

Factors associated with the survival of elderly men in almost 15 years

Fatores associados à sobrevivência de homens idosos em quase 15 anos

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ABSTRACT: *Objective:* To identify factors associated with a higher probability of survival for men aged 60 and over in the course of almost 15 years. *Methods:* Prospective cohort study, where time zero is the year 2000 and deaths (final event) were measured until November 2014. The independent variables were obtained from personal characteristics, childhood life, educational status, lifestyle, social support, work history, socioeconomic situation, and health condition. *Results:* At the end of the period, 25.8% of elderly men remained alive and the factors that stood out associated with a higher probability of survival were: performing 50% or more of the Basic and/or Instrumental Activities of Daily Living (95%CI 0.41 – 0.64), being the head of the family (95%CI 0.42 – 0.82), participating in the community (95%CI 0.52 – 0.88), working on their own (95%CI 0.54 – 0.88), and owning a home and goods (95%CI 0.56 – 0.92). *Conclusion:* Characteristics related to a greater autonomy of the elderly men, even after almost 15 years, contributed to an increase in the probability of survival.

Keywords: Survival analysis. Longevity. Aged. Demography.

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**In memoriam.*

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RESUMO: *Objetivo:* Identificar fatores associados a maior probabilidade de sobrevivência de homens com 60 anos ou mais em quase 15 anos. *Métodos:* É um estudo de coorte prospectivo, em que o tempo zero é o ano de 2000 e cujos óbitos (evento final) foram mensurados até novembro de 2014. As variáveis independentes foram obtidas por meio de características pessoais, da vida na infância, da condição educacional, do estilo de vida, do apoio social, da história laboral, da situação socioeconômica e da condição de saúde. *Resultados:* No final do período, 25,8% dos homens idosos permaneciam vivos, e os fatores que se destacaram para maior probabilidade de sobrevivência foram: realizar 50% ou mais das atividades básicas e/ou instrumentais da vida diária (intervalo de confiança [IC] de 95% 0,41 – 0,64), ser chefe de família (IC95% 0,42 – 0,82), ter participação comunitária (IC95% 0,52 – 0,88), trabalhar por conta própria ou como proprietário (IC95% 0,54 – 0,88) e possuir casa própria e bens móveis (IC95% 0,56 – 0,92). *Conclusão:* Características relacionadas à autonomia do homem idoso, mesmo depois de quase 15 anos, contribuíram para aumentar a probabilidade de sobrevivência.

Palavras-chave: Análise de sobrevivência. Longevidade. Idoso. Demografia.

INTRODUCTION

The changes in the demographic profile of the world population show that the increase in the number of people over 60 years of age is increasingly pressing for attention in several countries. In 2019, this portion of the population surpassed 1 billion people (1.018 billion), 2.7 times more than in 1980 (382 million), and in 2030, the elderly are expected to exceed the number of children under 10 years (1.41 billion versus 1.35 billion)^{1,2}.

However, the aging of the population is not uniform and there are significant differences in life expectancy around the world³. The odds of elderly survival differ between countries, municipalities, neighborhoods and even between men and women⁴. A 60-year-old person born on the African continent is expected to live, on average, 7.1 years less than someone born in Oceania (16.8 and 23.9 years, respectively). In Europe, at this age, men tend to live four years less than women (19.9 and 23.9 years, respectively)⁵. In Brazil, from 1940 to 2018, the number of years lived increased on average 30.8 years (from 45.5 to 76.3 years). In the same period, the tendency for women to live longer than men continued — on average, 7.1 years longer. At 60, Brazilian women tend to live 24.3 more years, while men would live 20.6 more years⁶.

