

# Factors associated to mortality in adults and elderly residents in the city of Rio Claro - SP: a cohort study

## Fatores associados à mortalidade de adultos e idosos residentes no município de Rio Claro - SP: um estudo de coorte

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**Abstract** – The factors associated to mortality may be distinct in each region and identifying them can contribute to develop public policies related to health promotion and prevention. Thus, the aims of this study were verify the factors associated with mortality and the influence of physical activity on the mortality rates of adults and elderly living in the city of Rio Claro, SP. The first moment of the cohort study was conducted in 2008 and the second in 2014. Participants answered questions about socio-demographic level, level of physical activity (PA), health and eating habits variables. In the case of individuals who were not found after three attempts, neighbors and relatives were questioned about whether they had the contact with that person or if he/she had passed away. To analyze factor associated to mortality, three independent Logistic Regression models for complex samples were used (total PA; commuting PA; leisure PA), as well as the SPSS software version 21.0, considering  $p < 0.05$ . The variables that were associated with mortality in the three models were: “male sex”, “elderly” and “poor/very poor health perception”. Further, individuals who spent 150 min/week of physical activity did not showed any protection against mortality when compared with those who did not achieve the recommendation. These results can guide public policies, mainly, to the health of the elderly, people with poor health perception and men.

**Key words:** Adults; Aged; Brazil; Mortality.

**Resumo** – Os fatores associados à mortalidade podem ser distintos em cada região e identificá-los contribuem para o desenvolvimento de políticas públicas voltadas à promoção e prevenção de saúde. Assim, os objetivos do estudo foram verificar fatores associados à mortalidade e analisar a influência da atividade física na mortalidade em adultos e idosos, residentes no município de Rio Claro - SP. Foi realizado um estudo de coorte em que o primeiro momento ocorreu no ano de 2008 e o segundo em 2014. Os participantes responderam questões sociodemográficas, nível de atividade física (NAF), variáveis de saúde e hábitos alimentares. No caso dos sujeitos que não foram encontrados após três tentativas, vizinhos e parentes foram questionados se tinham o contato daquela pessoa ou se a mesma havia falecido. Para analisar os fatores associados à mortalidade, foram utilizados três modelos de Regressão Logística para amostras complexas independentes (NAF total; NAF no transporte; NAF no lazer), por meio do programa SPSS versão 21.0, adotado um  $p < 0,05$ . As variáveis que tiveram associação com a mortalidade nos três modelos foram: “sexo masculino”, “idoso” e “percepção de saúde ruim/muito ruim”. Além disso, não houve uma proteção para pessoas que praticavam 150 minutos ou mais de atividade física por semana quando comparados com indivíduos insuficientemente ativos e inativos. Estes achados podem nortear políticas públicas voltadas, principalmente, para a saúde de idosos, pessoas com percepção de saúde ruim e homens na cidade de Rio Claro - SP.

**Palavras-chave:** Adultos; Brasil; Envelhecimento; Mortalidade.

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## INTRODUCTION

Mortality can be considered an indicator of living conditions and development<sup>1,2</sup>, in which possible risk factors in a given population can be identified. These factors can be mutable and/or treatable, such as malnutrition, lack of basic sanitation, alcohol consumption, smoking, inadequate nutrition, physical inactivity, high blood pressure, high body mass index, cholesterol and blood glucose. Thus, it becomes important to understand and investigate health conditions and new forms of prevention and health promotion<sup>3</sup> to reduce the mortality rate of a region.

Data from the World Bank Group<sup>4</sup> showed low mortality rate due to chronic and non-communicable diseases in adults from high-income countries, with Iceland (8%) having the lowest, and medium- and low-income countries with higher mortality rates, with Papua New Guinea (36%) having the highest rate. In Brazil, the mortality rate among adults is 14.7%<sup>5</sup>.

