Published in final edited form as:

J Am Geriatr Soc. 2012 June ; 60(6): 1085–1091. doi:10.1111/j.1532-5415.2012.03995.x.

Routine Physical Activity and Mortality Among Mexican Americans Aged 75 years and Older

Allison J. Ottenbacher, PhD^a, Soham Al Snih, MD, PhD^{b,c}, Amol Karmarkar, PhD^b, Jinhyung Lee, PhD^c, Rafael Samper-Ternent, MD^c, Amit Kumar, MS, PT^b, Saad Bindawas, PhD, PT^d, Kyriakos S. Markides, PhD^{c,e}, and Kenneth J. Ottenbacher, PhD^{b,c}

^aCenter for Healthcare Quality and Safety, University of Texas Health Science Center – Memorial Hermann, Houston, TX

^bDivision of Rehabilitation Sciences, University of Texas Medical Branch, Galveston, TX

^cSealy Center on Aging, University of Texas Medical Branch, Galveston, TX

^dCollege of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia

^eDepartment of Preventive Medicine & Community Health, University of Texas Medical Branch, Galveston, TX

Abstract

BACKGROUND—The connection between everyday physical activity and mortality in very old minority populations is unclear. We examined the association between routine physical activity and risk of 3-year mortality among Mexican Americans >75 years of age.

DESIGN—Longitudinal study involving a population-based survey.

SETTING—Hispanic Established Population for the Epidemiologic Study of the Elderly (EPESE) survey conducted in the southwestern United States (Texas, Colorado, Arizona, New Mexico, and California).

Corresponding Author: K. Ottenbacher, PhD, University of Texas Medical Branch, 301 University Blvd., Galveston, TX 77555-1137, kottenba@utmb.edu, Phone: (409) 747-1637, Fax: (409) 747-1638. **Alternate Author:** A. Ottenbacher, PhD, University of Texas Health Sciences Center-Houston, 6410 Fannin Street UTPB 1100 (WS26), Houston, Texas 77030-3006. Allison.J.Ottenbacher@uth.tmc.edu, Phone: 713-500-7905.

Conflict of interest: The authors have no financial or personal conflicts associated with this manuscript.

Author contributions:

A. J. Ottenbacher, analyzed data and provided interpretation, and wrote first draft.

S. Al Snih, assisted with data analyses, wrote methods and contributed to manuscript revisions.

A. Karmarkar, assisted with scoring and data interpretation related to the PASE and contributed to revisions.

J. Lee, assisted with data analyses and provided interpretation, particularly related to survival analysis.

Rafael Samper Ternent, contributed to revisions particular related to physical activity and exercise in older adults, provided clinical / biomedical expertise to interpretation.

A. Kumar, completed literature searches, integrated and summarized previous related studies, contributed to writing introduction.

Saad Bindawas, participated in interpretation, review and revision of manuscript particularly relate to physical function and strength measures.

K. Markides, provided background and information related to the Hispanic EPESE, interpreted data related to Mexican American health, contributed to revisions, PI for original Hispanic EPESE grant (R01-AG010939).

K. J. Ottenbacher, developed idea, guided research activity, provided funding (R01-AG017638), contributed to interpretation and revisions and wrote discussion.

PARTICIPANTS—Mexican American men and women aged 75 years and older (N = 948) participating in the Hispanic EPESE.

MEASUREMENTS—Responses to the *Physical Activity Scale for the Elderly* (PASE) were assessed in 2005–2006. Mortality was determined by report of relatives at 3-year follow-up and from the National Death Index. Covariates included socio-demographic characteristics, financial strain, smoking status, body mass index, activities of daily living, depressive symptoms, cognitive function, and comorbid conditions.

RESULTS—Mean age of the sample was 82.2 ($\pm$ 4.5) years. Cox proportional hazard regression estimated the hazard ratios of death for persons in the low, moderate and high quartiles of physical activity (PASE scale) ranged from HR = 0.36 (95% CI: 0.21, 0.62) to HR = 0.50 (95% CI: 0.31, 0.82) compared to persons in the sedentary quartile after adjusting for covariates.

CONCLUSION—Routine physical activity involving household and leisure activities was associated with 3-year reduced risk of mortality in a sample of older Mexican Americans living in the community.

