prevalence of hypertension is largely due to the progressive stiffening of the arterial wall, a development that is part of the ageing process in individuals of both sexes⁶. Obesity is also an important risk factor in the pathogenesis of arterial hypertension. Among of women, there is the additional effect of the estrogen depletion that occurs at menopause⁷.

The specific age at which the majority of chronic conditions develop is unknown⁸; however, knowing the age at which hypertension develops is important in order to implement lifestyle changes in the period preceding onset of the disease. If known in the beginning, this would allow an evaluation of the length of time the individuals will be living with the disease⁹. Few studies have evaluated hypertension-free survival in women. Therefore, the objective of this population-based study was to evaluate the factors associated with the occurrence rate of hypertension in Brazilian women of 50 years of age or more.

Methods

Subjects

A cross-sectional population-based study was carried out between May 10th and October 31th, 2011 in the city of Campinas (São Paulo, Brazil) based on self-reports. Sixty-eight census sectors (the primary sampling units) of the city of Campinas, were randomly selected by simple random sampling or equal probability of selection. The selection procedure was performed according to a table of random numbers based on a list supplied by the Brazilian Institute of Geography and Statistics (IBGE), classified according to the sector identification

number. Prior to selection, all sectors were linked to the number of women of 50 years of age or more living in each census sector (women eligible for the study). Sectors with fewer than 10 women in this age group were combined with the neighboring sector with the subsequent ID number. Research assistants, guided by maps of each census area, went to the odd-numbered houses and verified whether there were any women of 50 years of age or more living there. If there were eligible women living at the address, they were invited to participate in the study. For those accepting the study invitation, a questionnaire was applied by interviewers trained at the Campinas Center for Research in Reproductive Health (CEMICAMP). The procedure took place until 10 eligible women had been interviewed in each sector. If it proved impossible to interview 10 women in any given sector using this methodology, work began again in that sector by visiting the addresses not included at the first attempt (the even-numbered houses). Overall, 721 women were invited to participate in the study, 99 of whom (13.7%) declined. Therefore, 622 women participated in the present study.

The target population consisted of all the female residents of Campinas who were 50 years of age or more in 2007, comprising 131,800 women. The factor taken into consideration in calculating sample size was the most prevalent morbidity in elderly women in Brazil and in developed countries, arterial hypertension, with a prevalence of around 53%^{10,11}.

A type I error of 5% was defined, with a margin of error of 4% (the absolute difference between the proportion in the sample and that of the population), resulting in a sample size of 598 women. The final sample obtained consisted of 622 women of 50 years old or more¹². Only one woman was unable to provide information on her diagnosis of hypertension, while another 11 failed to answer the question regarding the time that had elapsed since diagnosis.

Inclusion and exclusion criteria

Women of 50 years of age or more were eligible for inclusion, while those with any factor that prevented the interview from taking place were excluded from the study. Precluding factors consisted of disease, lack of cognitive ability to answer the questionnaire, prior commitments, incompatibility of schedules, etc.

Instrument

The women who participated in the study answered a structured, pre-tested questionnaire based on three preexisting questionnaires. Two of these were Brazilian questionnaires. One had been used in the Saúde, Bem-estar e Envelhecimento (SABE) project on health, well-being and aging in Latin America and the Caribbean². The other

had been part of a population-based surveillance of the risk factors and protective factors associated with chronic non-transmissible diseases through telephone interviews (VIGITEL)¹³ conducted by the Brazilian Ministry of Health. The third questionnaire (“Women’s Health and Aging Study”¹⁴) was used in the United States nationwide. The questionnaire used in the present study was divided into five sections: sociodemographic evaluation; health-related habits; self-perception of health; and evaluation of functional capacity and health-related problems.

The independent variables consisted of: education level (≤ 8 years of schooling; > 8 years of schooling); marital status (no partner; partner); skin color (white; other); number of individuals residing in the home (≤ 2 ; > 2); smoking (never smoked; current or past smoker); number of cigarettes/day currently or in the past (≤ 15 ; > 15); alcohol consumption (yes; no); frequency of alcohol consumption (none or less than once a month; other); woman has private medical insurance (yes; no); weekly practice of physical exercise (yes; no); frequency of weekly physical exercise (≤ 2 days; ≥ 3 days); Body Mass Index (BMI) at 20–30 years of age (kg/m^2); self-perception of health (very good; good; other); menopause (yes; no).

The dependent variable consisted of time until the onset of SAH, i.e. the woman’s age at onset of SAH. If the woman did not have hypertension, the variable taken into consideration was her age at the time of the interview, taken in conjunction with a variable indicating that SAH had not occurred (censoring).

Data Analysis

Initially, the cumulative continuation (survival) rates for hypertension were obtained at annual intervals using the life-table method¹⁵. Next, a Cox multiple regression model was adjusted for the various predictive variables that could be associated with the cumulative occurrence rate of hypertension.

