

Flávia de O M Maia<sup>I</sup>

Yeda A O Duarte<sup>II</sup>

Maria Lúcia Lebrão<sup>III</sup>

Jair L F Santos<sup>IV</sup>

# Risk factors for mortality among elderly people

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## ABSTRACT

**OBJECTIVE:** The risk factors for diseases and premature deaths are important in drawing up preventive measures. This study had the aim of analyzing the risk factors for death among elderly people.

**METHODS:** This study was carried out among participants in the SABE (Health, Wellbeing and Aging) study, in the city of São Paulo in 2000. Interviews were conducted with 2,143 elderly people (60 years old or over), using a standardized questionnaire for the SABE study. The sample was obtained from census tracts, in two stages, with replacements and with probability proportional to the population, and with supplementation of the sample of people aged 75 years or over. The final data were weighted so that they could be expanded. Between the two data collection times, there were 38 deaths which comprised study sample. Logistic regression was utilized for the data analysis, with a significance level of 5%.

**RESULTS:** The risk factors found were: locomotion difficulty, advanced age, male gender, self-assessment of health as "bad" and difficulty in going to the bathroom, OR=3.15; 2.93; 2.90; 2.69 and 2.51, respectively.

**CONCLUSIONS:** The results may contribute towards the adoption of preventive measures for elderly people, with the aim of diminishing the expected number of fatal outcomes.

**KEYWORDS:** Aging health. Risk factors. Morbidity. Mortality. Multicenter studies. SABE. Pan American Health Organization.

<sup>I</sup> Hospital Universitário. Universidade de São Paulo (USP). São Paulo, SP, Brasil

<sup>II</sup> Departamento de Enfermagem Médico-Cirúrgica. Escola de Enfermagem. USP. São Paulo, SP, Brasil

<sup>III</sup> Departamento de Epidemiologia. Faculdade de Saúde Pública. USP. São Paulo, SP, Brasil

<sup>IV</sup> Departamento de Medicina Social. Faculdade de Medicina de Ribeirão Preto. USP. Ribeirão Preto, SP, Brasil

**Correspondence:**

Flávia de O M Maia  
Hospital Universitário da Universidade de São Paulo  
Av. Professor Lineu Prestes, 2565 Cidade Universitária  
05508-900 São Paulo, SP, Brasil  
E-mail: flaviamaia@hu.usp.br

Received: 9/20/2005 Reviewed: 4/27/2006  
Approved: 7/12/2006

## INTRODUCTION

Aging is a challenge in today's world that affects rich and poor countries. It is estimated that around one million people cross the threshold of 60 years of age every month, throughout the world. It is possible that by the year 2025, out of the 11 countries with the biggest populations of elderly people, eight will be in the category of developing countries, thus showing a transposition of large elderly populations from developed countries to countries that had been taken to be characteristically young, such as Nigeria, Brazil or Pakistan.<sup>18,20</sup>

In Latin America and the Caribbean, most countries are in an intermediate phase of demographic transition. According to Palloni & Peláez,<sup>13</sup> the transition in these countries is characterized by its rapidity. This, together with an unstable institutional context and unfavorable economic environment, generates conditions that make the process much more complex than in other areas of the world.

In Brazil in 1940, there were 1.7 million elderly people. By 2000, this total had reached 14.5 million, i.e. a ninefold increase. It is estimated that it will reach 30.9 million by 2020, thus placing this country's population of elderly people among the seven biggest in the world.<sup>5</sup>

Population groups have different risks of becoming ill, suffering accidents or dying. The presence of certain risk factors indicates greater likelihood that damage to health may appear. Once identified, these factors may be treated or modified by health actions, thereby altering the course of morbid or fatal events.

