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Community-Dwelling Older Adults and Physical Activity Recommendations: Patterns of Aerobic, Strengthening, and Balance Activities

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Abstract

Though it is known that most older adults do not meet the recommended physical activity (PA) guidelines, little is known regarding their participation in balance activities or the full guidelines. Therefore, we sought to describe PA patterns among 1,352 community-dwelling older adult participants of the Adult Changes in Thought study, a longitudinal cohort study exploring dementia-related risk factors. We used a modified version of the CHAMPS questionnaire to explore PA performed and classify participants as meeting or not meeting the full guidelines or any component of the guidelines. Logistic regression was used to identify factors associated with meeting PA guidelines. Despite performing 10 hours of weekly PA, only 11% of participants met the full guidelines. Older age, greater body mass index, needing assistance with instrumental daily activities, and heart disease were associated with decreased odds of meeting PA guidelines. These results can guide interventions that address PA among older adults.

Keywords

Health Promotion; Active Aging; Guidelines; Exercise

Introduction

Despite the known benefits of physical activity (PA), including fall prevention and reduced morbidity and mortality among older adults^{1,2}, one-third report no leisure-time PA participation^{3,4}. According to the US Department of Health and Human Services' 2018 Physical Activity Guidelines for Americans (PAGA), older adults should perform at least 150–300 minutes of aerobic activity at moderate-intensity, or 75–150 minutes a week of

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vigorous-intensity, or a combination of the two⁵. Strengthening activities are recommended at least twice per week at a moderate or greater intensity⁵. Additionally, older adults should perform multicomponent PA that includes balance training, though the PAGA does not provide specific recommendations regarding frequency, intensity, or duration for balance activities⁵. Research using self-report measures has identified that 27–44% of older adults meet the recommended aerobic PA and 19% of 65–74 year olds, 15% of 75–84, and 9% of those 85 years and older meet the recommended PA guidelines for aerobic and strengthening⁶. Although the PAGA for older adults also recommend performing weekly balance activities⁵, to our knowledge, no studies have examined the number of older adults who perform the balance component of these recommendations, or those that meet the full PA guidelines, including aerobic, strength, and balance recommendations. The high percentage of older adults who do not meet the recommended levels of PA has led to the development of various PA programs and national initiatives^{7–9}. However, even with the implementation of programs, many older adults are not meeting the recommended levels of PA^{3,4,6}. We believe that additional details about the modes of PA performed or not performed by older adults but recommended for maximal health benefits will allow programs to tailor their PA and potentially increase the number of older adults that meet recommendations¹⁰. Additional analysis is needed to further help programs tailor their PA interventions for subpopulations of older adults who are known to perform lower levels of PA, including women and the oldest old¹¹. In addition to the types of activities performed and not performed by older adults, programs also need information about barriers of engaging in PA, such as health conditions and fear of injury¹².

The most practical way to capture data about the context of physical movement and the multiple types of activities that comprise PA is to use questionnaires, which collect detailed information on the different types of PAs older adults engage in. However, a limitation of this approach is that people tend to overestimate the amount of PA compared to accelerometer measures¹³. While accelerometry is the ideal measurement to capture the duration, frequency, and intensity of physical activity, self-reported questionnaires provide researchers with the ability to explicitly examine various dimensions of PA (e.g. balance, strength training, etc.) and the activities performed within each of the dimensions. For the current study, the advantages of a self-report questionnaire, particularly regarding the ability to better contextualize the types of PA older adults engage in to meet the aerobic, strength, and balance recommendations, outweigh the disadvantage of self-report questionnaires. We sought to describe PA types, frequencies, durations, and intensities in a cohort of community-dwelling older adults using a validated, self-report questionnaire. We also explored demographic, co-morbidity, functional, cognitive, and behavioral factors associated with meeting (or not) PA recommendations among older adults.

Methods

Study Population

We used data from the Adult Changes in Thought (ACT) study. ACT is an ongoing longitudinal cohort study of Kaiser Permanente Washington (KPWA) that began in 1994 to investigate risk factors associated with dementia. Study participants undergo biennial follow-

up visits until they are diagnosed with dementia, study disenrollment, or death. During biennial visits, participants receive a take-home survey that they are asked to complete and mail back to the study team. Additional study details are described elsewhere¹⁴. The ACT study enrollment is held constant at approximately 2,000 participants aged 65 and older, with replacement members recruited as enrollees disenroll, develop dementia, or die. New enrollees are randomly selected from KPWA membership panels in King County, WA clinics. With a study research assistant, participants complete several cognitive and physical assessments and self-reported health and lifestyle measures. We used cross-sectional data collected from April 2016 to June 2018 because it included the subset of ACT participants that completed the supplemental questionnaire focused on PA.

Measures

Physical Activity

Community Healthy Activities Model Program for Seniors: Our primary measure of PA was based on a subset of items from the Community Healthy Activities Model Program for Seniors (CHAMPS). The CHAMPS instrument is designed to assess the weekly frequency and duration of lifestyle PAs that are meaningful to older adults, such as walking, cycling, yoga, and swimming^{15,16}. The CHAMPS' intraclass correlation coefficient for the moderate and greater caloric expenditure measure was 0.66–0.67¹⁶. The CHAMPS durations of high-light ($\rho = 0.27$), total activity ($\rho = 0.34$), and moderate-to-vigorous PA (MVPA, $\rho = 0.37$) were moderately associated with corresponding intensity minutes of accelerometry data¹⁷. Participants completed the CHAMPS by reporting whether a given activity was performed in the previous four weeks and if the answer was yes, the participant was prompted to report the frequency and duration of the activity.

For this study, the CHAMPS survey was reduced from 41 to 17 items due to concern of overly burdening participants with questionnaire items. The 17 items were selected based on relevance to recommended PA guidelines. For example, social activities measured in CHAMPS were dropped as these do not measure physically active endeavors. This modified version of the CHAMPS has not undergone reliability or validity testing.

Caloric Expenditure and Intensity: We calculated estimated caloric expenditure following directions given in the CHAMPS validation study, which instructs scale administrators to sum the duration of the activities and multiply the duration by the metabolic equivalent (MET) values provided¹⁵. The MET values provided are based on the research published by Ainsworth et al (1993) and others.¹⁸ The authors also used these MET values to categorize the CHAMP items' intensity, with a cut-off value > 3.0 indicating MVPA¹⁵. Questions regarding strength training and swimming items included intensity classification within the question. For example, for strength, the following two items provide language to differentiate intensities: 1) "Do moderate to heavy strength training (such as hand-held weights of more than 5 lbs., weight machines, or push-ups);" and 2) "Do light strength training (such as hand-held weights of 5 lbs. or less or elastic bands)." Similarly, the swimming questions had intensity qualifiers: 1) "Swim moderately;" and 2) "Swim gently." Each of these items had a corresponding MET value used to identify the items as either a light or MVPA.