Keywords

Activity; Exercise; Hispanic; Minority Health; Aging

INTRODUCTION

Fewer than two in ten adults 75 years and older report participation in regular leisure or structured physical activity (30 minutes of light to moderate activity on 5 or more days of the week).¹ Regular physical activity and exercise reduces body fat, increases muscle strength, improves psychological well-being, and lessens cognitive decline among older adults.^{2–4} Physical activity has also been shown to be useful in maintaining independent function and decreasing the risk of falls in older adults.^{2,3}

Previous investigations have reported hazard (or odds) ratios ranging from 0.14 through 0.74 for reduced risk of mortality in the most active individuals compared to the least active.^{5–10} This association is typically evaluated in samples of non-Hispanic white adults with mean age less than 75 years.^{5–10} Substantially less is known regarding the role of physical activity in minority populations and the very old.¹¹

Mexican Americans consistently report lower levels of physical activity compared to non-Hispanic whites.^{1,12,13} Neighbors et al.,¹² for example, reported that 47% of Mexican Americans did not engage in any leisure-time physical activity compared to 36% of non-Hispanic whites who reported no leisure related physical activity.

The Hispanic population in the U.S. grew by 43% from 2000 to 2010¹⁴ and is expected to comprise approximately 25% of the entire population by 2050.¹⁵ Mexican Americans are the largest sub-population comprising 67% of the Hispanic population¹⁶ and they will be major consumers of healthcare resources and services in the coming decades. Identifying methods to increase physical activity and maintain independence is an important social and health goal for this population.

The purpose of our study was to examine the association between mortality and everyday physical activity in a sample of older Mexican Americans (>75 years). Everyday activity was assessed using the *Physical Activity Scale for the Elderly* (PASE).^{17,18} We also explored differences in the types of physical activity as reflected in 2 subscales of the PASE (leisure activity and household activity). Based on our previous work with the Hispanic EPESE sample,^{19–21} we hypothesized that there would be an inverse association between level of physical activity and risk of mortality among both men and women, and that there would be no difference in the type of physical activity associated with reduced mortality risk.

METHODS

The Hispanic EPESE is an ongoing longitudinal study that began in 1993 with an original sample of 3,050 Mexican Americans aged 65 years and older residing in Texas, New Mexico, Colorado, Arizona, and California. Participants were recruited by area probability sampling procedures that involved selecting counties and households within defined census tracts. Sampling procedures and individual characteristics have been reported previously.^{19,20} In the current study, we included 948 participants from the Hispanic EPESE aged 75 years and older enrolled in a study of disability and who completed the PASE in 2005–2006.²¹ Inclusion criteria for this cohort included the ability to independently complete physical performance tasks related to disability and frailty²¹ including basic activities of daily living, a test of grip strength and an 8-foot walk.^{19, 21} Proxy information was not permitted. The sub-sample was significantly younger, with higher activity of daily living scores, higher grip strength, faster walking speed and fewer comorbid conditions than the 1,624 persons from the original Hispanic EPESE sample eligible for the study in 2005.

Data Collection

The participants were interviewed and examined in their homes by raters who received 20 hours of training in interviewing methods and performance-based assessments of physical functioning including gait and functional daily living skills. The study protocol and information on data collection are available in publications^{19,22} and from the Inter-University Consortium for Political and Social Research (ICPSR) archive.²³ The interviews were conducted in Spanish or English, depending on the respondent's preference. Seven hundred and eighty-seven (83%) interviews were conducted in Spanish. Informed consent was obtained at the time of the interview, and the protocol was approved by the university's Institutional Review Board.

Measures

Independent Variable—The *Physical Activity Scale for the Elderly* (PASE) is a well-established, validated instrument used to assess activity levels in older adults.^{17,18} Frequency and duration of activity are measured using 3 subscales: leisure activity, household activity, and occupational activity. Leisure physical activity includes walking; light, moderate, strenuous sports; and muscle strength / endurance exercise. Household activities include housework, home repairs, lawn work, gardening, and caring for others. Occupational activity is measured with respect to hours worked and type of job (sedentary

vs. active). Each item in the PASE refers to the previous week of activities. Calculations include an empirically derived weighting system used to obtain a score for each subscale (leisure, household, occupational) and a total physical activity score.¹⁸ For data analyses (see description below), we converted the total and subscale PASE scores into quartiles representing 4 levels of activity: sedentary, low, moderate and high. For example, a person categorized as “Sedentary” in the household activity subscale did not engage in any activity in this category during the previous week. A person in the “Low activity” group participated in 1 activity. An individual in the “Moderate activity” group engaged in a combination of 2 or 3 household activities, and a person in the “High activity” group (highest quartile) engaged in 4 or more household activities in the previous week.

