Revista de Saúde Pública
ISSN 0034-8910 versão impressa

Rev Saúde Pública 2003; 37(6)

Ischemic heart disease: mortality in natives and migrants, São Paulo, Brazil, 1979-1998

Luiz Francisco Marcopito

Departamento de Medicina Preventiva da Universidade Federal de São Paulo. São Paulo, SP, Brasil

ABSTRACT

Objective

The State of São Paulo has been a major center of attraction for foreign and Brazilian migrants since the 19th century. The pattern of mortality due to ischemic heart disease according to place of birth is, however, unknown. Thus, the objective of the study was to identify differences in mortality due to ischemic heart disease among residents of the State of São Paulo according to their place of birth.

Methods

Analytical time series study based on secondary data. Rates were not calculated due to lack of denominators. Instead, non-census indicators (proportionate mortality and standardized mortality ratio weighted for potential years of life lost before the age of 100 years) and medians were utilized. Temporal trends were analyzed by means of simple linear regression.

Results

In the State of São Paulo, about 40% of deaths due to ischemic heart disease occurred among migrants. The trend was negative for foreigners and positive for Brazilian migrants. Those born in northeastern Brazil, who presented the highest percentage of deaths in hospitals, had the worst performance: their proportionate mortality due to ischemic heart disease remained unchanged throughout the study period (while this clearly declined for all other groups) and they died at younger ages.

Conclusions

Migrants' share of total deaths due to ischemic heart disease in the State of São Paulo is very high. While there is a declining trend for foreigners, it is growing among Brazilian migrants. Among the compared groups, mortality due to ischemic heart disease in the State of São Paulo is most prominent for those born in northeastern Brazil.

Keywords

Myocardial ischemia, epidemiology. Myocardial ischemia, mortality. Migrants. Time series. Death certificates.

INTRODUCTION

Mortality due to ischemic heart disease (IHD) has shown diversified behavior over space and time.[13] In Western countries around the 1950s, mortality due to IHD was continuing to rise and constituted the most important cause of death. It was recognized at that time as the "epidemic of the 20th century" and the "rich countries' disease". However, this trend was reversed in the United States and some other countries, around the end of the 1960s to the beginning of the 1970s.[4]

In the municipality of São Paulo, over the period 1950-1981, the mortality rate due to IHD grew from 1950 to 1976 and declined from 1977 onwards. [7] A study on the trends in mortality due to IHD in eight Brazilian state capitals from 1979 to 1989 showed falls in Belém and São Paulo, a stable rate in Salvador, Belo Horizonte, Curitiba and Porto Alegre, and increases in Rio de Janeiro and Recife.[8] In the State of São Paulo, a declining trend was shown from 1979 to 1989,[9] which was confirmed in another study from 1980 to 1996.[11]

Marmot[13] analyzed IHD in rich countries in 1992 and verified that IHD was having more affect on the less favored groups, as if it was "passing through society as a wave, first reaching its more privileged parts and subsequently the less privileged parts, decreasing among its richer members first and, presumably, among the others later on." More recently, evidence has been seen that socioeconomic class is inversely related to the risk of death from IHD in countries like the United States.[5]

In the municipality of São Paulo, two ecological surveys[3,15] showed that in 1990-2 and 1999, the rates of mortality due to circulatory system diseases and IHD, calculated respectively for four and three "homogenous areas" of the municipality, were higher in the areas of "worse social conditions" where

historically the majority of the migrants coming from different regions of the country were concentrated.

Migrants are people who, in moving from their place of origin to some destination, cross frontier(s) with the purpose of setting up permanent or very long-lasting residence there. The State of São Paulo developed economically and demographically thanks to the entry of such people: the foreign immigrants (predominantly of Italian, Portuguese, Spanish, Japanese, German and Austrian origin)[6,14] and the internal migrants, termed the "national workers" (mostly from the northeast of Brazil and the State of Minas Gerais). The entry of foreigners predominated up to the end of the 1930s and, from that time, they began to be substituted by internal migrants.[2]

The State of São Paulo is a developing region, in which different health situation stages still coexist. Despite the decline in mortality rates, circulatory system diseases were, in 1998, still the main basic cause of death among people aged ≥20 years. Within this group, IHD was still the most prominent, representing 33.8% of these deaths.