Categorizing Physical Activity Based on Physical Activity Guidelines for Americans

Meeting the Recommended PAGA Aerobic Component: Participants were categorized as meeting the aerobic component of the guidelines if they completed the recommended 150 minutes of MVPA⁵. Items categorized as MVPA included jog/run, walk/hike uphill, walk fast for exercise, ride a bike/stationary cycle, other aerobic machines, swim moderately, and perform aerobic or dancing activities.

Meeting the Recommended PAGA Strength Component: Participants categorized as meeting the recommended amount of the strengthening component of the PAGA completed strengthening activities at a moderate or greater intensity at least two times per week⁵. Items categorized as moderate or greater intensity strengthening included water exercise and moderate to heavy strength training. Classification of water exercise as a moderate intensity strengthening activity was based on the intensity classification presented by the initial publication of the CHAMPS¹⁵ and previous research identifying that participants who completed a 12-week water exercise program had significant increases in strength¹⁹.

Meeting the Recommended PAGA Balance Component: Participants categorized as meeting the recommended amount of the balance component of the PAGA performed balance activities at least once per week⁵. Items categorized as balance included yoga or balance training. Classification of yoga as a balance activity is based on previous literature. Among older adults, participating in yoga is associated with moderate improvements in gait, upper/lower body flexibility, balance, and lower body strength^{20,21}. An additional examination into the effect size and level of association with each of the outcomes was presented by Roland et al (2011). The authors identified that improved balance is a primary outcome of yoga²⁰. Therefore, yoga was categorized as a balance activity. Not classifying yoga as a strength activity was further supported by the CHAMPS directions, which identified yoga as a light intensity PA^{15,16}.

Meeting and Not Meeting the Physical Activity Guidelines: Participants who performed 150 minutes of MVPA per week, moderate-intensity strengthening at least twice per week, and balance exercise at least once per week were categorized as meeting the PAGA⁵. The participants who did not perform any PA or did not meet all of the PAGA components (aerobic, strength, and balance) were classified as not meeting the guidelines.

Categorizing Physical Activity Based on Intensity: In addition to the groups defined above, we also categorized PA by intensity using the categories presented in the CHAMPS scoring directions^{15,16}. Each activity was placed into one of the two mutually exclusive groups: 1) Light PA; and 2) MVPA. Light activities consisted of walking for errands, walking leisurely, stretching or flexibility exercises, yoga, doing general conditioning exercises, and doing balance exercises. Moderate-to-vigorous PA included jogging or running, walking or hiking uphill, walking fast for exercise, riding a bicycle or stationary cycle, doing other aerobic machines such as rowing or step machine, water exercise, swimming moderately, swimming gently, aerobics or aerobic dancing, moderate to heavy strength training, and light strength training.

Demographics and Health Characteristics—Participants’ self-reported demographic information included age, gender, race, ethnicity, years of education, approximate household annual income, and marital status. For analysis, these variables were categorized as age (measured continuously with those age 90 or more assigned an age of 90), gender (men *vs.* women), race (white *vs.* other), ethnicity (Hispanic *vs.* Non-Hispanic), education (high school graduate or less *vs.* any post high school education to college graduate *vs.* college graduate or more), income (<\$30,000 *vs.* \$30,000-\$60,000 *vs.* >\$60,000), and marital status (married *vs.* not married). We characterized the types of PA performed by two different age groups, the “Younger Older Adults” who were between the ages of 65–79 and “Older Older Adults” who were ≥ 80 years. Among several other health status questions, participants indicated if they had previously been diagnosed with or had a history of heart disease, hypertension, cancer, or depression. Heart disease was defined as self-reported myocardial infarction (MI), coronary artery bypass grafting (CABG), angina, and angioplasty. Depression was measured using the Center for Epidemiological Studies – Depression Scale (CES-D), a 20-item measure to rate symptoms associated with depression, where CES-D ≥ 10 was considered depressed²². Body mass index (BMI; kg/m²) was calculated from height and weight values measured by a research assistant at the study visit closest to their survey response. Information on cognitive function, measured by the Cognitive Abilities Screening Instrument (CASI), was also collected at the ACT study visit closest to their survey response. The CASI quantitatively measures attention, concentration, orientation, short- and long-term memory, language and visual abilities, list-generating fluency, abstraction, and judgment and has a score that ranges from 0–100, with a score of <86 used in ACT to refer participants for evaluation for possible dementia²³. The ability to complete instrumental activities of daily living (IADL) was also collected via a self-reported questionnaire that asked participants about the difficulty of completing the following activities: light housework, meal preparation, telephone usage, bill management, and shopping. A participant was classified as having difficulty with IADLs if they reported having difficulty with at least one task. These variables were included based on the availability of data.

Statistical Analysis

We summarized demographic and health characteristics of our population by the five PA participation groups. We also aggregated weekly time spent in each intensity category described above to calculate descriptive measures of average frequency, duration, and caloric expenditure in each intensity group. Chi-squared tests were used to test differences in frequency and intensity of PA by gender and age. Here we categorized age as “Younger Old Adults” ages 65–79” and “Older Old Adults” ages ≥ 80 years. Logistic regression models were used to assess how demographics, medical conditions, IADLs, and cognitive function were associated with each PA participation group. Complete case analysis was performed. Stata 15.1 (StataCorp LP, College Station, Texas) was used for data management and statistical analysis. The original study (ACT) and the secondary data analysis were approved by the KPWA Institutional Review Board Institutional Review Board. Written informed consent was provided by all study participants prior to initiating data collection.

Results

Participant Characteristics and Physical Activity Participation

Our sample consisted of 1,352 participants with a mean age of 77.7 years ($SD=6.9$), over half were women (57%), most were non-Hispanic white (90%), and half had at least a college-level education (51%), over half were overweight or obese (61%), and most were independent with IADLs (82%). The mean CASI score of 95.4 indicates that the average score among our participants is above the cut-off (<86) used by the ACT study to refer participants for evaluation for possible dementia. Among the 1,352 participants, 4% ($n=58$) reported no PA, 30% ($n=406$) reported some PA but did not meet the recommended amounts of aerobic, strength, or balance activities, 39% ($n=531$) met the recommended 150 minutes of aerobic MVPA, 26% ($n=352$), met the recommended frequency and intensity for the strength component of the PAGA, 41% ($n=549$) met the recommended frequency for the balance component of the PAGA, and 9% ($n=118$) met the recommended frequency and intensity of the full PAGA, including the aerobic, strength, and balance component. Meeting the individual components of the PAGA or the full guidelines varied by gender. A higher percentage of women met the aerobic recommendations (52%), balance recommendations (65%), and full guidelines (54%). In contrast, men were more likely to meet the moderate strength recommendations (58%) than women. See Table 1 for additional detail related to participants' characteristics stratified by PA categorization.

