

Prevalence of Angina Pectoris in Pelotas (south of Brazil)

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Abstract

Background: Ischemic heart disease is the leading cause of death in the world and angina is its cardinal manifestation.

Objective: To determine the prevalence of angina and possible angina and its distribution by main demographic and socioeconomic characteristics among adults 40 years of age or older.

Methods: This is a population-based, cross-sectional study featuring residents of the urban area in Pelotas, a city located in the south of Brazil, from October through December 2007. A two-stage cluster sampling - census tracts and households - was used. The prevalence of angina and possible angina was defined according to the Rose questionnaire. These conditions were assessed by demographic and socioeconomic characteristics: age, sex, skin color, economic status, and schooling. Data were collected using standardized questionnaires in interviews with the individuals in their homes. The non-respondent rate was 6.8%.

Results: The prevalence of angina among the 1680 individuals taking part in the study was 8.2% (95% CI: 6.7 - 9.6), while that of possible angina came to 12.3% (95% CI: 10.6 - 14.0). The prevalence of angina and possible angina was higher among women, black/brown-skinned individuals, low economic class individuals and subjects with the low schooling. The prevalence of angina was higher among older individuals, while possible angina was found not to be associated with age.

Conclusion: The prevalence of angina and possible angina was found to be high, affecting approximately 20% of the population in Pelotas. (Arq Bras Cardiol 2010; 95(2): 179-185)

Key words: Angina; prevalence; population; cross-sectional studies.

Introduction

Ischemic heart disease is the main cause of death throughout the world, responsible for more than seven million deaths per year¹. Angina pectoris is its main manifestation, accounting for nearly half of the initial cases². The anginal symptom is caused by myocardial ischemia and is characterized by chest pain or discomfort. It is frequently set off by physical exertion and is relieved by rest. Obstruction of the coronary arteries by atherosclerotic plaque - a systemic inflammatory disease - is its main cause, although other conditions, such as hypertension, hypertrophic cardiomyopathy, and aortic valve disease may also be involved. Angina can also occur in individuals with normal coronary arteries in the presence of arterial spasm or endothelial dysfunction. Finally, similar manifestations may be observed in diseases of the esophagus, lungs or chest wall³.

The diagnosis of angina is essentially based on the patient's medical history; this fact makes the detection of the disease

difficult, especially on a populational level. Aiming at using it in epidemiologic surveys, Geoffrey Rose proposed a standardized questionnaire to evaluate angina in 1962⁴. It is still being widely used as observed in a recent systematic review which identified 74 studies conducted in 31 countries⁵.

This questionnaire, which uses the presence of specific characteristics of the anginal symptom, proved capable of predicting cardiovascular mortality⁶. Its accuracy has been compared to clinical diagnosis, ECG findings, myocardial radionuclide scan and coronary angiography, showing specificity from 80 to 95% and sensitivity from 20 to 80%⁷.

Not only because angina is an important indicator of ischemic heart disease, but also because Brazil lacks any updated representative populational studies using the Rose questionnaire, we decided to use this questionnaire to measure the prevalence of angina and possible angina among the adult population in Pelotas city.

Method

A population-based, cross-sectional study was carried out in Pelotas from October to December 2007. This city is located in the south of Brazil and most of its 340,000 inhabitants live in the urban area.

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The target population consisted of individuals 40 years of age or older living in the urban area. All those incapable of walking or of understanding the questions were excluded.

The following parameters were used to calculate the size of the sample: expected prevalence of 10%^{8,9}, precision of 1.6 percentage point, and confidence level of 95%. Besides, 20% was added to offset the design effect, and 10% to account for possible non-respondents, resulting in a total of 1781 individuals. Based on the 2000 Demographic Census, we estimated that we would find 1.2 individuals 40 years of age or older per household in Pelotas. Thus, in order to achieve the desired sample size we would have to visit 1484 households.

A two-stage probability cluster sampling was used to obtain a representative sample of these households. The primary units were the census tract sectors - based on data from the 2000 Demographic Census - while the secondary units were the households. In the first stage, the 404 eligible census tract sectors - excluding four essentially commercial sectors - were classified by the average income of the cluster. Next, 125 out of 404 eligible sectors were chosen by systematic sampling featuring probability of selection proportional to the number of households in those sectors. In the second stage, after the registration of all the occupied dwellings in the chosen sectors, a new systematic sampling was used to select an average of 11 households per sector. In the end, this process resulted in the selection of 1,534 households.