Dependent Variable—Death was ascertained at follow-up in 2008–2009. Ninety-six participants either refused to be re-interviewed or were lost to follow-up, and 194 were confirmed dead through the *National Death Index* and by relatives.

Covariates—Covariates included variables identified in previous research as associated with risk of mortality in older adults.²⁴ Sociodemographic variables included age (continuous), gender, years of formal education (continuous), married (yes / no), and financial strain measured by asking participants “how much difficulty do you have in meeting monthly payments on your bills?” (great difficulty, some difficulty, little difficulty, and none). Smoking status was assessed by asking subjects whether they were current smokers, former smokers, or never smoked. Body mass index (BMI) was computed as weight measured in kilograms divided by measured height in meters squared (kg/m^2). Functional disability was assessed by 7 items from a modified version of the *Katz Activities of Daily Living* (ADL) scale.²⁵ Depressive symptoms were measured by the *Center for Epidemiologic Studies Depression Scale* (CES-D) and considered high if the score was 16 or above.²⁶ Cognition was assessed (continuous variable) by the *Mini-Mental State Examination* (MMSE).²⁷ Comorbidities were assessed by asking if subjects had ever been told by a doctor that they had diabetes, heart attack, hypertension, stroke, hip fracture, cancer, anemia or emphysema. These variables have been collected in the Hispanic EPESE and other surveys of older adults and have provided reliable and consistent information.²²

Statistical Analysis

Frequencies, means and standard deviations were calculated for demographic characteristics. Comparisons across PASE quartiles and participant characteristics were assessed by chi-square tests and analyses of variance (ANOVA). A Kaplan Meier survival curve was used to display the (unadjusted) association between total physical activity and risk of mortality over 3 years.

Unadjusted and adjusted Cox proportional hazards regression models were computed to estimate 3-year mortality as a function of physical activity (total, leisure, and household) in quartiles. Occupational activity was not separately assessed because the majority of our sample was not currently working and the subscale contained too little information to analyze. Analyses were conducted on the entire sample and separately by gender. All

analyses were performed using the SAS System for Windows, Version 9.2 (SAS Institute, Cary, N.C.).

RESULTS

The mean age of the sample at the time of measurement was 82.2 ($\pm$ 4.5) years. Sixty three percent were female, 59% were unmarried, 56% never smoked, 75% had a BMI less than 30 kg/m², 40% had no difficulty meeting monthly bills, 63% reported no problems in basic ADLs, and 80% reported low depressive symptoms. The mean years of education was 5.0 ($\pm$ 3.9) and the mean MMSE score was 20.9 ($\pm$ 4.7). The most commonly identified comorbid conditions were hypertension (67%) and arthritis (62%) (Table 1).

Participant baseline characteristics by quartiles of physical activity (Sedentary, Low, Moderate, and High) are presented in Table 1. Those in the High activity quartile were significantly ($p < .01$) more likely to be younger, male, married, to experience no ADL problems, to report low depressive symptoms, to have better cognition, and to report fewer comorbidities. The range of response for the PASE is from 0 – 400. The range was 0 – 341.8 in this sample. The mean total PASE score was 78.5 ($\pm$ 61.6). The mean scores for the Sedentary, Low, Moderate and High quartiles were 11.6 ($\pm$ 12.2), 48.4 ($\pm$ 10.2), 89.0 ($\pm$ 14.9), and 165.0 ($\pm$ 41.3), respectively.

Figure 1 shows the Kaplan Meier survival curves over 3 years as a function of PASE score quartiles. Participants in the lowest quartile of activity (sedentary) had the highest risk of mortality over time. The unadjusted Cox proportional hazards regression displayed an inverse trend between level of physical activity and risk of mortality. Compared to persons in the lowest quartile of activity, there was a 77% reduction in risk of mortality among persons in the highest active quartile (Hazard Ratio (HR) = 0.23, 95% CI: 0.15, 0.35).