Physical Activity Dimensions

Participants reported performing an average of 5 ($SD=3$) different activities, averaging 16 ($SD=10$) total PA bouts each week and a cumulative weekly PA duration of 10 ($SD=7$) hours over the past month. As shown in Table 2, participants performed more types of light PA than MVPA, and the light PAs were performed for longer duration and more frequently. However, total weekly median caloric expenditure from MVPA was higher than for light intensity PA.

More detailed examination of specific types of PA revealed that participant engagement in activities in the past four weeks varied greatly, ranging from only 3% participation in swimming gently and 7% participating in any water exercise to 69% participating in walking leisurely for exercise or pleasure. Notably, 55% of ACT participants engaged in stretching, a PA component that is not part of the current PAGA. The weekly frequency, hours, and caloric expenditure were reported for each activity. Even though jogging or running is performed less frequently than other types of PA, it burned the most calories, while stretching and balance activities burned the least. When examining strengthening, a larger percentage of ACT participants perform light-intensity strengthening (31%) compared to the guidelines' recommended moderate-intensity strengthening (27%). For additional details about the number of individuals that performed each activity and the weekly frequency, duration, and caloric expenditure per activity, see Table 3.

The most frequently reported PA was walking, with 69% reporting that they walk leisurely for exercise and 66% reporting that they walk for errands. The least reported PA was swimming, with 3% reporting gentle swimming and 6% reporting moderate swimming.

When examining other components of the PA guidelines, only 27% do moderate-to-heavy strength training, 38% do balance exercises, and 12% do yoga.

We examined the types of activities performed by “Younger Older Adults” and “Older Older Adults” (See Figure 1). Compared with participants 80 years and older, a greater proportion of participants 65–79 reported walking or hiking uphill, walking fast for exercise, walking for errands, riding a bike, swimming moderately, doing yoga, and moderate to heavy strength training. Among participants 80 years and older, a significantly higher proportion reported doing water exercise and general conditioning. Notably, there was no difference by age groups in jogging/running, use of aerobic machines, aerobics/dancing, stretching, light strengthening, or balance activities.

We also stratified the sample by gender to explore differences in reported activity types and the odds of meeting individual components, or all aspects, of the PAGA. As shown in Figure 2, men were more likely to report jogging/running, riding a bike/stationary cycle, and participating in moderate-heavy strength training compared to women. A significantly higher number of women reported walking or hiking uphill, swimming gently, participating in water aerobics, yoga, aerobic classes or dancing, light strengthening, general conditioning, and balance compared to men. Participation in walking for exercise or errands, using aerobic machines, moderate-intensity swimming, and stretching did not differ between men and women.

Table 4 presents the odds of meeting the individual components of the PAGA or the full guidelines. For the aerobic component of the PAGA, older age, identifying as a woman, higher BMI, a history of heart disease, and needing IADL assistance were associated with lower odds of meeting the aerobic recommendations. For the strength component of the PAGA, having a history of hypertension and needing IADL assistance were associated with decreased odds of meeting the guidelines, while identifying as a man and higher income (>\$60K vs. <\$30K) were associated with increased odds of meeting the recommended weekly strength activities. For the balance component, identifying as a man and having a higher BMI were associated with lower odds of meeting the balance recommendations, whereas having more than a high school education was associated with increased odds of meeting the recommended balance component of the PAGA. For the full guidelines, a higher BMI was associated with lower odds of meeting the guidelines compared to not meeting the guidelines. The multivariable models had missing information on 66 (5%) records.

The gender-specific odds of meeting the individual components of the PAGA or the full guidelines are presented in Table 5 (men) and Table 6 (women). Among men, the odds of meeting the aerobic component decreased with older age, higher BMI, history of heart disease, and needing IADL assistance. For men, the odds of meeting strength recommendations decreased with a history of hypertension and needing IADL assistance, and increased with being married and reporting higher income. For the men’s balance component, greater than four years of post-secondary education was associated with greater odds of meeting the recommended amount of balance activity relative to an education of high school or less. For the full guidelines, among men the odds of meeting the full PAGA increased with being married. The variables associated with meeting the individual

components of the PAGA or the full guidelines were different for women. For the aerobic component, women with higher age, higher BMI, history of heart disease, and needing IADL assistance had lower odds of meeting the recommended amount of weekly aerobic activities. For the women's strengthening activities, women with 1–4 years of post-secondary education had lower odds of meeting the recommended amount of weekly strengthening activities relative to women with a high school education or less. For balance, the odds of meeting the recommended amount in women increased with more education and decreased with a higher BMI. For the full PAGA, women with a higher age and BMI had lower odds of meeting the guidelines.

Discussion

Our study investigated the patterns of PA among community-dwelling older adults. We found that despite averaging 10 hours of weekly PA, 39% met the aerobic component, 26% met the strengthening recommendations, 41% met the balance recommendations, and 9% met the full guidelines. The low percentage of participants that meet the recommended levels of aerobic and strengthening PA is consistent with previous literature^{3,6,24}. The low percentage of participants meeting the full guidelines is concerning particularly when examining the strong evidence that supports participating in all three PA components, aerobic, strength, and balance, particularly amongst older adults^{25–27}.

We also identified that the primary activities performed by older adults are low-intensity activities, including walking leisurely (69%), walking for errands (66%), and stretching (55%). When examining strengthening activities, a similar pattern of light versus moderate intensity is seen, with a higher percentage of ACT participants performing light-intensity strengthening. These findings indicate that older adults tend to perform PA that is classified as light-intensity and not the moderate-intensity recommended by the guidelines. It is also important to note that despite 41% of older adults meeting the recommended weekly frequency of balance activities, this may not be a sufficient amount of balance activity to impact fall risk. According to previous research, at least three hours per week of balance and functional activities are required to reduce the rate of falls²⁸. While PAGA promotes balance activities for older adults, the lack of a time recommendation may limit the overall impact on fall risk in older adults. Additionally, it is important to note that when we stratified by age and gender, we identified some differences. Compared to younger older adults, older adults 80 years and older were less likely to perform moderate intensity aerobic and strengthening activity. While compared to men, women were more likely to perform balance and walking, but less likely to jog/run and perform strengthening activities.