The social environment has a relevant role in the lives of those who reach old age, since the quality of life, active aging and the difference in the number of years to be lived would be impacted, among other reasons, by the access to social and health services, for example, as well as by behavioral, environmental, social and economic actions⁷⁻⁹. Therefore, old age would be a continuous process of reconstruction, in which each generation would be less marked by the age than by certain experiences in their social environment in the course of life¹⁰⁻¹³. The possibility of a long life would

involve a complex interaction between biological, psychological and socioeconomic features of individuals¹⁴. That is, in the last stage of life, the quality of life and the probability of survival would not be random, but rather influenced by practices and actions experienced in different ways over the years.

Thus, men present, in the different stages of their life course, the worst health, academic, social and behavioral indicators, although, as a group, they have had gender-related privileges and power¹⁵⁻²². Overall, men tend to have difficulties in adopting preventive measures, as well as finding the help they would need to solve various types of problems in their lives^{23,24}.

In short, several factors related to the social environment in the course of life can contribute in different ways to shape men and women as people and, in a way, impact their life expectations. In this perspective, the hypothesis of this study was that some of these factors, over time, are more relevant than others when it comes to the probability of survival among men who reach old age, regardless of their age. Thus, our objective was to identify which factors, after almost 15 years, contributed to a higher probability of survival for elderly men using data obtained in the study Health, Well-Being and Aging (SABE, acronym in Portuguese) in the city of São Paulo (SP)²⁵. The results can contribute to studies on the survival of elderly men, as well as support actions that allow increasing the number of years to be lived by this population.

METHODS

DATA SOURCE AND SAMPLE

This prospective cohort study used data from the SABE study, whose sample was designed to be representative of the elderly population aged 60 and more in the city of São Paulo²⁶. The final sample of 881 subjects represented the totality of them in the SABE study, with the year 2000 as baseline. The data related to the occurrence of deaths (final event) were measured until November 18, 2014.

STUDY VARIABLES

The dependent variable was the survival time of the elderly counted from the date of the interview (time zero) until the date of death.

The deaths were confirmed in the Mortality Information System of the São Paulo State Department of Health or by family members and/or neighbors of the elderly (verbal autopsy). In the case of non-possibility to measure the time of occurrence of the event, we assumed that these individuals were, on average, exposed to the risk of death for only half of the follow-up interval²⁷.

The independent variables were defined considering that aging is not uniform among individuals and that several factors would be related to the probabilities of survival. Therefore, variables that could assess characteristics of the life course were analyzed regardless of whether they were present at the beginning, in the middle or at the present stage of the subject's life. Details of the questions that helped define the variables are available at: http://hygeia3.fsp.usp.br/sabe/Artigos/Questionario_2000.pdf.

The variables were classified as:

- Personal characteristics: age group (60 to 69 years, 70 to 79 years, and 80 or more), skin color, being born in Brazil and having a father and/or mother died aged 60 or over;
- Childhood characteristics: from birth to 15 years: did not live in a rural area for five years or more; economic situation was good; never experienced food deprivation; had excellent health; had any of the diseases mentioned during the interview (hepatitis, measles, tuberculosis);
- Educational: knowing how to read or write, having attended school, studied for five years or more, and living with someone who studies or has studied;
- Lifestyle: religion (importance of religion in life), acting positively (answered 50% or more than 11 questions showing satisfaction with one's life), acting preventively for health problems (going to medical appointments or performing tests), performing or having performed physical activities, consuming alcoholic beverages, and relationship with smoking (currently smokes/former smoker or never smoked);
- Social support: living with someone, changes among residents in the last five years, being the head of the family, being in a marital union, having three or more children, having children who passed away, receiving or offering any type of help (financial or food purchases), being satisfied with one's social relationships and having some kind of community participation;
- Work history: having started working at the age of 15 or more, having worked as self-employed or being a company owner, having worked predominantly in the service sector, performing household activities, and currently having a job;
- Economic situation: considers to have sufficient income for their needs; having two or more sources of income; having a private health insurance; living in own home with electricity, water and sewage drainage system, and having bicycle, car and/or motorcycle; total income is greater than the minimum amount necessary for one's needs (in this case, the value of the basic food basket was calculated according to data on minimum consumption recommended by the Food and Agriculture Organization of the United Nations. Engel's coefficient reached the minimum global value necessary to meet these needs); income higher than the minimum wage in the month of the interview; paying three or more expenses (electricity, telephone or water); being satisfied with these last three situations;
- Health condition: having good memory and Mini Mental State Exam result greater than or equal to 13; considering in good health in relation to other elderly people; having any health problems (hypertension, diabetes, cancer, lung, heart or brain); presence