The trend of increased activity and reduced risk of mortality was reduced after adjustment for covariates, but remained statistically significant. The hazard ratio for the high activity quartile compared to the sedentary quartile was 0.45 (95% CI: 0.26, 0.78). The greatest reduced risk of mortality after adjusting for covariates, however, was for persons in the moderate activity quartile (HR = 0.36, 95% CI: 0.21, 0.62). Persons in the low activity quartile also showed a significant reduction in mortality risk (HR = 0.50, 95% CI: 0.31, 0.82) (Table 2) compared to persons in the sedentary quartile.

There were statistically significant associations between the type of activity and risk of mortality in our sample. A greater reduction in mortality risk was observed for persons active in the household subscale compared to the leisure subscale. The risk of mortality was reduced by 68% for persons in the high activity quartile of household activity compared to the sedentary quartile (HR = 0.32, 95% CI: 0.19, 0.55). The mean household activity score was 52.5 ($\pm$ 42.2). Those living alone (vs. with others) reported significantly higher mean household PASE scores (54.8 $\pm$ 42.9 vs. 39.7 $\pm$ 35.6 ($p < .01$)). (Data not presented).

Associations by Gender

Among both men and women, there was an inverse association between level of physical activity and risk of mortality. The risk of mortality was reduced by 74% for men in the moderate activity quartile (HR = 0.26, 95% CI: 0.10, 0.67) and by 53% in the high activity quartile (HR = 0.47, 95% CI: 0.20, 1.10) compared to men in the sedentary quartile (Table 3). Statistically significant ($p < .01$) associations were observed in men between household activity and risk of mortality, but not with leisure activity.

Among women, there was a 66% reduction in risk of mortality (HR = 0.34, 95% CI: 0.16, 0.73) in the high activity quartile compared to the sedentary quartile based on total PASE activity score. Similar to the males, associations with risk of mortality were predominately observed in the household activity subscale.

DISCUSSION

As hypothesized, we observed a reduced risk of mortality among men and women for individuals in the upper 3 PASE quartiles of activity (high, moderate, and low) compared to persons in the sedentary quartile. This finding is consistent with previous examinations of physical activity and mortality in non-Hispanic samples.^{5, 8–10}

Historically, Hispanics (including Mexican Americans) report lower levels of physical activity compared to non-Hispanic white individuals.^{12,13} The mean PASE score in our sample was 78.5, which is lower than the average score of 118.9 among adults 65 years in a validity study for the PASE instrument¹⁸ and lower than other previous reports involving non-Hispanic community-dwelling samples.^{28,29} The lower level of physical activity for women compared to men observed in our sample is also consistent with previous research.^{1, 5, 29}

Despite the relatively low levels of physical activity, our findings indicate a meaningful reduction in mortality risk for each PASE quartile above the sedentary level, suggesting that even minimal to moderate increases in physical activity are associated with improvement in survival outcomes in Mexican Americans over 75 years. This is reflected in the decreased mortality risk for persons in the mild and moderate activity quartiles (after adjusting for covariates). The benefit of physical activity related to mortality for persons in the High activity group may have plateaued in this sample of Mexican American older adults. There are, however, alternate explanations that need to be examined. For example, we do not have information regarding the consistency of physical activity over time.

We found a statistically significant difference in risk of mortality associated with the household activity subscale compared to the leisure activity subscale of the PASE. This is a potentially important finding as Mexican American over 75 years may experience the majority of their physical activity in this category (e.g., housework, gardening, home repairs). Chad et al. observed lower levels of activity among adults living in a senior home compared to those not living in a senior home, and suggested this was because services such as housework and repairs are typically provided in such facilities.²⁸ In our sample, the vast majority of older persons were living in the community. Less than 3% of the participants

reported residing in an assisted living setting. As older persons transition into levels of care they may lose an important opportunity for regular physical activity. This may be particularly true for older Mexican Americans who may not participate as frequently in traditional leisure forms of physical activity.²⁸

Limitations and Strengths

The PASE is a widely used and reliable instrument;^{17, 18} however, as with any study using self-reported physical activity, over or under reporting of activity levels may occur. As noted above, we did not have data on the consistency of the activities performed over a long period of time and this is a topic requiring additional study.

