ASSOCIATIONS BETWEEN LEVELS OF PHYSICAL ACTIVITY AND MORTALITY IN OLDER ADULTS: A PROSPECTIVE COHORT STUDY

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Abstract

Background: Research using objectively measured physical activity (PA) in older adults to assess relationship between PA levels and mortality is scarce. **Objective:** To investigate associations between level of physical activity and mortality in older adults over a four-year period. **Methods:** The population-based cohort study was carried out including 554 older participants (mean age: 76.2 $\pm$ 8.05 years) using data from the SABE study (Health, well-being and aging). Levels of physical activity were measured using accelerometers and participants were divided into tertiles and then categorized into two groups: (I) low level of physical activity and (II) intermediate/high level of physical activity. The dependent variable was mortality between 2010 and 2014. Control variables included socio-demographic and clinical factors. Multiple regression analysis was used from a hierarchical model, grouping the variables into two blocks ordered according to the magnitude of their effect. **Results:** Our results showed that mortality rate in participants with low level of physical activity was 20/1000 person/year and for those with intermediate/high levels of physical activity was 14/1000 person/year. In the adjusted model, by sociodemographic and clinical variables, those with low levels of physical activity presented a higher risk for mortality (OR=2.79, 95%CI= 1.71 – 4.57) when compared to individuals with intermediate/high levels of physical activity. **Conclusion:** Older adults with low levels of physical activity have a higher chance of mortality as compared to those with intermediate/high levels of physical activity, regardless of sociodemographic and clinical variables.

Key-words: Physical activity; mortality; longitudinal study; older adults

1. Introduction

Higher levels of physical activity (PA) are associated with lower risk of all-cause mortality [1]. Physical inactivity (i.e. not meeting government PA recommendations) is an important contribution towards early mortality worldwide and has been shown to be strongly associated with functional decline and comorbidity in older adults [2–5].

Evidence suggests that older adults should participate in at least 300 minutes of moderate-intensity PA per week, or 150 minutes of vigorous-intensity PA per week. Moreover, PA at a moderate or greater intensity on 3 or more days of the week, have additional health benefits, such as preventing falls, frailty, poor physical function, as well as a reduction in overall risk of mortality [6–10]. In addition, low levels of PA in older adults are associated with a higher risk of developing multiple chronic diseases (e.g., cardiovascular diseases, diabetes) [2]. Importantly, low levels of PA are associated with a higher risk of early mortality across all socio-economic settings [7,11].

Objective measured PA using an accelerometer is considered the reliable and preferred method of free-living PA evaluation in epidemiological research[12–14]. However, are scarce in countries with medium and low incomes. As far as we are aware, several studies have been conducted in Brazil - a country classified as an upper-middle-income country. In addition, a study has shown that higher levels of PA in different domains (particularly sport participation) is associated with a lower mortality rate among adults [15]. Moreover, another study reported that physical inactivity contributed to a substantial number of deaths in Brazil [16]. Although both studies used self-reported questionnaires of PA levels, that are prone to social desirability and recall bias, the present study differentiates by utilizing an objective measurement (accelerometers) of PA.

There is only one study that has measured PA level and mortality in older adults with accelerometry [17]. This three-year prospective cohort study, contributes to Latin American literature by showing that both total PA and moderate levels of PA were associated with survival. In addition, it was found that low levels of PA were associated with higher risk of mortality, regardless of previous health and functional conditions, including other factors related to higher mortality among the older population. Furthermore, this study [17] was conducted in a specific geographical area that was three times smaller than that observed in our cohort study. Nonetheless, it's important to consider that only one study with a small sample (n= 324) may not be sufficient to accurately determine the relationship between PA and mortality in a continental country, with 28 million older adults (WHO, 2019).

To date, several studies have investigated the relationship between PA level and mortality [18,19], nonetheless, to the best of our knowledge, there is just one study in Brazil that describes such an association utilizing objective measures of PA. More longitudinal research is clearly needed in different regions of Latin America, to confirm or refute findings in the single study carried out in Brazil, and including a quantitative method of PA to help further determine mortality rate for older people with low and intermediate/high levels of PA. Given this background the aim of the present study is to investigate associations between levels of objectively measured PA (accelerometer) and mortality in a sample of older Brazilian adults, over a period of four years.