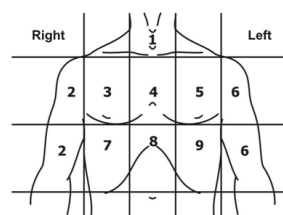
A standardized questionnaire, which had been pre-coded and previously tested in a pilot study, was used. Apart from the questions necessary for defining the outcome, collected data also included characteristics such as round age, sex, observed skin color - classified as white or black/brown - and socioeconomic characteristics such as schooling, measured in successfully completed grades, and economic status based on the *Associação Brasileira de Empresas de Pesquisa (ABEP)*¹⁰, a Brazilian association of companies for research. The economic status classification is mainly based on the accumulation of home appliances and on the schooling level of the head of the family; it is divided into five different categories (or classes): A, B, C, D, and E, where A represents the highest level.

The presence of angina was assessed using the Rose questionnaire (see Box 1) and expressed in terms of cumulative prevalence, i.e., at any time in the past¹¹. Individuals classified as having angina were those who had a history of chest pain (answer "yes" to question 1), set off by physical exertion (answer "yes" to questions 2 or 3), forcing them to stop or slow down (question 4), with subsequent relief ("yes" to question 5), within 10 minutes (question 6), and located in the sternum or the left anterior chest and left arm (quadrants 4, 8, or 5 and 6 in question 7).

In addition, the prevalence of possible angina was also assessed according to the Rose questionnaire. Its presence was characterized when respondents claimed chest pain on exertion (affirmative answer to question 1 and questions 2 or 3), but failed to fulfill the remaining criteria for definite angina (questions 4-7).

The questionnaire was applied by previously trained interviewers in direct contact with the respondents in their homes. Besides the revision of the questionnaires and double

- 1) Have you ever had any pain or discomfort in your chest?
- 2) Do you get it when you walk uphill or hurry?
- 3) Do you get it when you walk at an ordinary pace on the level?
- 4) What do you do if you get it while you are walking?
Stop or slow down; or carry on?
- 5) If you stand still, what happens to it?
Relieved or not?
- 6) How soon is it relieved?
More than 10 minutes; or less than 10 minutes?
- 7) Please look at the figure below and show where the pain or discomfort is located.



Box 1 - Rose Questionnaire.

data digitization - with automatic verification of amplitude and consistency - field work quality control included interview verification. The study supervisor verified interviews by revisiting 10% of the respondents. The agreement test (Kappa) result for the information under evaluation was higher than 0.8.

The following strategies were used to reduce the non-respondent rate: publicity in the local press, delivery of printed communication to the selected households; and at least three visits to individuals who were absent on the first try or who refused to take part in the study. Visits were paid at different times on different days, and at least one of them was paid by the study supervisor himself.

Epi Info¹² software was used for data entry and Strata 9.0¹³ for statistical analysis, taking into account the sample design (sampling by clusters) to correct the variability of the estimates. The intraclass correlation coefficients were 0.01 for angina and 0.02 for possible angina, resulting in design effects of 1.14 and 1.16, respectively, for these conditions.

The study was approved by the Research Ethics Committee at the Universidade Federal de Pelotas. All participants signed an informed consent prior to application of the questionnaire.

Results

Among the 1,534 selected households, we found 1,836 individuals 40 years of age or older. Of those, 34 were excluded - 30 who were unable to understand the questionnaire, and four who were unable to walk. We were unable to obtain information on 122 out of 1,802 eligible individuals, which represents a 6.8% non-respondent rate. Of those, 60% were between 40 and 59 years of age, 45% were females, and half resided in the areas of higher average income as defined by the 2000 Demographic Census. The final sample of this study totaled 1,680 individuals.

