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Relating Wrist Accelerometry Measures to Disability in Older Adults

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Abstract

Objective—This analysis assessed the extent to which: 1) wrist accelerometer measures were associated with difficulty performing specific activities of daily living and instrumental activities of daily living and 2) these measures contributed important information about disability beyond a typical self-reported vigorous activity frequency question.

Methods—We used data from the National Social Life, Health and Aging Project (NSHAP) accelerometry sub-study (n=738). Activity was assessed using two wrist-accelerometer measures assessed over 3 days (*routine activity* expressed as mean count/15 second epoch during wake time, and *immobile time* expressed as the proportion of wake time spent immobile), and self-reported average vigorous activity frequency. The association between routine activity, immobile time and difficulty performing fourteen activities of daily living (ADLs) and instrumental activities of daily living (IADLs) plus two summary measures (any ADL or IADL difficulty), was assessed using logistic regression models, with and without controlling for self-reported vigorous activity.

Results—Self-reported activity was mildly correlated with routine activity ($r = 0.27$) and immobile time ($r = -0.21$). Routine activity, immobile time, and self-reported vigorous activity were significantly associated with twelve, ten, and fourteen disability measures, respectively. After controlling for self-reported activity, significant associations remained between routine activity and eight disabilities, and immobile time and six disabilities.

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Author Contributions

Huisingh-Scheetz M - planned the study, performed statistical analysis, wrote the paper

Kocherginsky M - performed statistical analysis, revised paper

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Conclusion—Wrist accelerometry measures were associated with many ADL and IADL disabilities among older adults. Wrist accelerometry in older adults may be useful to help assess disability risks and set individualized physical activity targets.

Keywords

Accelerometry; Disability; Motor Activity; Frail Older Adult; Self Report

Physical activity (PA), whether done through formal exercise or routine every day activities, and limited sedentary time are important health indicators in older adults.^{1, 2} However, older adults face challenges to vigorous exercise participation due to higher rates of mobility limitations, vision loss, muscle weakness, social isolation, and endurance-limiting diseases.³ These limitations often result in changing patterns of activity with aging: reducing vigorous exercise, and spending more time doing low to moderate intensity exercise like walking or gardening, or routine activity like light housework or shopping, or being sedentary. Only half of adults over 65 report spending the recommended 150 minutes per week in moderate to vigorous activity.⁴ Increasing activity and reducing sedentary time are both feasible interventions among seniors if programs are individualized.⁵

Accurately assessing older adult physical activity patterns is challenging. Questionnaires designed to measure activity are limited to the specific activities evaluated, can become lengthy, and are subject to recall bias.^{6, 7} In older adults, cognitive impairment and fear of losing independence can also complicate the accuracy of self-report and may not reflect true daily activity patterns.^{8, 9} Providers' time constraints further limit adequate activity assessment.¹⁰ National guidelines currently do not recommend a standard physical activity screen.¹¹ Tools that measure vigorous activity, routine activity, and sedentary behavior simultaneously in older adults are limited.^{6, 12, 13} Therefore, alternative mechanisms for assessing activity in older adults must be explored.

Accelerometry may be a useful objective assessment of activity in disabled adults. Prior work using hip accelerometers worn for 7 days showed that adults with mobility impairments spend less time in activity and more time sedentary than those without mobility impairments.¹⁴ Duration of activity bouts using hip accelerometry was also associated with self-reported disability in older adults.¹⁵ Accelerometry has been used to detect activity recovery following stroke,^{16, 17} to measure change in activity following pharmacotherapy for rheumatoid arthritis,¹⁸ and to assess activity adherence in multiple sclerosis patients.¹⁹ Although hip accelerometry has a substantial body of evidence supporting its use in activity assessment, wrist accelerometers now firmly dominate the commercial markets. The relationship between wrist accelerometry measures and disability in older adults is not known despite a growing availability of these devices.

The objective of this analysis was to determine whether wrist accelerometer measures of activity and immobility are associated with difficulty performing activities of daily living (ADL) and instrumental activities of daily living (IADL). We also considered whether wrist accelerometry adds important information about disability beyond the traditional question on frequency of self-reported vigorous activity that might be used in a clinical encounter.