Our analyses were limited to data from those participants who were alive 12 years from the beginning of the Hispanic EPESE study. The original sample was representative of a large Mexican American population (n >500,000) living in the Southwestern U.S.¹⁹ The cohort we studied includes 'survivors' and represents the hardiest of the original 3,050 participants. It is also important to note that our findings apply to Mexican American older adults and not the general Hispanic population.¹⁶

Our study has several strengths including a large population-based original sample from 5 states with a substantial Mexican American population. To our knowledge, this is the first large scale study to longitudinally examine the association between level of everyday, routine physical activity and risk of mortality among very old Mexican Americans (mean age 82.2 years) using a well established and validated measure. The PASE instrument also allowed us to distinguish among common household and leisure activities versus more formal exercise or physical training programs engaged in by older adults.

Implications and Conclusion

The current evidence is strong for the short-term health benefits of structured exercise and fitness programs in older adults.^{2, 3, 4, 29, 30} Evidence, however, for the long-term benefits and adherence to structured exercise programs is poor.^{30, 31} Common barriers include poor health, pain, safety, cognitive issues, and lack of access to exercise facilities.³⁰⁻³⁵

Compliance with formal exercise and fitness programs appears to be particularly poor in older minority populations.³⁰ Our results suggest that engagement in routine daily tasks involving physical activity may have beneficial effects in the oldest Mexican Americans. This is a population that will expand dramatically in the next 20 years and currently lacks targeted, culturally relevant, evidence-based recommendations to maintain or enhance physical activity and reduce the risk of morbidity and mortality.

Acknowledgments

Funding Support:

This study was supported in part by grants from the National Institutes of Health: R01-AG017638 (K. Ottenbacher); R24-HD065702 (K. Ottenbacher, A. Karmarkar); R01-AG010939 (K. Markides), K12 HD052023 (S. Al Snih). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The funding agencies did not influence the design, analysis or interpretation of the study results.

Sponsor's role: The funding organizations had no role in the design of the study; collection, management, analysis, or interpretation of the data; or preparation of the manuscript.