of any limitations resulting from these diseases; having arthritis and/or rheumatism and/or osteoporosis, having suffered a fall and/or having a vision problem; having any other health problem, among 13 others mentioned (urinary incontinence, shortness of breath, headache, fatigue and nausea); having good oral health (more than half of the permanent teeth and no problems to eat); considering oneself well nourished (eats normally and does not lose weight without a diet); performs 50% or more of Basic Activities of Daily Living (BADL) and Instrumental Activities of Daily Living (IADL) without difficulty and without help.

STATISTICAL ANALYSIS

The data used comes from a complex sample, and to capture its effects, the command `svyset` (Stata 13)²⁸ was used, as each questionnaire has a specific weight.

In the univariate analysis, the Rao-Scott test, the Kaplan-Meier limit product estimator, the log-rank test and the Cox proportional hazards model were used. The variables that were significant at the 0.05 level were maintained and included in the multivariate analysis.

In the multivariate analysis, the statistical method used for the construction of Cox's model was the backward selection, in which the order of entry of the model was from the lowest to the highest p. When the values found were very similar ($p < 0.0001$), the hazard ratio (HR) value of the Cox proportional hazards model was used as an additional entry criterion, also from the lowest to the highest value, because the lower the HR, the greater the protection against death. After imputing all covariates, some are no longer significant. Therefore, the model was adjusted excluding one variable at a time and maintaining the ones that remained significant. However, to confirm that the excluded variables were not statically significant when in contact with the others, they returned to the model, one at a time, for a final check. With that, we could verify whether or not there was a change in the significance of the entries that had remained significant.

After obtaining the initial Cox model with all significant covariables, by using graphs (complementary material), the cumulative probability of survival was analyzed (command `stphplot`) and the proportional risk assumption test (command `stcoxkm`) was performed, assessing whether the HR remained proportional throughout the observation period. Those that met this criterion made up the final model.

In the last stage, a global test was applied to the model (Grambsch and Therneau test), in order to verify if the final model satisfactorily met the conditions of the Cox model.

ETHICAL ASPECTS

The SABE study was approved by the Research Ethics Committee of the Public Health School of Universidade de São Paulo.

RESULTS

The sample of 881 men aged 60 and over represents a population of 346,204 people.

At the deadline of this study, 57.4% of the participants had died, 25.8% were alive, and, among the others (16.8%), we could not identify whether they were still alive or not. Among these, 4.3% were alive in 2006, 0.7% in 2009, 0.2% in 2010, 3.6% in 2011, and 1.8% in 2012, with total loss occurring in 6.2% from them.

In 2000, 62.1%, 29.1% and 8.8% of the elderly men were between 60 and 69 years old, between 70 and 79 years old, and 80 years old or more, respectively. The median survival time was 10.9 years. When compared to the elderly aged 60 to 69 years old, the ones aged 70 to 79 and 80 years or more had a risk of death 1.66 (95%CI 1.32 - 2.08) and 4.35 times higher (95%CI 3.49 - 5.41), respectively. In addition, according to each age group, the probability of surviving until November 2014 was 53.5%, 32.2% and 4.3%, and the probability that the elderly would be alive in the years 5, 10 and 14 was 75%, 53% and 36.1%, respectively.

In Table 1, we show that, among the covariables in which elderly men had the lowest death rates, we had some reporting that they worked predominantly as self-employed or were company owners, those who reported having community participation and those who owned their own vehicles and other goods (4.6). In the last two situations, we found some of the largest proportions of elderly who were alive by the conclusion of the follow-up period, that is, 55.2% and 55.8%, respectively.

