Objective - To analyze the trends in mortality due to circulatory diseases in men and women aged ≥30 years in Brazil from 1979 to 1996.

Methods - We analyzed population count data obtained from the IBGE Foundation and mortality data obtained from the System of Information on Mortality of the DATASUS of the Ministry of Health.

Results - Circulatory diseases, ischemic heart disease, and cerebrovascular disease were the major causes of death in men and women in Brazil. The standardized age coefficient for circulatory disease in men aged ≥30 years ranged from 620 to 506 deaths/100,000 inhabitants and in women from 483 to 383 deaths/100,000 inhabitants for the years 1979 and 1996, respectively. In men, the mean coefficient for the period was 586.25 deaths with a significant trend towards a decrease (P<0.001) and a decline of 8.25 deaths/year. In women, the mean coefficient for the period was 439.58 deaths, a significant trend towards a decrease (P<0.001) and a rate of decline of 7.53 deaths/year. The same significant trend towards a decrease in death (P<0.001) was observed for ischemic heart disease and cerebrovascular disease. Risk of death from these causes was always higher for men of any age group (P<0.001). Cerebrovascular disease was the primary cause of death in women.

Conclusion – Although circulatory diseases have been the major cause of mortality in men and women in the Brazilian population, with a greater participation by cerebrovascular diseases, a trend towards a decrease in the risk of death from these causes is being observed.

Key-words: circulatory disease, ischemic heart disease, cerebrovascular disease, mortality, trends
1979 to 1996 were calculated by interpolation according to Largrane \textsuperscript{11} and were based on census data for 1970 \textsuperscript{12}, 1980 \textsuperscript{13}, 1991 \textsuperscript{14} and 1996 \textsuperscript{15}, for each age range and sex.

Mortality ratios were obtained from the Mortality Information System (SIM), the official source of the Ministry of Health \textsuperscript{16,17}. Deaths that occurred between 1979 and 1995 were classified according to CID-9, 9\textsuperscript{th} Conference of the Revision of the International Disease Classification, 1975, and adopted by the 20\textsuperscript{th} World Health Assembly \textsuperscript{18}. Mortality data for the year 1996 were obtained from the 10\textsuperscript{th} Revision of the International Disease Classification \textsuperscript{19}. Circulatory diseases are grouped by codes 390 to 459, ischemic heart disease by codes 410 to 414, and cerebrovascular diseases by codes 430 to 438, of the 9\textsuperscript{th} Revision of the International Classification of Disease for the population of Brazil for years 1979 to 1995. Mortality for the year 1996 was classified by the 10\textsuperscript{th} Revision of the International Disease Classification. Circulatory diseases are grouped by codes 110 to 182.9, ischemic heart disease by codes 120 to 125, and cerebrovascular diseases by codes 160 to 169.

Standardized mortality coefficients were calculated by the direct method, for the population aged ³30 years \textsuperscript{20}, using as a standard population sample Segi’s world of 1960 \textsuperscript{21}, based on 100,000 individuals. These coefficients were calculated for each period studied, taking into account total number of deaths and, separately, those for males and females \textsuperscript{22}. To analyze mortality trends, standardized mortality coefficients were used. Models of single linear regression were estimated \textsuperscript{23}, estimation being one of the statistical methods used for analyzing time series. In this modeling process, standardized mortality coefficients of circulatory disease, ischemic heart disease, and cerebrovascular disease were considered as dependent variables (Y) and calendar years of the study as independent variables (X). The year variable was transformed into the centralized variable (year-1987), because 1987 is the mean point of the historic series. Thus, the estimate model \( Y = \beta_0 + \beta_1 X \), where \( Y \) = standardized coefficient, \( \beta_1 \) = mean coefficient for the period, \( \beta_1 \) = mean annual increment, and X = year – 1987; was obtained.

**Results**

General mortality from all causes in the male and female population studied, standardized for age for individuals \( \geq 30 \) years, is shown in Table I. A reduction in mortality of 4.5% was observed over the period studied. In men, the reduction was 2.2%, in women 6.6%.