REFERENCES

1. Plies JR, Ward BW, Lucas JW. Summary health statistics for U.S. adults: National Health Interview Survey, 2009. *Vital Health Statistics*. 2010; 10:249.
2. Warburton D, Nicol C, Bredin S. Health benefits of physical activity: The evidence. *CMAJ*. 2006; 174:801–809. [PubMed: 16534088]
3. Nelson ME, Rejeski WJ, Blair SN, et al. Physical activity and public health in older adults. Recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation*. 2007; 116:1094–1105. [PubMed: 17671236]
4. Chodzko-Zajko WJ, Proctor DN, Fiatarone Singh MA, et al. Exercise and physical activity for older adults. *Med Sci Sports Exerc*. 2009; 41:1510–1530. [PubMed: 19516148]
5. Stessman J, Maaravi Y, Hammerman-Rozenberg R, et al. The effects of physical activity on mortality in the Jerusalem 70-year-olds longitudinal study. *J Am Geriatr Soc*. 2000; 48:499–504. [PubMed: 10811542]
6. Khaw K, Jakes R, Bingham S, et al. Work and leisure time physical activity assessed using a simple, pragmatic, validated questionnaire and incident cardiovascular disease and all-cause mortality in men and women: The European prospective investigation into cancer in norfolk prospective population study. *Int J Epidemiol*. 2006; 35:1034–1043. [PubMed: 16709620]
7. Bijnen FC, Caspersen CJ, Feskens EJ, et al. Physical activity and 10-year mortality from cardiovascular diseases and all causes. *Arch Intern Med*. 1998; 158:1499–1505. [PubMed: 9679790]
8. Chipperfield JG. Everyday physical activity as a predictor of late-life mortality. *Gerontologist*. 2008; 48:349–357. [PubMed: 18591360]
9. Gillum RF, Obisesan TO. Physical activity, cognitive function, and mortality in a US national cohort. *Ann Epidemiol*. 2010; 20:251–257. [PubMed: 20171901]
10. Hrobonova E, Breeze E, Fletcher AE. Higher levels of intensity of physical activity are associated with reduced mortality among community dwelling older people. *J Aging Res*. 2011; 2011:651931. [PubMed: 21437004]
11. Espino DV, Parra EO, Kriehbiel R. Mortality differences between elderly Mexican Americans and non-Hispanic whites in San Antonio, Texas. *J Am Geriatr Soc*. 1994; 42:604–608. [PubMed: 8201144]
12. Neighbors CJ, Marquez DX, Marcus BH. Leisure-time physical activity disparities among Hispanic subgroups in the United States. *Am J Public Health*. 2008; 98:1460–1464. [PubMed: 18048795]
13. Swenson CJ, Marshall JA, Mikulich-Gilbertson SK, et al. Physical activity in older, rural, Hispanic, and non-Hispanic white adults. *Med Sci Sports Exerc*. 2005; 37:995–1002. [PubMed: 15947725]
14. U.S. Census Bureau. [Accessed September 14, 2011] 2010 Census Data. Available at: <http://2010.census.gov/2010census/data/index.php>.
15. U.S. Census Bureau. [Accessed October 16, 2011] U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin: 2000–2050 (online). Available at: <http://www.census.gov/population/www/projections/usinterimproj/>.
16. Ramirez, RR.; Patricia de la Cruz, G. Current Population Reports. Washington, DC: U.S. Census Bureau; 2002. The Hispanic Population in the United States: March 2002. Publication P20-545.
17. Washburn RA, Smith KW, Jette AM, et al. The physical activity scale for the elderly (PASE): development and evaluation. *J Clin Epidemiol*. 1993; 46:153–162. [PubMed: 8437031]
18. Washburn RA, McAuley E, Katula J, et al. The physical activity scale for the elderly (PASE): Evidence for validity. *J Clin Epidemiol*. 1999; 52:643–651. [PubMed: 10391658]
19. Markides, KS.; Stroup-Benham, CA.; Black, SA., et al. The health of Mexican American elderly: Selected findings from the Hispanic EPESE. In: Wykle, ML.; Ford, AB., editors. *Serving Minority Elderly in the 21st Century*. New York: Springer Publishing; 1999. p. 72-90.

20. Markides KS, Stroup-Benham CA, Goodwin JS, et al. The effect of medical conditions on the functional limitations of Mexican-American elderly. *Ann Epidemiol.* 1996; 6:386–391. [PubMed: 8915469]
21. Ottenbacher KJ, Graham JE, Al Snih S, et al. Mexican-Americans and frailty: Findings from the Hispanic established population's epidemiologic studies of the elderly. *Am J Public Health.* 2009; 99:673–679. [PubMed: 19197079]
22. Cornoni-Huntley, JC.; Blazer, D.; Lafferty, ME., et al. Resource Data Book. Washington, DC: National Institute on Aging; 1990. Established Populations for the Epidemiologic Studies of the Elderly, II. NIA Publication 90-495.
23. Inter-University Consortium for Political and Social Research (ICPSR). [Accessed November 20, 2011] The University of Michigan, Institute for Social Research (online). Available at: <http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/4314?q=Hispanic+Epese&searchIn=ALL>.
24. Fried LP, Kronmal RA, Newman AB, et al. Risk factors for 5-year mortality in older adults: The cardiovascular health study. *JAMA.* 1998; 279:585–592. [PubMed: 9486752]
25. Branch LG, Katz S, Knipmann K, et al. A prospective-study of functional status among community elders. *Am J Public Health.* 1984; 74:266–268. [PubMed: 6696160]
26. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977; 1:385–401.
27. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State": A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res.* 1975; 12:189–198. [PubMed: 1202204]
28. Chad KE, Reeder BA, Harrison EL, et al. Profile of physical activity levels in community-dwelling older adults. *Med Sci Sports Exerc.* 2005; 37:1774–1784. [PubMed: 16260980]
29. Janney CA, Cauley JA, Cawthon PM, et al. Longitudinal physical activity changes in older men in the osteoporotic fractures in men study. *J Am Geriatr Soc.* 2010; 58:1128–1133. [PubMed: 20487074]
30. Brawley LR, Rejeski WJ, King AC. Promoting physical activity for older adults: The challenges for changing behavior. *Am J Prev Med.* 2003; 25:172–183. [PubMed: 14552942]
31. O'Neill K, Reid G. Perceived barriers to physical activity by older adults. *Can J Public Health.* 1991; 82:392–396. [PubMed: 1790502]
32. Pereira MA, Kriska AM, Day RD, et al. A randomized walking trial in postmenopausal women: Effects on physical activity and health 10 years later. *Arch Intern Med.* 1998; 158:1695–1701. [PubMed: 9701104]
33. Cohen-Mansfield J, Marx MS, Guralnik JM. Motivators and barriers to exercise in an older community-dwelling population. *J Aging Phys Act.* 2003; 11:242–253.
34. Centers for Disease Control and Prevention. Neighborhood safety and prevention of physical inactivity-selected states. *MMWR.* 1999; 48:143–146. [PubMed: 10077460]
35. Sallis JF, Johnson MF, Calfas KJ, et al. Assessing perceived physical variables that may influence physical activity. *Res Q Exerc Sport.* 1997; 68:345–351. [PubMed: 9421846]