The objective of the present study was to identify differences in mortality due to ischemic heart disease among residents of the State of São Paulo, according to their place of birth.

METHODS

The sources of data were the death certificates for people resident in the State of São Paulo who died between 1979 and 1998, whose basic cause of death, age (≥20 years) and place of birth were known. These were transcribed to electronic databases (dorsp__.dbc) available at the site of the Ministério da Saúde (Ministry of Health).*

*Data available at the site: www.datasus.gov.br/cdrom-sim-99/dores.

These compressed files with the extension ".dbc" were expanded onto Dbase® spreadsheets and the fields of interest were selected. All tabulations were done using SPSS® (Statistical Package for Social Sciences) version 10.0.

Deaths due to IHD were those coded as 410-414 and I20-I25 by the 9th and 10th revisions of the International Disease Classification, respectively.

The following annual measurements were made for the period studied:

proportionate mortality according to place of birth, within the total deaths due to IHD;

proportionate mortality due to IHD, within the total deaths from all causes, for each place of birth;

percentage variation, in relation to 1979, in the absolute number of deaths due to IHD and from other causes, according to place of birth;

percentage variation, in relation to the immediately preceding year, in the absolute number of deaths due to IHD and from other causes, according to place of birth;

coefficient (b) of the straight-line gradient, assuming that the time trend of the measurement (4) follows the simple linear regression model;

median of the measurement (4) and the age at which death due to IHD occurred;

the index here called the "standardized mortality ratio weighted by potential years of life lost before the age of 100 years" (SMR-$PYLL_{100}$) due to IHD, by place of birth of those who died, utilizing the reference of the age structure of deaths due to IHD among residents of the State of São Paulo that died aged ≥20 years in 1979. This index is simply the $MP_{APVP-100}$ total of Marcopito & Berlin,[10] with the use of the total deaths due to IHD in the place of the total deaths from all causes.* Values above 100 indicate mortality at younger ages and values below 100, at older ages than the reference age structure. For the calculation of the SMR-$PYLL_{100}$ the ages were grouped into closed classes of 10 years each, except for the group for 80 years and over, which remained open*;

*An example of the calculation of the SMR-$PYLL_{100}$ utilized in this work can be supplied to the reader, if requested via the following e-mail address: marcopito@medprev.epm.br

proportion of deaths due to IHD that occurred in hospital, for each place of birth.

For the deaths due to IHD that occurred among residents of the State of São Paulo, the places of birth were separated into eight categories: 1) State of São Paulo, 2) State of Minas Gerais, 3) northeastern region of Brazil, 4) other regions of Brazil, 5) western Europe, 6) eastern Europe and the former Soviet Union, 7) Japan, and 8) other regions of the world. The Brazilian places of birth were assembled from the frequency with which they occurred on death certificates for residents of the State of São Paulo; for foreigners, this came from the world balance drawn up by Marmot.[13]

With regard to the quality of the data, it was observed that in the State of São Paulo during the period of the study, the percentage of deaths from ill-defined causes in relation to the total deaths among people with known age and ≥20 years was 6.38% (the annual percentage ranged from 5.97% in 1983 to 7.00% in 1998).

Among the deaths due to IHD in the age group ≥20 years, the percentage of deaths with unknown place of birth and/or age was 0.64% (the annual percentage ranged from 0.32% in 1994 to 0.90% in 1998). Among the deaths from other causes in this age group, the percentage of deaths with unknown place of birth and/or age was 1.88% (the annual percentage ranged from 0.74% in 1994 to 2.37% in 1995). These deaths were excluded from the analysis.

