

Multiple causes of death related to cerebrovascular diseases in the State of Parana, Brazil

Causas múltiplas de morte relacionadas às doenças cerebrovasculares no Estado do Paraná

Abstract

Objective: To identify associated causes and the number of causes on death certificates that reported cerebrovascular diseases as the underlying cause among residents of the State of Paraná, in Brazil. **Methods:** Mortality data in 2004 were obtained on the Datasus website. The population was selected by the TabWin program and multiple causes were processed by the Multiple Causes of Death Tabulator program. **Results:** The mean number of causes listed on death certificates was 2.92 for women and 2.97 for men. Most people who died (74.8%) were aged 65 or older. Among the major causes associated with cerebrovascular disease deaths were respiratory diseases (37.9%), hypertensive diseases (37.5%), and symptoms, signs and abnormal clinical and laboratory tests (32.3%). **Final Considerations:** There was a relative improvement in the quality of mortality data regarding the number of causes registered. Hypertension as a major associated cause suggests the need for its control in the fight against mortality caused by cerebrovascular disease. Studies with multiple causes should be encouraged, taking into account all causes listed on death certificates, many of which are overlooked in mortality studies that only use the underlying cause of death.

Keywords: Multiple causes of death. Vital statistics. Death certificates. Mortality. Cerebrovascular disorders. Cardiovascular diseases.

Tatiane Sano Furukawa^I

Augusto Hasiak Santo^{II}

Thais Aidar de Feitas Mathias^{III}

^I Faculdade de Saúde Pública da Universidade de São Paulo.

^{II} Departamento de Epidemiologia da Faculdade de Saúde Pública da Universidade de São Paulo.

^{III} Departamento de Enfermagem da Universidade Estadual de Maringá-PR.

Correspondência: Tatiane Sano Furukawa. Avenida General Valdomiro de Lima, 590, apto 809A. CEP 04344-070. Jabaquara- São Paulo, SP. E-mail: tatifurukawa@bol.com.br

Resumo

Objetivo: Identificar as causas associadas de morte e o número de causas informadas nas declarações de óbito por doenças cerebrovasculares entre residentes no Estado do Paraná. **Material e métodos:** O banco de dados de mortalidade do ano de 2004 foi obtido do Sistema de Informação de Mortalidade disponível no endereço eletrônico do Datasus. A população escolhida foi separada pelo programa TabWin e as causas múltiplas foram processadas pelo programa Tabulador de Causas Múltiplas de Morte. **Resultados:** O número médio de causas informadas foi de 2,92 para as mulheres e 2,97 para os homens. A maioria dos óbitos (74,8%) foi de pessoas com 65 anos ou mais de idade. Entre as causas associadas aos óbitos por doenças cerebrovasculares se destacaram as doenças do aparelho respiratório (37,9%), as doenças hipertensivas (37,5%) e os sintomas, sinais e achados anormais de exames clínicos e de laboratório (32,3%). **Considerações Finais:** Foi observada relativa melhora na qualidade dos dados de mortalidade em relação ao número de causas citadas. A hipertensão arterial como uma das principais causas associadas sugere a necessidade do seu controle no combate à mortalidade por doenças cerebrovasculares. Incentivos devem ser promovidos para estudos com causas múltiplas, para que se utilizem melhor informações tão importantes, que são desprezadas em estudos de mortalidade feitos somente com a causa básica de morte.

Palavras-chave: Causas múltiplas de morte. Estatísticas Vitais. Atestado de óbito. Mortalidade. Transtornos cerebrovasculares. Doenças cardiovasculares.

Introduction

The increase in chronic non-communicable diseases (CNCDs) as causes of death has put renewed focus on cardiovascular diseases including cerebrovascular disease (CVD). In Latin America and Caribbean countries, including Brazil, the incidence rate of CVD has ranged between 135 and 151 per 100,000 inhabitants.¹

These conditions affect large population groups and have a highly significant social and economic impact.² Furthermore, the occurrence of CVD is associated to the prevalence of risk factors such as obesity, sedentary lifestyle, high intake of salt and saturated fats, smoking and arterial hypertension.²

For the analysis of mortality for CVD, as well as for other CNCDs, it is often not enough to examine only the underlying cause of death. This is because individuals with these diseases have often other concomitant conditions associated during their lifetime, a phenomenon that is gaining importance with longer life expectancy and growing elderly population.

