8-1-2005

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Edevar Daniel

Helio Germiniani

Eleusis Ronconi Nazareno

Simone Viana Braga

Anderson M. Winkler
The University of Texas Rio Grande Valley, Anderson.Winkler@utrgv.edu

See next page for additional authors

Recommended Citation

Daniel, E., Germiniani, H., Nazareno, E. R. D., Braga, S. V., Winkler, A. M., & Cunha, C. L. (2005). Mortality trend due to ischemic heart diseases in the city of Curitiba-Brazil, from 1980 to 1998. Arquivos brasileiros de cardiologia, 85, 100-104. https://doi.org/10.1590/S0066-782X2005001500005

Original Article

Mortality Trend due to Ischemic Heart Diseases in the City of Curitiba – Brazil, from 1980 to 1998

Edevar Daniel, Helio Germiniani, Eleusis Ronconi de Nazareno, Simone Viana Braga, Anderson Marcelo Winkler, Claudio L. Pereira da Cunha

Universidade Federal do Paraná - Curitiba, PR - Brazil

Objective

To assess mortality trends due to ischemic heart diseases, per sex, and acute myocardial infarction, per sex and age range, from 1980 to 1998, in the city of Curitiba.

Methods

Data of death due to ischemic heart disease and acute myocardial infarction from Sistema de Informação sobre Mortalidade do Ministério da Saúde (Information System on Mortality of Ministry of Health), per sex, age range and domicile location in Curitiba were used. Population data were obtained from Fundação Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics Foundation). Mortality rates were adjusted per age through direct method, by using the population of Curitiba, in 1980, as reference. The analysis of trend was calculated through simple linear regression, with a significance level of 5%.

Results

Mortality rates due to ischemic heart diseases showed a decrease trend among both sexes. In age ranges of acute myocardial infarction, male sex showed a decrease until 79 years of age, among female sex individuals, the decrease was until 59 years of age. They were shown stable after those periods. Among the remaining ischemic diseases, female sex individuals showed a greater decrease than male sex ones.

Conclusion

The study demonstrates a trend of reduction of mortality due to ischemic heart diseases, in both sexes, in the city of Curitiba, from 1980 to 1998. In acute myocardial infarction, such reduction has been happening in a more pronounced way among men, achieving stability, from 60 years of age, among women. The reasons for differentiated reduction trend between sexes are not clear, remaining as na important matter for new investigations.

Key words

trend studies; mortality; ischemic heart diseases; acute myocardial infarction

Mailing address: Edevar Daniel - Rua Padre Camargo, 280 - 7º - 80060-240 - Curitiba, PR - Brazil
E-mail: edevardaniel@uol.com.br
Received for publishing on 05/23/03
Accepted on 02/23/05

Circulatory system diseases constitute the main cause of death in the country. In the city of Curitiba, in 1998, they represented 33.8% from total of deaths, being ischemic heart diseases (IHD) and, especially, acute myocardial infarction (AMI), their greatest component[1].

However, despite the magnitude, in the last 40 years, the trend of such taxes has decreased in countries as the United States, Canada, Australia, Japan, the United Kingdom and others of Western Europe, after a practically stationary period[2].

In Brazil, from the 1970s, some studies have shown the trend decrease of mortality due to ischemic heart disease[3-9]. Souza et al., after analysis of mortality due to ischemic heart diseases in the five Brazilian regions, from 1979 to 1996, concluded that the risk of death due to ischemic heart diseases is decreasing in the South and Southeast regions, but increasing in Central-West, Northeast and North regions[7]. Mansur et al., in the analysis of trend of death risk due to circulatory system diseases in Brazil, from 1979 to 1996, demonstrated that there has been a reduction in mortality due to ischemic heart diseases[8].

For Curitiba, Lolio et al. verified that mortality due to ischemic heart diseases remained stable, in the period from 1979 to 1989, both among men and women[9]. However, the 10-year period, which was assessed, preceded the incorporation of new knowledge on risk factors and intervention, which has been used more and more, such as thrombolytic therapy and primary angioplasty, in addition to new diagnostic and therapeutic advancements that have contributed to a better diagnosis of patients with ischemic heart disease.