2. Materials and methods

2.1 Study Population

This is a prospective cohort study with a probabilistic sample of older adults (aged ≥60 years) living in São Paulo, Brazil between 2010 and 2014, and took part in the SABE Study - Health, Welfare, and Aging. The SABE Study is a longitudinal study of multiple cohorts which started in 2000 with a random sample of 2,143 individuals (aged ≥60 years) in the city of São Paulo (Brazil) (cohort A). In 2006, 1,115 individuals from the first cohort were located and re-interviewed. Attrition was owing to: participant deaths (649), refusals (177), relocation (51), institutionalization (older adults residing in long-stay institutions) (11), and not being located (140). At that time a new random sample of 298 individuals aged 60 to 64 years (cohort B) was introduced. In 2010, 990 individuals were located and interviewed and, as in 2006, a new cohort of older adults (n = 355) aged 60-64 years (cohort C) were introduced. The attrition corresponded to deaths (Cohort A and B) (280), refusals (109), relocation (49), institutionalization (10), and not being located (63). For the present study, in 2010, all located and re-interviewed participants (cohorts A and B, n = 990) were asked to use an accelerometer for three consecutive days; of these, 599 agreed to participate. Participants who presented less than two days valid use of the accelerometer device (described below) (31) were excluded. In total 568 older adults (mean age 76.2 ± 8.05 years), living in the city of São Paulo, took part in this study. Ethics Committee: Public Health College of the University of São Paulo - COEP/FSP (Protocol no. 2044/2010).

2.2 Measures

Dependent variable: Mortality

All participants of the initial 2010 intake were searched for and among the 568 who were submitted to identification of PA by means of accelerometry in 2010, 426 were found. Individuals not found in 2014 (n= 142) were classified into the following categories: deaths, institutionalizations, relocation, refusals and not located. Based on this classification, it was possible to determine the survival condition of each older adult at the end of the observation period (Table 1). The sample analyzed in this study included 460 survivors and 94 deaths, totaling 554. For fourteen participants (2.5% of the initial sample), it was not possible to determine their survival status in 2014.

Table 1. Distribution of older adults, according to survival conditions, from 2010. SABE Study: City of São Paulo, Brazil, 2014.

Insert table 1 here…

Independent variable

For the analysis of PA level, the Actigraph, model GT3X (Actigraph LLC, Pensacola, FL) was used, delivered by a trained technician to participants, who each received instructions in its use. Participants were instructed to wear the accelerometer on their waist on the right side of the body, held in place with the aid of an individually-tailored elastic waistband, for 24 hours for three consecutive days, removing it only for swimming or water activities [20].

The monitor was prepared the day before use (Monday) with the name and number of the questionnaire and monitor. The device was programmed to start the count from 9:00am on Tuesday and to finish at 9:00am on Friday morning. The use of accelerometer data from three weekdays of wear has previously been shown to be reliable demonstrating an intraclass correlation coefficient (ICC) of 0.80 [21].

On completion of the trial period, the monitors were collected for downloading the recorded data, using Actlife software (version 5.0). Only full days of monitoring were included in the data analysis. Consecutive time periods with zero counts were considered as non-wear time. Following the recommendations of Rikli and Jones (2013), days with less than ten hours of use of the device were excluded because their inclusion in the analysis could have increased the variability in data.

For the present study participants were divided into two levels of PA, from the percentile distribution of counts per minute (CPM). The study sample was divided into tertiles and then categorized into two groups, using the 33rd percentile as the criterion for classification. Participants in the lowest tertile were classified as having a low level of PA and participants in the other two tertiles were classified as having an intermediate/high level of PA. Such classification was based on the fact that there is no consensus amongst researchers in the area regarding the classification used to designate effort intensity from the CPM in Brazilian older adults [22].

2.3 Covariates

Socio-demographic characteristics include sex, age, years of education, marital status, and **work activity**. Age was grouped into two 10-year categories (specify), with individuals aged 75 years or older combined into a single group. Educational level was analyzed from the number of years of schooling and categorized as <3 years and> 4 years. Marital status was classified as married (married or in a stable relationship) or not married (single, widowed, divorced, or separated). **Work activity was defined by the question: "Do you currently work*?***"

Chronic pain was classified from two questions. *"Do you feel pain or discomfort when you make some physical efforts or movements such as standing up or walking"* and *"Have you experienced any pain for more than three months, which hurts continuously or comes and goes at least once a month?"* If the participant answered 'yes' to either of the two questions they were classified as having chronic pain.

For **falls,** the older adults were classified as faller or non-faller according to the question "*Have you had a fall in the 12 months prior to the interview??"*

Multimorbidity was classified and analyzed from the presence of two or more chronic diseases [23]. Number of chronic diseases reported was obtained from the question "*Have you ever been told by a doctor or nurse that you have or have had ...*?" including the following diseases: hypertension, diabetes, joint disease, heart disease, chronic lung disease, osteoporosis, stroke and cancer.

Sarcopenia was identified according to the criteria established by the *European Working Group on Sarcopenia in Older People* (EWGSOP). Participants with lower mass (20th percentile) and muscle strength (30 kg for men and 20 kg for women) or walking velocity (<0.8 m/s in normal walking) were considered sarcopenic [24].