The analysis of multiple cause-of-death data including all causes of deaths reported on a death certificate (DC) is a valuable methodological approach for improving knowledge on these conditions and more accurately understanding the causal complexity involving deaths from a certain cause.³

In Brazil, mortality data is centrally managed and released by the Brazilian Ministry of Health National Mortality Database (SIM). Studies on mortality are particularly relevant as they can provide information for planning actions in different areas of expertise and knowledge production, thus contributing to the improvement of SIM data quality.

There are no studies on CVD mortality based on multiple cause-of-death analysis in the state of Paraná, southern Brazil. This analysis may indirectly reveal the morbidity profile in the state's adult and elderly population since several causes reported

on DCs may indicate the prevalence of risk factors in a population, e.g., arterial hypertension.

The present study aimed to identify causes associated with CVD mortality and the distribution of causes of CVD deaths reported on DCs in the state of Paraná. The study findings may contribute to the planning and management of policies for tackling CNCDS and to the use of SIM as a source of data for multiple cause-of-death analysis.

Materials and Methods

Descriptive exploratory study that analyzed CVD deaths in residents in the state of Paraná, southern Brazil, in 2004. Data on CVD deaths was obtained from the SIM.* There were selected all deaths among people aged 45 years or more with CVD as the underlying cause of death, I60 to I69 codes of the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10).⁴

The causes of death analyzed were those originally recorded on DCs and internationally known as “entity axis codes.” Data collection from SIM database was focused on the fields of the underlying cause of death and related fields in the international form of medical certificate of cause of death (item 49 of the death certificate, “causes of death”). A field was added in the records to include a string created by grouping all codes of causes of death in the fields in lines (a), (b), (c) and (d) of Part I and Part II of the medical certificate. This additional field was used to prepare the input file for processing associated causes of death through the Multiple Cause of Death Tabulator.⁵

The number of associated causes varied depending on the range of the class the reported causes belong to. When two or more causes in the same class were reported on a medical certificate, only one cause was recorded for that class (category, group or chapter of ICD-10), thus avoiding duplica-

tion and multiplication of causes of death through the use of abridged lists.⁵

As for the age groups studied, adults aged 45 to 64 and elderly 65 and over.

The average number of causes reported on DCs was calculated by dividing the total number of cases reported on DCs by the number of deaths with CVD as the underlying cause. The associated causes of death were analyzed by calculating the percentage of total deaths from CVD.

Since this study was based on data publicly available at the Brazilian Ministry of Health official website, it did not require approval of a research ethics committee.

Results

Cardiovascular diseases were the leading cause of death in people aged 45 years and older in Paraná in 2004. CVD accounted for 32.8% (6,013 deaths) of all deaths, followed by ischemic heart disease (31.5%; 5,783 deaths).

Of the 6,013 deaths with CVD as the underlying cause, 17,706 causes were reported on DCs, an average of 2.94 causes per DC (standard deviation [SD]: 1.25). DCs most often reported three causes (32.4%), followed by two (26%) and four (18.9%) (Table 1). More than five causes of death were reported in 3.2% of DCs, and only one cause was reported in 11.9% (714 deaths).

The average number of causes of death was similar for both women and men (2.92 and 2.97, respectively). A higher proportion of DCs reporting one, two, and three causes was seen among females, and four to nine among males. Nine causes were reported in a very small number of DCs and for male deaths only (Table 1).

Most deaths (74.8%) occurred in elderly, and 25.2% in adults. Of all CVD deaths, most were in males, of which 57% in adults (aged 45 to 64) and 52.8% in elderly (aged 65 and older) (Table 2).

A comparison of the number of causes between adults and elderly showed that

* Datasus website. Available at www.datasus.gov.br

Table 1 - Distribution of deaths due to CBVD, of adults and elderly, according to sex and number of causes reported. Paraná, 2004 (N e %).