Besides those factors, the population of the city of Curitiba has increased in that period. In 1980, the population was 1,024,975 inhabitants; in 1998, 1,550,317, which shows an increase of 51%[10,11]. Its age composition also changed, with an increase of aged individuals.

Concerning mortality, in 1980, IHD represented 12.1% and AMI, 7.9% from the total of deaths, whereas, in 1998, IHD represented 12.8% and AMI, 9.0% from total of deaths. By assessing those data, the need for a study along the time (trend), which took into consideration the adjustment of mortality rate per age (age range) was verified.

Within such perspective, this study aimed at assessing the trend of mortality due to ischemic heart diseases, per sex, and to acute myocardial infarction, per sex and age range, from 1980 to 1998, in the city of Curitiba.

Methods

Data from deaths due to acute myocardial infarction and the remaining ischemic heart diseases were available in the Sistema

de Informação sobre Mortalidade do Ministério da Saúde (Datasus), per sex, age range and domicile location, in Curitiba, classified in 410-414 (CID-9) and I20-I25 (CID-10) groups[12,13]. Population data were obtained from Fundação Instituto Brasileiro de Geografia e Estatística, being sex and age range used as denominators, according to estimates for the period from 1980 to 1998.

Mortality due to acute myocardial infarction was also analyzed per age ranges, between 30 and 80 years old or older, grouped in 10-year intervals, so there would be compatibility with age range classification of deaths shown in DATASUS.

Mortality rates were adjusted per age, through direct method, by suing age range composition in the city of Curitiba, in 1980, as reference.

Rate trend in the study period, per sex and age range, was calculated through simple linear regression and the explainable total variance proportion, through linear method, expressed in R^2 (it may vary from 1 to 0), being that, the closer it is from 1, it shows a strong trend rate and the closer it is from 0, it shows a weak trend rate. In the equations of straight lines ($y=bx+a$), which are going to be shown, "x" had the minimum value of 0, in 1980, and the maximum of 18, in 1998. The "b" value, which multiplies "x" in each equation, is the coefficient of straight line incline: the greater "b" module is, the more inclined the straight line is. Negative values of "b" indicate downward inclination (decrease). Hypothesis test were run with a significance level of 5% ($p<0.05$).

The percentage of yearly variation was calculated from (b/a)x100 rate.

Results

Table I shows mortality coefficients (/100000) per sex, from the total of ischemic heart diseases, which start with 98.4 for male sex individuals, and 62.9, for female sex ones, in 1980, going to 66.1 among male sex individuals, and 43.4, among female sex individuals, in 1998. In acute myocardial infarction, with 70.8 for male sex individuals and 34.4, for female sex individuals, in 1980, and going to 48.3 among male sex patients and 30.3, among female sex ones, in 1998. In remaining ischemic heart diseases, with 27.6 for male sex patients and 28.5 for female sex ones, in 1980, going to 17.7 among male sex individuals and 13.1 among female sex ones, in 1998.

Male/female rate of ischemic heart diseases was kept stable, beginning with 1.6, in 1980, and decreasing to 1.5, in 1998. In acute myocardial infarction, mortality coefficient reduction was more pronounced among male sex individuals, in which male/female rate, which started with 2.1, in 1980, went down to 1.6, in 1998. In remaining ischemic heart diseases, there was a higher decrease trend among women, in which male/female rate, which started with 1.0, in 1980, rose to 1.4, in 1998.

In figure 1, it is verified that ischemic heart diseases showed a significant reduction for both sexes ($p<0.05$). male sex showed a strong decrease trend ($R^2=0.76$), and the female sex, a medium decrease trend ($R^2=0.54$).

In figure 2, in acute myocardial infarction group, which represents the largest number of deaths, there was a reduction among both sexes ($p<0.05$), and the reduction was much more pronounced among male sex individuals ($R^2=0.73$) than among female sex ones, which showed a lower reduction ($R^2=0.29$).