Difficulty in performing **basic activities of daily living (BADLs)** was identified if the participant answered yes to one or more of the following questions: Do you have difficulty 1) dressing your upper body (above your waist)?; 2) dressing your lower body (below the waist)?;

3) taking a shower?; 4) performing personal hygiene routines? (wash and dry hands, wash and dry face, comb hair, shave, or apply makeup); 5) eating?; 6) walking across the room?; 7) lying down or getting up from the bed or sitting and getting up from a chair?; and 8) going to the bathroom alone? [25].

Difficulty in performing **instrumental activities of daily living (IADLs)** was identified from the presence of difficulty in performing eight activities (using the telephone, shopping, preparing meals, performing light or heavy household chores, taking medication, managing money, and using transportation). Participants who reported difficulty or inability to perform one or more of the activities was classified as having difficulty in performing IADLs [25].

Cognitive decline was identified using a modified version of the Mini-Mental State Examination (MMSE) [26]. Example items include: the time and place of the test, repeating lists of words, basic arithmetic, language use and comprehension, and basic motor skills. This instrument contains 13 items (maximum score of 19 points), not dependent on level of education, and the cut-off point used for positive screening for cognitive decline is 12 or less [27].

Nutritional status was verified from body mass index (BMI); participants were classified as normal weight (< 28 kg/m²) or overweight (≥ 28 kg/m²) (OPAS, 2003). Body weight was measured using a digital scale, Filizola, with an accuracy margin of error of +/-0.1 kg and maximum capacity of 150 kg and height was measured using a fixed metal stadiometer, accurate to 0.1 cm, with a maximum length of two meters.

3. Statistical Analyses

Differences between groups were estimated using Wald's generalized test of equality between means and the Rao-Scott test, which take into consideration sample weights for estimates with population weightings [29].

Chi-squared tests were used to analyze associations between variables and compare proportions. A binary logistic regression was represented by the *Odds Ratio* (OR) and 95%CI values. The variables that presented an association of $p \leq 0.20$ in the univariate model were selected for the multiple regression analysis.

Multiple regression analysis was performed using hierarchical analysis, grouping the variables into two blocks ordered according to the magnitude of effect (lower or higher) they had on the outcomes. First, the block of sociodemographic variables was included, and then the block of clinical variables. The variables selected in the first block were kept in the model even if the statistical significance was not preserved with the inclusion of the subsequent block, remaining as control variables for the proximal block, according to the theoretical model proposed in Figure 1.

For the regression models, a "partial model" was considered adjusted only by sociodemographic variables and, "final model", adjusted by both blocks of variables. For the interpretation of the results in the final models, we considered the identification of a statistically significant association ($p<0.05$) between a given variable under study and the outcome in question, after adjusting for the potential variables of the same block and the upper hierarchical blocks, which would indicate the existence of an independent association pertaining to that variable.

Figure 1. Hierarchical analysis theoretical model for investigation of variables associated with mortality, structured in two blocks of variables.

Insert figure 1 here…

To verify the incidence density, the numerator was the number of deaths in the analyzed period and the denominator was the sum of the observation period for the population in question. Follow-up losses between 2010 and 2014 were excluded from this analysis. The variables used in this study were compared among the participants who did not die to those of the participants who died. The Wald and Chi-Square test with correction of Rao and Scott was used.

All deaths that occurred during the four-year period were examined. The survival curve was analyzed according to the Kaplan-Meier method to explore the impact of low level of PA on survival. The difference between the curves was analyzed using the log-rank test. The unadjusted and adjusted proportional risk, and the 95% Confidence Interval (95%CI) mortality due to low level of PA was calculated using cox's proportional risk model. The model was adjusted for sociodemographic and clinical variables.

Because it is a multi-stage cluster sampling, the sample weights were used in all analyses to age. All calculations were performed using STATA version 11.0 and statistical significance was established at the 5% level.

All study participants were informed about the study procedures and only those who signed the informed consent were included in the sample. All protocols were reviewed and approved by ethics committee.

4. Results

Sociodemographic variables, according to accelerometer counters per minutes (CPM), are presented in Table 2. A higher prevalence of low-level PA was found in those aged 75 years and older, who live without a partner, and who do not currently work. Older participants have five years or more of study were mostly at the intermediate/high level of PA.

The highest proportion of participants who reported the presence of chronic pain, difficulty in performing activities of daily living (ADL and IADL) and cognitive decline were identified with low levels of PA (Table 2).

Table 2. Distribution (%) of the sample according to the level of physical activity and sociodemographic variables. SABE Study: City of São Paulo, 2010.

