Trends in Relative Mortality from Cerebrovascular Diseases in Brazilian State Capitals, 1950–1988[1]

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This article seeks to describe trends in relative mortality from cerebrovascular diseases (CVDs) in Brazilian state capitals from 1950 through 1988. Absolute numbers of deaths from all causes; from CVDs; and from ill-defined signs, symptoms, and afflictions were obtained from official Brazilian mortality statistics. In calculating relative CVD mortality, deaths from ill-defined signs, symptoms, and afflictions were excluded. The collected data permitted calculation of relative CVD mortality in most state capitals for 1950, 1955, 1960, 1961–1965, 1966–1970, 1971–1975, 1977–1980, 1981–1985, and 1986–1988.

During the study period CVD mortality was found to play an increasing role in overall mortality in all the state capitals. Regional grouping of data showed greater relative CVD mortality in the South and Southwest Regions toward the start of the study period. However, over the course of this period the part that CVD mortality played in overall mortality grew most rapidly in the less-developed North, Northeast, and Center-West Regions.

In general, relative CVD mortality data in nearly all the state capitals demonstrate the attention that needs to be devoted to CVDs within the context of adult public health. In particular, there is a clear need to greatly strengthen and improve the marginal existing programs for detection and control of hypertension and diabetes in Brazil. This should be done by assessing international experience with programs of this type and adapting that experience to Brazilian conditions. Beyond that, it will be important to support health promotion and protection efforts that can deal with risk factors and secure prevention through lifestyle modification—something that can provide benefits in dealing not only with CVDs but also with diabetes, obesity, and certain neoplasias.

Mortality from cerebrovascular diseases (CVDs) has been declining over the past several decades in the countries of Western Europe, the United States, and Japan, at the same time that it has been rising in the countries of Eastern Europe (*1*). There is also evidence that cerebrovascular mortality declined in a number of Latin American countries over the periods 1969–1986 (*2*) and 1975–1985 (*3*), although increases were observed in some countries—including Colombia, the Dominican Republic, El Salvador, Guatemala (*2*), French Guiana, Honduras, Martinique, and Paraguay (*3*). In some of these latter countries the increase was found in only one sex, while in others it was found in both.

Geographically, the magnitude of CVD mortality differs from one country to another and also in different regions of the same country (*1–6*). For example, regional differences in CVD mortality trends have been observed in the United States, where pronounced mortality declines in the more affluent regions of the country have contrasted with lesser declines, stability, or even increases in poorer regions (*4*).

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Declining CVD mortality trends have been attributed to modification of the population frequencies of certain lifestyle risk factors, improved medical care for acute CVD patients, and improved treatment of cardiac and respiratory sequelae. It has also been claimed that such declines are attributable to greater emphasis on detection, treatment, and control of arterial hypertension (*7–13*), which is recognized as the leading determinant of CVDs (*7, 11*).

In the United States, an overall CVD decline of 57% was observed between 1972 and 1993 (*7*). Of the generally lesser declines observed in Latin America over the period 1969–1986, the greatest were recorded for Cuban men (26.1%) and Mexican women (33.9%) (*2*).

In Brazil, CVDs have long been the leading cause of death among adults of both sexes (*14*). For example, in 1985 CVDs caused the premature loss of some 287 000 years of productive life among people 15 to 59 years old (*15*). A comparison of 1985 age-adjusted CVD mortality in two Brazilian states (São Paulo in the southeast and Rio Grande do Sul in the south) and the city of Fortaleza (in the northeast) with CVD mortality in 35 other countries found the Brazilian rates to be among the highest, ranking between 4th and 7th place for men and between 3rd and 7th place for women (*16*).

The period between 1940 and 1969 witnessed an upward trend in the cardiovascular disease mortality in São Paulo, from 209.7 to 258.4 deaths per 100 000 inhabitants (*17*), though the city later recorded a decline of 17.3% in cerebrovascular disease (CVD) mortality between 1970 and 1981 (*18*). Examination of trends in five other state capitals over the period 1979–1986 identified no consistent trends, although rates in some cities showed distinct decreases or increases among at least one of various age groups studied (*19*).