RESULTS

In Table 1 it can be seen that, among residents of the State of São Paulo, around 40% of the deaths due to IHD occurred among migrants. It can also be seen that the percentage contribution to the total for IHD remained practically the same for those born in the States of São Paulo and Minas Gerais and other regions of Brazil (except for the northeastern region) during those 20 years. On the other hand, there was a clear increase in the percentage contribution from those born in the northeastern region, and a concomitant reduction for those born abroad.

Table 1 – Percentage distribution of the total deaths due to IHD, according to the individual's place of birth, for those aged ≥20 years and resident in the State of São Paulo, 1979-1998.

Year	Place of birth							
	State of São Paulo	Northeastern region	State of Minas	Other regions of	Western Europe	Eastern Europe	Japan	Other regions of

			Gerais	Brazil		and former Soviet Union		the world
1979	59.3	9.6	10.3	4.1	11.6	2.1	1.6	1.4
1980	60.4	9.0	10.2	4.3	11.1	2.0	1.6	1.5
1981	60.4	9.6	10.2	4.7	10.4	1.9	1.5	1.3
1982	60.6	9.9	10.4	3.9	10.2	2.0	1.6	1.4
1983	60.6	10.2	10.5	4.3	9.6	1.9	1.5	1.3
1984	61.0	10.8	10.6	3.8	9.4	1.9	1.4	1.2
1985	61.1	10.8	10.4	4.3	8.7	1.8	1.6	1.3
1986	61.6	11.3	10.6	4.1	8.1	1.7	1.5	1.1
1987	61.6	11.5	10.6	4.5	7.8	1.5	1.5	1.1
1988	61.9	12.0	10.6	4.1	7.2	1.5	1.5	1.1
1989	62.1	12.0	10.7	4.5	6.9	1.4	1.4	1.0
1990	61.4	13.1	10.7	4.4	6.4	1.3	1.6	1.0
1991	61.6	13.5	10.5	4.6	6.1	1.4	1.5	1.0
1992	62.0	13.2	10.7	4.2	6.1	1.4	1.3	1.0
1993	62.1	14.2	10.5	4.2	5.8	1.2	1.3	0.7
1994	62.4	13.8	10.8	4.4	5.6	1.1	1.2	0.7
1995	61.6	14.8	10.6	4.5	5.2	1.2	1.1	0.9
1996	61.3	15.8	10.8	4.2	5.0	1.1	1.1	0.8
1997	61.9	16.0	10.6	3.8	4.6	1.0	1.2	0.8
1998	60.8	17.2	10.7	4.3	4.2	0.9	1.2	0.7

This growth among people from the northeast was not just due to the "proportionate effect" resulting from the fall among the foreigners and stability among other Brazilians, considering that the deaths due to IHD increased by almost the same proportion as for deaths from other causes. The median of the annual percentage variation in the absolute number of deaths due to IHD, in relation to the immediately preceding year, was positive for the four places of birth of Brazilian origin and negative for the four places of birth of foreign origin. It can be seen in Table 2 that the largest median for percentage variation in the number of deaths due to IHD occurred among people from the northeast, and this was larger than the median of percentage variation in deaths from other causes (contrasting with all the other places of birth).

Table 2 – Median of the annual percentage variation in the number of deaths due to ischemic heart disease, other causes and all causes, in relation to the immediately preceding year, for individuals aged ≥20 years and resident in the State of São Paulo, according to their place of birth, 1980-1998.

Cause of death	Place of birth: State of São Paulo	Northeastern region	State of Minas Gerais	Other regions of Brazil	Western Europe	Eastern Europe and former Soviet Union	Japan	Other regions of the world	Total
IHD	1.1	5.4	0.9	1.6	-3.4	-2.6	-0.6	-2.9	0.6
Other causes	4.7	4.0	2.5	5.9	-2.2	-0.3	0.5	1.1	4.0
All causes	4.2	4.1	2.3	5.6	-1.9	-1.5	0.7	0.4	3.7

IHD – ischemic heart disease

Although these medians were found to be positive for all the Brazilians, the trend in the percentage variation in the number of deaths due to IHD was only positive among the people from the northeast (Table 3), thus indicating greater growth than for deaths from other causes.