Significance level was pre-established at 5% (95% confidence level) and the sampling plan (primary sampling unit) was taken into consideration in the bivariate and multiple analyses. The statistical analysis was performed using the SPSS software program, version 20.0 and the Stata program, version 7.0.

All the women participated voluntarily in the study and signed an informed consent form. The study protocol was approved by the internal review board of the School of Medical Sciences, University of Campinas.

Results

Excluding one woman who failed to answer the questionnaire, 55.9% of the 622 women interviewed reported having hypertension (data not presented in

tables). The sociodemographic characteristics of the women in the sample are shown in Table 1.

The median age of the women in this sample at the onset of hypertension was 64.3 years. The cumulative continuation rate without hypertension at 90 years of age was 20% (Figure 1).

No association was found between menopausal status and the cumulative occurrence rate of hypertension. The cumulative occurrence rate of SAH over time increased as a function of BMI at 20–30 years of age (coefficient=0.078; $p < 0.001$). Being white was associated with a lower cumulative occurrence rate of SAH over time (coefficient=-0.439; $p = 0.03$) and smoking more than 15 cigarettes/day was associated with an increase in the cumulative occurrence rate of SAH over time (coefficient=0.485; $p = 0.004$) (Table 2).

Table 1. Distribution of the women according to sociodemographic and behavioral characteristics

Variable	n	%
Age (years)		
50–59	234	38.8
60–69	193	32.0
≥ 70	176	29.2
Body Mass Index (kg/m^2) at 20–30 years of age		
< 20	156	36.1
20.0–24.9	222	51.3
≥ 25	54	12.6
Current Body Mass Index (kg/m^2)		
< 20	26	5.3
20.0–24.9	155	31.8
25–29	181	37.2
≥ 30	125	25.7
Education level (years of schooling)		
≤ 8	424	70.3
> 8	179	29.7
Marital status		
No partner	310	51.4
Partner	292	48.6
Skin color/ethnicity		
White	423	71
Other	172	29
Monthly family income (USD)		
$\leq \text{USD } 750$	207	53.2
$> \text{USD } 750$	182	46.8
Smoking		
Never smoked	387	64.2
Used to smoke	140	23.2
Smoker	76	12.6
Woman has private medical insurance		
Yes	292	48.4
No	311	51.6
Woman stopped menstruating over one year ago		
Yes	564	93.7
No	38	6.3

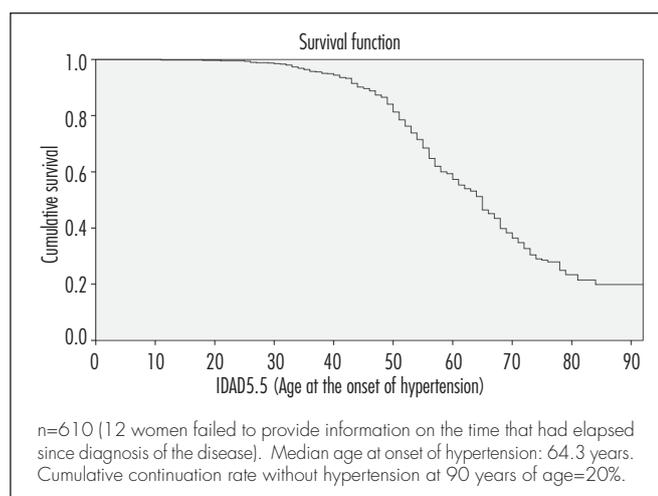


Figure 1. Cumulative survival rate without hypertension in women of 50 years of age or more

Table 2. Variables associated with the cumulative occurrence rate of hypertension over time: Cox multiple regression analysis (n=428)

Variable	Estimated coefficient	Standard error of the estimated coefficient	p-value
BMI at 20–30 years of age (kg/m ²)	0.078	0.016	<0.001
Skin color (white)	-0.439	0.148	0.003
Number of cigarettes smoked/day currently or in the past (> 15)	0.485	0.169	0.004

BMI: Body Mass Index

Variables considered as possible predictors: education level (≤ 8 years of schooling: 0/ > 8 years of schooling: 1); marital status (without partner: 1/partner: 0); skin color (white: 1/other: 0); number of individuals residing in the home (≤ 2 : 0/ > 2 : 1); smoking (never smoked: 0/current or past smoker: 1); number of cigarettes/day currently or in the past (≤ 5 : 0/ > 5 : 1); alcohol consumption (yes: 1/no: 0); frequency of alcohol consumption (none or less than once a month: 0/other: 1); woman has private medical insurance (yes: 1/no: 0); weekly practice of physical exercise (yes: 1/no: 0); frequency of weekly physical exercise (≤ 2 days: 0/ ≥ 3 days: 1); BMI at 20 to 30 years of age (kg/m²); self-perception of health (very good, good: 1/other: 0); menopause (yes: 1/no: 0).