Besides being the leading cause of death among Brazilian adults, CVDs are one of the principal causes of hospitalization (*20*) and have a great potential for debilitating their survivors. Overall, it seems clear that CVDs constitute a major health problem for the Brazilian population.

MATERIALS AND METHODS

The study reported here was designed to provide a historical and ecological description of CVD mortality. Studies such as this that are based on relative mortality data can show the importance of a particular cause of death relative to total deaths and, accordingly, can suggest the priority merited by that cause in terms of health planning. However, they do not measure the demographic risk of dying from the cause in question, and this can be considered their greatest limitation.

Faced with the impossibility of measuring mortality coefficients, the study presented here sought to describe trends in relative mortality from CVDs in the state capitals of Brazil for the 39-year period 1950–1988.

The absolute numbers of deaths from all causes, from the combined total of all cerebrovascular diseases, and from ill-defined symptoms, signs, and afflictions were obtained from Brazil's statistical yearbooks for the period 1950–1976 (*21–24*) and from the Ministry of Health's Estatísticas de Mortalidade (*Mortality Statistics*) for the period 1977–1988 (*25–36*). The statistics for the first period show deaths by place of occurrence, whereas those for the second show deaths by place of residence.

Data for the first period include the state capitals existing at the time, with the Federal District being included around the time of its creation in the 1960s. In the second period data were included for Campo Grande, the capital of Mato Grosso do Sul, a new state that was split off from the state of Mato Grosso. However, data were not included for capitals of former territories that were transformed into

states or for the capital of the recently-created state of Tocantins, which was split off from the state of Goiás (capital Goiânia).

In both periods, cerebrovascular diseases were identified separately in the official statistics, although they were classified as belonging to different groups of causes (diseases of the nervous system and sensory organs or diseases of the circulatory system), depending on whether the eighth or ninth revision of the International Classification of Diseases was then in effect. Following harmonization of the two revisions' classification codes, cerebrovascular diseases were ordered according to the listings of the ninth revision (ICD categories 430–438), which include subarachnoid hemorrhage (430), intracerebral hemorrhage (431), other and unspecified intracranial hemorrhage (432), occlusion and stenosis of precerebral arteries (433), occlusion of cerebral arteries (434), transient cerebral ischemia (435), acute but ill-defined cerebrovascular disease (436), other and ill-defined cerebrovascular disease (437), and late effects of cerebrovascular disease (438).

Relative CVD mortalities in different state capitals and regions were calculated after excluding deaths from ill-defined causes. With regard to 1950, 1955, and 1960, data have been provided only for the specific year cited, because data for the intermediate years were not available (see Table 1). Beginning in 1961, however, five-year averages were calculated for three five-year periods (1961–1965, 1966–1970, 1971–1975). Later averages (those for 1977–1980, 1981–1985, and 1986–1988) respectively covered four-, five-, and three-year periods.

Due to the unavailability of a complete series, the data available for certain state capitals in 1961–1975 covered three- or four-year periods rather than five years. Specifically, this is true of the data obtained for São Luiz, Aracaju, Vitória, Rio de Janeiro, Pôrto Alegre, Goiânia, and Cuiabá for the period 1961–1965; Pôrto Alegre for 1966–1970; and São Luiz and João Pessoa for 1971–1975. Data from Cuiabá were not published for the year 1960 or for the period 1971–1975. The capital city of Florianópolis was excluded from the first part of the series because of the irregularity of the available data.

In addition to these averages, average trend ratios (ATR) were calculated for 1950/1971–1975 (ATR-1) and 1977–1980/1986–1988 (ATR-2). These ATR values correspond to the CVD mortality reported in the later part of the period (1971–1975 for ATR-1 and 1986–1988 for ATR-2) divided by CVD mortality in the earlier part of the period. The overall trend ratio (OTR) corresponds to the ratio between mortality of the latest (1986–1988) period and that of the first year studied (1950).