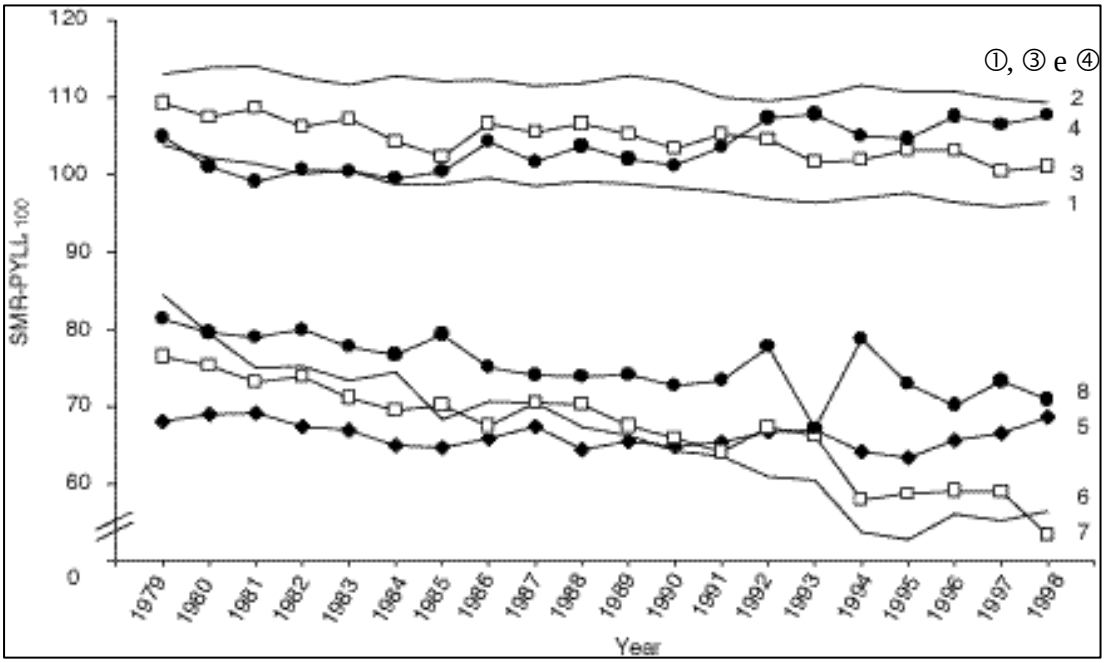
Table 3 – Coefficient of the straight-line gradient, assuming a linear regression model for the annual percentage variation in the number of deaths due to ischemic heart disease, other causes and all causes, in relation to the immediately preceding year, for individuals aged ≥20 years and resident in the State of São Paulo, according to their place of birth, 1980-1998.

Cause of death	Place of birth: State of São Paulo	Northeastern region	State of Minas Gerais	Other regions Brazil	Western Europe	Eastern Europe and former Soviet Union	Japan	Other regions of the world	Total
IHD	-0.112	+0.133	-0.056	-0.112	-0.124	-0.170	-0.087	-0.187	-0.040
Other causes	-0.129	-0.228	-0.195	-0.205	-0.104	-0.271	-0.085	-0.111	-0.132
All causes	-0.123	-0.187	-0.177	-0.189	-0.102	-0.245	-0.085	-0.126	-0.116

IHD – ischemic heart disease

With regard to the proportionate mortality due to IHD in relation to total deaths, this diminished markedly with the passage of time. The trend evaluated using the linear regression model showed that the coefficient of the straight-line gradient (b) was –0.21 in general and clearly negative for all the place-of-birth groups studied (São Paulo: –0.23; Minas Gerais: –0.10; other regions of Brazil: –0.26; western Europe: –0.26; eastern Europe and former Soviet Union: –0.30; Japan: –0.11; other regions of the world: –0.49), except for the people from the northeast, who presented practically no linear reduction (b=–0.02).