Table 1 shows the demographic and socioeconomic characteristics of the sample under study. The median age was 56 years old. Women made up 58% of the sample, and 81% of the study subjects were white. In regard to the economic condition, approximately 40% were in the highest economic classes (A and B), and approximately 20%, in the lowest one (D and E). As to schooling, approximately a third had completed up to four grades of schooling, and another third, nine grades or more. Average schooling for the sample as a whole amounted to eight successfully completed grades.

Table 2 shows the prevalence of angina and possible angina according to certain demographic and socioeconomic characteristics of the population under study. The cumulative prevalence of angina for the sample was 8.2% (95% CI: 6.7 - 9.6). Prevalence increased with advancing age. For example, the prevalence of angina among individuals from 40 to 49 years of age was 7.1%, while the prevalence for those 70 years of age or older was 12%. Women had higher rates than men (9.8% vs 5.9%) regardless of the age group, and that difference was more pronounced in the extreme age groups: 40 to 49, and 70 or older (Figure 1). Black/brown-skinned individuals had higher rates of angina than those with white skin (10.9% vs 7.5%), and that difference was nearly twice as high among the men (Figure 2).

Table 1 - Description of the sample according to demographic and socioeconomic characteristics. Pelotas, 2007

Characteristics	n (1,680)	%
Age (years)		
40 - 49	591	35.2
50 - 59	516	30.7
60 - 69	314	18.7
≥ 70 or more	259	15.4
Sex		
Male	699	41.6
Female	981	58.4
Observed skin color		
White	1,369	81.5
Black/brown	311	18.5
Economic level (ABEP) (n=1,659)		
Class A (highest level)	99	6.0
Class B	541	32.6
Class C	722	43.5
Class D	271	16.3
Class E (lowest level)	26	1.6
Schooling (grades)		
0 - 4	552	32.9
5 - 8	568	33.8
9 - 11	282	16.8
12 or more	278	16.5

ABEP - Associação Brasileira de Empresas de Pesquisa.

Table 2 shows a substantially higher incidence of angina among the lowest economic classes (D and E), classified according to ABEP. The prevalence of angina in these two categories was double that of class A (10.8% vs 5.1%). The prevalence of angina was also higher among individuals with less schooling. Prevalence for those who had successfully completed up to four grades was 10.3%, compared with 5.2% for those who had finished nine grades or more.

The cumulative prevalence of possible angina was 12.3% (95% CI: 10.6 - 14.0) with no significant difference among the age groups. Women were more affected than men (14.6% vs 9.2%), as were black/brown-skinned individuals, compared to white-skinned ones (14.5% vs 11.8%), but without statistical significance. Possible angina was also more prevalent among individuals in economic classes D and E than in class A (18.9% vs 5.1%). Finally, whereas only 6.3% of the individuals who had finished nine grades or more at school had possible angina, 17.9% of those who had not finished more than four grades had possible angina.

Discussion

The prevalence of angina and possible angina was 8% and 12%, respectively. In both conditions, the highest rates were found among individuals of the female sex, with black/brown skin color, the poorest economic condition, and the least schooling. Among the older individuals, only the prevalence of angina was higher.

When interpreting these findings, at least two limitations that may have affected the estimates must be taken into consideration: 1) the recall time was unlimited, so, some episodes may have been forgotten; it would result in reduction of the prevalence, and 2) the lack of accuracy assessment (sensitivity and specificity) of the Rose questionnaire for the population under study could change prevalence in either direction, depending on those properties.

In addition, caution must be taken regarding the inference of the accuracy of this tool when used on other populations, since local populational characteristics can influence the assessment. In this regard, a study compared the accuracy of this tool in two different communities, obtaining a difference of 16 percentage points in sensitivity among men (37% vs 21%) and women (24% vs 8%) when compared to self-reported medical diagnosis. A similar situation was found when comparing ischemic changes on resting ECG, with a difference of 18 percentage points among men (36% vs 18%) and 27 percentage points among women (33% vs 6%)¹⁴. The author justifies these findings stating that chest pain may be experienced, interpreted, and described according to local cultural aspects, or socioeconomic and educational factors that may lead them to be perceived differently¹⁴.

However, there are aspects that reinforce the importance of the findings presented herein, such as the use of a representative sample in Pelotas - which reduces the possibility of selection bias - and the low non-respondent rate observed in this study.