The logistic regression results provide insight about factors that may contribute to the odds of meeting all components of the PAGA. Although this study is unique in describing factors associated with meeting PA recommendations in U.S. older adults, similar findings were described in a study examining adherence with PA guidelines among Finnish adults, wherein, older age, higher BMI, poorer self-rated health, and lower levels of education were associated with lower odds of meeting recommended levels of PA²⁹. Given the association between obesity and risk for worse physical function³⁰, promoting PA for older adults with obesity is a potentially effective strategy to mitigate loss of physical function and promote

healthy aging. The varying logistic regression results by gender also suggest gender-specific strategies may be needed to engage men and women in PA in general and for meeting the various components of the PAGA. Additional efforts to engage women and men in strength and balance activities, respectively, needs to be a priority, especially when considering the benefits of strength and balance training for reducing fall risk and improving physical function. Our finding that older adults requiring assistance with IADLs, a marker of reduced physical function, are less likely to participate in aerobic and strengthening activities, aligns with previous research^{31,32} indicating a continued need for PA promotion in this higher risk population.

A potential reason for older adults not meeting all components of the current PA recommendations may have to do with the types of exercise that are most accessible to older adults or emphasized by current interventions within this population. Among ACT participants, the primary PA consisted of various forms of light activities, including walking at a light intensity and stretching. The popularity of walking aligns with previous research³³. The limited participation in balance and strengthening activities highlights the need to develop programs that focus on these aspects of the guidelines. This need is further supported by a recent systematic review that examined characteristics of exercise interventions and identified that only 32% included balance exercises and 55% included strength, power, or resistance training³⁴. The need is even greater among women and adults 80 years or older, as we identified that they perform a significantly lower amount of moderate-to-high intensity strength training compared to younger older adults and men, respectively.

When examining participants' higher amount of light-intensity PA, it is essential to note that previous research has identified that self-report questionnaires inadequately measure light-intensity PA^{17,35}. A challenge with collecting self-report on light PA is that several light activity items, including walking at a light intensity, are susceptible to over-reporting¹⁷. The lack of reliability of self-reported light intensity may contribute to the dearth of evidence for health benefits related to light PA³⁶. Emerging evidence from the Objective Physical Activity and Cardiovascular Health (OPACH) study has identified positive health benefits associated with light PA, including the ability to maintain independence with functional mobility³⁷, reduce risk of cardiovascular disease³⁸, and mortality³⁹. However, MVPA has many demonstrated health benefits, and for some outcomes, such as diabetes, movement at higher intensities may be required for disease prevention in older adults⁴⁰. Another challenge is the current classification system of MVPA. As highlighted in findings from the OPACH Study, the energy costs of movement increase with aging,³³ but self-report questionnaires and metabolic equivalents (METs) used to calculate intensity do not account for age⁴¹. Therefore, it is possible that some of the light activities should be classified as MVPA. The misclassification may also account for why PA questionnaires underestimate older adults' levels of MVPA⁴².

Additional strategies may be needed to engage older adults in higher intensity PA. For example, many older adults do not meet the recommended levels of PA because they have a fear of injury or falling, perceive themselves as being too old, weak, or sick, or feel that they have insufficient endurance or balance¹². Yet, research has indicated that

high-intensity PA is safe for older adults, even if they are frail, deconditioned, or have an acute illness⁴³⁻⁴⁵. In addition to factors associated with fear or concerns related to PA intensity, programs should also consider factors associated with meeting the PA guidelines. For example, our results identified that older age, higher BMI, history of heart disease, difficulty with IADLs, and lower education are associated with significantly reduced odds for meeting the PA guidelines among older adults. These factors are consistent with previous literature identifying that not meeting the recommended amount of PA is associated with co-morbidities^{46,47}, difficulty with IADLs⁴⁸, being overweight⁴⁷, and having a lower level of education⁴⁹. Publications describing factors associated with PA program adherence further emphasize the association between decreased adherence to PA intervention among participants with chronic conditions, lower cognitive function, decreased self-efficacy, or worse self-rated health⁵⁰⁻⁵³. The importance of assessing and addressing contextual factors that impact PA adherence was emphasized by a mixed-methods study conducted by Jancey et al (2007;⁵². They concluded that assessing and addressing characteristics associated with lower odds of meeting the PA guidelines increases participants' retention in a PA program⁵². The effectiveness of assessing and addressing perceived barriers associated with age, history of heart disease, and difficulty with IADLs needs to be explored with a high-quality intervention study.

Strengths and Limitations

Our primary study strength is that by using CHAMPS data we can provide specific information about the types and amount of each PA older adults performed. By looking at specific activities, we can examine older adults' participation in balance and strengthening components of the PAGA. However, using the CHAMPS also results in our study's largest limitation, the potential of double-counting activity. For example, some individuals may walk to do errands both at a leisurely pace and uphill. Therefore, they may select yes to all three activities and then circle each activity's frequency and amount. Another limitation is that only select questions from the CHAMPS were used in the ACT study and we do not have information about the reliability and validity of the shortened version compared to the full version of the CHAMPS. Additionally, our data is missing information about several contextual factors associated with performing PA, including personal factors such as enjoyment or motivation related to PA, social support, and environmental barriers^{12,54,55}. It is important to note that although new enrollees over the age of 65 reside in King County and are randomly selected from KPWA, our sample has an over-representation of non-Hispanic White people with high levels of education and income, thereby limiting the generalizability of our results.

Conclusion

About one-tenth of the ACT participants met the recommended PA full guidelines, highlighting the need to increase the implementation of interventions and programs that incorporate all recommended types of physical activity. Physical activity promotion programs should also consider factors associated with lower odds of meeting the full guidelines, including age, BMI, history of heart disease, and difficulty with IADLs. Physical activity programs can use our result about types of activities performed and factors

that impact PA participation to incorporate higher intensity aerobic activities, along with activities focused on improving balance or strength, and address the above-mentioned PA participation factors. By incorporating PA that are currently not performed by older adults, the percent of older adults that meet the full PA guidelines may increase.