Table 1. Percentage of elderly men who answered yes in the Health, Well-Being and Aging Study, death rate and percentage of survivors in November 2014, according to covariables present in the final model, municipality of São Paulo (SP), 2000–2014*.

Covariables	% SABE	Death rate**		Alive in November 2014 in%***		
	Yes	No	Yes	No	Yes	p
Performs 50% or more of BADL/IADL	79.9	13.9	5.5	15.5	49.9	< 0.0001
Lives with someone who goes to or went to school	74.7	9.4	5.9	30.0	47.4	0.0004
Owns a home and goods	32.2	7.9	4.6	36.9	55.8	0.0007
Participates in community	25.2	7.5	4.6	38.9	55.2	0.0008
Head of family	92.8	14.1	6.3	21.8	44.6	0.0035
Had illnesses up to 15 years of age	80.8	8.9	6.2	32.8	45.4	0.01
Predominantly self-employed or owner of company	24.4	7.3	5.0	40.1	51.9	0.0535

*Adjusted by age; **death rate per 100 elderly people/year; ***survivors in November 2014 (Rao-Scott association test); SABE: Health, Well-Being and Aging; BADL: Basic Activities of Daily Living; IADL: instrumental activities of daily living.

In Table 2, according to the Cox proportional hazards model test, the highlight in relation to the lower risk of death was among subjects who were heads of household, with 0.45% (95%CI 0.31 - 0.65), and who performed 50% or more of BADL/IADL, with 0.43% (95%CI 0.34 - 0.53).

In the final model, as shown in Table 3, these covariables remained relevant as protective factors against death, with the following results: performing 50% or more of BADL/IADL (95%CI 0.41 - 0.64), being head of the family (95%CI % 0.42 - 0.82), having community participation (95%CI 0.52 - 0.88), working as self-employed (95%CI 0.54 - 0.88), owning a

Table 2. Death risk rate among elderly men, according to covariables present in the final model, municipality of São Paulo (SP), 2000–2014*.

Covariables	Death risk rate**			
	Yes	95%CI		p
Performs 50% or more of BADL/IADL	0.43	0.34	0.53	< 0.0001
Head of family	0.45	0.31	0.65	< 0.0001
Participates in community	0.62	0.48	0.80	< 0.0001
Owens a home and goods	0.62	0.49	0.79	< 0.0001
Predominantly self-employed or owner of company	0.68	0.53	0.86	0.001
Had illnesses up to 15 years of age	0.73	0.57	0.93	0.010
Lives with someone who goes to or went to school	0.73	0.58	0.92	0.007

*Adjusted by age; **hazard ratio (Cox proportional hazard model test); 95%CI: 95% confidence interval; BADL: Basic Activities of Daily Living; IADL: Instrumental Activities of Daily Living.

Table 3. Final model of factors associated with higher probability of survival for elderly men, adjusted for age, municipality of São Paulo (SP), 2000–2014.

Covariables	HR	Error	z	P > z	95%CI	
Performs 50% or more of BADL/IADL	0.51	0.057	-5.99	0.000	0.41	0.64
Head of family	0.58	0.100	-3.14	0.002	0.42	0.82
Participates in community	0.67	0.091	-2.91	0.004	0.52	0.88
Predominantly self-employed or owner of company	0.69	0.085	-2.98	0.003	0.54	0.88
Owens a home and goods	0.72	0.092	-2.58	0.010	0.56	0.92
Had illnesses up to 15 years of age	0.77	0.100	-2.06	0.040	0.59	0.99
Lives with someone who goes to or went to school	0.79	0.094	-1.95	0.051	0.63	1.00

HR: hazard ratio; 95%CI: 95% confidence interval; BADL: Basic Activities of Daily Living; IADL: Instrumental Activities of Daily Living.

home, car and other goods (95%CI 0.56 - 0.92). In addition, they included: having had illnesses in the initial 15 years of life (95%CI 0.59 - 0.99) and living with someone who goes to or went to school (95%CI 0.63 - 1.0), as they were shown to be important for the probability of survival.