Understanding whether and how wrist accelerometry measures are related to disability will help determine their clinical functionality and use in this population.

METHODS

Study Design

The National Social Life, Health and Aging project (NSHAP) is a longitudinal U.S. population-based survey that collected extensive information on physical, cognitive, and social health. A nationally-representative sample of 3,005 community-dwelling older adults (ages 57- 86) was recruited for Wave 1 (2005-2006).²⁰ These participants and their partners (n=3,377) were re-interviewed in W2 (2010-2011). The NSHAP survey was conducted in the home by trained, non-medical interviewers and included a computer-assisted personal interview (CAPI), a biomeasure assessment, and a leave-behind questionnaire. The detailed sampling design and study methods have been reported elsewhere.²⁰ The data collection was approved by the local Institutional Review Board.

Study Participants

A subset of 738 age-eligible (ages 62-91) W2 participants was included in a wrist accelerometer sub-study.

Wrist Accelerometry Sub-Study

Respondents in the accelerometry sub-study wore the Actiwatch® Spectrum on their non-dominant wrist for 72 consecutive hours (not removed during water activities like bathing.)²¹⁻²⁴ It is an uniaxial, omnidirectional, piezoelectric, waterproof accelerometer used to measure sleep and (in)activity patterns.^{21, 22} A detailed description of the device and its use in NSHAP has been reported elsewhere.²⁵ It continuously collects acceleration/deceleration data, which are averaged over 15-second intervals called “epochs” and recorded as an activity “count.” If no activity occurs during the epoch, such as during sleep or rest, “0” is recorded for that activity count. Data were pre-processed using the Actiware® software available from the manufacturer.²¹ Non-wear time was automatically excluded using a built-in galvanic sensor that identified when the device was worn. Rest and wake intervals were determined using manufacturer-suggested guidelines, cues from respondent recordings, data on ambient light in each epoch, and were manually curated by study investigators as described in detail elsewhere.²⁶ Actiwatch® accelerometer counts have been shown to be moderately and significantly correlated with indirect calorimetry-measured energy expenditure during routine activity in older adults with chronic disease and in middle-aged but sedentary adults.^{23, 24, 27}

Routine Activity and Sedentary Behavior

We calculated two summary measures from the accelerometer output to estimate “routine activity” and “immobile time.” *Routine activity* was estimated by summing the activity counts per 15-second epoch for the wake intervals and dividing by the total number of epochs during wake time. *Immobile time* was estimated by the proportion of “0” activity counts among all activity counts during wake time, multiplied by 100%. Summary measures were used because equations predicting kilocalorie expenditure or METs from

accelerometer activity count data have had inconsistent accuracy among older adults engaging in routine activity outside of the laboratory setting.²⁸ Continuous summary measures were also chosen because wrist accelerometer count cut-offs that distinguish sedentary, mild, moderate, and vigorous metabolic equivalents were established in children rather than older adults for the Actiwatch®.²⁹ Because we could not estimate sedentary time, we estimated time spent completely immobile. Immobile time underestimates actual sedentary time (e.g. a sedentary activity like watching television or reading will not be categorized as immobile due to low-level wrist movements).³⁰ Using continuous accelerometry measures provides the highest resolution and most power for detecting significant pair-wise correlations.

Disability

Participants' self-reported degree of difficulty (4-point scale) completing seven ADLs and seven IADLs. ADL and IADL limitation was defined by the presence of any difficulty with each task (yes = 1/no = 0). The ADLs included: walking one block, dressing, walking across a room, transferring in/out of bed, toileting, bathing, and eating. The IADLs included: driving at night, driving during the day, light housework, shopping, meal preparation, managing money, and taking medications. Separate indicator variables were also created identifying participants with at least one ADL disability or at least one IADL disability.