Several studies have sought to understand and investigate new forms of prevention and health promotion to reduce mortality rates<sup>3</sup> and within this perspective, regular practice of physical activity has been an important ally in reducing mortality<sup>6</sup>. Lee et al.<sup>7</sup> in a systematic review, showed that regular practice of physical activity is associated with improved health and reduced mortality from cardiovascular diseases, type 2 diabetes, certain cancers, hypertension, obesity, depression, and other chronic diseases. However, studies involving the level of physical activity and mortality rate should consider unmodified factors, such as age and sex.

The prevalence of physical inactivity increases with age<sup>8</sup> and the protective effect of physical activity for mortality is sex dependent, being beneficial for both, especially for men<sup>9</sup>. In this way, a study on the factors associated with mortality of adults and elderly in medium-sized municipalities becomes important, since different regions have different characteristics and behaviors<sup>10</sup>. The findings of this study may contribute to future public policies in order to minimize the number of deaths, considering that the mortality rate in 2014 corresponds to approximately 7.46 (deaths/thousand inhabitants)<sup>11</sup>.

In view of the above, the aims of the present study were: i) to describe the mortality rate and its associated factors in a 6-year interval; and ii) to analyze the influence of physical activity on mortality in adults and elderly living in the municipality of Rio Claro. The hypotheses of this study are: i) the highest number of deaths is related to inadequate lifestyle (smoking, physically inactive, among others) and ii) regular practice of physical activity presents a protective factor to mortality.

## METHODOLOGICAL PROCEDURES

The study was carried out in the city of Rio Claro – SP<sup>12</sup> (urban area) with individuals aged 20 years or older who have lived for more than one year in the city. The municipality of Rio Claro is located in the administrative

region of Campinas, SP, with territorial area of 498,422 km<sup>2</sup>, population density of 373.69 (pop/km<sup>2</sup>) and population estimated in 2016 of 201,473 thousand inhabitants, Human Development Index of 0.80312 and *per capita* income of R\$ 1,049.16<sup>13</sup>.

The present cohort study began in 2008 and was developed by the Department of Physical Activity, Sport and Health (NAFES) and the Laboratory of Physical Activity and Aging (LAFE), belonging to the “Júlio de Mesquita Filho” State University of São Paulo - Rio Claro - SP, with support from the Municipal Health Department of Rio Claro and Regional Council of Physical Education (CREFA/SP).

For sample size calculation, sample error of 5% and prevalence of 50% of physical inactivity were considered in the adult population of Rio Claro - SP. The sample estimate was of 764 participants; however, as the sample was selected by clusters, a design effect (deff) equal to 2 was adopted, doubling the number of participants, totaling 1,528 participants:  $n = (N \cdot z^2 \cdot P \cdot (1-P)) / (d^2 \cdot (N-1) + z^2 \cdot P \cdot (1-P))$ . Where  $n$  = sample size,  $N$  = population of Rio Claro - SP aged 20 years or older, approximately 128,000 people<sup>14</sup>,  $z$  = significance level (established in 95%),  $P$  = expected prevalence of the phenomenon to be investigated (based on previous studies and aiming to obtain the largest possible number of participants, was defined as 50%, i.e., 0.5), and  $d$  = tolerable sample error (defined as 5%).

The random sample process occurred as follows: the city of Rio Claro - SP contains 200 census tracts, so 100 odd sectors were selected aiming at reaching the sample number with a balanced spatial distribution. The exclusion criteria of census tracts were: a) to be exclusively an industrial area; b) prison area; c) rural area and d) hospital and nursing home areas. Thus, three odd sectors were excluded, as these were hospitals or nursing homes, so the even sectors 50, 100 and 150 were included due to their equidistances to compose the 100 sectors. Then, eight households were drawn from each sector, totaling 800 households. All residents 20 years of age or older were interviewed, except individuals with severe and intellectual motor disabilities.

In order to collect data, questionnaires were used on personal and sociodemographic issues (Brazilian Association of Research Companies - ABEP)<sup>15</sup>, International Physical Activity Questionnaire (IPAQ - long version)<sup>16</sup> translated into Portuguese to verify the level of physical activity, quality of life questionnaire (SF-36)<sup>17</sup>, questionnaires of barriers to physical activity<sup>18</sup> and questionnaire on nutrition (INCA)<sup>19</sup>. All questionnaires used have a validation study for the Brazilian population.