In figure 3, in remaining ischemic heart diseases there was a reduction for both sexes ($p<0.05$). Among female sex individuals, the reduction is medium ($R^2=0.50$), whereas it is lower ($R^2=0.27$) among male sex ones. In specific coefficients of mortality due to acute myocardial infarction, per sex and age range, it was verified that male sex individuals show reduction up to age range from 70 to 79 years old ($p<0.05$) (figs. 4, 5, 6, 7 and 8), keeping stable in the age range over 80 years old ($p>0.05$) (fig. 9). Among female sex individuals, it was verified a reduction up to the age range from 50 to 59 years old ($p<0.05$) (figs. 4, 5 and 6), keeping stable from the age range from 60 to 69 years old to age range of 80 years old and older ($p>0.05$) (figs. 7, 8 and 9).

Linear straight lines show a decrease trend, whose intensity can be assessed through values of beta, R^2, p and yearly%. As an example, the equation of total of IHD, among male sex individuals ($y=-1.7522 +103.29$), says that, from 1980 ($x=0$), for each change unit in x (from 1 to 16), the rate reduced in -1.7522, on average (starting from 103.29), leading to a decrease trend of the straight line, which shows an $R^2=0.76$ (regarded as strong, as it is close to 1). By expressing in percentage, that yearly reduction was -1.7% (1.7522/103.29x100). the same principle is valid for all other straight lines.

Discussion

Results shown allowed for identifying a reduction of mortality coefficients, adjusted per age, in acute myocardial infarction and remaining ischemic diseases, which shows a reduction of ischemic heart diseases, in both sexes, in the city of Curitiba, from 1980 to 1998.

Such reduction in both sexes can be partly explained by a better contribution of medical care, as well as of primary prevention measures for those diseases, as explanatory variables for the observed decrease of their mortality rates. Goldman and Cook detected that 60% from the decrease of mortality due to ischemic heart disease, observed for the United States, between 1968 and 1976, was related to changes in lifestyle, especially smoking reduction, whereas 40% was due to specific medical interventions on those diseases[14,15].

Among the many studies already carried out in Brazil, the accurate participation of factors involved in the determination of mortality decrease due to ischemic heart diseases [3-8] is still unknown. The absence of studies for risk or protection factors or for the incidence of that disease, as well as analytical studies that can test their association between mortality, limit desired explanations for the observed decrease.

However, it may be considered, for the city of Curitiba, that the improvement of medical care quality, with an increase of populational coverage by hypertension and diabetes mellitus control programs from Secretaria Municipal de Saúde (Local Health Secretariat)[16], in educational prevention campaigns, in the introduction of new diagnostic resources, coronary units, angioplasties, thrombolysis and myocardial revascularizations must be contributing for a mortality decrease.

Regarding age ranges in acute myocardial infarction, we verified that there was a reduction trend up to the age range from 70 to 79 years old ($p<0.05$) among male sex individuals, which was kept stable after that period. In female sex patients, we verified

Table I - Mortality coefficient (/100,000) adjusted per age, sex, from the total of ischemic heart diseases, due to acute myocardila infarction, due to remaining ischemic heart diseases, with their respective male/female rates. Column x indicates the values with which years under study were entered in the calculation of simple linear regression

		Total of IHD			AMI			Remaining IHD		
Year	x	Male	Female	M/F	Male	Female	M/F	Male	Female	M/F
1980	0	98.4	62.9	1.6	70.8	34.4	2.1	27.6	28.5	1.0
1981	1	95.7	64.6	1.5	68.0	39.6	1.7	27.7	25.1	1.1
1982	2	90.3	48.1	1.9	76.3	34.8	2.2	14.0	13.3	1.1
1983	3	94.3	60.8	1.6	72.2	38.9	1.9	22.1	21.8	1.0
1984	4	97.0	57.0	1.7	73.9	36.4	2.0	23.1	20.7	1.1
1985	5	89.1	64.7	1.4	68.0	38.4	1.8	21.1	26.3	0.8
1986	6	94.2	59.7	1.6	73.5	42.1	1.7	20.6	17.7	1.2
1987	7	104.7	58.1	1.8	77.4	38.8	2.0	27.4	19.4	1.4
1988	8	87.7	60.1	1.5	62.8	37.6	1.7	24.9	22.5	1.1
1989	9	88.1	60.0	1.5	65.2	40.7	1.6	23.0	19.3	1.2
1990	10	90.3	58.7	1.5	68.7	41.9	1.6	21.7	16.8	1.3
1991	11	83.5	45.9	1.8	65.5	32.0	2.0	18.0	13.9	1.3
1992	12	81.2	50.3	1.6	60.9	34.0	1.8	20.3	16.3	1.2
1993	13	78.4	47.8	1.6	57.8	33.5	1.7	20.6	14.3	1.4
1994	14	78.5	52.0	1.5	60.3	35.2	1.7	18.1	16.8	1.1
1995	15	80.7	53.2	1.5	59.7	34.9	1.7	21.0	18.3	1.1
1996	16	65.6	48.3	1.4	48.3	34.1	1.4	17.3	14.2	1.2
1997	17	65.9	45.2	1.5	47.4	31.2	1.5	18.4	13.9	1.3
1998	18	66.1	43.4	1.5	48.3	30.3	1.6	17.7	13.1	1.4