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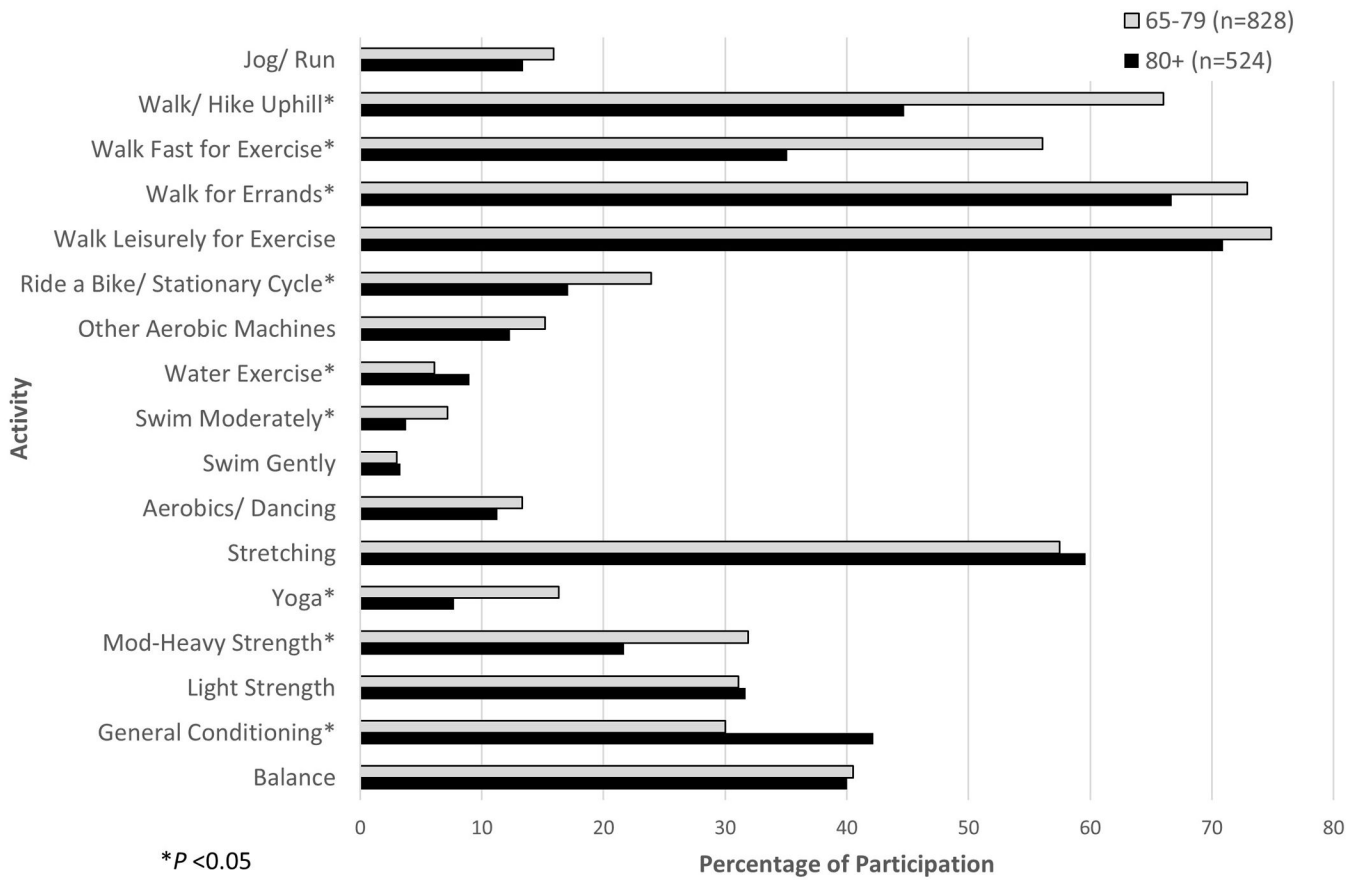


Figure 1 — Physical activity types by age group. **p*<.05.

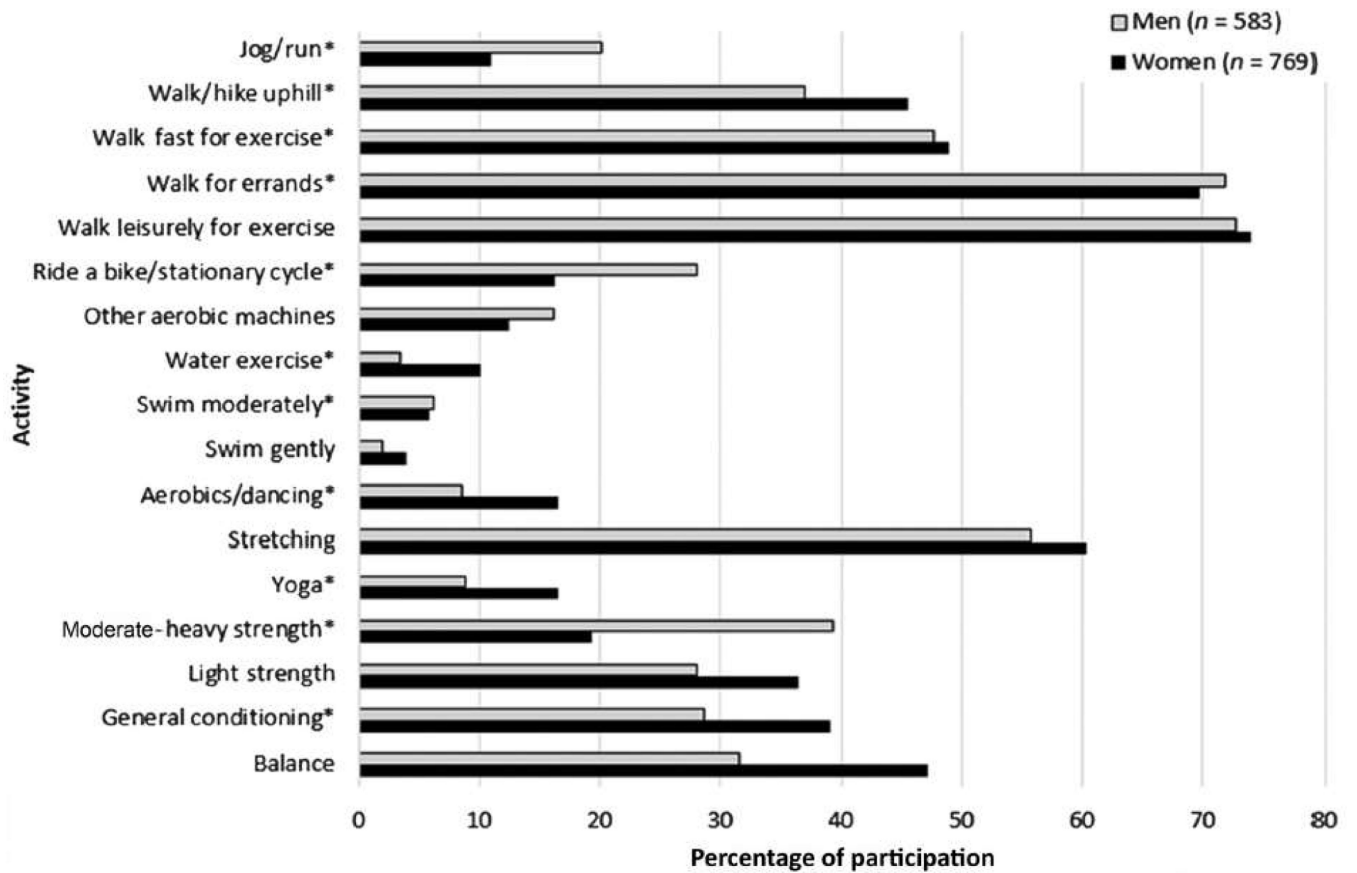


Figure 2 —
Physical activity types by gender. * $p < .05$.