Risk factors can be defined as conditions that predispose towards a greater risk of developing certain health-related events after a given time. Risk factors that present the possibility of change and/or treatment are therefore of great interest, and the promotion of preventive measures is a central feature of maintaining and recovering the health of elderly people.<sup>4,14</sup>

With the growth in the elderly population, there has also been increasing interest in establishing factors that might, singly or jointly, better explain the risk of death that an elderly individual presents over the short term, thereby postponing an early fatal outcome.<sup>17</sup>

The Pan-American Health Organization coordinated a multicenter study named Health, Wellbeing and Aging (*Saúde, Bem-Estar e Envelhecimento* - SABE), to outline the profile of elderly people in Latin America and the Caribbean. Argentina, Barbados,

Brazil, Chile, Cuba, Mexico and Uruguay took part in this study.<sup>1</sup> In Brazil, the study was composed of elderly people living in the municipality of São Paulo in the year 2000.

The risk factors for death among elderly people that are often described in the literature as immutable are age and sex. Among the factors that are described as alterable are hospitalization, dependence for carrying out activities of daily living, cognitive deficit, lifestyle (such as smoking and not practicing physical exercise), some diseases such as depression and cancer, social isolation and the lack of family support, socioeconomic level and negative self-assessment of health as a predictor of mortality.<sup>16,21</sup>

Thus, the present study had the objective of investigating the risk factors for mortality among elderly people.

## METHODS

The population studied was composed of elderly people living in the municipality of São Paulo in the year 2000, as part of the SABE study conducted in Brazil. The study was characterized as a cross-sectional, exploratory and descriptive investigation with a quantitative approach.

The sample was made up of two segments. The first of these resulted from a draw and was based on the permanent records of 72 census tracts that are available in the Department of Epidemiology of Faculdade de Saúde Pública of Universidade de São Paulo (USP). This sample was taken from the records of the National Home Sampling Survey (PNAD, 1995), which are composed of 263 census tracts drawn by cluster sampling using the criterion of probability proportional to the number of homes. This segment consisted of a probabilistic sample of 1,568 interviewees. The second segment was composed of 575 people living in the districts in which the preceding interviews had been conducted, and constituted additions made to compensate for mortality among elderly people aged over 75 years and to complete the desired number of interviews within this age group. The minimum number of home drawn in the second stage was approximated to 90. Completion of the sample of people aged 75 years and over was done by means of locating homes that were close to the census tracts selected or, at most, within the limits of the districts to which the selected census tracts belonged, in accordance with the SABE study.<sup>11</sup>

The data were gathered simultaneously, by means of home interviews using an instrument consisting of

11 thematic sections.\* In the first phase, the following were gathered: personal data; cognitive assessment; state of health; functional state; medications; use of and access to services; family and social support network; work history and income sources; and housing characteristics. In the second phase, anthropometric data were obtained and flexibility and mobility tests were carried out. There was a maximum of six months between the two phases.<sup>11</sup>

Each questionnaire had a weight calculated in accordance with the corresponding census tract (weight=1/f). For the questionnaires applied to individuals in homes that were not drawn (age group of 75 years and over), the weighting calculation was done in accordance with the list of the elderly population within this age group who were living in the municipality of São Paulo in 1998, and the total number of elderly people in this age group found in the final sample for the study.<sup>11</sup> A detailed descrip-

tion of the methodology utilized can be found in Lebrão & Duarte.<sup>10</sup>

The study subjects were 38 elderly people living in the municipality of São Paulo who died between the two phases of data collection.

To analyze the risk factors for death, the pertinent variables were extracted from the questionnaire and were grouped into six thematic types: personal information, reported diseases, health care attendance, state of health, health conditions and activities of daily living.

Each variable was grouped into two classes: zero (0) as the reference class and one (1) for the contrast (Table 1). For this, the information corresponding to "did not know" and "did not answer" and information not filled in (missing values) was disregarded.

Stepwise regression was utilized,<sup>7</sup> because in this way

**Table 1** - Presentation of the thematic groups according to reference and contrast. Health, Wellbeing and Aging Study (SABE). Municipality of São Paulo, 2000.