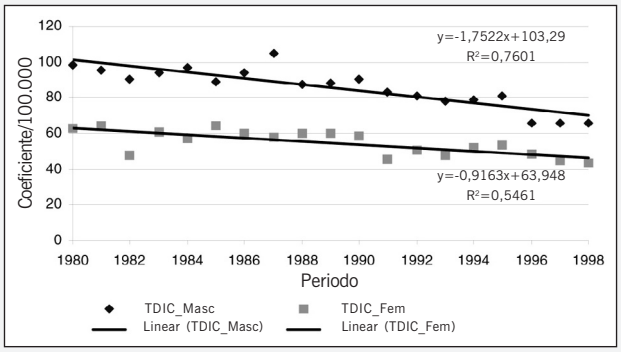

Fig. 1 - Tendência do coeficiente de mortalidade no total das DIC, segundo o sexo. (Masc. p=0,000001 - Fem. p=0,000301).

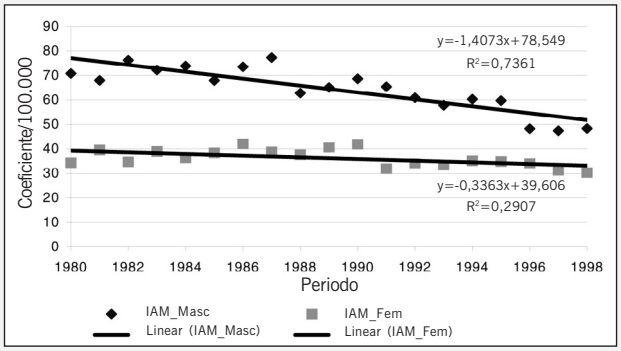

Fig. 2 - Tendência do coeficiente de mortalidade no IAM, segundo o sexo. (Masc. p=0,000003 - Fem. p=0,017200).

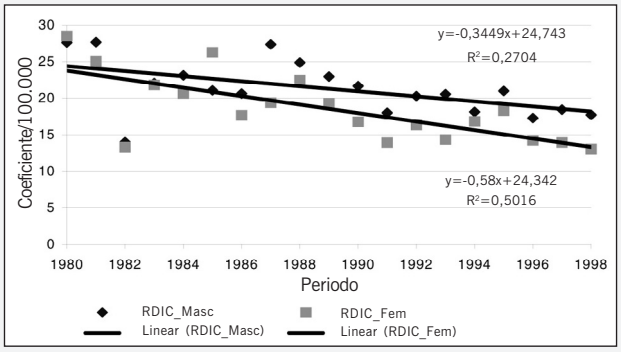

Fig. 3 - Tendência do coeficiente de mortalidade do restante das DIC, segundo o sexo. (Masc. p=0,022469 - Fem. p=0,000690).

a reduction up to the age range from 50 to 59 years old ($p<0.05$). There was no significant reduction after that period ($p>0.05$).

Data show that mortality coefficient decrease trend, attributed to acute myocardial infarction, has been occurring in a more pronounced way among men than women, in the age over 60 years old, did not show reduction, which indicated that mortality among men showed a trend of getting closer to mortality rate among women.

Difference in mortality decrease between sexes and the non-reduction of mortality rate after 60 years of age among women, were a clear confirmation in this work. Some studies, after adjustment for all risk and age variables, have showed that in-hospital lethality due to acute myocardial infarction and stable angina is higher among women than among men[17-20].