Insert table 2 here…

Among the of 568 participants who wore accelerometers in 2010, 94 individuals died over a mean period of 2.21 (SD=1.1) years. Among these participants, 58.6% were female and had an average age of 78.8 years (SD=1.1) years. A higher proportion of participants who died presented low levels of PA (Table 3).

Table 3. Distribution of the sample (%) mortality (from 2010 to 2014) and level of physical activity. SABE Study: City of São Paulo, 2010 - 2014.

Insert table 3 here…

In the unadjusted model, there was an association between low level of PA and mortality from 2010 to 2014 (PR = 4.24, CI= 2.58 - 6.95). In addition, the mortality rate for people with low level of PA was 20/1000 person/year and those with intermediate/high level of PA was 14/1000 person/year. Moreover, the low level of PA adjusted in the model with the block of sociodemographic variables presented a proportional risk of 3.55 (CI= 2.21 - 5.71) **(Table 4)**. Furthermore, in the adjusted model, by sociodemographic and clinical variables, participants demonstrating low levels of PA were at higher risk for death (OR=2.79, 95%CI= 1.71 – 4.57) when compared to individuals with intermediate/high level of PA **(Table 4).**

Table 4. Mortality, in the four-year period, in 568 older adults, according to cox's predictive proportional risk model. SABE Study: City of São Paulo, 2010 - 2014.

Insert table 4 here…

The effect of low levels of PA on the survival of participants over the four-year period was tested, comparing the Kaplan-Meier survival curves, and showed significant differences according to the log-rank test ($p<0.001$). Participants in the low level of PA classification presented approximately 30% mortality, while those classified as intermediate/high level of PA, only 10% (Figure 2).

Figure 2. Kaplan-Meier survival curve for the sample, according to low level of physical activity. SABE Study: City of São Paulo, 2010 - 2014.

Insert figure 2 here…

The effect of low levels of PA on the survival of older adults in the four-year period was tested for each sex, comparing the Kaplan-Meier survival curves, which showed significant differences with the log-rank test in both sexes ($p<0.001$) (Figure 3). It can be observed that, although there was no significant difference between males and females ($p = 0.124$), the survival curve for males (Figure 3A) with low level of PA is more pronounced than for female (Figure 3B).

Figure 3. Kaplan-Meier survival curve for the sample, according to low level of physical activity in each sex. SABE Study: City of São Paulo, 2010 - 2014.

Insert figure 3 (A) and (B) here…

5. Discussion

The aim of this study was to investigate associations between low and intermediate/higher levels of PA and mortality in older adults over a period of four years. The main findings show a higher prevalence of low physical activity levels in older adults aged 75 years or older. Furthermore, the mortality rate for participants with low levels of PA was 20/1000 person/year and those with intermediate/high levels of PA was 14/1000 person/year. Even after adjusting for sociodemographic variables, low levels of PA present a higher risk of death in approximately 30%, while those classified as intermediate/high level of PA have only 10%.

Previous studies have shown that low levels of PA may result in difficulties in daily life activities and cognitive decline [30]. However, there are few cohort studies in low and middle-income countries that have analyzed the association between these variables and their risk over the mortality rate. In the present study, we found an association between mortality and difficulties in performing basic activities of daily living. This supports a large body of extant literature showing that aging can result in deleterious conditions (e.g. sarcopenia and chronic diseases) [31]. This, int turn, may impair PA levels and the performance of basic daily activities [32]. Interestingly, our study identified that older people with high BMI were composed of 25%

of the sample of elderly with low levels PA. Although we did not find in our study a direct association between BMI and mortality. Interestingly, a recent meta-analysis showed a 4–10% lower risk of mortality for participants in the overweight range, with a 21% increase in the risk of mortality for the obesity range [33]. In addition, low levels of PA represents a risk factor that contributes to many deaths via chronic non-communicable diseases (coronary heart disease, type 2 diabetes and breast and colon cancer) [34]. Therefore, increasing the level of PA in insufficiently active older adults would result in an average increase in the life expectancy of the world population by 0.68 years, while in Brazil these numbers would be 1.0 years of life [35]. Furthermore, with addition increase time of PA it could decrease the risk of death, regardless of gender, age and risk factors [7].

Numerous studies show the association between low level of PA and early mortality [35–39]. However, our understanding of the potential health benefits is not only related to time and frequency in moderate/vigorous PA, usually reported in most studies, but in the total daily time spent on PA [40]. The results of the present study showed that the low level of PA (lower tertile) was associated with mortality in the period from 2010 to 2014, regardless of sociodemographic and clinical variables. Among the participants who died in the years leading to 2014, 57% had a low level of PA in 2010, while among survivors, this percentage was only 23%. The association between low level of PA with mortality remained significant after adjustments in the multiple hierarchical model. The participants who demonstrated low levels of PA had a 179% higher risk of death over four years (PR= 2.79; 95%CI= 1.71 - 4.57).