The analysis of the trends in mortality coefficients from all causes standardized for age by the linear regression method showed that (Figure 1): a) the mean standardized coefficient of mortality between 1979 and 1996 was 1,338.76 deaths per 100,000 inhabitants; b) the stable tendency of the standardized coefficient in men was 1,598/100,000 in 1979, and 1,564 in 1996 (P=0.059); c) the mean standardized coefficient for the period in men was 1,652 with a decline of 6.75 deaths per 100,000 inhabitants; d) the standardized coefficient of mortality between 1979 and 1996 was 1,652 with a decline of 6.75 deaths per 100,000 inhabitants; e) the standardized mean coefficient for the period in women, was 1,088.93 and the decline of 8.3 deaths/100,000/year.

The mortality from circulatory disease in the general population, men and women, standardized for age of individuals \( \geq 30 \) years, is shown in Table II.

A 19.6% reduction in mortality due to circulatory diseases in individuals \( \geq 30 \) years, over the period studied, was observed. In men, the reduction was 18.3%, in women 20.7%.

The analysis of the trends in mortality coefficients from circulatory diseases standardized for age by the linear regression method showed that (Figure 2): a) the mean standardized coefficient of mortality between 1979 and 1996 was 509.95 deaths per 100,000 inhabitants; b) the decreasing trend in the standardized coefficient in men was 620/100,000 in 1979, and 509 in 1996 (P<0.001); c) the standardized mean coefficient for the period in men was 856.25, with a decline of 8.25 deaths per 100,000 inhabitants per year; d) the standardized coefficient in women was 483/100,000 in 1979, and 383 in 1996 (P<0.001); e) the standardized mean coefficient for the period in women was 439.58, and the decline in deaths was 7.53/100,000/year.

The mortality from ischemic heart disease in the general population, men and women, standardized for age of individuals \( \geq 30 \) years, is shown in Table III. A 12.7% reduction in mortality due to ischemic heart diseases in individuals \( \geq 30 \) years, over the period studied, was observed. In men, the reduction was 15.3%, in women 11.6%.

The analysis of the trends in mortality coefficients from ischemic heart diseases standardized for age by the linear regression method showed that (Figure 3): a) the mean standardized coefficient of mortality between 1979 and 1996 was 151.29 deaths per 100,000 inhabitants; b) the decreasing trend in the standardized coefficient in men was 194/100,000.
The present study shows that although circulatory diseases are still the primary cause of death in Brazil, such deaths are decreasing in number. Using the simple linear regression method, mortality reduction was noted for circulatory diseases, ischemic heart disease, and cerebrovascular disease in both sexes; ischemic heart disease reduction was noted to be almost twice as high in men (-2.94 deaths/year) compared with that in women (-1.67 deaths/year). Cerebrovascular diseases decreased by nearly three deaths/year for both sexes. Circulatory disease in general had a reduction of around 8 deaths/year in both sexes, suggesting that other diseases participated in the reduction in mortality from circulatory diseases, not just ischemic heart diseases and cerebrovascular diseases. However, this reduction was only observed from the year of 1985 onwards, but in developed
countries it had been noted since the 1960s. The reasons for this difference are unknown; it has been speculated that better control of circulatory disease risk factors, improved socioeconomic conditions, technical and scientific progress, and a better understanding of the physiopathology of these diseases may be associated with more adequate diagnosis and treatment 24.

Mortality in Brazil was compared with that in other countries, mostly European, making up countries analyzed by Uemura and Pisa with data from the World Health Organization 25. In the majority of the more developed countries in Europe, a progressive reduction in mortality from circulatory, ischemic heart, and cerebrovascular diseases was observed. Although in the more developed countries (Western block) of Europe, a tendency towards a gradual decrease has been observed since 1970, mortalities due to these diseases showed a discrete increase between 1980 and 1985 in Brazil, in a manner similar to that observed in countries in the European Oriental block, in particular, Poland, Rumania, Hungary, Bulgaria, and Yugoslavia, as well as in Greece and Spain, in the period from 1970 to 1985.

Compared with the (MONICA - Monitoring Trends and Determinants in Cardiovascular Disease) project, mortality due to ischemic heart disease standardized by age in both sexes of the Brazilian population was similar to that of the more developed countries of Europe. In men, the ratio was similar to that observed in France, Italy, Spain, and Switzerland, the lowest observed in Europe. In women, the result observed was not the same as that in men, but even so, it was closer to the ratios recorded in the countries of Western Europe, which on average were lower than those of the Eastern countries. The reduction in mortality from ischemic heart disease reported in the MONICA project was greater in men, a result similar to that reported for the Brazilian population 26.