Self-Reported Physical Activity

Self-reported vigorous PA was assessed using a self-report question that represents what might be asked in a typical physician-patient encounter: "On average over the last 12 months, how often have you participated in vigorous PA or exercise? By vigorous PA, we mean 30 MINUTES OR MORE of things like sports, exercise classes, heavy housework, or a job that involves physical labor." Answer choices included: a) 5 or more times per week, b) 3 or 4 times per week, c) 1-2 times per week, d) 1-3 times per month, e) Less than 1 time per month, or f) Never. This question and response options were found to be significantly associated with future functional decline and 10-year mortality.^{31, 32}

Covariates

Age at the survey date, gender, race (white/Caucasian, black/African American, Other), Hispanic ethnicity, employment status (currently working, not working), education (< high school, high school, some college, bachelors or more), and household assets (<\$10,000; \$10-49,000; \$50-99,000; \$100-499,000; \$500,000+) were self-reported. Body mass index (BMI) was calculated using objectively measured height and weight: $[703 * (\text{weight, pounds}) / (\text{height, inches})^2]$.³³ BMI was then categorized as underweight/normal (BMI 16 to <25), overweight (BMI 25 to <30), and obese (BMI ≥ 30). Only 2 respondents had a BMI < 18. Cognitive function was assessed using the survey-adapted Montreal Cognitive Assessment (MoCA-SA) (range 0-20, higher scores indicate better function).³⁴ Timed walk (seconds) was measured using the fastest of two timed 3-meter walks performed at the participant's "usual pace."³⁵ We also calculated and controlled for total wake wear time (hours).

Statistical Analysis

Sample design and survey weights were used in all analyses to account for the complex survey design and to obtain point estimates and standard errors that reflect the U.S. national population in 2010, with the exception of Spearman rank correlation estimates. Sample characteristics were described using means and frequencies. The relationship between self-reported PA and the wrist actigraphy measures were assessed using Spearman rank correlation.

Separate logistic regression models were used to assess whether routine activity (Model 1), immobile time (Model 2), and self-reported PA (Model 3) were associated with ADL/IADL difficulty, controlling for covariates (age, gender, education, race, ethnicity, household assets, BMI categories, timed gait, cognitive function, employment status, wear time). Accelerometer measures were divided by 10 to show the effect per an increase of 10 activity counts (routine activity) or 10 percent (percent of wake time spent immobile), and reflect differences between two individuals who are 10 points apart on a given activity measure. We then expanded Models 1 and 2 by adding the self-reported PA variable as a predictor to determine if the magnitude and significance of each accelerometry predictor changed (Models 4 and 5). Although we expect a decrease in significance resulting from the additional covariate³⁶ to a logistic regression model, no change in effect size would suggest that accelerometry and self-reported measures are independently associated with the outcome. Analyses were conducted using all available wear time, and, as a sensitivity analysis, were repeated using only days with ≥ 10 hours of wear time (defined as “valid” days in some other studies, for example NHANES).³⁷ Results were similar, so reported analyses are based on all days. Statistical analyses were conducted with Stata 14.0 and NSHAP data release 2.2 (version d34186f4ce5f).³⁸

RESULTS

Descriptive statistics for the accelerometer sub-study sample are provided in Table 1. Among the 738 age-eligible sub-study participants, 623 had complete data for accelerometry, self-reported physical activity, and covariates. The mean age was 72 (95% CI: 71.4-72.6), 52.6% (95% CI: 48.1-57.1) were female, 83.8% were White/Caucasian (95% CI: 79.0-87.7), 26.3% (95% CI: 21.9-31.2) were still working, and 5.4% had less than \$10,000 of household assets (95% CI: 3.6-8.0%). The mean MoCA-SA score for the group was 14.4 (95% CI: 14.0-14.9), the mean timed 3 meter walk was 5.7 seconds (95% CI: 4.4-6.9). The most prevalent ADL disability was difficulty walking one block (24.0%, 95% CI: 20.5-27.9%), and the most common IADL disability was difficulty driving at night (35.0%, 95% CI: 30.2-40.1%). Approximately 45% of the sample reported participating in vigorous activities three or more times per week over the last year: 5+ times/week = 25.6% (95% CI: 20.3-31.8) and 3-4 times/week = 19.2% (95% CI: 16.2-22.5). The mean wake time activity count was 54.0 (95% CI: 51.9-56.2) and the average percent of the wake time spent immobile was 27.1% (95% CI: 26.1-28.2). The average total wake wear time was 42.1 hours (95% CI: 41.2-43.0).