Relative 1988 CVD mortalities in each state capital and region were also calculated for the 20–59 and ≥60 age groups. Again, deaths from ill-defined causes were excluded.

RESULTS

As the bottom line of Table 1 indicates, combined data for all the state capitals show an upward trend in relative CVD mortality over the study period, the share of mortality attributable to CVDs increasing 4.4 times between 1950 and 1988. During the first part of the study period (1950 through 1971–1975) this average share increased by a factor of 3.1, while in the second part (1977–1980 through 1986–1988) it increased by a factor of 1.2. With regard to particular capitals, the high relative CVD mortalities recorded for the city of São Luiz in the northeast appear to deserve attention. Relatively high figures were found for this city from the beginning through the end of the study period. During 1986–1988, CVDs in São Luiz accounted for 15.1% of all recorded deaths from known causes, this being the highest relative CVD mortality found for

Table 1. Relative mortality (%) from cerebrovascular diseases (CVDs) in Brazilian state capitals and in data for those capitals grouped by region, 1950–1988. ATR-1 = average trend ratio for 1950/1971–1975 (ratio of 1971–1975 relative mortality to 1950 relative mortality); ATR-2 = average trend ratio for 1977–1980/1986–1988 (ratio of 1986–1988 relative mortality to 1977–1980 relative mortality). OTR = overall trend ratio (ratio of 1986–1988 relative mortality to 1950 relative mortality).

Regions and capitals	1950	1955	1960	1961–65	1966–70	1971–75	ATR-1	1977–80	1981–85	1986–88	ATR-2	OTR
Northern Region:	**1.9**	**1.9**	**2.9**	**3.4**	**6.1**	**6.0**	**3.1**	**7.3**	**8.0**	**10.1**	**1.4**	**5.3**
Manaus	1.6	1.6	2.7	2.6	5.0	5.3	3.3	6.1	5.5	7.7	1.3	4.8
Belém	2.3	2.3	3.2	4.3	7.2	6.7	2.9	8.5	10.5	12.7	1.5	5.5
Northeast Region:	**1.9**	**2.3**	**2.6**	**3.3**	**5.1**	**6.8**	**3.6**	**8.8**	**10.4**	**11.6**	**1.3**	**6.1**
São Luiz	5.7	4.4	3.5	3.7*	6.7	9.3*	1.6	12.7	13.8	15.1	1.2	2.6
Teresina	1.2	0.7	1.1	1.8	4.8	5.8	4.8	8.1	9.8	11.0	1.3	9.2
Fortaleza	1.8	2.4	0.8	1.3	5.5	7.5	4.2	8.3	9.8	11.8	1.4	6.5
Natal	1.8	1.2	1.4	2.9	4.5	5.6	3.1	7.3	8.1	12.3	1.7	6.8
João Pessoa	1.4	1.9	3.9	2.2	4.7	7.2*	5.1	9.0	10.3	8.3	0.9	5.9
Recife	0.6	1.2	0.9	3.2	4.3	5.8	9.7	8.3	10.3	11.7	1.4	19.5
Maceió	1.3	1.8	2.7	3.7	5.6	6.9	5.3	9.9	12.1	11.6	1.2	8.9
Aracaju	1.8	3.9	4.8	5.2*	5.0	7.8	4.3	7.6	10.5	12.4	1.6	6.9
Salvador	2.0	3.2	4.1	4.7	5.6	5.6	2.8	8.4	9.3	10.6	1.3	5.3
Southeast Region:	**3.5**	**5.2**	**6.2**	**7.4**	**8.7**	**9.6**	**2.7**	**10.8**	**11.3**	**11.6**	**1.1**	**3.3**
Belo Horizonte	1.3	2.8	4.7	5.5	6.2	7.0	5.4	7.7	9.6	10.6	1.4	8.1
Vitória	3.2	3.7	4.4	7.1*	6.4	9.9	3.1	12.9	12.4	13.9	1.1	4.3
Rio de Janeiro	3.8	7.0	8.0	8.8*	12.7	12.6	3.3	13.3	13.4	12.7	0.9	3.3
São Paulo	5.6	7.4	7.8	8.3	9.6	9.0	1.6	9.5	9.8	9.2	1.0	1.6
Southern Region:	**4.7**	**3.4**	**5.7**	**7.1**	**9.2**	**9.4**	**2.0**	**11.1**	**12.0**	**11.4**	**1.0**	**2.4**
Curitiba	3.4	2.6	6.0	6.5	7.4	7.7	2.3	10.4	12.0	12.5	1.2	3.7
Florianópolis	—	—	—	—	—	—	—	11.9	13.0	10.9	0.9	—
Pôrto Alegre	6.0	4.2	5.4	7.7*	11.0*	11.1	1.8	11.1	11.1	10.8	1.0	1.8
Center-West Region	**1.1**	**2.1**	**1.6**	**3.7**	**5.6**	**4.4**	**4.0**	**6.1**	**7.9**	**8.1**	**1.3**	**7.4**
Goiânia	1.5	0.9	1.6	5.4*	5.0	4.4	2.9	7.7	10.4	10.0	1.3	6.7
Cuiabá	0.8	3.4	—	2.8*	8.7	—	—	6.0	6.0	7.8	1.3	9.6
Campo Grande	—	—	—	—	—	—	—	6.2	8.7	8.0	1.3	—
Federal District	—	—	—	3.0	3.1	4.5	—	4.5	6.5	6.7	1.5	—
Brazil, state capitals	**2.5**	**3.0**	**3.8**	**4.5**	**6.4**	**7.7**	**3.1**	**8.9**	**10.1**	**11.0**	**1.2**	**4.4**