Similar results were found in a study conducted with 460 men and women, with a mean of 71.9 years and followed for 4 years and 9 months, in which PA was identified by objective methods (accelerometer) for seven days and the level of PA was distributed in quartile. Also, the analysis adjusted for sociodemographic, lifestyle and clinical variables, and those in the lowest PA quartile presented higher mortality (PR= 3.48; CI95%= 1.23 - 9.87) when compared to the highest quartile [36]. Wen et al. (2011), in a study conducted with Taiwanese older adults, found a reduction of 14% (PR=0.86; CI95%= 0.81 - 0.91) in mortality in physically active individuals (> 30 min of moderate/vigorous activities). Although studies are conducted in individuals of different nationalities with different methods. Consequently, higher or lower probabilities, the association between the low level of PA and the risk for death remains.

Levels of physical activity and sedentary behaviour in Brazil have been shown to be associated with socioeconomic position which is strongly associated with living in different regions of Brazil [41]. It seems that a high socio-economic is associated with high levels of PA and vice versa [42]. Non-compliance with the physical activity guidelines recommended by the

World Health Organization (WHO) [10] or simply having low levels of PA may be associated not only with all causes of mortality, but also with specific causes of mortality. For example, there are some explanations of the relationship between socioeconomic levels and decreased PA levels that can lead to higher mortality rates. Firstly, retirement has been proposed as a possible explanation, because patterns of physical activity may change due to a decline in occupational demands [43,44]. Secondly, the lack of financial resources in retirement and the preference for sedentary activities [42]. Finally, neighborhood environments with insecurity, may result in a lower adhering to PA practice in older people [42].

This study is important, since it presents results of low level of PA analyzed not only according to time spent in moderate/vigorous activities, but in the performance of PA throughout the day, which allows an interpretation more consistent with reality. The level of PA identified by the counter per minute, without classification by time, but by tertile, corroborates the recommendations proposed by [45]. The volume of PA is important (> 30 min of moderate activity/day), however, the data of the present study show that to reduce the risk of mortality it is necessary to encourage older adults to move habitually during the day. Active behavior throughout the day may reduce the risk of death among older adults who participate in intermediates/high levels of PA, as demonstrated by data from the present study.

Findings from the present study must be interpreted in light of the study limitations. Firstly, the use of the accelerometer over a period of just three days may not be representative of one's free-living levels of PA. Secondly, recent studies [46,47] have showed that it is possible to estimate the level of weekly PA in just two days, from moderate and vigorous intensities in older adults using accelerometers. Moreover, since there is a daily variation in the level of PA during the week as we consider the count from Tuesday to Friday it is possible that preferences exist for PA at different times in the week that may have been missed in our analysis. Nonetheless, it is important to highlight that the Brazilian population has shown stability in exposure to physical inactivity, based on a temporal analysis, conducted from 1990 to 2017 [16]. The state of São Paulo, was the third state with the highest percentage reductions in all-cause mortality rate attributable to physical inactivity [16]. São Paulo is an economically established city, despite this, a low level of physical activity was predominant in our study. Several studies have shown that physical inactivity is a serious problem in economically disadvantaged populations and social inequality may be reflecting on the health of the general population [48,49]. For this, we suggest an analysis with accelerometer measurements in several states so that there is a reliable and robust comparison. This research also has strengths. First, it was conducted with a representative sample of the older adult population of the city of

São Paulo (representing 511,587 elderly with 65 years and more). Second, to date, this is one of the first population studies that analyzes the prevalence of low levels of PA of older Brazilian adults using objective measurement. There is a high correlation (r=0.83) between this type of method and those considered the gold standard of energy expenditure analysis [50], which considerably increases the reliability of the results found. Third, we analyzed not only the unadjusted association between low levels of PA and mortality in the older people over a four-year period, but also considered socio-demographic and clinical variables which may have influenced this relationship.

6. Conclusion

Older adults with low levels of PA have a higher risk of mortality, regardless of sociodemographic and clinical variables. Survival analysis showed that after four years of follow-up, mortality among older Brazilian adults with low levels of PA was approximately 30% compared to 10% among those with intermediate/high levels of PA.

Thus, not necessarily only sedentary behavior, but also low levels of PA can be used as a method to identify older adults with a higher risk of impaired mobility and mortality.

Declarations

- **Competing interests:** The authors declare that they have no competing interests
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Tables and Figures

Table 1. Distribution of older adults, according to survival conditions, from 2010. SABE Study: City of São Paulo, Brazil, 2014.