The cumulative failure rates of the covariates over the period remained proportional, reinforcing the basic assumption of the final model. In addition, it appears that the model is adequate and satisfactorily meets the conditions of use of the Cox model (Table 4).

The subjects who have all characteristics of the final model tend to live, on average, 4.5 years longer (12.5 years) than those with different characteristics (8 years). In addition, their probability of living for another 14 years is 73.5% higher than the others, since, on average, 43.0% of them lived until this period, to the detriment of 24.8% with the opposite profile (Table 5).

DISCUSSION

Survival is higher among elderly men who have autonomy in managing situations in their social environment, who had had health problems during childhood and who live with people with access to the school environment. Among the situations of autonomy, being able to perform BADL/IADL stands out, considering oneself responsible for their household, participating in activities in the Community, and owing more goods.

Having autonomy in BADL is very different from having autonomy in IADL; however, in both cases, being dependent in some way reinforces the severity of the elderly person's disability, the structure they need and of their health status in the end of life. The ability to perform daily life activities without difficulty has an important role in the lives of elderly

Table 4. Global test * associated with the proportionality of failure rates in the Cox model adjusted for age among elderly men, municipality of São Paulo (SP), 2000–2014.

Covariáveis	rho	Chi2	df	Prob > chi2
Performs 50% or more of BADL/IADL	-0.03579	1.05	1	0.3046
Head of family	-0.01832	0.28	1	0.5986
Participates in community	-0.01530	0.23	1	0.6342
Predominantly self-employed or owner of company	0.05484	2.54	1	0.1109
Owens a home and goods	-0.02391	0.50	1	0.4786
Had illnesses up to 15 years of age	0.00429	0.02	1	0.8905
Lives with someone who goes to or went to school	0.04741	2.21	1	0.1371
Global test		6.88	7	0.4413

*Grambsch and Therneau test; BADL: Basic Activities of Daily Living; IADL: Instrumental Activities of Daily Living; rho: correlation coefficient test; df: degrees of freedom; Prob: probability.

people²⁹⁻³². Elderly people who have autonomy in carrying out their activities live longer than those who do not^{33,34}. Our results reinforce this by identifying that, in 14 years, the probability of an independent man to survive is almost five times greater (4.8) than a man whose autonomy is impaired (Table 5).

With the current new family structures and compositions, the term “head of the family” linked to the image of a male tends to be readjusted to the new patterns of social relations built on a daily basis. This change tends to make individual rights and responsibility among family members more egalitarian¹⁵. The role in probability of survival identified in subjects who perceived themselves as responsible for their households may indicate that they would be adapted to this new reality, unlike the ones who lived less years.

Elderly people of both genders who live in less favorable social situations are linked to a higher mortality rate³⁵. The attributes of their family composition and the community they

Table 5. Probability of survival of elderly men, according to covariables present in the final model, adjusted for age, municipality of São Paulo (SP), 2000–2014.

Covariables	Category	% elderly alive in said year*			Survival time**		
		5	10	14	75%	50%	25%
Performs 50% or more of BADL/IADL	No	54.7	23.9	8.9	2.6	5.4	9.9
	Yes	80.2	60.6	43.1	6.2	12.4	-
Head of family	No	56.9	21.2	16.4	2.5	5.4	7.7
	Yes	76.4	55.5	37.6	5.3	11.4	-
Participates in community	No	72.7	48.2	32.1	4.7	9.8	-
	Yes	82.1	67.7	48.0	8.4	13.5	-
Predominantly self-employed or owner of company	No	71.8	49.8	33.8	4.5	9.9	-
	Yes	85.0	63.1	43.0	8.4	12.5	-
Owns a home and goods	No	70.8	48.2	28.8	4.2	9.6	-
	Yes	84.0	63.5	51.4	7.5	14.3	-
Had illnesses up to 15 years of age	No	65.7	40.0	28.1	3.3	8.2	-
	Yes	77.3	56.3	38.0	5.5	11.6	-
Lives with someone who goes to or went to school	No	66.1	37.0	25.3	3.3	7.9	14.2
	Yes	78.1	58.7	39.8	5.5	11.9	-
Has all features of the model	No	65.5	38.3	24.8	3.6	8.0	-
	Yes	80.4	60.8	43.0	6.7	12.5	-