In relation to cerebrovascular diseases, studies in the more developed countries have been demonstrating a significant reduction in mortality from 1950 onwards in the USA and from 1970 onwards in European countries 4. However, in some countries of Eastern Europe, the incidence of the disease has been increasing and is directly related to a high prevalence of arterial hypertension 27. In Brazil, an increase in mortality due to circulatory, ischemic heart, and cerebrovascular diseases in men and women in the 35-64 year range group was observed between 1979 and 1984. Following this period, reduction was significant and progressive in both sexes. This reaction was similar to that observed in the majority of the countries in the MONICA project in the period from 1985 to 1990 26. However, mortality due to cerebrovascular diseases in men and women in Brazil was always lower than the values reported for the countries composing the MONICA project.

In relation to mortality from ischemic heart disease in
the USA, in the period between 1980 and 1994, a progressive reduction of around 3% per year has been observed between 1980 and 1988 and of 2.6% per year between 1990 and 1994. Between 1990 and 1994, mortality due to ischemic heart disease decreased by 10.3%, from 416.3 to 373.6 deaths per 100,000 inhabitants. However, mortality decreased more rapidly for Caucasians and for men. Annual reduction in mortality was 2.9% for Caucasian men, 2.5% for Caucasian women, 2.3% for black men, and black women 1.6%. Among the Brazilian population, a discrete increase was reported in mortality from ischemic heart disease in the period from 1979 to 1984 followed by a progressive reduction until the year 1995. The annual reduction was lower than that observed in the USA, between 1985 and 1990 and from 1990 to 1995, being respectively 1.6% and 2.0%. Mortality was reduced from 157.24 in 1990 to 140.96 deaths/100,000 inhabitants in 1995. Mortality reduction in Brazil was also greater in men. Although ischemic heart disease is one of the major causes of death in the Brazilian population, death from it was 2.6 times higher in the USA, probably a reflection of an important difference in the incidence of circulatory disease in the populations. In Brazil, the participation of other diseases, for instance infectious ones, must also have influenced this difference. The pronounced participation of other diseases in developing countries produces a "double load" on the public health system. Other factors that most probably influenced this result were socioeconomic, nutritional, behavioral, and medical structural in character. Studies have shown an inverse relationship between these factors and the incidence of ischemic heart disease in developed countries. As observed for ischemic heart diseases, cerebrovascular diseases in the USA were more prevalent in black persons of both sexes, and also, had a nonuniform geographical distribution, being more prevalent in the southeastern part of the USA. Socioeconomic inequalities appear to play a fundamental role in the incidence and regional distribution of cerebrovascular diseases.

In Latin-American countries, in particular Argentina, Chile, Colombia, Uruguay, and Venezuela, between 1969 and 1986, a reduction in circulatory diseases in men and women has also been observed. It varied from 1.1% in Colombia to 27.2% in Chile. However, in regards to ischemic heart and cerebrovascular diseases, and contrary to that in other countries, which had over a 20% reduction, Colombia had increases in ischemic heart of 24.4% and in cerebrovascular of 11%. Between 1979 and 1984, Brazil showed a similar tendency as that observed in Colombia in the period.
between 1969 and 1986. Over this period in Brazil, an increase in mortality from ischemic heart and cerebrovascular diseases of around 11% was observed. From 1985, Brazil started to show the same trend as that observed in the other Latin-American countries analyzed 37.

This study presents an important limitation in the mortality data, the most important variable of epidemiological studies. The data suffer from the negative influence of the diversity in the competence and quality of the collecting services or of the recording of the data, a worldwide problem. In Brazil, regional differences exist in the levels of competence of diverse structures. However, gradual improvement in the recording of data is being noted.

In conclusion, we verified that a reduction in mortality from circulatory, ischemic heart, and cerebrovascular diseases exists, attributed to factors involving the control of risk factors (prevention) and progress in the quality of medical assistance (improvement in survival). However, it remains a matter of discussion, which of the major groups have been responsible for the drop in mortality due to circulatory diseases 38-41. Despite the absence of a strong correlation, there appears to exist a consensus among major government agencies, medical associations, and population projects 42-44 about the importance of the prevention and the control of risk factors. These agencies attribute the reduction in mortality from circulatory diseases to the control of smoking, of arterial hypertension, of blood cholesterol, of increased physical activity, and of better dietary habits 45. In Brazil, an even greater reduction in mortality from circulatory diseases may be obtained if efforts in the field of their prevention and improved technical and scientific aspects are made.

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References