Spearman correlation coefficients between self-reported PA and the accelerometer measures revealed that self-reported PA was only mildly, though significantly, correlated with routine

activity count ($r = 0.27$, p -value <0.001) and immobile time ($r = -0.21$, p -value <0.001). Routine activity and immobile time were highly, negatively correlated ($r = -0.81$, p -value <0.001). These results suggest that self-reported PA behavior over the last year reflects only a small portion of the day-to-day information captured by the accelerometry measures.

Multivariate logistic regression models (Table 2) revealed that routine activity was significantly associated with difficulty performing all ADLs (p -value range 0.02 to <0.001) except transferring in and out of bed (p -value=0.07). Routine activity was significantly associated with difficulty performing five IADLs (range 0.004 to <0.001) including light housework, shopping, meal preparation, driving during the day, as well as with “any IADL difficulty”. All estimated odds ratios (ORs) were <1 , indicating that an increase of 10 points in routine activity corresponds to decreased risk of reporting disability (e.g. every 10 point increase in mean activity count is associated with a 15% decreased risk of reporting difficulty walking one block). Immobile time was significantly associated with difficulty performing five ADLs (p -value range 0.03 to 0.003) including dressing, walking across a room, toileting, bathing, and eating, and five IADLs (p -value range 0.03 to <0.001) including light housework, shopping, meal preparation, managing money, and driving during the day. All estimated ORs were >1 , indicating that a 10% increase in awake time spent immobile is associated with an increased risk of reporting a disability (e.g. a 55% increased risk of reporting difficulty walking across a room). Self-reported vigorous PA was significantly associated with difficulty performing all ADLs (p -value range 0.048 to <0.001) and six IADLs (range 0.04 to <0.001) except driving at night and taking medications.

Adding the self-reported vigorous PA behavior to models with routine activity or immobile time changed the estimated effects (ORs) very little, but reduced the significance for some outcomes (Table 2). In Model 4, adjusted for the self-reported vigorous PA behavior, accelerometer-measured routine activity was no longer significantly associated with walking one block, dressing, “any ADL difficulty”, and “any IADL difficulty,” whereas self-reported vigorous PA was no longer significantly associated with walking across a room, transferring in/out of bed, or managing money, but became a significant predictor of “any ADL difficulty.” Routine activity remained significantly associated with walking across a room, toileting, bathing, eating, light housework, shopping, meal preparation, and driving during the day. Routine activity and self-reported vigorous activity were both significant predictors of seven of the sixteen outcomes suggesting they have independent and additive effects in these models.

In Model 5, when adjusted for self-reported vigorous PA, immobile time was no longer significantly associated with difficulty dressing, bathing, meal preparation and managing money, whereas self-reported vigorous PA was no longer significantly associated with difficulty transferring in/out of bed and managing money. Immobile time remained significantly associated with walking across a room, toileting, eating, light housework, shopping, and driving during the day. Immobile time and self-reported vigorous activity were both significant predictors of six of the sixteen outcomes suggesting they have independent and additive effects in these models.

DISCUSSION

Difficulty performing ADLs and IADLs and factors associated with these disabilities are important to understanding the functional status of older adults. In a nationally-representative sample of older adults, we demonstrated summary measures of routine activity and immobile time measured by wrist accelerometry were strongly and consistently associated with difficulty performing certain ADLs and IADLs. The direction and magnitude of the associations changed very little when self-reported vigorous PA behavior was also considered, although the significance level changed for a few. Of the two accelerometry measures that we considered, routine activity was associated with the most disabilities. Hip, rather than wrist, accelerometers have traditionally been preferred for measuring day-to-day activity in research.^{24, 30, 39} However, wrist accelerometry data are far more widely available and easily obtainable from commercial devices. Our results provide some preliminary evidence that wrist accelerometry measures have significant relationships with older adult function as well.