Analysis of the age at which death due to IHD occurred revealed the existence of two groups with different behavior: the Brazilians and the foreigners. The evolution of the SMR-$PYLL_{100}$ due to IHD (Figure 1) over these 20 years of observation showed that the Brazilians from the northeastern region died at younger ages than did all the other groups they were compared with. With regard to the general median for the age of death due to IHD, this was 69 years in 1998, and was as follows for the different places of birth: Japan, 82 years; eastern Europe and former Soviet Union, 80; western Europe, 78; other regions of the world, 77; São Paulo, 69; Minas Gerais, 67; other regions of Brazil, 65; and the northeastern region, 64 years.



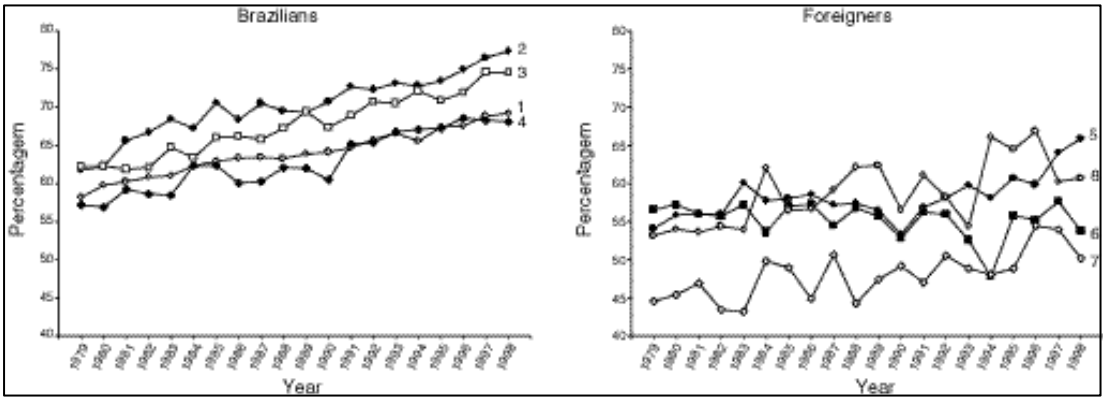
SMR– Standardized mortality ratio. PYLL– Potential years of life lost.

*SMR-PYLL$_{100}$ in relation to the age at death due to ischemic heart diseases in residents of the State of São Paulo that died aged ≥20 years in 1979. Values of over 100 indicate ages younger than the reference and under 100, older than the reference.

1- State of São Paulo; 2- northeastern region; 3- State of Minas Gerais; 4- other regions of Brazil; 5- western Europe; 6- eastern Europe and former Soviet Union; 7- Japan; and 8- other regions of the world.

Figure 1 – Standardized mortality ratio weighted by potential years of life lost before the age of 100 years (SMR-PYLL$_{100}$)* for all ischemic heart diseases in individuals aged ≥20 years and resident in the State of São Paulo, 1979-1998, according to their place of birth.

This worsened situation for the people from the northeast does not appear to be due to lack of access to hospital assistance for the illness that led to death, considering that the Brazilians from the northeastern region showed the highest percentages of deaths due to IHD occurring in hospital, for all the years of the period studied (Figure 2). This percentage was, incidentally, greater among Brazilians than among foreigners.



1- State of São Paulo; 2- northeastern region; 3- State of Minas Gerais; and 4- other regions of Brazil.

5- western Europe; 6- Eastern Europe and former Soviet Union; 7- Japan; and 8- other regions of the world.

Figure 2 – Percentage of deaths due to ischemic heart diseases occurring in hospital, in individuals aged ≥20 years and resident in the State of São Paulo, during the period 1979-1998, according to their place of birth.

DISCUSSION

What draws attention first of all is the high percentage of deaths due to IHD (among residents aged ≥20 years) among those not born in the State of São Paulo (around 40%), thus confirming that the migration process was important in the demographic development of the State. This also suggests that a large proportion of those born in the State of São Paulo must be the descendants of migrants.