*Data for three or four years rather than the entire five-year period

any of the state capitals during any of the periods listed.

Figure 1 shows that relative CVD mortalities were higher in the South and Southeast Regions at the start of the study period, that upward trends were evident in all five regions over the course of this period (with some irregularities in the Center-West Region), and that by the end of the period relative CVD mortality in the regions was fairly similar, except in the Center-West. Looking at the chart more closely, it may be seen that the increasing trend in the South and Southeast Regions began to taper off slightly in 1977–1980, while sharp increases registered in the Northeast Region from 1961–1965 onward caused the latter to catch up with the South and Southeast Regions in 1986–1988.

ATRs (indicating increases in relative CVD mortality) were highest in the North, Northeast, and Center-West Regions between 1950 and 1971–1975 (Figure 2). Differences between regions were less marked between 1977–1980 and 1986–1988, while relative CVD mortalities in the South and Southeast Regions exhibited stabilizing trends. The highest OTRs (relating to 1950 through the 1986–1988 period) were found in the Center-West and Northeast Regions.

In adults between 20 and 59 years of age, relative 1988 mortality from CVDs exceeded 10% in 12 of the 22 state capitals studied, five of these being in the northeast (Table 2). Relative CVD mortality above 20% was recorded for people 60 and over in a number of state capitals including São Luiz (28.5%), Aracaju (24.9%), and Maceió (23.5%) in the northeast and Belém (22.3%) in the north. The lowest relative CVD mortalities among this latter age group were recorded for São Paulo (13.0%) in the southeast, Pôrto Alegre (14.0%) in the south, and Cuiabá (14.6%), Campo Grande (13.7%), and the Federal District (14.4%) in the center-west.

Figure 1. Data for relative CVD mortality in Brazilian state capitals, by region, 1950–1988. The city data were combined by adding together the number of CVD deaths in each state capital within a given region, dividing this total by the number of deaths from all causes (except ill-defined causes) in the same set of capitals, and multiplying the result by 100. The regional results are based entirely on the state capital data.