Condition in 2014	Participant	%	Condition analysis
Survivors	426	75.0	Survivor
Deaths	94	16.5	Deaths
Missing	14	2.5	*Missing*
Relocation	16	2.9	Survivor
Institutionalized	3	0.5	Survivor
RTP	15	2.6	Survivor
Total	**568**	**100**	

Note: RTP = refused to participate; Study SABE 2010-2014.

Table 2. Distribution (%) of the sample according to the level of physical activity and sociodemographic variables. SABE Study: City of São Paulo, 2010.

Variables	Low level of physical activity	Intermediate/high level of physical activity	p
Gender			
Men	30.15	69.85	0.1700
Women	25.34	74.66	
Age			
65 to 74 yrs	19.20	80.80	0.0001
≥ 75 yrs	40.17	59.83	
Years of Study			
≤ 4 yrs	32.19	67.81	0.0251
≥ 5 yrs	23.06	76.94	
Marital Status			
Lives with a partner	22.76	77.24	0.0139
Lives without a partner	31.91	68.09	
Work Activity			
Currently works	14.91	85.09	0.0033
Not currently work	30.54	69.46	
Chronic Pain			
No	21.13	78.87	0.0090
Yes	31.21	68.79	
Fall in the last 12 months			
Not fall	24.86	75.14	0.0778
Fall	31.80	68.20	
Multimorbidities			
No	22.87	77.13	0.0994
Yes	29.74	70.26	
Sarcopenic			
No	27.91	72.09	0.2912
Yes	26.70	73.30	
Difficulty in BADL			
No	21.46	78.54	0.0001

Yes	42.43	57.57	
Difficulty in IADL			
No	14.78	85.22	0.0001
Yes	43.22	56.78	
Cognitive Decline			
No	22.01	77.99	0.0001
Yes	61.63	38.37	
BMI			
< 28 kg/m^2	26.19	73.81	0.7661
≥ 28 kg/m^2	25.01	74.99	

Source: Study SABE, 2010. **Legend**: BADL = Basic Activity of Daily Life; IADL = Instrumental Activity of Daily Life; BMI = Body Mass Index.

Table 3. Distribution of the sample (%) mortality (from 2010 to 2014) and level of physical activity. SABE Study: City of São Paulo, 2010 - 2014.

Variables	Total	Low level of physical activity	Intermediate/high level of physical activity	p
Mortality				0.0001
No	83.46	22.59	77.41	
Yes	16.54	56.88	43.12	

Table 4. Mortality, in the four-year period, in 568 older adults, according to cox's predictive proportional risk model. SABE Study: City of São Paulo, 2010 - 2014.

Variables	Partial Model PR (95%IC)	Final Model PR (95%IC)
Low level of physical activity	3.55** (2.21 – 5.71)	2.79** (1.71 – 4.57)
Gender (Women)	0.63 (0.33 – 1.21)	0.57 (0.29 – 1.11)
Age (≥ 75 anos)	1.76* (1.01 – 3.05)	1.55 (0.88 – 2.75)
Activity work (Not work)	1.18 (0.53 – 2.65)	1.02 (0.44 – 2.32)
Marital status (Lives without a partner)	1.11 (0.58 – 2.14)	1.06 (0.55 – 2.08)
Years of study (< 4 years)	1.55 (0.93 – 2.60)	1.20 (0.68 – 2.13)
Cognitive decline (Yes)		1.75 (0.99 – 3.10)
Difficulty in IADL (Yes)		1.20 (0.63 – 2.27)
Difficulty in BADL (Yes)		1.80* (1.05 – 3.08)
Chronic pain (Yes)		0.82 (0.48 – 1.42)
Fall in the last 12 months (Yes)		1.52 (0.92 – 2.51)
Multimorbidities (Yes)		1.16 (0.66 – 2.03)

Source: Study SABE, 2010. **Legend**: BADL = Basic Activity of Daily Life; IADL = Instrumental Activity of Daily Life; PR = Proportional risk

Figure 1. Hierarchical analysis theoretical model for investigation of variables associated with mortality, structured in two blocks of variables.