Table 1

Participant Characteristics Stratified Based on Activity Level

Characteristics	150 Minutes of MVPA	>1/Week Strength	1/Week Balance	Not Meeting Full Guidelines	Meeting Full Guidelines*
n (%)	531 (39%)	352 (26%)	549 (41%)	1234 (91%)	118 (9%)
Age, y, mean (SD)	76 (5.8)	77 (6.6)	77 (6.5)	78 (7.0)	75 (5.5)
Women, n (%)	274 (52)	147 (42)	359 (65)	705 (57)	64(54)
Race, n (%)					
Non-Hispanic White	480 (91)	316 (90)	489 (89)	1102 (90)	105 (89)
Black	7 (1)	11 (3)	7 (1)	20 (2)	3 (3)
Asian	14 (3)	11 (3)	26 (5)	43 (4)	7 (6)
Pacific Islander	1 (0)	0 (0)	0 (0)	2 (0)	0 (0)
Other	28 (5)	13 (4)	25 (5)	62 (5)	3 (3)
Hispanic Ethnicity, n (%)	12 (2)	6 (2)	10 (2)	20 (2)	3 (3)
Education Level, n (%)					
High School	34 (6)	31 (9)	33 (6)	130 (11)	6 (5)
1–4 Years of Post-Secondary	151 (28)	95 (27)	181 (33)	444 (36)	30 (25)
> 4 Years of Post-Secondary	346 (65)	226 (64)	335 (61)	660 (53)	82(69)
Income, n (%)					
< \$30K	40 (8)	25 (7)	54 (10)	148 (12)	7 (6)
\$30–60K	120 (23)	85 (24)	139 (25)	319 (26)	26 (22)
>\$60K	304 (57)	199 (57)	276 (50)	559 (45)	75(64)
Don't Know/Refused	66 (12)	42 (12)	79 (14)	204 (17)	10 (8)
Married, n (%)	336 (63)	219 (62)	298 (54)	666 (54)	73 (62)
Self-Report Medical Diagnoses, n (%)					
Cancer	102 (19)	82 (23)	131 (24)	302 (25)	22 (19)
Depression (CES-D >10)	35 (7)	19 (5)	54 (10)	111 (9)	8 (7)
Heart Disease	44 (8)	43(12)	60 (11)	186 (15)	9 (8)
Hypertension	219 (41)	140 (40)	247 (45)	620 (50)	40 (34)
Smoking, n (%)					
Never Smoked	288 (54)	177 (50)	303 (55)	658 (54)	56 (47)
Past Smokers	236 (45)	171 (49)	237 (43)	547 (44)	60 (51)
Current Smokers	5 (1)	4 (1)	9 (2)	25 (2)	2 (2)
Weight status, n (%)					
Underweight	3 (1)	3 (1)	7 (1)	12 (1)	2 (2)
Normal Weight	235 (45)	131 (38)	236 (44)	447 (37)	54 (46)
Overweight	193 (37)	143 (41)	195 (36)	444 (37)	45 (38)
Obese	92 (18)	69 (20)	101 (19)	293 (25)	16(14)
CASI score **, mean (SD)	96.1 (3.0)	95.6 (4.2)	95.8 (3.4)	95.4 (4.3)	96.3 (2.6)
Independent with	477 (91)	312 (89)	468 (86)	992 (81)	110 (93)

Characteristics	150 Minutes of MVPA	>1/Week Strength	1/Week Balance	Not Meeting Full Guidelines	Meeting Full Guidelines *
n (%)	531 (39%)	352 (26%)	549 (41%)	1234 (91%)	118 (9%)

IADLs *

Numbers reported in this table are based on non-missing data. The only mutually exclusive columns within the table are the last two (not meeting and meeting the full guidelines)

* Full Guidelines includes 150 min of weekly aerobic MVPA, 2/week strengthening, and 1/week balance activities.

** Abbreviation: CASI = Cognitive Abilities Screening Instrument; CES-D = Center for Epidemiological Studies-Depression; IADLs = Instrumental Activities of Daily Living

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Table 2

An Aggregate of Physical Activity Dimensions Stratified by Level of Intensity

Dimension	Light Physical Activity 6 activities	Moderate-to-Vigorous Physical Activity 11 activities	All Physical Activity 17 activities
Number of Different Types of PA			
Median (IQR [*])	3 (2–4)	2 (1–3)	5 (3–7)
Mean (SD)	3 (2)	2 (2)	5 (3)
Weekly Caloric Expenditure			
Median (IQR)	2,310 (1,118–3,883)	2,574 (1,191–4,910)	4,233 (2,234–7,384)
Mean (SD)	2,813 (2306)	3,618 (2,492)	5,552 (4,817)
Weekly Frequency			
Median (IQR)	10 (6–15)	9 (4–9)	15 (9–22)
Mean (SD)	11 (7)	7 (4)	16 (10)
Weekly Hourly Duration			
Median (IQR)	5 (2–9)	4(2–6)	8 (4–13)
Mean (SD)	6 (5)	4 (4)	10 (7)
Most Frequently Reported Physical Activity Types			
	Walk leisurely for exercise errands Stretching	Walk/hike uphill Ride a bike/stationary	Walk fast for exercise Cycle Walk leisurely for exercise errands Stretching