In the year 2014, contact with the same 1,588 participants of 2008 was performed. The subjects were contacted and submitted to the same questionnaires applied in 2008. For data collection, a course was held to prepare interviewers, with duration of 10 hours, where approximately 15 people from the community who were on the list of interviewers of the Brazilian Institute of Geography and Statistics (IBGE) participated in the training course, in addition to two doctoral students, three masters and one

undergraduate Physical Education student, all familiar with the subject. After the end of the training course, data collections began, in which both interviewers and students involved in the research divided the sectors for better logistics. In 2008, questionnaires were applied through paper and in 2014, collection was done through tablets and postgraduate students were responsible for training the interviewers in the use of this tool. The use of tablets has reduced the collection time from 60 to 38.9 minutes, as well as enabling fast data tabulation and paper economy.

### **Dependent variable**

In 2014, all cases confirmed by neighbors, friends or relatives who died were recorded as deaths. In addition, these people were questioned about the cause of death. After confirmation of the death and its cause, the interviewer completed the loss questionnaire where for the question "cause of loss", "death" alternative was selected. Thus, as a dependent variable, all-cause mortality was adopted.

### **Independent variables**

The characteristics of the subjects who died were obtained through self-reported questions about sex (male and female), age (60 years or more, 40 to 59 years, 20 to 39 years), weight and height for the calculation of the Body Mass Index, considering: malnutrition ( $<18.5 \text{ kg/m}^2$ ), eutrophic ( $18.5$  to  $24.9 \text{ kg/m}^2$ ), overweight ( $25$  to  $29.9 \text{ kg/m}^2$ ) and obese ( $\geq 30 \text{ kg/m}^2$ )<sup>20</sup>, marital status (widowed/divorced, married, single), perception of current health status (poor, very poor, good, very good and excellent), smoking (smoker; not smoker, former smoker), schooling (complete high school / higher education, incomplete high school, up to 4<sup>th</sup> grade), economic class (A, B, C, D and E) (ABEP), level of physical activity, considering separately total PA, commuting and leisure, classified as active ( $> 150 \text{ min/wk}$ ), insufficiently active ( $10$  to  $149 \text{ min/wk}$ ) and inactive ( $<10 \text{ min/wk}$ ) (IPAQ– long version). For the total PA, all physical activities performed in the four domains (work, domestic, leisure and commuting) were considered. It was considered vigorous physical activity, those that require a great physical effort, causing the individual to breathe much stronger than the resting levels<sup>16</sup>.

### **Statistical analysis**

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS®) software version 21.0 and adopting  $p < 0.05$ . A descriptive analysis of data was performed (absolute frequency, relative and their respective 95% confidence intervals).

Considering that the sample was selected by conglomerates, an analysis plan was elaborated for complex samples having as grouping units variables age and sex. Considering that age was divided into three groups (20 to 39 years, 40 to 59 years, 60 years or more) and sex in two (male and female), six categories of groups were created, from the combination of these two

variables. After this, data from the present sample were compared with the 2010 Census data, and sample weighting values were created. Finally, after the creation of groupings and the sample weighting values, a Logistic Regression analysis was performed for complex samples.

To analyze factors associated with mortality, mortality was considered as outcome and gender, age, BMI, marital status, health perception, smoking, schooling, economic class and physical activity were considered as exposure.

Specifically in relation to physical activity, three independent models were elaborated: a) total PA, b) commuting PA and c) leisure PA. These last two models were created to evaluate the specific effects of physical activity on commuting and leisure, respectively. Thus, it was necessary to correct for physical activities performed in the other three domains. For example, in the commuting PA model, specific physical activity time was recorded in the commuting domain and categorized into three groups: active (> 150 min/wk), insufficiently active (10 to 149 min/wk) and inactive (< 10 min/wk). In order to isolate the effect of only physical activity in the commuting domain, the commuting PA model was adjusted by physical activity performed in the other three domains (work, domestic and leisure). The analysis for leisure PA was performed in an analogous way.