Routine activity remained a significant predictor in half and immobile activity remained a significant predictor in six of the sixteen ADL/IADL models even after controlling for self-reported vigorous activity. Self-reported vigorous activity is a well-documented predictor of disability, and our models confirmed these relationships.⁴⁰ Of particular interest was that the accelerometer variables and the self-reported vigorous activity variable were *both* significant predictors in the same model for ~40% of the outcomes. These findings suggest that the day-to-day wrist accelerometry measures have an ADDITIONAL effect on these outcomes above and beyond self-reported vigorous activity frequency in older adults. Simply asking older adults the average number of vigorous activities performed without objectively assessing their day-to-day patterns may be inadequate to assess their activity risk factors. Assessment of day-to-day activity and inactivity patterns using wrist accelerometry may improve the disability risk assessment and provide new, targetable behavior measures such as reducing the amount of time spent immobile by 10%, or focusing on increasing the time spent in low-to-moderate activity if vigorous exercise is not feasible.

There are several challenges to implementing accelerometry in a clinical setting. The medical or research grade devices can be costly and cumbersome to implement in the ambulatory setting, although less expensive, lighter commercial models are increasingly available.⁴¹ To date, no study has evaluated the cost-effectiveness of providing a personal accelerometer with individualized activity goals to older patients, and such a study would be necessary before their routine clinical application. The cut-offs used to distinguish exercise intensity and sedentary behavior are also not well established in older adults for wrist accelerometry, though they have been for some hip accelerometers.⁴² Establishing such cut-offs for older adults would help translate wrist accelerometer counts to more broadly understood clinical terminology such as “light activity” or “moderate activity.” Exploration of new ways to use the wrist accelerometer output to inform the assessment of disability, such as studying hourly patterns of movement over the course of a day, may also prove to be valuable to the clinician.³⁹ The use of accelerometers in clinical practice has just begun to be explored,⁴³ and future research should address the utility of these devices in assessing clinically meaningful activity patterns and targets in older adults.

While the benefits of vigorous and moderate-intensity activity have been known for some time,^{11, 44} sedentary behavior has also been recently recognized as a discrete health risk beyond a measure of activity.⁴⁵⁻⁴⁸ There are currently no screening or treatment guidelines for sedentary behavior in the adult population.⁴⁹ With growing evidence suggesting reduced sedentary time will have a positive health effect in older adults, the case for implementing these measures into the standard geriatric assessment is becoming stronger.⁵⁰⁻⁵³ Since older adults spend more time doing routine activities and being sedentary than young adults, screening for and treating deficits in these areas would likely have a great impact on their functional health.^{51, 54} Accelerometers may help in measuring sedentary behavior. Although we don't measure sedentary behavior directly, our measure of immobile time is a conservative estimate of the sedentary behavior, and its relationship with health outcomes supports this theory. Hip accelerometers or accelerometers with an inclinometer feature are capable of measuring sedentary behavior with acceptable accuracy.^{6, 47} Newer algorithms with wrist accelerometers are allowing similar measurements.⁵⁵ Guidelines for screening and treatment for routine activity and sedentary behavior should be established specifically for older adults.^{56, 57}

Study Limitations

This study has several limitations. While the sample reflects the U.S. population of community-dwelling older adults in 2010-11, our findings do not capture those in nursing homes or other group facilities, those with dementia or the very ill living at home. We conducted a cross-sectional study comparing the accelerometry measures to self-reported disability. The findings indicate a relationship exists between these measures, but the study design is not able to detect causal relationships. We used 72 hours of continuous wrist accelerometry to assess routine activity and immobile time, thought to be adequate in this mostly retired sample.⁵⁸ Sampling longer periods of five to seven days may better capture true lifestyle averages and would likely strengthen the accelerometry findings. We also chose a conservative activity count cut-off of zero to detect immobile time, representing just a small portion of total sedentary time. Using a better measure of sedentary time, such as with a hip accelerometer, may also have shown stronger disability relationships. We measured average self-reported vigorous activity adherence through a single question though other, longer and validated tools exist for measuring vigorous PA.^{12, 13} Wide spread use of these tools in the clinical setting has not been documented, and our suspicion was that a shorter question was more representative of the typical physician-patient encounter.