The prevalence of angina in this study was higher than the 5.1% found in a major populational survey in the United

Table 2 - Prevalence of angina and possible angina according to demographic and socioeconomic characteristics among individuals 40 years of age or older, Pelotas, 2007

Characteristics	Angina			Possible angina		
	Prevalence	95% CI	P-value	Prevalence	95% CI	P-value
General (n=1680)	8.2%	6.7 – 9.6	–	12.3%	10.6 – 14.0	–
Age (years)			0.04*			0.9*
40 – 49	7.1%	4.9 – 9.3		12.2%	9.5 – 14.8	
50 – 59	6.8%	4.4 – 9.2		12.2%	9.6 – 14.8	
60 – 69	9.2%	5.7 – 12.8		13.4%	8.9 – 17.9	
≥ 70	12.0%	7.5 – 16.4		11.6%	8.1 – 15.1	
Sex			0.01†			0.001†
Male	5.9%	4.1 – 7.6		9.2%	7.1 – 11.2	
Female	9.8%	7.9 – 11.7		14.6%	12.2 – 16.9	
Skin color						
White	7.5%	6.1 – 9.0	0.03†	11.8%	9.9 – 13.7	0.19†
Black/brown	10.9%	7.6 – 14.3		14.5%	10.7 – 18.2	
Economic level (ABEP)			0.01*			0.001*
Class A	5.1%	1.0 – 9.3		5.1%	1.2 – 8.9	
Class B	7.2%	4.8 – 9.7		7.4%	5.2 – 9.6	
Class C	8.2%	6.4 – 10.0		14.1%	11.8 – 16.4	
Class D/E	10.8%	7.3 – 14.3		18.9%	14.3 – 23.4	
Schooling (grades)						
0 – 4	10.3%	8.0 – 12.6	0.001*	17.9%	14.4 – 21.4	0.001*
5 – 8	9.0%	6.5 – 11.5		12.9%	9.8 – 15.9	
9 or more	5.2%	3.1 – 7.2		6.3%	4.3 – 8.2	

* Chi-square test for linear trend. † Chi-square test for heterogeneity. ABEP - Associação Brasileira de Empresas de Pesquisa.

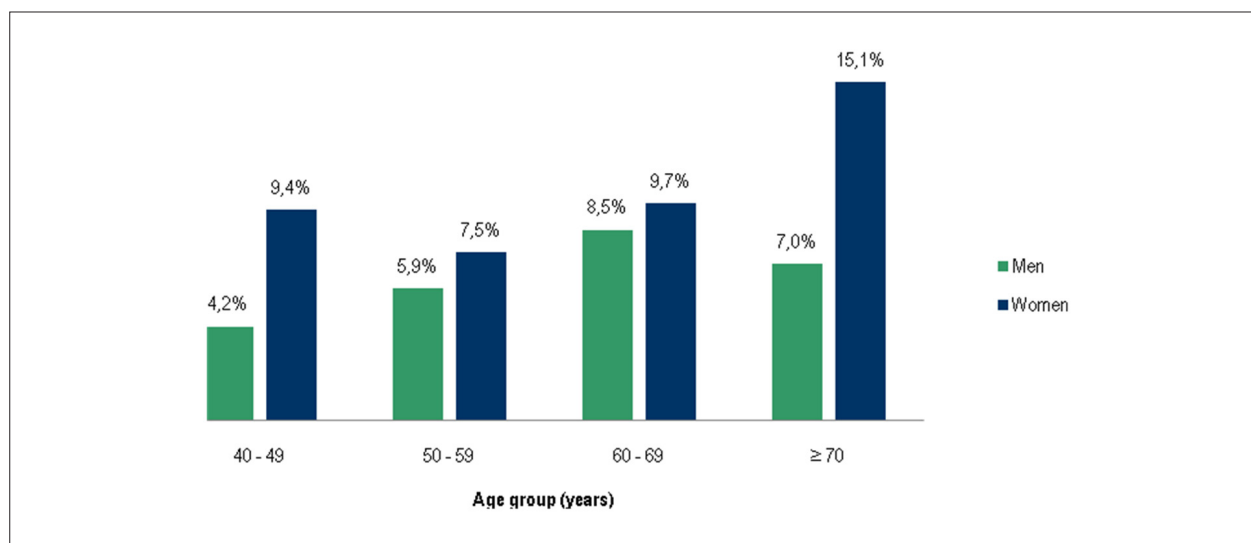


Figure 1 - Prevalence of angina among men and women according to age groups. Pelotas, 2007.