Tabela 1 - Distribuição dos óbitos por DCBV, de adultos e idosos, segundo sexo e número de causas informadas. Paraná, 2004 (N e %).

Number of causes to DCs	Female	Male	Total number of deaths	Total number of causes
	N (%)	N (%)	N (%)	N (%)
1	340 (12.3)	374 (11.5)	714 (11.9)	714 (4.0)
2	734 (26.5)	833 (25.7)	1567 (26.0)	3134 (17.7)
3	899 (32.4)	1048 (32.3)	1947 (32.4)	5841 (33.0)
4	512 (18.4)	628 (19.4)	1140 (18.9)	4560 (25.8)
5	209 (7.5)	249 (7.7)	458 (7.6)	2290 (12.9)
6	70 (2.5)	86 (2.7)	156 (2.6)	936 (5.3)
7	09 (0.3)	13 (0.4)	22 (0.4)	154 (0.9)
8	01 (0.1)	03 (0.1)	04 (0.1)	32 (0.2)
9	00 (0.0)	05 (0.2)	05 (0.1)	45 (0.2)
Total	2774 (100.0)	3239 (100.0)	6013 (100.0)	17706 (100.0)

Source/Fonte: SIM, MS.

Table 2 - Distribution of deaths due to CBVD, of adults and elderly, according to the number of causes reported by death certificates, by age group and sex. Paraná, 2004 (N e %).

Tabela 2 - Distribuição dos óbitos por DCBV, de adultos e idosos, segundo número de causas informadas por declarações de óbito, por grupos etários e sexo. Paraná, 2004 (N e %).

Number of causes to DCs	45 a 64 years		≥ 65 years	
	Male	Female	Male	Female
	N (%)	N (%)	N (%)	N (%)
1	97 (11.2)	87 (13.3)	277 (11.7)	253 (11.9)
2	236 (27.3)	188 (28.8)	597 (25.1)	546 (25.7)
3	274 (31.7)	200 (30.7)	774 (32.6)	699 (32.9)
4	173 (20.0)	123 (18.9)	455 (19.2)	389 (18.3)
5	59 (6.8)	38 (5.8)	190 (8.0)	171 (8.1)
6	20 (2.3)	14 (2.1)	66 (2.8)	56 (2.6)
7	03 (0.3)	02 (0.3)	10 (0.4)	07 (0.3)
8	00 (0.0)	00 (0.0)	03 (0.1)	01 (0.0)
9	02 (0.2)	00 (0.0)	03 (0.1)	00 (0.0)
Total	864 (100.0)	652 (100.0)	2,375 (100.0)	2,122 (100.0)

Source/Fonte: SIM, MS.

both had a higher proportion of deaths with three causes reported in DCs (Table 2).

The main causes associated with CVD deaths in both adult and elderly men and women were cardiovascular diseases, followed by respiratory diseases, ill-defined causes, infectious and parasitic diseases and endocrine diseases. (Figure 1).

Cardiovascular diseases were reported in 52.2% and 46.5% of DCs of adults and elderly, respectively. Among elderly, hypertensive diseases (ICD-10: I10-I13) were reported in

35% of DCs; other heart conditions (I26-I51) in 12%; and atherosclerosis (I70) in 4.9%. Hypertensive diseases were reported in 44.7% of DCs of adults (Table 3).

Among respiratory diseases, the most reported causes were pneumonia (J12-J18) and respiratory failure (J96): 23.9% and 17.9% in elderly and 17.5% and 14.9% in adults, respectively. Symptoms, signs and abnormal clinical and laboratory data were reported in 27% and 34% of DCs of adults and elderly, respectively (Table 3). Nervous