*Percentage of elderly people who survived until year 5, 10 and 14; **survival time (in years) in the 25th, 50th and 75th percentiles; BADL: Basic Activities of Daily Living; IADL: Instrumental Activities of Daily Living.

live in are important so we better understand the differences in life expectancy^{36,37}. The prevailing understanding is that the social environment and socioeconomic conditions play a relevant role in people's life expectancy. Social relationships and other personal characteristics are developed and altered in the course of one's life³⁸. Social capital is just as important as human capital³⁹. In addition, it is important to emphasize that individual behavior would be influenced, restricted or pre-programmed by the social structure and by the agents of the environment to which subjects are exposed^{4,40-44}. Therefore, our result stands out as it points out the importance of community participation and living with people who go/went to school in the survival of elderly men.

Old age is not a water divider in relation to a "previous" life; on the contrary, it is a continuation of childhood, youth and maturity, which may have been experienced in different ways¹². Social agents incorporate a generating habitus – dispositions acquired by experience – that vary in time and space. That is, from birth to death, the habitus would be continuously restructured^{45,46}. Factors such as sex, growth conditions in childhood, diet and socioeconomic conditions have a direct and indirect influence on the longevity of the elderly^{47,48}. Thus, health professionals cannot neglect the social environment in which their patients are inserted, neither aspects of their past⁴⁹. Our results allow us to infer that elderly men who remember having diseases in childhood brought with them, throughout their lives, knowledge about the importance of taking care of health, which in this case result in a greater probability of survival compared to those who apparently did not have the same conduct.

Some authors argue that individuals, regardless of the environment they are inserted in, could make and transform their own history. However, they would not be immune to the values and social practices institutionalized in their social context, as these values and practices would influence both present and future generations, just as they had already impacted past generations⁵⁰. Senile involution is generated within society and is closely related to the role an individual occupies in society and in place⁴⁷.

In almost all causes of death, there was an inverse relation between social status and mortality; that is, people with less economic resources at their disposal die earlier^{51,52}. However, the limitation of income would not be the only factor to prevent people from doing or achieving something, as the physical and social characteristics acquired throughout life significantly affect their lives. The inability to acquire goods – and not having goods – is what would contribute to deprivation of food and the increase in social inequality⁵³. The stages of the course of life would be influenced by cultural differences, as well as by the material conditions of each individual^{54,55}. Thus, the economic factor cannot be analyzed isolated from the social, political and ideological superstructures in which individuals are involved; if we consider two individuals with the same income, depending on the environment they belong to, one could be considered rich in a poor society, and the Other could be considered poor in a rich society⁴⁷. In the case of elderly men from São Paulo, the difference in goods they claim to have made a difference in the probability of survival, since subjects who had more goods had beneficial results.

This study can contribute to the understanding of survival probabilities of elderly men. However, it has limitations regarding the interpretation of survival data and its tendency, especially when the results are compared with those of studies with different populations, defined geographically and in different ways⁵⁶. In addition, it is important to mention the possibility of selection bias due to the losses that occurred among individuals who, for various reasons, were not found, as their profile could differ from those that were actually studied. These differences probably imply greater dependence for BADL and IADL, more expression of pathologies, and less survival.

The autonomy to take part in social conditions, combined with the understanding of situations experienced, and having contact with people with access to school contribute to a higher probability of survival among elderly men. In this sense, public policies that enable the autonomy of elderly men, as well as their ability to understand and relativize their role in society, can help to increase their chances of survival.

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