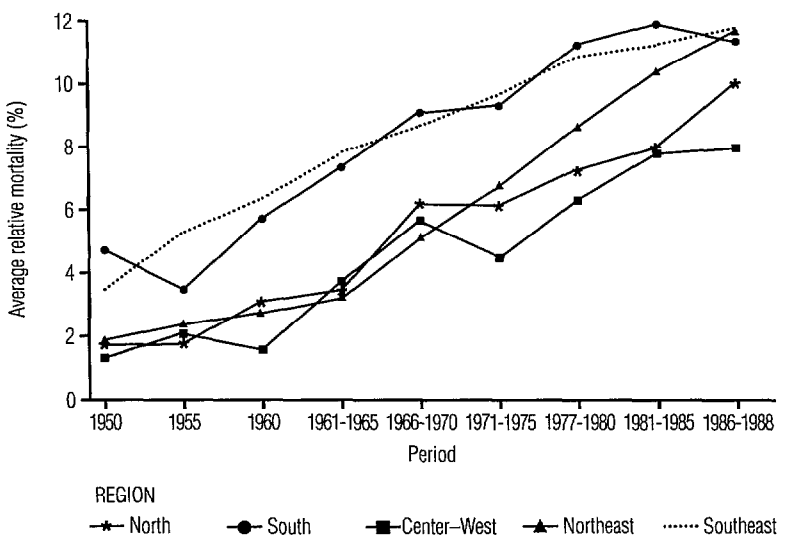
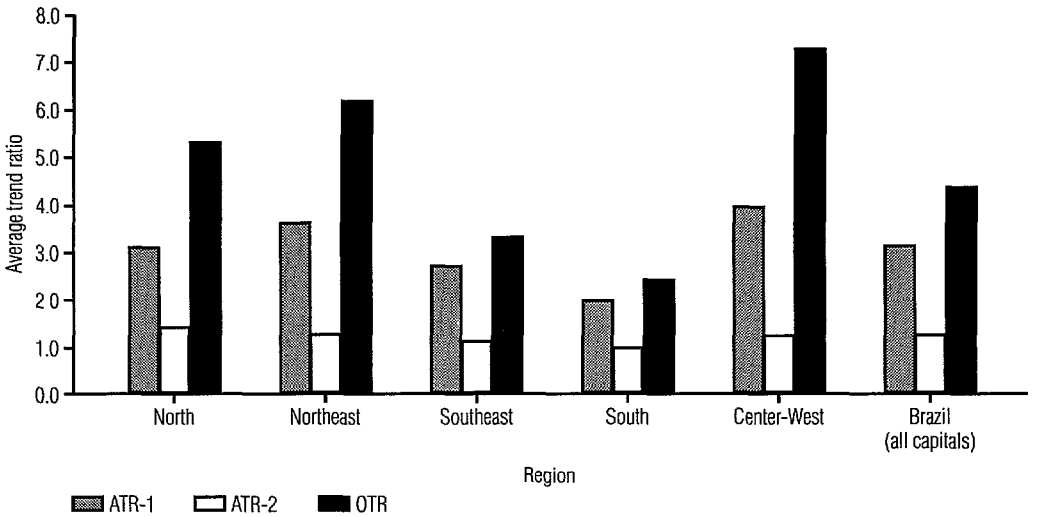


Figure 2. Average trend ratios of relative CVD mortality in Brazilian state capitals, by region, 1950–1988. ATR-1 = average trend ratio for 1950/1971–1975 (ratio of 1971–1975 relative mortality to 1950 relative mortality); ATR-2 = average trend ratio for 1977–1980/1986–1988 (ratio of 1986–1988 relative mortality to 1977–1980 relative mortality); OTR = overall trend ratio for 1950/1986–1988 (ratio of 1986–1988 relative mortality to 1950 relative mortality). The regional ATR-1, ATR-2, and OTR results were derived in the same manner as the CVD mortality data in Figure 1 (see Figure 1 caption).