Conclusions

In a nationally-representative sample, we found only a weak correlation between the wrist accelerometry measures of routine activity and immobile time versus self-reported PA in older adults. We also found that these three measures of (in)activity are uniquely important to the disability assessment. Measuring only self-reported vigorous PA frequency may not adequately identify all activity risk factors, leading to missed opportunities to intervene. Missing these health risks/benefits is of particular public health importance for seniors who spend more of their time in routine and sedentary activity, and are most likely to realize benefits from increasing light activity and reducing sedentary activity.⁵⁹ Future studies

should investigate whether wrist accelerometry measures predict incident disability and disability outcomes and should study the potential clinical applications of accelerometry.

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Abbreviations

PA	Physical Activity
NSHAP	National Social Life, Health and Aging Project
W2	Wave 2
NORC	National Opinion Research Center
CAPI	Computer-Assisted Personal Interview
ADL	Activities of daily living
IADL	Instrumental activities of daily living

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Highlights

- Wrist acclerometry was related to difficulty performing activities of daily living.
- Average routine activity and immobile time were calculated for the wake periods over three days of wear.
- Higher mean activity level was associated with fewer reported difficulties.
- Less time spent immobile was associated with fewer reported difficulties.
- Associations persisted after controlling for self-reported moderate-to-vigorous activity over the prior year.

Table 1Study Sample Characteristics (n = 623^{*})

	Estimate	95% CI
Age (years, mean)	72.0	71.4-72.6
Female	52.6%	48.1-57.1%
Education		
< High School	11.3%	8.0-15.6%
High School Graduate	25.3%	20.6-30.5%
Some College	38.9%	34.4-43.6%
College Graduate	24.5%	19.4-30.5%
Race		
White/Caucasian	83.8%	79.0-87.7%
Black/African American	6.1%	4.1-9.1%
Hispanic, non-Black	6.5%	3.9-10.7%
Other	3.5%	1.9-6.4%
Household assets		
<\$10,000	5.4%	3.6-8.0%
\$10-49,000	11.3%	8.5-14.9%
\$50-99,000	11.3%	8.1-15.7%
\$100-499,000	42.9%	37.3-48.4%
\$500,000	29.1%	23.5-35.4%
Employment Status		
Working	26.3%	21.9-31.2%
Survey-Adapted Montreal Cognitive Assessment (mean)	14.4	14.0-14.9
Weight Status		
Underweight or Normal Weight	25.8%	21.3-30.9%
Overweight	35.7%	31.2-40.4%
Obese	38.5%	34.1-43.1%
Timed 3 meter Walk (seconds, mean)	5.7	4.4-6.9
Activities of Daily Living Disability		
Walking One Block	24.0%	20.5-27.9%
Dressing	11.3%	8.8-14.5%
Walking Across a Room	10.1%	8.0-12.7%
Transferring In/Out of Bed	9.2%	6.5-12.8%
Toileting	8.0%	6.0-10.5%
Bathing	5.8%	4.1-8.1%
Eating	2.2%	1.3-3.8%
Difficulty with at least one ADL	31.1%	26.8-35.8%
Independent Activities of Daily Living		
Driving at Night	35.0%	30.2-40.1%
Light Housework	13.3%	10.4-16.7%
Shopping	9.9%	7.3-13.4%

	Estimate	95% CI
Meal Preparation	8.6%	6.1-12.0%
Managing Money	6.7%	5.0-9.0%
Driving During the Day	4.8%	3.6-6.3%
Taking Medications	3.9%	2.6-5.9%
Difficulty with at least one IADL	44.8%	38.7-51.0%
Self Reported Vigorous Physical Activity Level in the last 12 Months **		
5+ times/week	25.6%	20.3-31.8%
3-4 times/week	19.2%	16.2-22.5%
1-2 times/week	15.2%	11.9-19.2%
1-3 times/month	8.4%	6.3-11.0%
< 1 time/month	11.3%	9.0-14.1%
Never	20.4%	16.2-25.3%
Wrist Accelerometry Measures		
Routine Activity (counts/15 second epoch, mean)	54.0	51.9-56.2
Immobile Time (mean)	27.1%	26.1%-28.2%
Wake Time Worn (hours, mean)	42.1	41.2-43.0