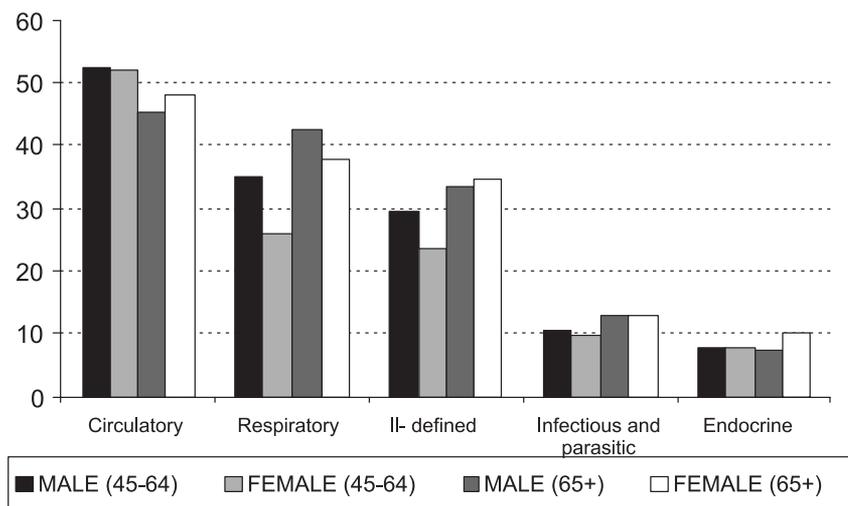


Figure 1 - Distribution of associated causes of deaths due to CBVD, according to age group and sex. Paraná, 2004.

Figura 1 - Percentual de causas associadas de morte nos óbitos por DCBV, segundo grupos etários e sexo. Paraná, 2004.

Table 3 - Associated causes of deaths due to CBVD, according to age group and sex. Paraná, 2004 (N e %).

Tabela 3 - Causas associadas de morte nos óbitos por DCBV, segundo grupos etários e sexo. Paraná, 2004 (N e %).

Associated (non-underlying) causes of death	Adults (N=1516)		Elderly (N=4497)	
	N	%	N	%
Infectious and parasitic (A00-B99)	156	10.3	568	12.6
Endocrine (E00-E90)	117	7.7	389	8.7
- Diabetes mellitus (E10-E14)	84	5.5	274	6.1
Nervous system (G00-G99)	185	12.2	231	5.1
Circulatory system (I00-I99)	791	52.2	2.090	46.5
- Hypertensive (I10-I13)	678	44.7	1.576	35.0
- Ischaemic heart (I20-I25)	13	0.9	43	1.0
- Others of heart (I26-I51)	138	9.1	541	12.0
- Atherosclerotic (I70)	36	2.4	221	4.9
Respiratory system (J00-J99)	472	31.1	1.808	40.2
- Pneumonia (J12-J18)	265	17.5	1.074	23.9
- Chronic lower (J40-J47)	25	1.6	153	3.4
- Respiratory failure (J96)	226	14.9	806	17.9
Genitourinary system (N00-N99)	51	3.4	214	4.8
Ill-defined (R00-R99)	410	27.0	1.531	34.0

Source: SIM, MS. / Fonte: SIM, MS.

Note: Proportion in relation to number of deaths. / Nota: Proporção em relação ao número de óbitos.

system diseases and infectious and parasitic diseases were less frequently reported, 12.2% and 10.3% of DCs of adults and 5.1% and 12.6% of DCs of elderly, respectively.

Endocrine disorders were reported in 7.7% of DCs of adults and 8.7% of elderly. Diabetes mellitus was reported in 5.5% and 6.1%, respectively (Table 3).

Discussion

Effective health care programs and policies aimed at disease management and death reduction have to rely on timely and adequate information about the nature and magnitude of the problems observed. The analysis of mortality data by age, gender and cause of death is the most widely used approach to planning health strategies and programs.⁶

Primary mortality statistics are usually presented by underlying cause of death; however, they do not show the full impact of a disease or condition in a given set of deaths. On the other hand, the approach of presenting multiple cause mortality statistics can provide a broader, more comprehensive overview of all causes of death.⁷

The World Health Organization (WHO) defines underlying cause of death as (a) "the disease or injury that initiated the train of morbid events leading directly to death or (b) the circumstances of the accident or violence that produced the injury."⁴ Other causes known as associated causes of death include morbid conditions giving rise to the underlying cause (terminal and intervening causes in Part I of the medical certificate), and contributory causes of death (Part II), which are not related to the disease or condition directly causing death.⁴