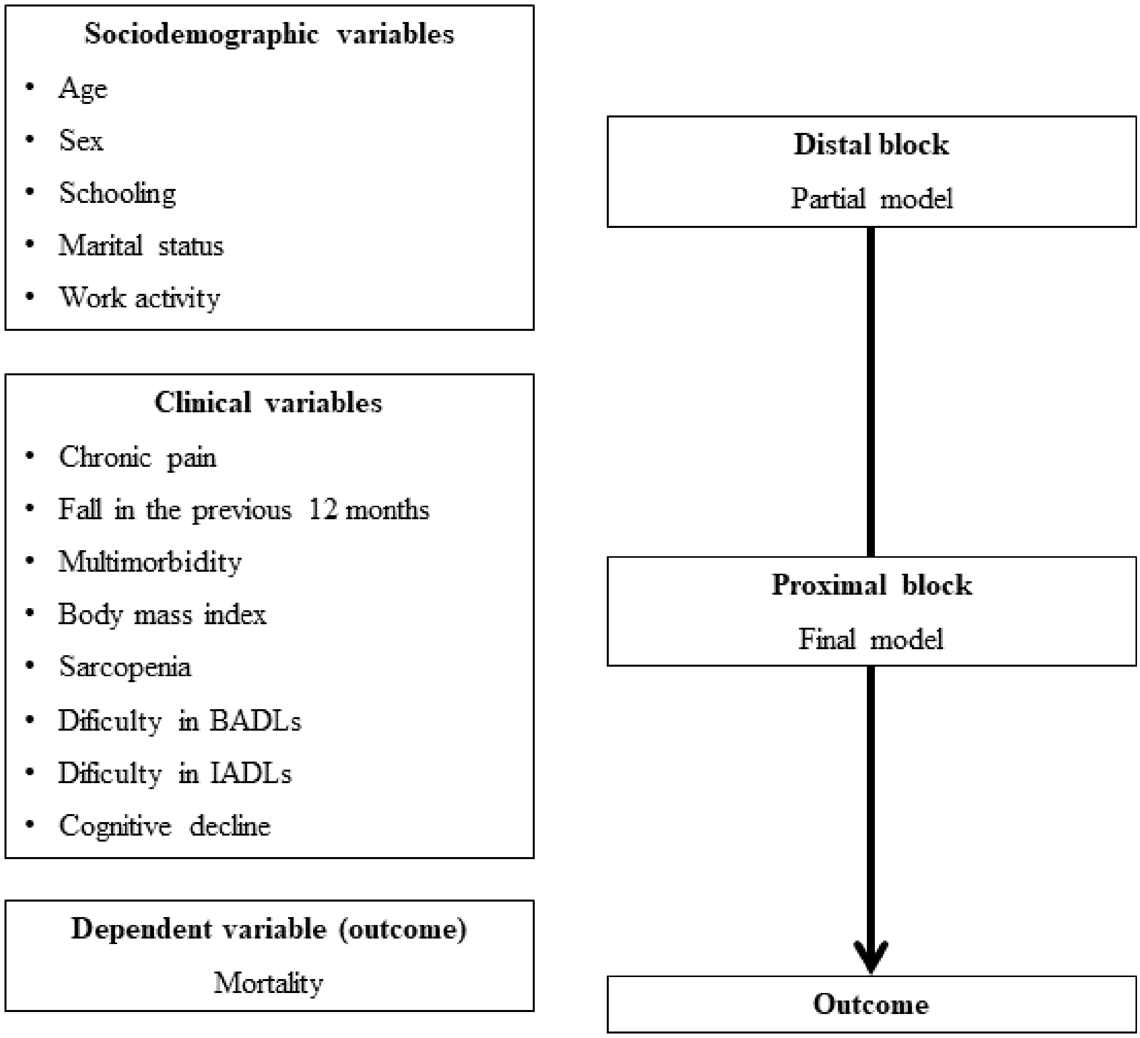


Figure 2. Kaplan-Meier survival curve for the sample, according to low level of physical activity. SABE Study: City of São Paulo, 2010 - 2014.