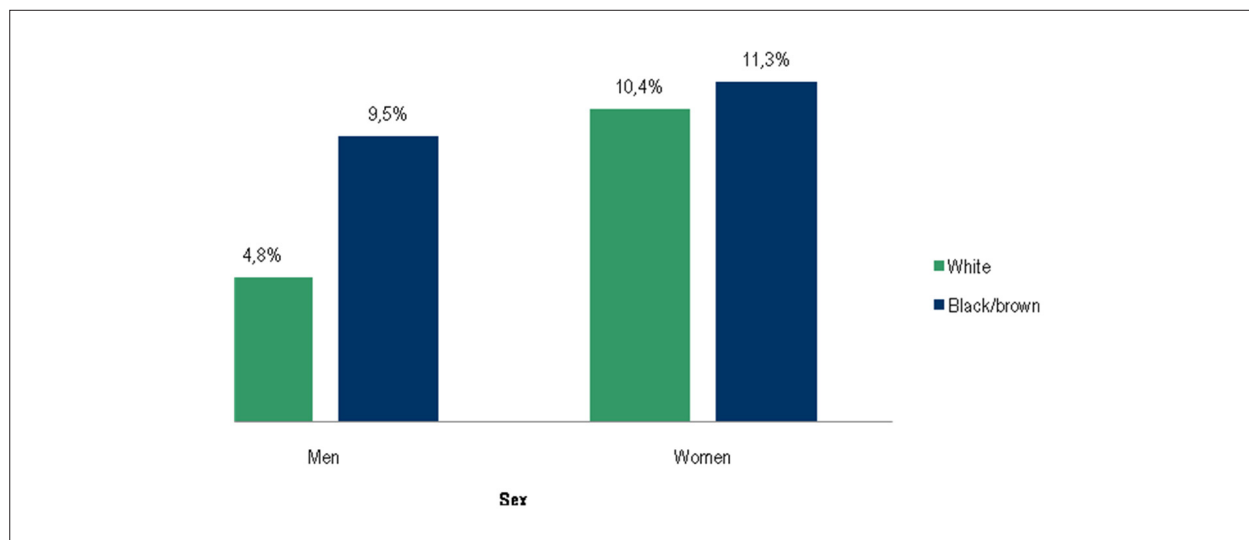


Figure 2 - Prevalence of angina among white-skinned and black/brown-skinned individuals according to sex. Pelotas, 2007.

States¹⁵. Another study conducted in that country found a rate of 5.8% for the same age groups¹⁶. However, no Latin American studies that had used the Rose questionnaire for angina at the populational level were found. Such studies could have been used to compare countries featuring similar customs and levels of development. The importance of the prevalence of angina is due to the fact that individuals with this condition have higher risk of heart attack and death².

The high incidence of angina at advancing age, in both sexes, was also observed in a populational survey in the United States¹⁵ and in studies in other countries such as Italy¹⁷ and Spain¹⁸. This is mainly due to the accumulation of atherosclerotic disease, reflecting cumulative exposure to risk factors¹⁹.

Similar to our findings, a recent meta-analysis showed higher prevalence of angina among women, with a prevalence ratio of 1.2⁵. The rates were high in all age groups under study, as was observed in a North American study²⁰. This fact can be explained by the difference in the manifestation of coronary heart disease between both sexes: myocardial infarction and sudden death are more frequent among males, while angina is more common among females²¹. In regard to the higher difference in the prevalence of angina found in the extreme age groups, women, above all young women, may have more chest pain unrelated to coronary heart disease²⁰. In addition, among older individuals, that difference may also stem from the higher mortality rate among men with angina, thus diminishing its prevalence²².

The higher prevalence of angina among male individuals with black/brown skin color is consistent with a North American study that showed higher prevalence among individuals of African descent as compared to those of white skin color (6.2% vs 3.9%). Such difference was not observed among women²⁰. However, another study conducted in the same country showed higher prevalence among women with black skin, but not among men¹⁶.