Group	Variable	Reference	Contrast
Personal information			
	Age in years (A1b)	60 to 74	75 and over
	Sex (C18)	Female	Male
	Highest school level attended (A6)	High = beyond third year	Low = up to third year
	Working at present (H21)	Yes	No
	Marital status (A13a)	Yes	No
	Income (H27)	Low = zero or less than 2 <sup>nd</sup> quintile	High = above 2 <sup>nd</sup> quintile
	Living alone or with a companion (A7)	Yes	No
Reported diseases			
	Arterial hypertension (C4)	Normal	High
	Diabetes (C5)	No	Yes
	Neoplasias (C6)	No	Yes
	Chronic pulmonary disease (C7)	No	Yes
	Heart disease (C8)	No	Yes
	Cerebrovascular disease (C9)	No	Yes
	Osteoarticular disease (C10)	No	Yes
	Fall during the past year (C11)	No	Yes
	Nervous or psychiatric problem (C20)	No	Yes
Health care attendance			
	Ill during the past year (F3)*	No	Yes
	Assistance sought over the last four months (F11)	No	Yes
	Location of last consultation (F14)	Public	Private
	Who paid for the last consultation (F18)	Public	Private
State of health			
	Signs and symptoms over the last 12 months (C13 a to k)	No	Yes
Health conditions			
	Self-rated health (C1)	Good = good + very good + excellent	Bad = regular + bad
	Result from MEEM (B9)	Greater than 12	Less than or equal to 12
	Consumption of alcoholic drinks during the last three months (C23)	None	Some
	Smoking habit (C24)	No	Yes
	Regular physical activity over the past year (C25)	Yes	No
	Depression level (C21a to C21o)**	No = normal	Yes = some degree of depression
Activities of daily living			
	Difficulties in activities of daily living (D11 to D17)	No	Yes
	Difficulty in taking medicines (D25a)	No	Yes
	Receiving help (D26)	No	Yes

The letters and numbers beside the variables correspond to the questions from the SABE questionnaire that were utilized.

\*The variable F3 was eliminated from the analysis because of collinearity with the variable F11

\*\*This variable was eliminated from the analysis because of the high proportion of deaths among the "not stated" responses

the desired ranking of the relevance of each variable for explaining the model in the presence of the other variables could be built up. The significance level was set at 5%, both for including each variable in the model and for calculating the confidence intervals for the odds ratios.

For each thematic group, logistic regression was applied with the response variable of death, thereby making it possible to analyze the importance of the variables in each group. From the significant variables from each of these, a general model was built up and the relative importance of the response variables was verified.

## RESULTS

Table 2 shows the variables that presented statistical significance in each thematic group. In the "personal information" group, the variables of age and sex were the most important. Age of 75 years or over presented a risk of death approximately four times greater than for the elderly people aged between 60 and 74 years. Male sex implied the possibility of dying that was 2.7 times greater than for female sex.

In the "health care attendance" thematic group, none of the variables analyzed presented statistical significance. Thus, it seems that whether or not there was any attendance by the health care system over the preceding four months, for example, there was no influence on the occurrence of the fatal event.

The "reported diseases" grouping contained the principal diseases and complaints that affect the elderly. Among these, cardiac disease was shown to be the most important, and this increased the risk of death by a factor of 2.7 times.

The "state of health" grouping contained the symptoms reported by the elderly people. Of these, only "persistent cough, catarrh or chest wheezing" was

shown to be statistically significant in the analysis, increasing the risk of death by a factor of 3.2 times, in relation to those who did not present such symptoms.

In the "health conditions" grouping, the variable of health rated as "bad" was 4.5 times more significant than the variable of health rated as "good". The variables of smoking, drinking, not performing physical activities and cognitive abnormalities did not present statistically significant results for the risk of death.

In the "activities of daily living" grouping, the activities that presented statistical significance were those related to performing self-care activities and therefore those related to elderly people with a greater degree of dependence. Among these, difficulty in going to the bathroom, in feeding and in walking across the bedroom increased the possibility of the elderly individual dying by factors of 5.4, 3.3 and 2.8 times, respectively.

Difficulty in going to the bathroom, which has often been neglected in assessments on elderly people, was shown to be very important information, since it presented the largest risk ratio in relation to the occurrence of a fatal event. The elderly people with "difficulty in lying down on or getting up from a bed" presented a negative correlation (0.24).

In Table 3, the variables of the thematic groups that maintained significance of their results after again being put into the analysis model are presented.