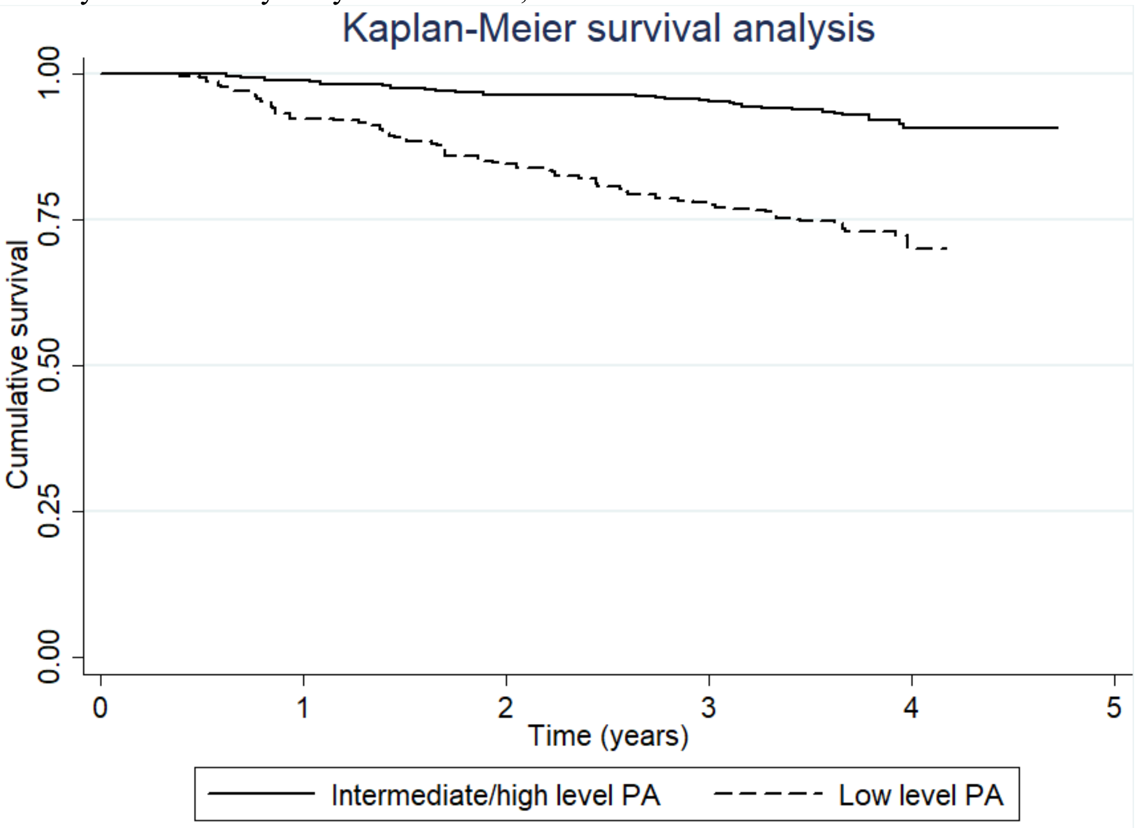
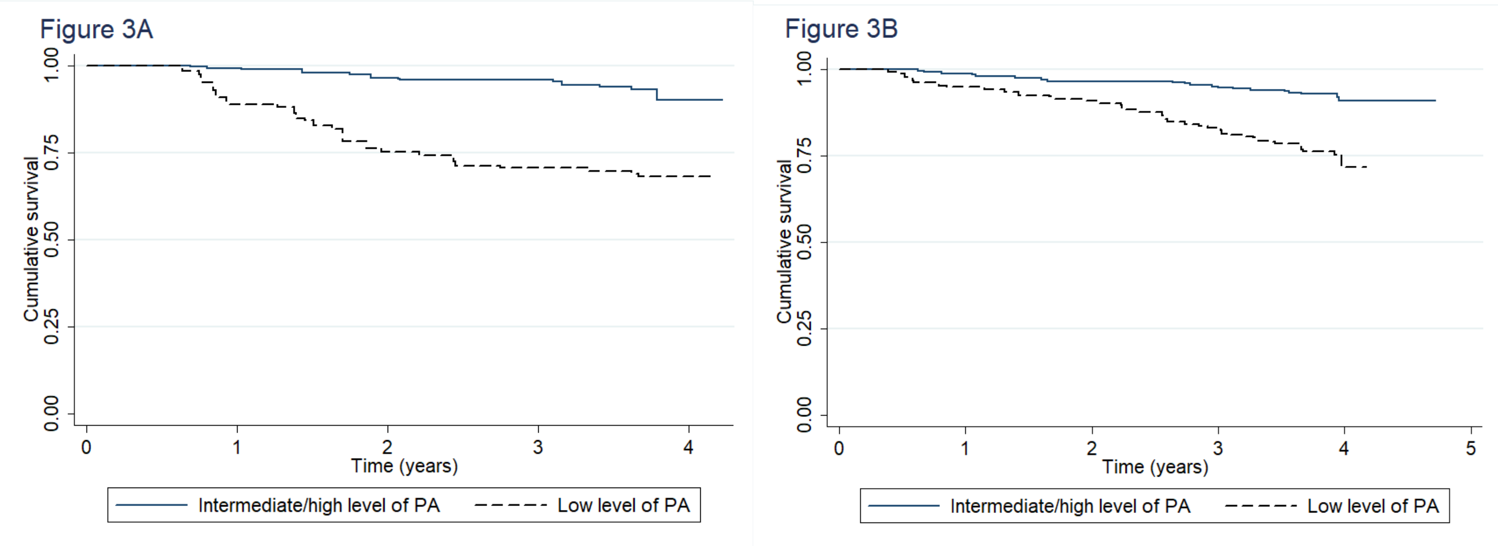


Figure 3. Kaplan-Meier survival curve for the sample, according to low level of physical activity in each sex. SABE Study: City of São Paulo, 2010 - 2014.



Legend: 3A) Curve of survive for men; 3B) Curve of survive for women