The economic levels - characterized in this study by ABEP economic classes - and levels of schooling proved to be associated with the prevalence of angina. These findings are in accordance with Brazilian studies that showed association between the worst indicators of socioeconomic level and higher rates of death due to ischemic heart disease^{23,24}. Such pattern was even found in countries featuring less social inequity than Brazil. A Canadian study showed that educational level and occupations are associated with angina regardless of the classical risk factors for coronary heart disease²⁵. Another study, carried out in the United States, showed that individuals with less schooling have higher prevalence of angina, regardless of sex or race²⁰. An unhealthy diet, smoking, and lack of physical activity, associated with less access to good quality health care and less attention to doctors' recommendations, at a proximal level, constitute explanations for such association²⁶.

The prevalence of possible angina found in this study (12%) was higher than that found in Spain (6.7%)¹⁸. This finding is relevant in view of the proven association between possible angina and future myocardial infarction and cardiac death^{27,28}. In a North American study, the risk of death due to ischemic heart disease among individuals with possible angina was 2.4 among males, and 2.7 among females⁶, regardless of the classical risk factors associated with ischemic heart disease.

In view of the fact that, in this study, the prevalence of angina and possible angina are mutually exclusive, either one or other condition affects one out of five individuals in Pelotas. Taking into account that a poor diet, smoking, and a sedentary lifestyle are the main modifiable risk factors associated with ischemic heart disease²⁹, efforts should be made to attempt to reduce these factors. Such efforts would undoubtedly lead to a reduction in the prevalence of angina and, consequently, in deaths caused by ischemic heart disease in the city under study. In turn, it would also reduce the economic impact since

this disease constitutes a significant burden on family budgets and on the Brazilian public health system³⁰.

Potential Conflict of Interests

No potential conflict of interest relevant to this article was reported.

