Mortality from Acute Myocardial Infarction and Other Ischemic Heart Diseases in the State of São Paulo from 1980 to 1996

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Reports have been published regarding the decline in mortality from ischemic heart diseases (ICD-10th: 410-414; ICD-10th: 129-125) in the municipality of São Paulo from 1950 to 1981 [1], in the State of São Paulo from 1970 to 1989 [2] and in a few other Brazilian capital cities from 1979 to 1989 [3], but no specific information is available regarding mortality from acute myocardial infarction (ICD-10th 410; ICD-10th 121) in the State of São Paulo, or of its participation in total mortality from ischemic heart diseases. The aim of this article is to show the evolution of mortality rates from acute myocardial infarction and the remaining ischemic heart diseases in the State of São Paulo from 1980 to 1996.

Methods

The data on specific mortality due to acute myocardial infarction and to the remaining ischemic heart diseases by usual residence of the deceased were obtained from the Datasus (provided by the System of Information of Mortality of the Health Ministry). The resident population information in census data years was obtained from the *Instituto Brasileiro de Geografia e Estatística* and the estimates for the years in between censuses, was obtained from the SEADE Foundation.

The mortality rates were adjusted by age using the direct method and as a reference the age structure of the total population (both sexes) of the State of São Paulo in 1980.

The trend in rates by sex during the period under study was calculated by simple linear regression, and the proportion of the total variability is explained by the linear model expressed as r^2 (the maximum possible is 1.00). In the straight-line equation (y=a+bx), which will be shown, "x" was given the minimum value of 0 in 1980 and the maximum of 16 in 1996. The value (b), which multiplies "x" in each equation, is the coefficient of inclination of the straight line. The greater the "b" module, the more inclined is the line. Negative "b" values indicate a downward trend (decline). The probability (p) of "b" being statistically equal to zero (or of not having changes in the rates during the period) is supplied.

The percentage of annual variation was calculated from the ratio b/a.

Results

Table I shows mortality rates from acute myocardial infarction and the remaining ischemic heart diseases, by sex adjusted by age. It can be seen that an important reduction occurred during the 17 years under study, better observed in figure 1, where these rates appear individually as symbols. The lines drawn show the trend toward decline, and its intensity can be evaluated by the beta values in the equations presented in table II.

The equation of line 1, for example (y=67.204–0.8100x), indicates that from 1980 (x=0), for each unit of change in x (from 1 to 16) the mortality rate from acute myocardial infarction in men (y) declined 0.8100 of a unit on average (from 67.204). In percentages, this annual reduction was 1.2% (0.8100/67.204x100). The same principle applies to the remaining lines presented in table II.

It is interesting to observe in figure 1 that the rates show cyclical variations, of more and less above and below the lines, justifying the need for a general overview of the trend during the period.

To judge by the values of r^2, the linear model adjusted itself very well to the trend in mortality rates represented by 1,3 and 4 (r^2 in 0.86 to 0.97) and a little less is represented by line 2(r^2 of 0.55).

In the four series, changes (decline) occurred in the rates during the period under study ($p<0.001$), and the differential of reduction in the rates caused the percentage contribution of mortality by acute myocardial infarction to mortality from all the ischemic heart diseases, in women, to come close to that in men during the period under study (fig. 2).

Discussion

The mortality rates (age adjusted) from ischemic heart

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Table I - Mortality rates (/100,000) adjusted by age *, sex, of acute myocardial infarction (AMI), the remaining ischemic heart diseases (IHD), and the total of IHD, with the respective male to female ratio (M:F), State of São Paulo, 1980 - 1996. The "x" column indicates the values with which the years under study entered in the calculation of simple linear regression.

		AMI			Remaining IHD			Total IHD		
Year	X	Male	Female	M:F	Male	Female	M:F	Male	Female	M:F
1980	0	68.8	32.2	2.1	27.1	24.7	1.1	95.9	56.9	1.7
1981	1	66.6	31.8	2.1	26.1	23.5	1.1	92.7	55.3	1.7
1982	2	63.2	29.7	2.1	25.3	22.3	1.1	88.5	52.0	1.7
1983	3	64.7	30.2	2.1	27.0	23.8	1.1	91.7	54.0	1.7
1984	4	63.4	29.4	2.2	26.2	22.3	1.2	89.6	51.7	1.7
1985	5	62.2	29.6	2.1	24.8	21.1	1.2	87.0	50.7	1.7
1986	6	61.2	29.7	2.1	22.9	19.6	1.2	84.1	49.3	1.7
1987	7	61.4	30.8	2.0	22.1	18.6	1.2	83.5	49.4	1.7
1988	8	64.5	31.3	2.1	22.0	17.5	1.3	86.5	48.8	1.8
1989	9	62.1	30.5	2.0	20.5	16.5	1.2	82.6	47.0	1.8
1990	10	60.6	29.5	2.1	20.5	16.8	1.2	82.6	47.0	1.8
1991	11	57.1	29.2	2.0	18.3	14.4	1.3	75.4	43.6	1.7
1992	12	56.2	27.7	2.0	17.5	13.5	1.3	73.7	41.2	1.8
1993	13	55.1	27.5	2.0	18.1	13.4	1.4	73.2	40.9	1.8
1994	14	54.0	27.0	2.0	17.5	12.6	1.4	71.5	39.6	1.8
1995	15	55.7	29.4	1.9	17.3	13.3	1.3	73.0	42.7	1.7
1996	16	55.5	28.2	2.0	17.3	12.1	1.4	72.8	40.3	1.8

*Reference population: the total of State of São Paulo, 1980.