DISCUSSION AND CONCLUSIONS

On the whole, health statistics in Brazil still tend to be unreliable; however, mortality statistics are generally satisfactory for most state capitals and other major cities, where all deaths must be certified by physicians and when pertinent by forensic medical institutes. Recorded mortality from ill-defined causes was low (from 0.8% to 3.0%) in most (64%) of Brazil's state capitals in 1988. However, in two state capitals (Manaus and João Pessoa) over a fifth of all recorded deaths were attributed to ill-defined causes (*36*). For these and other reasons, the Ministry of Health recommends that studies based on obituary data use relative mortality rather than mortality coefficients (*36*). Even so, it seems likely that the data from the first (1950/1971–1975) period of the present study may significantly overestimate or underestimate relative CVD mortality in some state capitals as a result of deaths attributed to ill-defined causes and deaths among nonresidents (number unknown) within the city.

Relative mortality data cannot be compared with data from studies conducted in other countries, where the statistics are presented on the basis of population. Similarly, higher or lower relative CVD mortality in an individual Brazilian state capital does not necessarily imply a greater or lesser demographic risk of dying from CVDs vis-a-vis another state capital. Furthermore, an increasing trend in relative mortality from CVDs may or may not reflect an increasing risk of dying from CVDs unless overall mortality trends are known and given due consideration.

In a similar vein, between 1930 and 1980 a considerable share of the apparent increase in relative cardiovascular disease mortality in Brazil was attributable to marked reductions in mortality from infectious and parasitic diseases at a time

Table 2. Relative 1988 CVD mortality (%) in Brazilian state capitals and in data for those capitals grouped by region among inhabitants 20–59 and ≥60 years of age.

Capitals	20–59 years	≥60 years
Northern Region:	**8.6**	**20.3**
Manaus	7.5	18.4
Belém	9.6	22.3
Northeast Region:	**9.9**	**21.1**
São Luiz	12.2	28.5
Teresina	12.2	19.7
Fortaleza	11.1	19.9
Natal	8.6	18.4
João Pessoa	7.1	16.7
Recife	9.1	19.5
Maceió	8.2	23.5
Aracaju	10.0	24.9
Salvador	10.6	19.2
Southeast Region:	**10.6**	**15.7**
Belo Horizonte	10.3	15.4
Vitória	12.8	18.8
Rio de Janeiro	10.6	15.7
São Paulo	8.7	13.0
Southern Region:	**9.4**	**15.5**
Curitiba	10.6	15.7
Florianópolis	9.1	16.3
Pôrto Alegre	8.5	14.0
Center-West Region:	**11.1**	**14.6**
Goiânia	10.8	15.8
Cuiabá	9.0	14.6
Campo Grande	13.0	13.7
Federal District	11.8	14.4

when the actual risk of dying from cardiovascular diseases (as indicated by mortality coefficients) remained relatively stable (*37*).

Also, the city of São Paulo, like all the other state capitals studied, had a trend of increasing relative mortality from CVDs during the study period. However, the mortality coefficients in São Paulo were reportedly declining in the 1970–1981 period, suggesting that while CVDs continued to constitute a high-priority cause of death relative to other causes, the demographic risk of dying from them in São Paulo was decreasing for reasons not explained by the authors (*18*).

It is important to note that the average trend ratios (which show how relative mortality from CVDs has been increasing) have been larger in the capitals of the less developed regions (North, Northeast, and Center-West) than in the capitals of the more developed (South and Southeast) regions. Possible explanations include: (1) relatively greater reductions in overall mortality (especially from infectious diseases) in the former cities; (2) relatively greater improvements in filling out death certificates and recording statistics in the former cities, with corresponding reductions in reported mortality from ill-defined causes and significant impacts on CVD reporting; (3) a poorer quality of medical care in the former cities with regard to detection, treatment, and control of hypertension and its complications and of other important CVD risk factors such as diabetes mellitus (*38*); and (4) less access in the less-developed regions to hospitalization under the system contracted by the former INAMPS, as well as under the public health system (*39*), these two sectors being responsible for nearly 75% of the hospital medical care in Brazil (*40*).