* Inter-quartile range

Table 3

Frequency and Total Hours Based on Type of Physical Activity

Activity	N (%)	Weekly Frequency N (%)							Weekly Hours N (%)					Weekly Caloric Expenditure Mean (SD) Range
		1	2	3-4	5+	Unknown	<1	1-2.5	3-4.5	5-6.5	>7	Unknown		
Jog / Run	190 (14)	37 (20)	52 (27)	50 (26)	39 (21)	12 (6)	63 (33)	54 (28)	39 (21)	5 (3)	7 (3)	22 (12)	2,559(2,287) 404-12,303	
Walk/Hike Uphill	728 (54)	114 (16)	171 (24)	217 (30)	199 (27)	27 (4)	279 (38)	260 (36)	61 (8)	31 (4)	15 (2)	82 (11)	1,891 (1,943) 299-12,715	
Walk Fast for Exercise	611 (45)	81 (13)	152 (25)	188 (31)	154 (25)	36 (6)	142 (23)	203 (33)	131 (21)	42 (7)	27 (4)	66 (11)	1,527(1,300) 175-8,671	
Walk for Errands	885 (66)	127 (14)	223 (25)	261 (30)	226 (26)	48 (5)	194 (22)	345 (39)	150 (17)	44 (5)	28 (3)	124 (14)	1,025 (888) 129-5,707	
Walk Leisurely for Exercise or Pleasure	926 (69)	156 (17)	268 (29)	218 (24)	220 (24)	64 (7)	212 (23)	354 (38)	143 (15)	50 (5)	29 (3)	138 (15)	992 (843) 125-5,707	
Ride a Bike/Stationary Machines	271 (20)	55 (20)	67 (25)	85 (31)	43 (16)	21 (8)	85 (31)	99 (37)	35 (13)	13 (5)	5 (2)	33 (12)	1,324(1,144) 208-7,207	
Cycle Other Aerobic Machines	178 (13)	38.0 (21)	53 (30)	45 (25)	21 (12)	21 (12)	69 (39)	67 (38)	16 (9)	5 (3)	2 (1)	19 (11)	1,486(1,374) 252-9,009	
Water Exercise	92 (7)	19 (21)	30 (33)	31 (34)	6 (7)	6 (7)	28 (30)	32 (35)	23 (25)	4 (4)	0 (0)	5 (5)	1,144 (919) 165-4,039	
Swim Moderately	76 (6)	10 (22)	24 (32)	20 (26)	7.0 (9)	8 (11)	29 (38)	28 (37)	13 (17)	1 (1)	0 (0)	5 (7)	1,515 (1,263) 257-6,038	
Swim Gently	39 (3)	12 (31)	12 (26)	4 (13)	4 (10)	9 (23)	24 (62)	8 (21)	1 (2)	0 (0)	0 (0)	6 (15)	496.0(463.8) 197-2,339	
Aerobics/Dancing	166 (12)	35 (21)	52 (31)	51 (31)	14 (8)	14.0 (8)	55 (33)	57 (34)	26 (16)	4 (2)	6 (4)	18 (11)	1,199(1,230) 182-6,915	
Stretching	740 (55)	59 (8)	156 (21)	247 (33)	242 (33)	36 (5)	285 (39)	266 (36)	81 (11)	11 (2)	10 (1)	87 (12)	559(509) 100-3,808	
Yoga	166 (12)	62 (37)	47 (28)	28 (17)	18 (11)	11 (7)	45 (27)	75 (45)	26 (16)	1 (1)	3 (2)	16 (17)	615 (457) 100-2,881	
Mod-Heavy Strength	358 (27)	42 (12)	114 (32)	135 (38)	49 (14)	18 (5)	130 (36)	138 (39)	43 (12)	9 (3)	3 (1)	35 (10)	1,358 (1,176) 224-7,560	
Light Strength	417 (31)	56 (13)	122.0 (29)	150 (36)	62 (15)	27 (7)	198 (48)	135 (32)	28 (7)	5 (1)	2 (1)	49 (12)	681 (627) 150-4,907	
General Conditioning	439 (33)	58.0 (13)	116.0 (26)	141 (32)	92 (21)	32 (7)	163 (37)	169 (39)	46 (11)	7 (2)	2 (1)	52 (12)	670 (537) 125-32,35	
Balance	516 (38)	79 (15)	140.0 (27)	165 (32)	107 (21)	25 (5)	284 (55)	133 (26)	39 (8)	5 (1)	2 (0)	53 (10)	408 (405) 100-3,256	

Table 4

Estimated Associations Between Participant Characteristics and Meeting Physical Activity Guidelines
(n=1281)

	Physical Activity Recommendations			
	150 Minutes of MVPA vs. <150 Minutes of MVPA	>/Week Strength vs. 1/ Week Strength	1/Week Balance vs. <1/Week Balance	Meeting Full Guidelines vs. Not Meeting Full Guidelines
	OR (95% CI)			
Gender, men	1.37* (1.06, 1.78)	2.19* (1.67, 2.88)	0.51* (0.39, 0.65)	1.10 (0.73, 1.63)
Age, years	0.94* (0.92, 0.96)	1.00 (0.97, 1.02)	0.99 (0.97, 1.01)	0.97 (0.93, 1.0)
Race, white	1.07 (0.71, 1.61)	0.99 (0.64, 1.53)	1.05 (0.71, 1.54)	0.82 (0.43, 1.54)
Ethnicity, Hispanic	2.06 (0.81, 5.20)	1.11 (0.41, 3.00)	1.31 (0.53, 3.23)	1.63 (0.46, 5.82)
Education, HS	-ref-	-ref-	-ref-	-ref-
1-4 Years of Post- Secondary	0.93 (0.57, 1.52)	0.64 (0.39, 1.06)	1.74* (1.09, 2.78)	0.97 (0.38, 2.45)
> 4 Years of Post- Secondary	1.32 (0.81, 2.12)	0.95 (0.59, 1.54)	2.31* (1.45, 3.68)	1.43 (0.58, 3.48)
Income, <\$30k	-ref-	-ref-	-ref-	-ref-
\$30k-60k	1.30 (0.81, 2.01)	1.51 (0.89, 2.55)	1.24 (0.81, 1.90)	1.56 (0.65, 3.76)
>\$60k	1.56 (0.97, 2.53)	1.81* (1.07, 3.09)	1.37 (0.88, 2.13)	2.10 (0.87, 5.00)
Don't Know/Refused	1.34 (0.78, 2.28)	1.37 (0.76, 2.47)	1.15 (0.71, 1.85)	1.12 (0.40, 3.10)
Marital Status, Married	0.88 (0.66, 1.18)	1.09 (0.79, 1.49)	1.07 (0.80, 1.41)	1.14 (0.71, 1.83)
Heart Disease, yes	0.52* (0.35, 0.77)	0.83 (0.55, 1.24)	0.82 (0.57, 1.17)	0.68 (0.32, 1.42)
Hypertension, yes	0.95 (0.74, 1.22)	0.68* (0.52, 89)	0.98 (0.77, 1.25)	0.73 (0.48, 1.12)
BMI, kg/m²	0.93* (0.91, 0.96)	1.00 (0.97, 1.02)	0.96* (0.94, 0.98)	0.94* (0.90, 0.99)
CASI score	1.01 (0.98, 1.05)	0.99 (0.98, 1.01)	1.00 (0.97, 1.03)	1.02 (0.95, 1.03)
Needs IADL Assist, yes	0.55* (0.38, 0.79)	0.62* (0.42, 0.92)	0.78 (0.56, 1.09)	0.48 (0.23, 1.03)