There has been recently an increased demand for presentation of all causes of death reported in DCs.⁸ The multiple cause-of-death analysis is a more time-consuming, complex and costly approach but these methodological difficulties are fully paid off in view of its contribution to the knowledge of the actual epidemiological profile of a population.⁷

The multiple cause-of-death mortality data in the present study showed that the average number of causes reported on DCs was 2.94. This is close to that found in studies conducted in the state of São Paulo⁵ and in the city of Belo Horizonte, both in southeastern Brazil.⁹ The first study examined the overall mortality and the second one mortality due to chronic degenerative diseases

in people aged 20 years and more and the average number of causes found was 2.7⁵ and 2.6,⁹ respectively. In addition, in Belo Horizonte,⁹ 22.5% of the deaths studied had only one cause reported and less than 1% had more than five causes reported. When compared with this study, the data suggest that the quality of DC completion was better in Paraná than in Belo Horizonte in 2004.

The mode of three causes per DC was similar to that found in Brazil and in most Brazilian regions in 2003.¹⁰

The average number of cases reported in DCs can be used as an indicator of mortality data quality assuming that the greater the number of deaths reported the more comprehensive the knowledge on the natural history of a disease, and thus, the greater the likelihood of preventing deaths from this disease.³

Studies have shown that the number of causes reported in DCs has been increasing since the introduction of multiple cause-of-death data analysis, particularly in recent years, and that the average number of more than two causes per DC is appropriate for using this methodology.¹⁰ This growth can be attributable to increased awareness by physicians of clinical and legal importance of adequate completion of DCs. Moreover, the addition of paragraph (d) in Part I of the medical certificate after the introduction of ICD-10, in 1996,⁴ also contributed to this improvement.¹⁰

With regard to the number of deaths, little difference was found between men and women, with a higher number of deaths among male adults and elderly, in contrast to that found by Lewsey et al.¹¹ While most deaths occurred in people aged 65 and more, 1,516 deaths (25.2%) were seen in adults aged between 45 and 64, i.e., early deaths, which could possibly have been prevented. Health services need to identify and prioritize actions to effectively reduce preventable mortality and meet the main needs of patients. The proportion of DCs with five or more causes of deaths was slightly higher among the elderly than adults, which is consistent with the likelihood of a

greater number of comorbidities in people older than 65 years.

In multiple cause-of-death analysis it is recommended to perform a comparison between the proportions of the association of a cause, which can indicate those causes that are most often associated with an underlying cause of death.¹² Olson et al.¹³ emphasized the difficulty in determining the statistical significance in the association of causes of death since the methods available are based on the assumption of independence of variables, which is not true for a multiple cause approach that is based on the assumption of interaction between causes.

The main causes associated with CVD deaths in São Paulo in 1998 were similar to those found in the present study. In São Paulo study, they reported 41.8% of respiratory diseases, 37.8% of hypertensive diseases and 26.3% of ill-defined causes.⁵

Arterial hypertension was also associated with CVD in other studies^{9,14} and with stroke,¹⁵ and it was seen in 87.8% of elderly patients with stroke, regardless of gender and age.¹⁵

According to the current criteria as proposed by WHO, the underlying cause is the one that initiated the process or chain of events that led to death.⁴ The certifying doctor has only to follow the specific design of DC. Or otherwise other criteria have to be applied to establish a sequence of events or to select the first cause reported. The goal is prevention, so the focus lies on the cause that initiated the process.¹⁶

However, when there are causes of death that are not regarded as underlying, rules of modification are applied. One of these rules is the arbitrary rule of "association of causes" that is applied when there is a second reported cause that is associated to the underlying cause and that then becomes the new underlying cause. This is true for arterial hypertension and CVD or hypertension and ischemic heart diseases.¹⁶ A 2002 study in the city of São Paulo with women aged 20 to 49 years showed that, of all deaths with hypertensive disease reported, 48% ended up being considered an associated cause.¹⁷

In a study on underlying and associated causes of death carried out in the state of São Paulo, hypertensive diseases were reported 25,480 times on DCs, of which 4,830 were selected as the underlying cause of death.⁵ In another study on mortality data in Brazil, hypertensive disease ranked 8th among the leading underlying causes of death.¹⁰ When all causes reported were considered, hypertensive disease ranked 2nd,¹⁰ which stresses the importance of multiple cause-of-death analysis to better understand the magnitude of hypertension in a population.