The main limitation on the interpretation of the results is the fact that rates were not utilized (events/persons-time) – nor could they have been, because national censuses in almost all countries do not enumerate people by place of birth. In Brazil, the Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics) has, since 1960, applied more detailed questionnaires to residents of 10 to 20% of homes, selected by drawing lots, with specific questions regarding place of birth, which provides a reasonable general view of migratory movements per federal state, but not the total composition of the population by age and place of birth. It would thus be improper to use an indicator with a numerator containing all deaths and a denominator containing only the estimate coming from 10 to 20% of the population.

Because of the lack of such denominators from census data, it was not possible to determine risks in the present work. From other studies,[9,11] it is known that the risk of dying from IHD in the State of São Paulo as a whole is diminishing, which coincides with the trend observed in the total proportionate mortality due to IHD, even though the indicators are of differing nature: proportionate mortality from one cause is directly affected by deaths from other causes. Nonetheless, and with the assistance of the SMR-PYLL$_{100}$, interesting observations could be made in relation to the trends and the age at death due to IHD.

With regard to the large difference in the age at death due to IHD between foreigners and Brazilians, one plausible explanation is that these two groups are not comparable, considering that the foreigners who died must the remainder of the large wave of international immigration to the State of São Paulo that took place in the past, which is no longer fed by young foreigners arriving (or in other words, the population of foreigners must be proportionally older than the Brazilian population).

Among the foreigners, however, the behavior of the age at death due to IHD for western Europeans can be highlighted. This began to go down slightly from the middle of the 20-year observation period.

This phenomenon is better observed through the graphic evolution of the SMR-$PYLL_{100}$, a more sensitive indicator than the median, which is little affected by extreme values. Regarding the median (the middle value that divides the observations into two halves), this was presented more because of tradition, considering that its definition is difficult when there are repeated values in the 50^{th} percentile of the distribution.

With regard to the reduction in proportionate mortality due to IHD among the foreigners, two factors may be influencing this: 1) the general trend itself towards reduction in the State, and 2) now, with increasingly advanced aged, the pattern of mortality for the foreigners has become altered such that room is given for other causes of death with more incidence in this age group.

On the other hand, among the Brazilians, the worse situation faced by people from the northeast is clear: 1) for them, the linear trend of proportionate mortality due to IHD has remained stable, in contrast with the other groups, which have shown evident declining trends; 2) their linear trend in the absolute number of deaths due to IHD is growing (in contrast to the deaths from other causes, which are following the general falling trend); and 3) those born in that region are the ones who die at youngest ages. This situation cannot be explained by the access to medical assistance in hospitals during the acute episode that caused the death, considering that the people from the northeast presented the highest proportion of deaths due to IHD occurring in hospitals. The causes must have a more remote origin and must be linked with their living and dietary conditions and their primary and secondary healthcare.

Studies from other countries have shown that, within groups of the same ethnicity, the less favored members have the “least healthy” dietary habits in relation to IHD,[12] probably as a result of acquiring products of more accessible price but lower quality.[17] Between groups of different ethnicity but similar socioeconomic class, the consumption of foods with the higher fat content occurs in the group with higher morbidity-mortality due to IHD, possibly for cultural reasons.[6] The combination of the two conditions, socioeconomic and cultural, may be exacerbating the worsening of the lipid profile seen among people from the northeast who migrate from rural to urban areas,[16] thus partially explaining these indicators for mortality due to IHD in the State of São Paulo.

Early detection and regular control of arterial hypertension and diabetes mellitus, other recognized risk factors for IHD, are possibly being applied selectively within the healthcare system, considering that outpatient attendance depends on a variety of factors such as coverage, education level and compliance. By extension, prenatal care could be included here, judging by the recent evidence regarding the fetal origin of IHD,[1] linked with low birth weight.

A comparative study between deaths due to IHD among migrants in São Paulo and people born and resident in the northeast might clarify whether this phenomenon also occurs in the region of origin.

REFERENCES

1. Barker DJP, Eriksson JG, Forsén T, Osmond C. Fetal origins of adult disease: strength of effects and biological basis. *Int J Epidemiol* 2002;31:1235-9.