Table II - Models of simple linear regression for mortality rates (100,000) adjusted by age, sex, acute myocardial infarction (AMI), and the remaining ischemic heart disease (IHD), State of São Paulo, 1980 - 1996. "r ^{2}" represents the adjustment of the model (the maximum possible is 1.00). "P" is the probability of no changes having occurred in time, and "%annual" is the mean percentage variation of each year.

Mortality rate (y)	equation line	r^2	p	%annual
AMI, male	y=67.204-0.8100 x	0.86	<0.001	- 1.2
AMI, female	y=31.339-0.2137 x	0.55	= 0.001	- 0.7
Remaining of IHD, male	y=27.520-0.7157 x	0.94	< 0.001	- 2.6
Remaining of IHD, female	y=24.773-0.8466 x	0.97	< 0.001	- 3.4

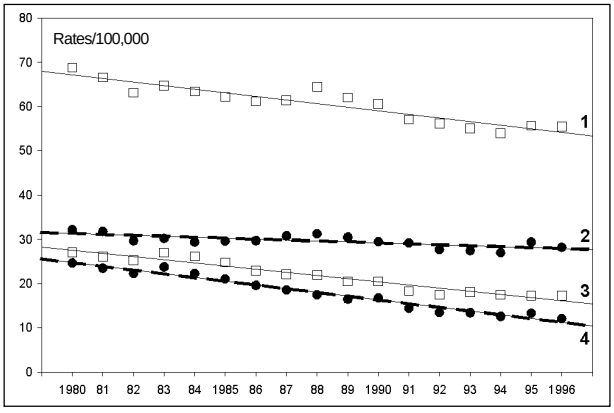

Fig. 1 - Rates adjusted by age* and trends in mortality from acute myocardial infarction (AMI) and remaining ischemic heart diseases (IHD), by sex, State of São Paulo, 1980 - 1996. 1) AMI, men, 2) AMI, women; 3) Remaining of IHD, men, and 4) Remaining of IHD, women.
* Refernce population: the total of State of São Paulo, 1980.

diseases showed a clear decline in the State of São Paulo from 1980 to 1996. The decline was more pronounced in the group "remaining of ischemic heart diseases", in which the male: female ratio showed a trend toward an increase due to a more accentuated fall in women.

In the acute myocardial infarction group, which represents the greater part of mortality from ischemic heart diseases, the reduction was much more remarkable in men than in women, and the male:female ratio, which was 2.2 in 1984, declined to 2.0 during the final years of observation.

As a result of these modifications, the percentage contribution of acute myocardial infarction to mortality from all ischemic heart diseases increased in the period under study in both sexes, but was more pronounced in women. In more recent years, about 76% of mortality from ischemic heart diseases in men was due to acute myocardial infarction (versus about 71% in the initial years of this study) and, in women, these numbers were 57% and 70%, respectively.

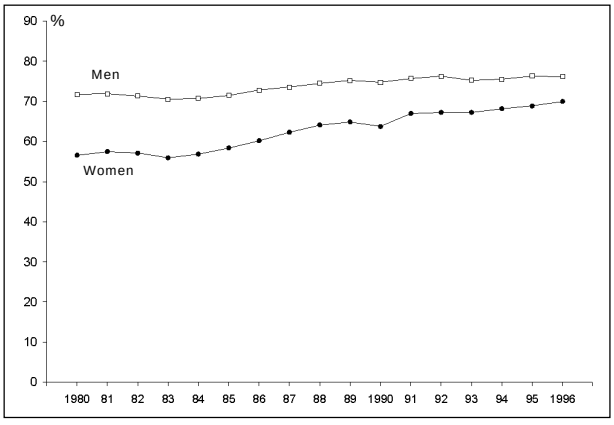

Fig. 2 - Percentage contribution of mortality rate (age adjusted*) from acute myocardial infarction to the mortality rate (age adjusted*) from all ischemic heart diseases, by sex, State of São Paulo, 1980-1996.
*Reference population: the total of the State of São Paulo, 1980

As pointed out in the introduction, studies of population trends in mortality have focused on ischemic heart diseases as a whole, or a larger group within the circulatory diseases, in Brazil [1-3] as well as internationally [4-6]. As far as the total of ischemic heart diseases is concerned, the trends observed in the State of São Paulo are similar to those in the United States of America from 1980 to 1988 and from 1990 to 1994 [6].

The comparison of these results with those in the other units of the Federation will depend on the percentage of mortality by symptoms, signs, and misdiagnosed afflictions that, in the State of São Paulo, remained around 6% in the period under study and that, in Brazil as a whole, reached 15% of the registered mortality in 1996 [7].

We conclude that in the State of São Paulo, from 1980 to 1996, occurred a decline in mortality rates from acute myocardial infarction and the remaining ischemic heart diseases, in both sexes. Acute myocardial infarction was the main cause of death from all types of ischemic heart disease and occurred primarily in men.

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