In applying the regression model by means of multivariate analysis, it was observed that the principal risk factors for death among the elderly people were, in decreasing order: difficulty in locomotion, age of 75 years or over, male sex, health self-rated as "bad", and difficulty in going to the bathroom.

## DISCUSSION

Among the risk factors analyzed, age is considered to

**Table 2** - Odds ratios with significance for death among the variables from the thematic groups of interest. Health, Wellbeing and Aging Study (SABE). Municipality of São Paulo, 2000.

Thematic groups/ Variable	Reference	Contrast	Odds ratio	p	95% CI
Personal information					
Age	60 to 74 years	75 years and over	3.79	0.001	1.73
Sex	Female	Male	2.69	0.015	1.21
Reported diseases					
Heart disease	No	Yes	2.67	0.022	1.15
State of health					
Persistent cough, catarrh or chest wheezing	No	Yes	3.16	0.004	1.43
Health conditions					
Health rating	Good (good,very good and excellent)	Bad (regular and bad)	4.52	0.005	1.56
Activities of daily living					
Difficulty in walking across bedroom	No	Yes	3.33	0.013	1.29
Difficulty in going to bathroom	No	Yes	5.37	0.002	1.81
Difficulty in lying down on or getting up from bed	No	Yes	0.24	0.025	0.07
Difficulty in eating	No	Yes	2.80	0.027	1.12

**Table 3** - Ranking of risk factors for death among elderly people. Health, Wellbeing and Aging Study (SABE). Municipality of São Paulo, 2000.

Variable	Reference	Contrast	Odds ratio	p	95% CI
Difficulty in walking across bedroom	No	Yes	3.15		1.58; 6.26
Age	60 to 74 years	75 years and over	2.93	0.006	1.36; 6.28
Sex	Female	Male	2.90	0.007	1.33; 6.31
Health rating	Good	Bad	2.69	0.025	1.13; 6.41
Difficulty in going to bathroom	No	Yes	2.51	0.019	1.16; 5.42

be the best indicator of the risk of dying, since the likelihood of acquiring a chronic disease or incapacity increases with age.<sup>16,21</sup> Likewise, functional capacity and reserves also progressively diminish, thereby increasing the susceptibility to health problems and consequently the possibility of death. The mortality rates among elderly Brazilians increase for both sexes with age. Dependence on others for performing basic activities of daily living (feeding, hygiene, transfer, getting dressed and sphincter control) also increases. Chronic conditions such as hypertension, diabetes and osteoarticular diseases, among others, become more frequently reported. According to the data from the present study, age of 75 years or over represented a greater risk of dying. This characteristic is shared with developed countries, in which for every five years added to age, the risk of death goes up by 50%.<sup>4,16,21</sup>

Sex is also indicated as a risk factor for death, such that men are more susceptible than women. This difference in mortality between men and women occurs as a result of a variety of factors that, singly or jointly, cause women to live longer than men. The reduction in mortality due to maternal causes has been one factor contributing towards this difference. It is more a female characteristic than a male characteristic to seek health services, and this facilitates early treatment of diseases. There are also the biological differences that are considered to be protective for women, such as female hormones during fertile age, in relation to cardiocirculatory events. The domestic environment, where women traditionally remain, may be considered to be a safe environment, in relation to what men are exposed to. Environmental and occupational risks, such as work accidents, traffic accidents and homicide, and the stress associated with socioeconomic changes, have contributed towards greater mortality among elderly men. The smoking habit and alcohol consumption, which increase the risk for large numbers of diseases, were more common among the men than among the women in the elderly population studied. Nonetheless, these relationships might become equal or inverted in the future, consequent to changes in female habits and behavioral patterns.<sup>3,6</sup>

Among the diseases reported, the circulatory system disease group presented a significantly greater risk of death, and these diseases are the principal cause of death among elderly people, according to national statistics.\* Given that coronary cardiopathy is the principal cause of death among cardiovascular disease in many countries, and in view of its importance among the elderly, the World Health Organization has outlined preventive strategies and strategies for stabilizing clinical conditions, with the aim of avoiding illness, incapacity and death resulting from these diseases.<sup>12</sup>

Hospitalization is considered to be a risk factor for death among elderly people, because it provokes adverse effects on health such as infections, social isolation and iatrogenic conditions, among others. These may cause loss of independence and autonomy, and may often lead to death.<sup>15</sup> Despite this, in the present analysis hospitalization was shown to be significant. Hospitalized elderly people present progressive physical decline and, after discharge from hospital, they do not always manage to recover their previous functional performance, which results in high mortality rates following hospitalization.<sup>15</sup> According to Ponzetto et al,<sup>15</sup> loss of functional capacity is a more reliable prognostic factor for mortality among elderly people than the diagnoses made during hospitalization.