* Statistically significant at $P < 0.05$

Table 5

Estimated Associations Between Participant Characteristics and Meeting Physical Activity Guidelines Among Men (n=557)

	Physical Activity Recommendations			
	150 Minutes of MVPA vs. <150 Minutes of MVPA	>/Week Strength vs. 1/Week Strength	1/Week Balance vs. <1/Week Balance	Meeting Full Guidelines vs. Not Meeting Full Guidelines
	OR (95% CI)			
Age, years	0.95* (0.92, 0.98)	1.02 (0.98, 1.04)	1.02 (0.99, 1.05)	1.02 (0.97, 1.07)
Race, white	0.77 (0.40, 1.48)	0.87 (0.45, 1.67)	1.11 (0.57, 2.20)	1.27 (0.40, 4.00)
Ethnicity, Hispanic	1.01 (0.24, 4.20)	2.55 (0.62, 10.40)	2.10 (0.52, 8.53)	4.74 (0.80, 28.10)
Education, HS	-ref-	-ref-	-ref-	-ref-
1–4 Years of Post-Secondary	1.24 (0.54, 2.86)	1.15 (0.52, 2.55)	2.25 (0.90, 5.64)	3.60 (0.44, 29.17)
> 4 Years of Post-Secondary	1.69 (0.76, 3.76)	1.32 (0.62, 2.82)	2.53* (1.04, 6.17)	3.82 (0.49, 29.67)
Income, <\$30k	-ref-	-ref-	-ref-	-ref-
\$30k-60k	1.50 (0.64, 3.52)	1.65 (0.69, 3.95)	0.85 (0.37, 1.97)	2.01 (0.41, 9.76)
>\$60k	1.97 (0.85, 4.55)	2.60* (1.10, 6.14)	1.26 (0.55, 2.86)	2.95 (0.63, 13.95)
Don't Know/Refused	2.68* (1.01, 7.10)	3.17* (1.20, 8.35)	1.11 (0.43, 2.87)	2.54 (0.43, 14.91)
Marital Status, Married	1.04 (0.66, 1.63)	1.72* (1.11, 2.68)	1.21 (0.77, 1.89)	2.10* (1.06, 4.15)
Heart Disease, yes	0.50* (0.30, 0.83)	0.73 (0.44, 1.22)	0.73 (0.44, 1.22)	0.64 (0.26, 1.61)
Hypertension, yes	1.01 (0.69, 1.47)	0.64* (0.44, 0.94)	0.76 (0.52, 1.12)	0.70 (0.37, 1.32)
BMI, kg/m²	0.92* (0.89, 0.96)	1.01 (0.97, 1.05)	0.97 (0.93, 1.01)	0.97 (0.90, 1.04)
CASI score	1.02 (0.97, 1.08)	1.00 (0.99, 1.01)	1.00 (0.94, 1.05)	1.08 (0.97, 1.20)
Needs IADL Assist, yes	0.50* (0.29, 0.86)	0.57* (0.34, 0.98)	0.91 (0.54, 1.53)	0.31 (0.09, 1.05)

* Statistically significant at $P < 0.05$

Table 6

Estimated Associations Between Participant Characteristics and Meeting Physical Activity Guidelines Among Women (n=724)

	Physical Activity Recommendations			
	150 Minutes of MVPA vs. <150 Minutes of MVPA	>/Week Strength vs. 1/Week Strength	1/Week Balance vs. <1/Week Balance	Meeting Full Guidelines vs. Not Meeting Full Guidelines
	OR (95% CI)			
Age, years	0.93* (0.90, 0.96)	0.98 (0.95, 1.02)	0.97 (0.95, 1.00)	0.93* (0.88, 0.98)
Race, white	1.25 (0.73, 2.14)	1.17 (0.62, 2.22)	1.04 (0.65, 1.68)	0.66 (0.30, 1.47)
Ethnicity, Hispanic	3.40 (0.92, 12.55)	0.33 (0.04, 2.64)	0.97 (0.30, 3.17)	0.77 (0.09, 6.39)
Education, HS	-ref-	-ref-	-ref-	-ref-
1–4 Years of Post-Secondary	0.79 (0.43, 1.46)	0.43* (0.22, 0.84)	1.60 (0.92, 2.78)	0.54 (0.18, 1.62)
> 4 Years of Post-secondary	1.15 (0.62, 2.12)	0.84 (0.44, 1.63)	2.33* (1.33, 4.10)	0.99 (0.35, 2.83)
Income, <\$30k	-ref-	-ref-	-ref-	-ref-
\$30k-60k	1.28 (0.72, 2.29)	1.63 (0.82, 3.23)	1.33 (0.80, 2.21)	1.40 (0.47, 4.20)
>\$60k	1.39 (0.76, 2.54)	1.52 (0.74, 3.10)	1.29 (0.75, 2.21)	1.76 (0.59, 5.22)
Don't Know/Refused	0.98 (0.51, 1.89)	0.67 (0.30, 1.51)	1.09 (0.62, 1.91)	0.66 (0.18, 2.50)
Marital Status, Married	0.82 (0.55, 1.22)	0.74 (0.46, 1.18)	1.03 (0.71, 1.50)	0.85 (0.44, 1.63)
Heart Disease, yes	0.46* (0.23, 0.93)	0.79 (0.38, 1.65)	0.89 (0.53, 1.51)	0.51 (0.12, 2.24)
Hypertension, yes	0.91 (0.64, 1.29)	0.75 (0.50, 1.13)	1.21 (0.88, 1.68)	0.80 (0.44, 1.45)
BMI, kg/m²	0.93* (0.90, 0.97)	0.98 (0.94, 1.02)	0.95* (0.92, 0.98)	0.92* (0.87, 0.98)
CASI Score	1.00 (0.97, 1.06)	0.95 (0.90, 1.00)	1.00 (0.96, 1.06)	0.97 (0.89, 1.06)
Needs IADL Assist, yes	0.57* (0.34, 0.96)	0.60 (0.33, 1.12)	0.69 (0.45, 1.06)	0.62 (0.23, 1.66)

* Statistically significant at $P < 0.05$