..... Sedentary
 - - - Low activity
 - - - Moderate activity
 - - - High activity

FIGURE 1.
 Kaplan Meier survival curve for physical activity quartiles and 3-year mortality.

TABLE 1

Participant Characteristics, by Physical Activity Quartile

Baseline characteristics	Total	Sedentary	Low activity	Moderate activity	High activity	p-value ^a
	N = 948 n (%)	n = 237 n (%)	n = 237 n (%)	n = 237 n (%)	n = 237 n (%)	
Age						<0.01
Mean (± SD)	82.2 (4.5)	83.6 (4.9)	82.3 (4.5)	81.6 (4.4)	81.2 (3.9)	
Gender						<0.01
Male	352 (37)	75 (32)	61 (26)	77 (32)	139 (59)	
Female	596 (63)	162 (68)	176 (74)	160 (68)	98 (41)	
Years of education (n = 894)						
Mean (± SD)	5.0 (3.9)	4.7 (3.7)	4.8 (3.7)	5.1 (4.2)	5.5 (3.9)	0.08
Marital Status						<0.01
Not married	564 (59)	153 (65)	166 (70)	137 (58)	108 (46)	
Married	384 (41)	84 (35)	71 (30)	100 (42)	129 (54)	
Smoker (n = 892)						0.24
Current	58 (7)	11 (5)	18 (8)	15 (7)	14 (6)	
Former	336 (38)	90 (40)	71 (32)	79 (36)	96 (43)	
Never smoked	498 (56)	126 (56)	132 (60)	128 (58)	112 (50)	
Body Mass Index, (kg/m²) (n = 849)						0.09
<30	633 (75)	124 (69)	158 (74)	165 (74)	186 (80)	
30	216 (25)	56 (31)	55 (26)	58 (26)	47 (20)	
Difficulty meeting monthly bills (n = 861)						0.25
None / little	348 (40)	86 (40)	78 (37)	84 (39)	100 (46)	
Some / great deal	513 (60)	128 (60)	134 (63)	133 (61)	118 (54)	
Limitation with Activities of Daily Living						<0.01
0	599 (63)	82 (35)	131 (55)	175 (74)	211 (89)	
1 or more	349 (37)	155 (65)	106 (45)	62 (26)	26 (11)	
Depressive symptoms						<0.01
Low	758 (80)	143 (60)	185 (78)	209 (88)	221 (93)	
High (CES-D 16)	190 (20)	94 (40)	52 (22)	28 (12)	16 (7)	

Baseline characteristics	Total	Sedentary	Low activity	Moderate activity	High activity	p-value ^a
	N = 948 n (%)	n = 237 n (%)	n = 237 n (%)	n = 237 n (%)	n = 237 n (%)	
MMSE (n = 878)						<0.01
Mean (± SD)	20.9 (4.7)	18.8 (5.9)	21.0 (4.2)	21.4 (4.2)	22.3 (3.7)	
Comorbidities						
Cancer	74 (8)	24 (10)	19 (8)	17 (7)	14 (6)	0.37
Stroke	52 (5)	24 (10)	8 (3)	10 (4)	10 (4)	<0.01
Diabetes	327 (34)	108 (46)	86 (36)	71 (30)	62 (26)	<0.01
Hip fracture	16 (2)	9 (4)	5 (2)	2 (1)	0 (0)	<0.01
Hypertension	638 (67)	156 (66)	167 (70)	166 (70)	149 (63)	0.25
Anemia	147 (16)	47 (20)	46 (19)	37 (16)	17 (7)	<0.01
Emphysema	87 (9)	37 (16)	16 (7)	21 (9)	13 (6)	<0.01
Arthritis	586 (62)	162 (69)	165 (70)	140 (60)	119 (50)	<0.01
Heart attack	29 (3)	14 (6)	7 (3)	4 (2)	4 (2)	0.02