This was corroborated by the present study, in which the odds ratios for basic activities of daily living presented significance for the occurrence of death. Dependence on others for performing these activities is considered to be a risk factor for death among elderly people because such individuals have an indispensable need for help in performing the elementary tasks of life. Without an adequate structure for meeting their needs, dependent elderly people can be considered to be in an at-risk situation for worsening health and death.

Losses of cognitive abilities may alter functional capacity and compromise other domains such as physical and social characteristics. Deterioration among elderly individuals, whether due to dementia or de-

\*Ministério da Saúde, Datasus. Indicadores e dados básicos - Brasil, 2005 (IDB-2005). Disponível em <http://tabnet.datasus.gov.br/cgi/idb2005/matriz.htm> [acesso em 11 out 2006]

pression, leads to loss of autonomy and independence. Moderate to severe cognitive deficit is associated with greater risk of death among elderly people, even when controlled for demographic conditions and chronic comorbidities.<sup>18</sup> Nevertheless, this relationship could not be discerned in the present study.

Self-rated health, in response to the question "How do you rate your health?" has been widely utilized in investigations on elderly populations. Even though this a subjective assessment, it has shown results that are similar to those from objective evaluations of health conditions.<sup>2,8</sup> In addition to being easily obtained information, since it only depends on the elderly person's own opinion about his health, it was shown to be very important, because when it was considered bad, the likelihood of that elderly person dying became greater.

In reviews of the literature, Benyamini & Idler<sup>2</sup> and Idler & Benyamini,<sup>8</sup> showed that in most studies conducted since the 1980s, the elderly people who self-rated their health as bad presented greater incidence of death than did those who considered it to be excellent.

Among elderly people, self-rated health may present greater sensitivity for men than for women. Since women live longer than men and experience more years with diseases and incapacities, they tend to rate their health more negatively than do men, but do not necessarily die because of this, over the short term. Thus, negative self-rated health expressed by women may be more associated with quality of life. On the other hand, when men rate their health negatively, they present a greater risk of succumbing to a fatal event.<sup>9</sup>

Diseases relating to the respiratory system are the second biggest cause of hospitalization and the third biggest cause of death in Brazil. The findings from the present study reinforce the need for there to be monitoring of elderly people with chronic respiratory conditions, and for increases in preven-

tion services relating to vaccinations for this age group and their principal communicants, against colds and pneumonia. These should also be monitoring of circulating viruses, to contribute towards improving the composition of such vaccines offered to this population.

Smoking, drinking and not doing physical activities are more associated with the risk of developing diseases such as cardiovascular diseases than directly with the risk of death.

The negative correlation between bedridden elderly people and death leads to the inference that dependence requires greater attention, which seems to act as a protection factor against the occurrence of fatal events. On the other hand, individuals who are moderately dependent, i.e. who have difficulty in locomotion and transfer, presented greater risk of death. The results now presented indicate that there is a need for greater reflection regarding prioritization of care and reorganization of services.

The variables indicated by the model utilized may assist in building up an instrument for assessing the risk of death, thereby contributing towards the prevention of fatal events.

Elderly people who present greater risk of death ought to deserve differentiated attention from the bodies responsible for organizing the services destined for this population and their families, such that this would result in decreased premature death among these elderly people.

It is not intended through this that life should be prolonged at any cost. On the contrary, the idea is to avoid deaths associated with lack of health care, structure and resources, in a society that is rapidly aging and where elderly people's needs are often inadequately met, thereby increasing the possibilities of worsening health, incapacity, compromised quality of life, and death.

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