### **Ethical aspects**

The research was approved by the Research Ethics Committee Involving Human Beings of the Institute of Biosciences of the State University of São Paulo - UNESP, Campus of Rio Claro (process: 8592).

## **RESULTS**

The sample studied in 2008 and 2014 is described in Table 1. In the year 2014, after the attempt of contact with the 1,588 participants, 693 subjects were located and information was collected, being recorded 895 sample losses, among them 81 deaths. This result indicates a mortality of 10.5% in 6 years of follow-up, and for females this value was 8.6% and for males 13.4%.

Regarding factors associated with mortality, the results indicate that, regardless of proposed model (total PA, commuting PA and leisure PA), men and older adults presented higher mortality risks. Higher mortality risk was also identified for individuals with poor/very poor health perception when compared with the group with good/very good/excellent health perception in the total PA and leisure PA models (Table 3). Moreover, in the leisure PA model, people aged 40-59 years presented higher risk when compared to those aged 20-39 years.

Regarding the physical activity aspects, people who had 10 or more minutes of PA had no protection for mortality when compared to those who performed less than 10 minutes of PA per week. This pattern was also observed when only physical activities in the leisure and commuting domain were analyzed separately from other physical activity practices.

**Table 1.** Socio-demographic characteristics, level of physical activity, health perception and smoking habits of the adult population of Rio Claro in the two research moments.

Characteristics		2008		2014	
		n total = 1,588		n total = 693	
		n	%	n	%
Sex	Female	918	57.8	430	62
	Male	670	42.2	263	38
Age	20 to 39 years	638	40.2	134	19.3
	40 to 59 years	593	37.4	289	41.7
	60 years or older	356	22.4	270	39
	Malnutrition	21	3.1	12	1.8
BMI	Eutrophic	292	43.1	239	35.3
	Overweight	235	34.7	241	35.6
	Obese	130	19.2	185	27.3
Marital status	Married	999	62.9	459	66.2
	Divorced / Widowed	283	17.8	137	19.8
	Single	306	19.3	97	14
Schooling	Up to 4 <sup>th</sup> grade	586	36.9	273	39.4
	Incomplete high school	296	18.7	105	15.2
	Complete high school /higher education	705	44.4	315	45.5
Smoking	Smoker	110	15.9	100	14.4
	Former smoker	121	17.5	148	21.4
	Not smoker	462	66.7	445	64.2
Health perception	Excellent	175	11.5	450	64.9
	Very good	249	16.4	83	12
	Good	935	61.4	106	15.3
	Poor	98	6.4	43	6.2
	Very poor	10	0.7	9	1.3
Economic class	D and E	280	18.1	29	4.3
	C	728	47.2	289	42.8
	A, B	535	34.7	358	53
Leisure PA	>150 min/wk	414	26.1	196	28.3
	10 to 149 min/wk	186	11.7	114	16.5
	<10 min/wk	988	62.2	383	55.3
Commuting PA	>150 min/wk	577	36.3	137	19.8
	10 to 149 min/wk	546	34.4	308	44.4
	<10 min/wk	465	29.3	248	35.8
Total PA	>150 min/wk	414	26.1	593	85.6
	10 to 149 min/wk	186	11.7	54	7.8
	<10 min/wk	988	62.2	46	6.6

**Table 2.** Prevalence of deaths stratified by personal and sociodemographic characteristics in the city of Rio Claro - SP.

	n	Deaths
		(%)
Sex		
Male	41	13.4%
Female	40	8.6%
Age		
60 years or older	47	20.5%
40 to 59 years	24	7.5%