2. Camargo JF. O desenvolvimento da população paulista depois de 1886: a população alienígena no estado de São Paulo. *In*: Camargo JF. *Crescimento da população no estado de São Paulo e seus aspectos econômicos*. São Paulo: IPE/USP; 1981. p. 113-53.

3. Drumond Jr M, Barros MBA. Desigualdades socioespaciais na mortalidade do adulto no município de São Paulo. *Rev Bras Epidemiol* 1999;2:34-49.

4. Epstein FH. Contribution of epidemiology to understanding coronary heart disease. In: Marmot M, Elliott P, editors. *Coronary heart disease epidemiology – from aetiology to public health*. Oxford; Oxford University Press: 1992. pp. 20-32.

5. Escobedo LG, Giles WH, Anda RF. Socioeconomic status, race, and death from coronary heart disease. *Am J Prev Med* 1997;13:123-30.

6. Lip GYH, Malik I, Luscombe C, McCarry M, Beevers G. Dietary fat purchasing habits in whites, blacks and Asian peoples in England: implications for heart disease prevention. *Int J Cardiol* 1995;48:287-93.

7. Lolio CA, Laurenti R. Mortalidade por doença isquêmica do coração no município de São Paulo. Evolução de 1950 a 1981 e mudanças recentes na tendência. *Arq Bras Cardiol* 1986;46:153-6.

8. Lolio CA, Lotufo PA, Lira AC, Zanetta DM, Massad E. Tendência da mortalidade por doença isquêmica do coração nas capitais de regiões metropolitanas do Brasil, 1979-89. *Arq Bras Cardiol* 1995;64:213-6.

9. Lotufo PA, de Lolio CA. Tendência da mortalidade por doença isquêmica do coração no estado de São Paulo: 1970-1989. *Arq Bras Cardiol* 1993;61:149-53.

10. Marcopito LF, Berlin JA. A method for calculating age-weighted death proportions for comparison purposes. *Int J Epidemiol* 1998;27:1044-52.

11. Marcopito LF, Shirassu MM. Mortalidade por infarto agudo do miocárdio e pelas demais doenças isquêmicas do coração no estado de São Paulo, 1980-1996. *Arq Bras Cardiol* 2000;75:69-71.

11. Martikainen P, Brunner E, Marmot M. Socioeconomic differences in dietary patterns among middle-aged men and women. *Soc Sci Med* 2003;56:1397-410.

13. Marmot MG. Coronary heart disease: rise and fall of a modern epidemic. *In*: *Coronary heart disease epidemiology - from aetiology to public health*. Marmot M, Elliott P, editors. Oxford: Oxford University Press; 1992. p. 3-19.

14. Paiva OC. Breve história da Hospedaria de Imigrantes e da imigração para São Paulo. Secretaria de Estado da Cultura de São Paulo 2000; Série Resumos, nº 7. p. 56.

15. Pro-AIM (Programa de Aprimoramento das Informações de Mortalidade no Município de São Paulo). Mortalidade por doenças do aparelho circulatório na cidade de São Paulo em 1999. Pro-AIM 2000; Boletim nº 40.

16. Torun B, Stein AD, Schroeder D, Grajeda R, Conlisk A, Rodriguez M, Mendez H, Martorell R. Rural-to-urban migration and cardiovascular disease risk factors in young Guatemalan adults. *Int J Epidemiol* 2002;31:218-26.

17. Turrell G, Hewitt B, Patterson C, Oldenburg B, Gould T. Socioeconomic differences in food purchasing behaviour and suggested implications for diet-related health promotion. *J Hum Nutr Diet* 2002;15:355-64.

Address to correspondence

Luiz Francisco Marcopito
Departamento de Medicina Preventiva – UNIFESP
Rua Pedro de Toledo, 675
04039-032 São Paulo, SP, Brasil
E-mail: marcopito@medprev.epm.br

Received on 14/8/2002. Reviewed on 28/4/2003. Approved on 11/6/2003.

Avenida Dr. Arnaldo, 715
01246-904 São Paulo SP Brazil
Tel./Fax: +55 11 3068-0539

revsp@org.usp.br