With respect to the above, it should be noted that the prevalence of arterial hypertension in the Brazilian population is high, but the early data needed for time comparison purposes are not available (*41*). Also, in some capitals of the south and southwest ischemic heart diseases have already surpassed CVDs as the leading cause of death, a development that partly explains the pattern of stabilization observed in the trends of relative mortality from CVDs within the capitals in these regions.

Among the state capitals studied, São Luiz stands out for its high recorded relative mortality from CVDs throughout the study period and also within the two 1988 adult age groups studied. (It should be noted that the proportion of deaths from ill-defined causes in São Luiz in 1988 was only 2.5%—*36*.) The data thus point up a special need to conduct population-based epidemiologic studies of CVDs (with re-

gard to morbidity, mortality, and risk factors) in this city in order to obtain a better understanding of the serious CVD problem it confronts.

Relative mortality beginning at age 20 (rather than at birth) provides a better idea of the relative size of the CVD problem, partly because comparatively few CVD deaths occur in the under-20 group, and partly because this group accounts for a significant share of overall mortality. (In 1988 this share of overall mortality ranged from 9.8% in Rio de Janeiro to 39.6% in Manaus—*36*.) Accordingly, relative CVD mortality data for the 20–59 year and ≥60 year groups in nearly all the state capitals, particularly in the north and northeast for the older group, demonstrate the priority that these diseases demand within the general panorama of adult public health.

Within the Brazilian context, it is important to note the impossibility of working with trends for each specific type of CVD, as is done in industrialized countries. The earliest Brazilian statistics within the selected study period do not permit this type of analysis; and while the more recent statistics are reliable with regard to overall diagnosis of CVDs (which is clinically easy), certain social groups have only limited access to the more modern and less invasive diagnostic bioimaging procedures that permit more precise diagnosis of the type of CVD involved. Thus, most CVD diagnoses fall into ICD category 436 (acute but ill-defined cerebrovascular disease) (*42*).

Undeniably, analysis of CVD mortality by specific CVD type would be desirable, as CVDs constitute a heterogeneous subgroup within diseases of the circulatory system, and since they involve a variety of risk factors—although arterial hypertension is the most important. Knowledge of the frequency trend for morbidity and mortality of a specific type of CVD within the population, combined with knowledge of its corresponding risk factors, diagnostic methods, specific and nonspecific therapies, and other relevant social factors, would support preventive measures, at least for the most frequent types of CVDs. In addition, such analyses of specific CVDs could help to clarify both regional differences in CVD mortality found within Brazil and the differences observed between CVD trends in Brazil and those prevailing in most other Latin American countries (*2, 3*).

Although certainly not perfect, the data presented here clearly demonstrate a need for practical implementation of programs to detect and control hypertension and diabetes in Brazil. (Although such programs already exist, they operate only marginally at best in most state capitals.) This should be done by assessing experience with programs of this type at the international level and adapting that experience to the Brazilian context.

In particular, health policies need to support health promotion and protection efforts by emphasizing population strategies dealing with risk factors capable of securing prevention through lifestyle modification, with concomitant benefits for dealing not only with cardiovascular diseases but also with diabetes, obesity, and some neoplasias. Among other things, such strategies have been identified in the international literature as holding out the best prospects for primary prevention of hypertension (*7, 9, 10, 12*) and for dealing with the large share of cardiovascular complications resulting from it.

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APHA Annual Meeting

The American Public Health Association will hold its 123rd Annual Meeting from 29 October to 2 November 1995 in San Diego, California (U.S.A.). Over 12 000 public health researchers, practitioners, and policymakers are expected to attend, making this the world's largest gathering of public health professionals. This year's meeting will feature a close look at the health needs of the diverse population groups in the United States and how those needs can be met. The theme "Decision Making in Public Health: Priorities, Power, and Ethics" will be addressed through research presentations, round-table discussions, films, poster sessions, lectures, and special events. The keynote speaker will be Dr. C. Everett Koop, former Surgeon General of the United States. Further information may be obtained by calling the automated Convention Information line: (202) 789-5646.