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Study Association

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References

- Mackay J, Mensah GA. The Atlas of Heart Disease and Stroke: World Health Organization; 2004.
- Kannel WB, Feinleib M. Natural history of angina pectoris in the Framingham study: prognosis and survival. *Am J Cardiol*. 1972; 29 (2): 154-63.
- Gibbons RJ, Abrams J, Chatterjee K, Daley J, Deedwania PC, Douglas JS, et al. ACC/AHA 2002 guideline update for the management of patients with chronic stable angina - summary article: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines (Committee on the Management of Patients With Chronic Stable Angina). *J Am Coll Cardiol*. 2003; 41 (1): 159-68.
- Rose GA. The diagnosis of ischaemic heart pain and intermittent claudication in field surveys. *Bull World Health Organ*. 1962; 27: 645-58.
- Hemingway H, Langenberg C, Damant J, Frost C, Pyorala K, Barret-Connor E. Prevalence of angina in women versus men: a systematic review and meta-analysis of international variations across 31 countries. *Circulation*. 2008; 117 (12): 1526-36.
- LaCroix AZ, Guralnik JM, Curb JD, Wallace RB, Ostfeld AM, Hennekens CH. Chest pain and coronary heart disease mortality among older men and women in three communities. *Circulation*. 1990; 81 (2): 437-46.
- Fox K, Garcia MA, Ardissino D, Buszman P, Camici P, Crea F, et al. Guidelines on the management of stable angina pectoris: the Task Force on the Management of Stable Angina Pectoris of the European Society of Cardiology. *Eur Heart J*. 2006; 27 (11): 1341-81.
- Câncer INd. Inquérito Domiciliar sobre Comportamentos de Risco e Morbidade Referida de Doenças e Agravos Não-transmissíveis. Brasília: Ministério da Saúde; 2003.
- Theme-Filha MM, Szwarcwald CL, Souza-Júnior PRBd. Socio-demographic characteristics, treatment coverage, and self-rated health of individuals who reported six chronic diseases in Brazil, 2003. *Cadernos de Saúde Pública*. 2005; 21: S43-S53.
- Associação Brasileira de Empresas de Pesquisa. Critério de Classificação Econômica Brasil. São Paulo; 2008.
- Szklo M, Javier Nieto F. *Epidemiology: beyond the basics*. 2nd ed. Boston: Jones and Bartlett Publishers; 2007.
- Dean AG, Dean JA. *Epi Info, Version 6: A Word Processing, Database, and Statistics Program for Epidemiology on Microcomputers*. Atlanta: Centers of Disease Control and Prevention; 1994.
- StataCorp Stata Statistical Software: Release 9.0. Lakeway Drive, College Station TX: Stata Corporation; 2003.
- Fischbacher CM, Bhopal R, Unwin N, White M, Alberti KG. The performance of the Rose angina questionnaire in South Asian and European origin populations: a comparative study in Newcastle, UK. *Int J Epidemiol*. 2001; 30 (5): 1009-16.
- Ford ES, Giles WH. Changes in prevalence of nonfatal coronary heart disease in the United States from 1971-1994. *Ethn Dis*. 2003; 13 (1): 85-93.
- Ford ES, Giles WH, Croft JB. Prevalence of nonfatal coronary heart disease among American adults. *Am Heart J*. 2000; 139 (3): 371-7.
- Krogh V, Trevisan M, Panico S, Farinero E, Mancini M, Menotti A, et al. Prevalence and correlates of angina pectoris in the Italian nine communities study. Research Group ATS-RF2 of the Italian National Research Council. *Epidemiology*. 1991; 2 (1): 26-32.
- Cosin J, Asin E, Marrugat J, Elosua R, Arós F, de los Reyes M, et al. Prevalence of angina pectoris in Spain. PANES Study group. *Eur J Epidemiol*. 1999; 15 (4): 323-30.
- Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation*. 2002; 106 (25): 3143-421.
- LaCroix AZ, Haynes SC, Savage DD, Havlik RJ. Rose questionnaire angina among United States black, white, and mexican-american women and men prevalence and correlates from the second national and hispanic health and nutrition examination surveys. *Am J Epidemiol*. 1989; 129 (4): 669-86.
- Lerner DJ, Kannel WB. Patterns of coronary heart disease morbidity and mortality in the sexes: a 26-year follow-up of the Framingham population. *Am Heart J*. 1986; 111 (2): 383-90.
- Orencia A, Bailey K, Yawn BP, Kottke TE. Effect of gender on long-term outcome of angina pectoris and myocardial infarction/sudden unexpected death. *Jama*. 1993; 269: 2392-7.
- Bassanesi SL, Azambuja MI, Achutti A. Mortalidade precoce por doenças cardiovasculares e desigualdades sociais em Porto Alegre: da evidência à ação. *Arq Bras Cardiol*. 2008; 90 (6): 403-12.
- Ishitani LH, Franco GdC, Perpétuo IHO, França E. Desigualdade social e mortalidade precoce por doenças cardiovasculares no Brasil. *Rev Saúde Pública*. 2006; 40 (4): 684-91.
- Feldman L, McMullan C, Abernathy T. Angina and socio-economic status in Ontario: how do characteristics of the county you live in influence your chance of developing heart disease? *Can J Public Health*. 2004; 95 (3): 228-32.
- Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. *Circulation*. 1993; 88 (4 Pt 1): 1973-98.
- Cook DG, Shaper AG, Macfarlane PW. Using the WHO (Rose) angina questionnaire in cardiovascular epidemiology. *Int J Epidemiol*. 1989; 18 (3): 607-13.
- Lampe FC, Whincup PH, Wannamethee SG, Ebrahim S, Walker M, Shaper AG. Chest pain on questionnaire and prediction of major ischaemic heart disease events in men. *Eur Heart J*. 1998; 19 (1): 63-73.
- Kromhout D, Menotti A, Kesteloot H, Sans S. Prevention of coronary heart disease by diet and lifestyle: evidence from prospective cross-cultural, cohort, and intervention studies. *Circulation*. 2002; 105 (7): 893-8.
- Azambuja MIR, Foppa M, Maranhão MFdC, Achutti AC. Impacto econômico dos casos de doença cardiovascular grave no Brasil: uma estimativa baseada em dados secundários. *Arq Bras Cardiol*. 2008; 91 (3): 163-71.