Among potential explanations, differences between men and women must be considered in the control of coronary risk factors along the time. Men are traditionally recognized as having higher risk. Late arrival after the beginning of chest pains, undervaluation or denial of symptoms, atypical initial clinical records of acute myocardial infarction in women who seek coronary units could be the other possible explanations for mortality difference between sexes.

Unequal hospital handling could also be responsible for the difference between mortality coefficients. It has been described that women are less aggressive approached than men, from the lowest probability of admission in coronary unit to the reference concerning the use of coronary angiography, even that ischemia probability is equal among men and women[21-23]. It has been suggested that eligibility of thrombolytic therapy among women with acute myocardial infarction is also done in a differentiated manner. In Western Washington Emergency Department, only 16% form women, against 25% from men were eligible for thrombolysis and, among the eligible individuals, only 55% of women (against 78% of men), had effectively received that medication[24].

Another important factor to be analyzed is the presence of a specific biological factor of female sex, maybe with hormonal substrate, which takes place when women enter menopause[25,26]. Recognition of such biological fact will lead to the identification of modifiable factors and adjustment of therapeutic conducts, in a way to reduce mortality, after 60 years of age, among female sex individuals.

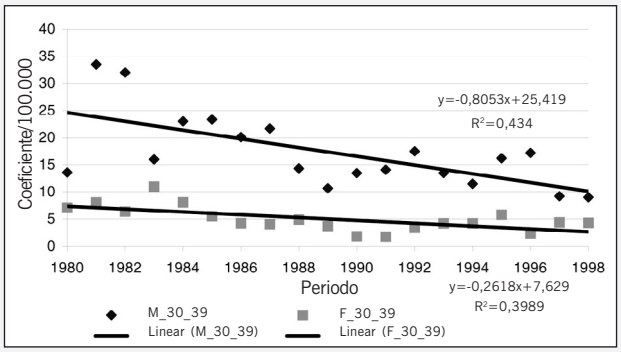

Fig. 4 - Tendência do coeficiente de IAM na faixa etária de 30 a 39 anos, segundo o sexo. (Masc. p=0,002158 - Fem. p=0,003727).

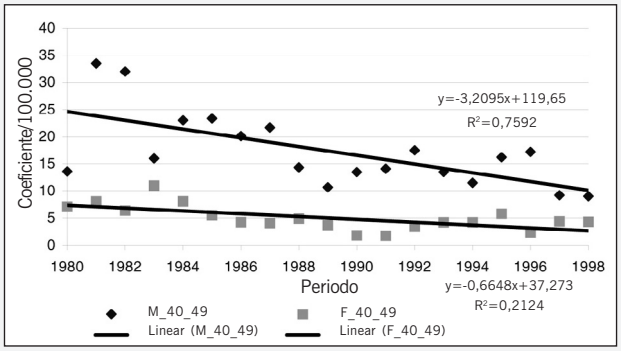

Fig. 5 - Tendência do coeficiente de IAM na faixa etária de 40 a 49 anos, segundo o sexo. (Masc. p=0,000001 - Fem. p=0,047050).

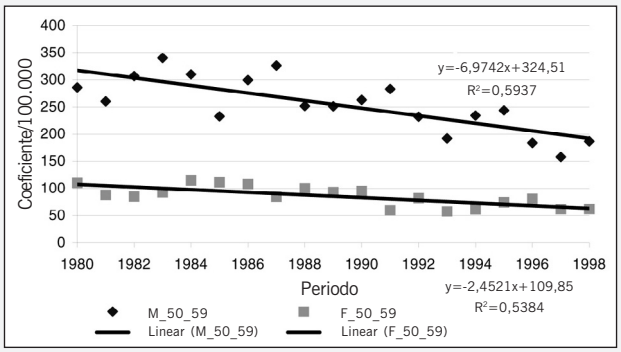

Fig. 6 - Tendência do coeficiente de IAM na faixa etária de 50 a 59 anos, segundo o sexo. (Masc.p=0,000113 - Fem. p=0,000349).