* Participants without missing data for covariates, self-reported physical activity, and accelerometry variables

** Sports, exercise, heavy housework, physical labor

Table 2

Logistic Regression Models: Association between Accelerometry-Measured Routine Activity and Immobile Time and Self-Reported Vigorous Activity Frequency with Disability

		Model 1	Model 2	Model 3	Model 4	Model 5	
		Routine Activity	Immobile Time	Self-Reported Vigorous Physical Activity	Routine Activity	Self-Reported Vigorous Physical Activity	Immobile Time
Logistic Regression Outcomes		<i>n</i>	OR (p-value)	OR (p-value)	OR (p-value)	OR (p-value)	OR (p-value)
Activities of Daily Living (ADL)							
Walking One Block	622	0.85 (0.02)	1.12 (0.33)	0.64 (<0.001)	0.93 (0.26)	0.64 (<0.001)	0.98 (0.85)
Dressing	622	0.83 (0.02)	1.30 (0.03)	0.75 (0.001)	0.88 (0.09)	0.76 (0.002)	1.19 (0.14)
Walking Across a Room	623	0.66 (<0.001)	1.55 (0.007)	0.76 (0.01)	0.69 (<0.001)	0.80 (0.05)	1.46 (0.02)
Transferring In/Out of Bed	623	0.82 (0.07)	1.21 (0.25)	0.78 (0.05)*	0.86 (0.14)	0.80 (0.08)	1.14 (0.44)
Toileting	623	0.77 (0.02)	1.48 (0.007)	0.73 (0.003)	0.82 (0.05)**	0.76 (0.007)	1.38 (0.03)
Bathing	623	0.74 (0.01)	1.48 (0.008)	0.66 (0.001)	0.79 (0.03)	0.68 (0.002)	1.36 (0.07)
Eating	468	0.43 (0.003)	2.26 (0.003)	0.65 (0.01)	0.42 (0.01)	0.65 (0.04)	2.29 (0.02)
Any ADL Difficulty	622	0.87 (0.04)	1.1 (0.46)	0.65 (<0.001)	0.94 (0.32)	0.32 (<0.001)	0.95 (0.64)
Independent Activities of Daily Living (IADL)							
Driving at Night	619	0.94 (0.32)	1.07 (0.55)	0.89 (0.06)	0.96 (0.48)	0.90 (0.08)	1.03 (0.78)
Light Housework	623	0.75 (0.002)	1.47 (0.002)	0.71 (<0.001)	0.80 (0.01)	0.73 (0.001)	1.36 (0.02)
Shopping	623	0.60 (<0.001)	1.60 (<0.001)	0.68 (0.001)	0.64 (<0.001)	0.72 (0.007)	1.48 (0.002)
Meal Preparation	621	0.77 (0.004)	1.30 (0.03)	0.81 (0.005)	0.80 (0.02)	0.84 (0.02)	1.22 (0.10)
Managing Money	622	0.82 (0.05)	1.42 (0.02)	0.75 (0.04)	0.87 (0.14)	0.78 (0.05)	1.31 (0.06)
Driving During the Day	620	0.59 (0.002)	1.69 (0.02)	0.68 (<0.001)	0.60 (0.004)	0.70 (0.004)	1.57 (0.05)***
Taking Medications	623	0.95 (0.68)	0.91 (0.63)	0.98 (0.88)	0.95 (0.70)	1.0 (0.97)	0.90 (0.50)
Any IADL Difficulty	553	0.88 0.02	1.16 (0.16)	0.80 (<0.001)	0.91 (0.06)	0.80 (<0.001)	1.08 (0.49)

* 0.048

** 0.046

8400

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