^aChi-square or ANOVA (F-test).

TABLE 2
Unadjusted and Adjusted Hazard Ratios (95% CI) of Physical Activity Quartile for 3-Year Mortality

Variable	Model 1 (N = 948) ^a		Model 2 (N = 768)	
	Hazard ratio	95% CI	Hazard ratio	95% CI
Total PASE				
Sedentary	(PASE: 0–32)	1.00	1.00	
Low activity	(32.1–65.6)	0.35 (0.24, 0.51)	0.50	(0.31, 0.82)
Moderate activity	(65.6–118.2)	0.25 (0.17, 0.38)	0.36	(0.21, 0.62)
High activity	(>118.2)	0.23 (0.15, 0.35)	0.45	(0.26, 0.78)
Age			1.07	(1.03, 1.11)
Gender, female			0.80	(0.52, 1.22)
Education			1.06	(1.01, 1.11)
Married			1.06	(0.71, 1.60)
Smoker				
Current			1.00	
Former			0.92	(0.45, 1.91)
Never smoked			0.61	(0.29, 1.30)
Body Mass Index (kg/m ²), 30			0.67	(0.42, 1.07)
Bills, difficulty meeting – Yes			0.84	(0.59, 1.21)
ADL, 1 or more			1.25	(0.83, 1.88)
Depressive symptoms, high			1.40	(0.89, 2.20)
Cognition (MMSE)			0.94	(0.91, 0.98)
Cancer			2.16	(1.23, 3.81)
Stroke			0.86	(0.39, 1.92)
Diabetes			1.65	(1.13, 2.41)
Hip fracture			1.45	(0.34, 6.17)
Hypertension			0.89	(0.61, 1.29)
Anemia			1.67	(1.08, 2.56)
Emphysema			1.01	(0.51, 2.01)
Arthritis			0.93	(0.65, 1.35)
Heart attack			1.16	(0.46, 2.97)

^aThe unadjusted model was also run with the 768 participants included in the adjusted model. The pattern of association between PASE quartile and mortality risk was the same as for the 948 participants: low activity (HR = 0.38, 95% CI: 0.24, 0.60), moderate activity (HR = 0.28, 95% CI: 0.17, 0.44), high activity (HR = 0.29, 95% CI: 0.18, 0.47).

TABLE 3

Adjusted Hazard Ratios (95% CI) of Total, Leisure, and Household PASE Scores for 3-Year Mortality, by Gender^{a, b}

	Physical Activity Quartile			
	Sedentary	Low	Moderate	High
Men (n = 288)				
Total PASE	1.00	0.39 (0.17, 0.90)	0.26 (0.10, 0.67)	0.47 (0.20, 1.10)
Leisure	1.00	0.78 (0.35, 1.77)	1.49 (0.68, 3.25)	1.22 (0.54, 2.76)
Household	1.00	0.53 (0.25, 1.14)	0.12 (0.04, 0.37)	0.32 (0.13, 0.76)
Women (n = 484)				
Total PASE	1.00	0.50 (0.26, .97)	0.38 (0.19, 0.75)	0.34 (0.16, 0.73)
Leisure	1.00	0.78 (0.42, 1.45)	0.67 (0.33, 1.36)	0.42 (0.21, 0.86)
Household	1.00	0.37 (0.17, 0.79)	0.32 (0.16, 0.64)	0.29 (0.14, 0.61)

^a Adjusted for age, education, marital status, smoking status, body mass index, trouble paying bills, activities of daily living, depressive symptoms, cognition, and comorbidities.

^b Occupational subscale activity was extremely low in our sample, and was not evaluated separately.