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	n	Deaths (%)
20 to 39 years	10	4.5%
<b>BMI</b>		
Obese	13	16
Overweight	32	39.5
Eutrophic	33	40.7
Malnutrition	2	2.5
<b>Marital status</b>		
Divorced / Widowed	21	18.75%
Married	53	9.7%
Single	7	6.1%
<b>Health perception</b>		
Poor and very poor	19	35.8%
Good, very good and excellent	59	8.9%
<b>Smoking</b>		
Smoker	19	23.5
Former smoker	24	29.6
Not smoker	38	46.9
<b>Schooling</b>		
Complete high school /higher education	21	6.6%
Incomplete high school	16	11.3%
Up to 4 <sup>th</sup> grade	44	14.0%
<b>Economic class</b>		
A/ B	23	8.1%
C	31	9.0%
D/ E	26	20.0%
<b>Leisure PA</b>		
>150 min/wk	22	27.2%
10 to 149 min/wk	12	14.8%
<10 min/wk	47	58.0%
<b>Commuting PA</b>		
>150 min/wk	23	28.4%
10 to 149 min/wk	31	38.3%
<10 min/wk	27	33.3%
<b>Total PA</b>		
>150 min/wk	62	76.5%
10 to 149 min/wk	11	13.6%
<10 min/wk	8	9.9%

**Table 3.** Factors associated with mortality considering sociodemographic variables, health perception and level of physical activity in all domains.

	Total PA			Commuting			Leisure			
	OR	95% CI		OR	95% CI		OR	95% CI		
<b>Sex</b>										
Male	1.76	1.09	2.86 *	1.87	1.09	3.21 *	1.91	1.06	3.45 *	
Female	1			1			1			
<b>Age</b>										
60 years or older	5.21	3.26	8.33 *	5.15	2.77	9.57 *	5.62	3.45	9.17 *	

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	Total PA			Commuting			Leisure		
	OR	95% CI		OR	95% CI		OR	95% CI	
40 to 59 years	1.42	0.90	2.23	1.45	0.90	2.35	1.60	1.04	2.45 *
20 to 39 years	1			1			1		
<b>BMI</b>									
Obese	2.74	0.25	29.55	2.58	0.24	27.19	2.77	0.26	29.29
Overweight	0.87	0.22	3.37	0.88	0.22	3.45	0.84	0.22	3.21
Eutrophic	1.25	0.60	2.58	1.20	0.58	2.51	1.11	0.57	2.17
Malnutrition	1			1			1		
<b>Marital status</b>									
Divorced /Widowed	0.39	0.04	3.80	0.36	0.04	3.41	0.30	0.02	3.73
Married	0.86	0.25	2.94	0.83	0.24	2.89	0.71	0.21	2.38
Single	1			1			1		
<b>Health perception</b>									
Poor and very poor	4.21	1.08	16.43 *	4.28	0.94	19.42	4.51	1.06	19.17 *
Good, very good and excellent	1			1			1		
<b>Smoking</b>									
Smoker	1.65	0.96	2.83	1.64	0.97	2.78	1.55	0.99	2.45
Former smoker	2.71	0.52	14.23	2.59	0.45	15.04	2.84	0.50	16.22
Not smoker	1			1			1		
<b>Schooling</b>									
Complete high school / higher education	0.68	0.28	1.63	0.67	0.28	1.61	0.81	0.33	2.00
Incomplete high school	1.30	0.40	4.26	1.37	0.46	4.04	1.66	0.64	4.29
Up to 4 <sup>th</sup> grade	1			1			1		
<b>Economic class</b>									
A/ B	0.28	0.07	1.08	0.29	0.07	1.17	0.26	0.06	1.04
C	0.41	0.17	0.96	0.41	0.16	1.01	0.39	0.15	1.00
D/ E	1			1			1		
<b>Total PA</b>									
≥ 150 min/wk	0.70	0.18	2.70						
De 10 to 149 min/wk	1.27	0.15	11.00						
< 10 min/wk	1								
<b>Commuting PA #</b>									
≥ 150 min/wk				0.89	0.37	2.13			
De 10 to 149 min/wk				1.10	0.63	1.92			
< 10 min/wk				1					
<b>Leisure PA €</b>									
≥ 150 min/wk							2.67	0.75	9.51
De 10 to 149 min/wk							1.47	0.65	3.30
< 10 min/wk							1		

\* There was difference between groups, # - Adjusted for other physical activity domains, € - Adjusted for other physical activity domains.