Discussion

The objective of this study was to evaluate the factors associated with the occurrence rate of systemic arterial hypertension in women of 50 years of age or more in a city in southeastern Brazil. In this sample, 55.9% of the women reported hypertension. This prevalence is in agreement with the findings of a nationwide study conducted in Brazil showing that 56.5% of women of 55 to 64 years of age report having hypertension¹⁶.

No association was found between menopausal status and the cumulative occurrence rate of hypertension in this study, a result that differs from the findings of a population-based study conducted with younger women of 40 to 65 years old who had a higher education level. That study showed that being postmenopausal increased the likelihood of having hypertension by a factor of 2.6¹⁷. Other studies have also shown an association between

menopause and an increased risk of both cardiovascular disease and high blood pressure compared to the premenopausal period^{7,18}. Nevertheless, the role of estrogens in the pathogenesis of hypertension in menopausal women has yet to be fully established. In fact, hypertension may develop in postmenopausal women through different mechanisms that may include inflammation¹⁹. Studies in female rats have shown that the alterations in cardiovascular hemodynamics and impairment of the autonomic parameters that lead to hypertension appear to be a consequence of the aging process rather than ovarian hormone deprivation²⁰.

The median age at onset of hypertension in the women in this sample was 64.3 years. Aging, irrespective of hormone status, is a major risk factor for cardiovascular morbidity in healthy women. In young women, parasympathetic tone predominates. The transition from parasympathetic to sympathetic control may contribute to the age-related increase in cardiovascular morbidity²¹.

Higher BMI at 20–30 years of age was directly proportional to the cumulative occurrence rate of SAH over time in the present study. Another population-based study showed that in white women, being overweight prior to 29 years of age was associated with obesity-related diseases such as hypertension, reducing the survival of these women in average by 5.2 years²². Recent theories suggest that obesity is associated with a chronic inflammatory response characterized by abnormal adipokine production and the activation of proinflammatory signaling pathways, resulting in the induction of several biological markers of inflammation²³, which may explain the physiopathology of the development of obesity-related morbidities. Various studies have shown that obesity increases the risk of acquiring cardiovascular diseases, particularly hypertension^{3,23,24}. The Coronary Artery Risk Development in Young Adults (CARDIA) study recruited healthy individuals of 18–30 years old who were not obese and followed them up for 25 years, evaluating for heart disease and associated risk factors every 2–5 years. The results showed that for each additional year of obesity, the risk of developing subclinical heart disease increased by 2–4% regardless of the absolute level of generalized or abdominal obesity²⁵.

Factors that have been well established in the literature as being associated with SAH, such as skin color and smoking, were also identified in the present study. Being white was associated with a lower cumulative occurrence rate of SAH over time. Studies have shown that black women run a greater risk of developing arterial hypertension^{26–28}. A common gene that determines both skin color and blood pressure is a possible explanation for the higher rates of hypertension in blacks; however, the genetic mechanisms controlling melanin biosynthesis are complex and poorly understood²⁹. Smoking more than

15 cigarettes/day was associated with a higher cumulative occurrence rate of SAH over time. A prospective paper from the Women's Health Study with more than 28,000 women, conducted to evaluate the association between hypertension and smoking, found that this habit increases the risk of developing hypertension, principally in smokers of more than 15 cigarettes/day³⁰. Smoking may lead to arterial stiffening, affecting the onset of hypertension³¹.

Some limitations of the present study must be taken into account. First, this was a cross-sectional study; therefore, the causal pathways underlying the reported relationships cannot be inferred. Secondly, the presence of hypertension was based on self-reports and was not confirmed by clinical diagnosis, although previous data indicate that the reliability of self-reported hypertension is high³². Thirdly, the actual prevalence of the disease, including non-diagnosed cases, is clearly under-reported. On the other hand, the population-based nature of this study represents an important feature. The representativeness of the population sample allows these conclusions to be extrapolated to the entire population of women of 50 years of age or more in a Brazilian city. Furthermore, no similar studies have been conducted

with the Brazilian population to evaluate factors associated with the occurrence rate of hypertension in women of 50 years old or more. Therefore, it is important to evaluate the factors associated with the age at which hypertension develops to permit preventive measures to be proposed to reduce the incidence of hypertension or increase disease-free survival.

Menopause was not associated with the onset of hypertension. The results of the present study highlight the importance of weight control in young adulthood, and of avoiding smoking in preventing hypertension in women of 50 years of age or more. Measures to control weight earlier in life and to encourage individuals to stop smoking, implemented in conjunction with programs aimed at raising public awareness to the dangers of smoking and providing support for those wishing to stop, may increase the age at which hypertension develops, thus delaying onset of the disease.

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