In addition to hypertensive diseases, diabetes mellitus is also relevant in the multiple cause-of-death analysis as it is underestimated in studies including only the underlying cause of death. Data from Brazil in 2000 revealed cardiovascular diseases were the most prevalent underlying causes when diabetes mellitus was the associated cause (54.5%).¹⁸ The literature shows 20% of diabetes in patients with stroke.^{15,19} Santo and Pinheiro⁵ found an association of CVDs and endocrine, nutritional and metabolic diseases in 12.3% while it was found around 8% in the present study. These results demonstrate the importance of controlling diabetes because besides being a risk factor for cardiovascular disease, it may cause severe complications and early disability and placing a heavy burden on patients and the general population.¹⁴

Other diseases with a major role among the causes mentioned above, maybe because they are consequences of CVD and its sequelae, were respiratory diseases, especially pneumonia and respiratory failure among the elderly. High rates of pneumonia were also found in patients with stroke admitted to a secondary care hospital,¹⁹ and were among the main causes of death.²⁰

It is noteworthy the high proportion of ill-defined causes reported along with CVD. Ill-defined causes can be classified as terminal causes such as heart arrest, respiratory failure and multiple organ failure.¹⁰

The associations found in the present study stress the importance of primary prevention through a program for the ma-

nagement of arterial hypertension and diabetes mellitus. In addition, raising people's awareness and reducing risk factors are also strategies to prevent most of these deaths. Effective prevention programs are believed to significantly reduce early deaths from complications of hypertension and CVD.²¹ Respiratory problems that often develop as a consequence of CVD should also be tackled, especially pneumonia.

One of the study limitations is the use of secondary data. Underreporting of deaths, data entry errors and inadequate quality of data in the medical certificates are issues likely to occur in SIM database. However, SIM data quality has improved and Paraná is known to have relatively good quality.²² The basic indicator used to assess the quality of mortality data statistics is the proportion of ill-defined causes reported as the underlying cause of death.^{8,23} It reflects people's access to medical care and aspects of DC completion.²³ In the year of this study, the proportion of ill-defined causes as the underlying cause of death relative to all deaths** in the State of Paraná was 5.1%, which is low compared to nationwide statistics.⁸

Final Considerations

Although the present study was conduc-

ted during only one year of observation, it allowed further understanding mortality data. The analysis of causes associated with CVD improved our knowledge of the natural history of this disease, on how causes were associated with each another and developed into morbid events leading to death. This study demonstrated that multiple cause analysis allowed to investigate 16,992 other causes of death on DCs with more than one cause of death reported that otherwise would have been overlooked.

The multiple cause-of-death analysis is an approach that allows profiling morbidity associated with underestimated diseases and evidencing increased risk of death in patients with these diseases. It provides greater understanding of the diseases that contribute to death from specific causes and this information can be used in the formulation of policies for prevention and health promotion. Further studies are needed so that valuable information that is usually overlooked in mortality studies investigating only the underlying cause of death can be more effectively used.

Acknowledgements: We thank the lecturers of HSM5723 course at the Universidade de São Paulo School of Public Health for their guidance in completing this article.

** Datasus/Brazilian Ministry of Health. Health Information. 2009. Available at: <http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obtptr.def>