## DISCUSSION

The main findings showed that being male, having advanced and middle age and having poor health perception presented high mortality rates. Unexpectedly, there was no protection for those who practiced 150 minutes or more of physical activity per week when compared to insufficiently active and inactive individuals.

It is known that mortality is linked to several factors and being male is associated with higher prevalence of mortality (13.4%) when compared to women (8.6%). These results are compatible with study conducted by Brasil<sup>10</sup>, who indicates that noncommunicable diseases are predominant in men (19.3%) when compared with women (5.4%), and the highest difference occurs in the ages of 10 to 40 years. Another factor responsible for the premature death of men is alcohol intake, with males being the more prevalent (3.8%) when compared with females (0.7%), brown color / race and age between 50 and 59 years are the most susceptible groups<sup>10,21</sup>. Moreover, mortality from traffic accidents is also more frequent among men (81.5%) than among women (18.5%)<sup>10</sup>.

Regarding age, mortality risk is higher with increasing years of life<sup>10</sup>, which was confirmed in the present study. Being 60 years old or older represented 20.5% of cases of death, while being between 40 to 59 years old, represented 7.5% of cases and being between 20 to 39 years old only 4.5%. The literature is consistent in demonstrating that the aging process causes several physiological changes in the nervous, cognitive and musculoskeletal systems<sup>10</sup>. In addition, the aging process is also associated with an increased risk of chronic conditions and diseases, such as cognitive decline, cardiovascular diseases, neurodegenerative diseases, and metabolic syndromes<sup>10</sup>. Thus, the association between these factors together with the aging process increases the mortality rate in the elderly population.

Also, poor health perception (poor/very poor) also presented a higher risk for mortality than people who considered their health to be good. This finding is consistent with the findings of Kaplan et al.<sup>22</sup>, who followed 2,512 middle-aged men from Kuopio, eastern Finland, and found that risk factors for mortality were substantially higher among participants who reported poor or very poor health perception. The study by Menec, Chipperfield and Perry<sup>23</sup> developed with 1,178 elderly people from the province of Manitoba in Canada, also demonstrated that older adults who perceived their health as poor/very poor were 3.4 times more likely to die than those who perceived their health as excellent.

An interesting finding that goes against the results of other studies is that there was no difference between physically active individuals when compared to insufficiently or inactive individuals. Practicing physical activity is generally a protective factor for mortality<sup>24</sup>, but it should be remembered that questionnaires may overestimate levels of physical activity<sup>25</sup>, but it is a widely used method when there is no possibility of using direct measures<sup>26</sup>. Another hypothesis to justify this result would be the existence of a latency

period between the beginning of the physical activity practice and the mortality outcome, and on the other hand, the habits of physical activity practice may have changed during the period in which data were collected.

A limitation of the study was the non-control of the causes of death; however, the present article brings data about the lifestyle and characteristics of participants, and it is possible to estimate the causes of death in this population. In addition, it is relevant to say that mortality data are from the year 2014 and behaviors and habits may have changed over six years, such as moving from physically active to physically inactive. Another limitation was the sample loss due to refusals, change of domicile and city, hospitalized and bedridden people and problems in data tabulation.

This article is important for the area of epidemiology. The findings of this study confirm some results of literature and present the possible causes of mortality in the city of Rio Claro - SP, which can contribute to the reflection of new public policies and forms of interventions to minimize the number of deaths in the population.

## CONCLUSION

Higher mortality risks for the municipality of Rio Claro - SP were observed in men, individuals with poor / very poor health perception, and people with advanced and middle age. In addition, there was no influence of the level of physical activity on mortality. In this way, the present study provides information for the creation of public policies aiming to increase the life expectancy of the population of Rio Claro - SP and of cities that have similar characteristics.

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