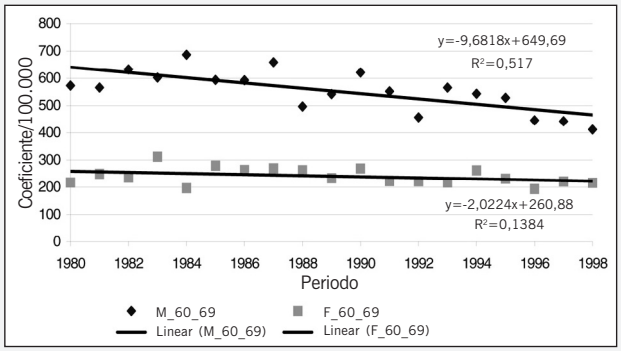

Fig. 7 - Tendência do coeficiente de IAM na faixa etária de 60 a 69 anos, segundo o sexo. (Masc. p=0,000512 - Fem. p=0,116785).

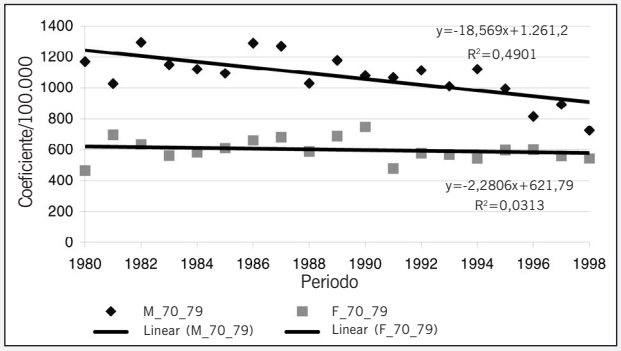

Fig. 8 - Tendência do coeficiente de IAM na faixa etária de 70 a 79 anos, segundo o sexo. (Masc. p=0,000846 - Fem. p=0,469025).

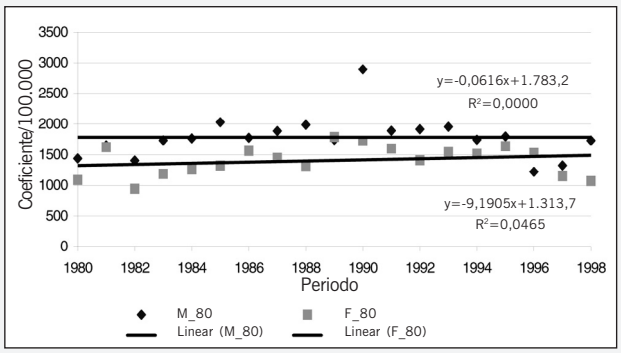

Fig. 9 - Tendência do coeficiente de IAM na faixa etária de maior de 80 anos, segundo o sexo. (Masc. p=0,996802 - Fem. p=0,375520).

Another psychosocial and behavioral factors, body mass index, socioeconomic level, frequency of detection and treatment of associated diseases, psychological stress and the behavior of the patient seeking for medical care, could also be contributing for mortality differences between sexes. The study of those factors, as well as the influence from the type of therapeutic intervention and differences of in-hospital lethality of acute myocardial infarction among men and women, represent important matters to be studied in future investigations.

Limitations of healthcare statistics are always present in any mortality study. The quality of proven information in death validation studies and the progressive decrease of deaths classified in the chapter of badly-defined causes, indicate an improvement in information quality. Even with record improvement, it is recommended that the percentage of badly-defined causes should not exceed 10%. In the city of Curitiba, the mean for that group of causes, within the studied period, was 1.1%, which showed a good information quality of basic death causes, supplying reliable data for that analysis[1].

In conclusion, the study demonstrates a trend of reduction of mortality due to ischemic heart diseases in both sexes, in the city of Curitiba, from 1980 to 1998. In acute myocardial infarction, that reduction has happened more pronouncedly among men, keeping stable from 60 years of age in women. In the remaining ischemic diseases, the decrease is higher among women. The reasons for the differentiated reduction trend between sexes are not clear, remaining as an important matter for new investigations.

Even with the demonstration of decrease in mortality rates of ischemic heart diseases, they remain as the main cause of death, deserving a constant and prioritized attention by healthcare and public service professionals in primary and secondary prevention.

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