References

1. Lavados PM, et al. Stroke epidemiology, prevention, and management strategies at a regional level: Latin America and the Caribbean. *Lancet Neurol* 2007, 6(4): 362-72.
2. Carvalho EMF de, Branco MAF. Perfil de mortalidade por doenças cardiovasculares na Região Metropolitana de Recife, segundo o Sistema de Informação sobre Mortalidade (SIM). *IESUS* 1996, 5(4): 61-71.
3. Santo AH, Pinheiro CE, Jordani MS. Causas básicas e associadas de morte por Aids, Estado de São Paulo, Brasil, 1998. *Rev Saúde Pública* 2000, 34(6): 581-88.
4. Organização Mundial da Saúde. *Classificação Estatística Internacional de Doenças e Problemas Relacionados à Saúde-10ª Revisão*. Edusp; v. 1, São Paulo: 2001.
5. Santo AH, Pinheiro CE. Tabulador de causas múltiplas de morte. *Rev Bras Epidemiol* 1999, 2: 90-7.
6. Santo AH. Causas mal definidas de morte e óbitos sem assistência. *Rev Assoc Med Bras* 2008; 54(1): 23-8.
7. Oliveira BZ, Gotlieb SLD, Laurenti R, Mello Jorge MHP. Mortalidade feminina por hipertensão: análise por causas múltiplas. *Rev Bras Epidemiol* 2009; 12(4): 556-65.
8. Santo AH. Tendência da mortalidade relacionada à doença de Chagas, Estado de São Paulo, Brasil, 1985 a 2006: estudo usando causas múltiplas de morte. *Rev Panam Salud Publica* 2009; 26(4): 299-309.

9. Rezende EM, Sampaio IBM, Ishitani, LH. Causas múltiplas de morte por doenças crônico-degenerativas: uma análise multidimensional. *Cad Saúde Pública* 2004, 20(5): 1223-31.
10. Santo AH. Potencial epidemiológico da utilização das causas múltiplas de morte por meio de suas menções nas declarações de óbito, Brasil, 2003. *Rev Panam Salud Pública* 2007, 22(3): 178-86.
11. Lewsey JD, et al. Sex differences in incidence, mortality, and survival in individuals with stroke in Scotland, 1986 to 2005. *Stroke* 2009, 40: 1038-43.
12. Ishitani LH, França E. Uso das causas múltiplas de morte em Saúde Pública. *IESUS* 2001a, 10(4): 163-75.
13. Olson FE, Norris FD, Hammes LM, Shipley PW. A study of multiple causes of death in California. *J Chronic Dis* 1962; 15: 157-70.
14. Ishitani LH, França E. Doenças crônico-degenerativas em adultos da região centro sul de Belo Horizonte: análise sob a perspectiva de causas múltiplas de morte. *IESUS* 2001 b, 10(4): 177-88.
15. Pires SL, Gagliard RJ, Gorzoni ML. Estudo das freqüências dos principais fatores de risco para acidente vascular cerebral isquêmico em idosos. *Arq Neuro-Psiquiatr* 2004 62(3b): 844-51.
16. Laurenti R, Mello Jorge MHP, Gotlieb SLD. Informação em mortalidade: o uso das regras internacionais para a seleção da causa básica. *Rev Bras Epidemiol* 2009,12(2): 195-203.
17. Chiavegatto Filho ADP et al. Mortalidade por doença hipertensiva em mulheres de 20 a 49 anos no município de São Paulo, SP, Brasil. *Rev Bras Epidemiol* 2004, 7(3): 252-58.
18. Barreto SM, Passos VMA, Almeida SKF, Assis TD. The increase of diabetes mortality burden among Brazilian adults. *Rev Panam Salud Publica* 2007, 22(4): 239-45.
19. Radanovic M. Características do atendimento de pacientes com acidente vascular cerebral em hospital secundário. *Arq Neuro-Psiquiatr* 2000, 58(1): 99-106.
20. Slot KB, et al. Causes of death by level of dependency at 6 months after ischemic stroke in 3 large cohorts. *Stroke* 2009, 40: 1585-9.
21. Lessa I. *O adulto brasileiro e as doenças da modernidade; epidemiologia das doenças crônicas não transmissíveis*. São Paulo: HUCITEC; 1998.
22. Paes NA. Qualidade das estatísticas de óbitos por causas desconhecidas dos Estados brasileiros. *Rev Saúde Pública* 2007; 41: 436-45.
23. Silvi J. On the estimation of mortality rates for countries of the Americas. *Epidemiol Bull* 2003; 24: 1-5.

Received: 13/07/10
 Final version: 08/11/10
 Approved: 12/11/10