ABSTRACT

CORRELATES AMONG OBJECTIVE AND SUBJECTIVE MEASUREMENTS OF PHYSICAL ACTIVITY IN OLDER ADULTS, AND THEIR RELATIONSHIP TO COGNITIVE FUNCTION

by Kelsey D. Loss

Evidence has shown relationships between physical activity (PA) and cognitive function (CF) in older adults. Yet, there is little research comparing subjective measures PA (SMPA, CHAMPS questionnaire) and objective measures of PA (SMPA, accelerometry) in older adults, 65 years+. Thus, the primary PURPOSE of this study is to examine the validity of the CHAMPS questionnaire and accelerometry data to assess PA in older adults 65 years+. The secondary purpose of this study is to determine if SMPA or SMPA is a better predictor of CF. METHODS: In sixty-five older adults (age: 77.1±7.9 years) we examined the relationship between SMPA and OMPA using partial correlations (controlling for age, gender, and BMI). Hierarchical regression was utilized to determine if SMPA or OMPA was a better predictor of CF. RESULTS: Both total and moderate-to-vigorous intensity (MVPA) OMPA and SMPA were correlated (p< 0.05). CF was correlated with: counts/min (r=0.38, p<0.01), OMPA MVPA (r=0.40, p<0.001), and sedentary:moderate minutes/day (r= -0.53, p<0.0001). Sedentary:moderate ratio, MVPA, and sedentary minutes/day contribute (p < 0.05) to predicting CF. CONCLUSIONS: This suggests that the CHAMPS questionnaire may serve as an acceptable proxy for OMPA. Our findings also show that OMPA is superior to SMPA for the prediction of CF.
CORRELATES AMONG OBJECTIVE AND SUBJECTIVE MEASUREMENTS OF PHYSICAL ACTIVITY IN OLDER ADULTS, AND THEIR RELATIONSHIP TO COGNITIVE FUNCTION

A Thesis

Submitted to the
Faculty of Miami University
in partial fulfillment of
the requirements for the degree of

Master of Science

by
Kelsey D. Loss

Miami University
Oxford, OH
May 2017

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This thesis titled

CORRELATES AMONG OBJECTIVE AND SUBJECTIVE MEASUREMENTS OF PHYSICAL ACTIVITY IN OLDER ADULTS, AND THEIR RELATIONSHIP TO COGNITIVE FUNCTION

by
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ACKNOWLEDGEMENTS

This thesis becomes a reality with the kind support, encouragement, and contributions of many individuals. I would like to express my heartfelt appreciation to all of them. I couldn’t have done it without you.

I would like to express my gratitude towards my family for the constant encouragement, which helped me in completion of this paper. My supportive fiancé, Stu, who is always by my side in times I need him most and for inspiring me.

Thank you to my thesis committee members, Dr. Thelma Horn and Dr. Randal Claytor, for imparting your knowledge and expertise in this study.

Thank you to all the other graduate students, for your support, encouragement, and motivation to complete my thesis in a timely manner.

Most of all, thank you to my thesis advisor, Dr. Kyle Timmerman. I am extremely grateful for his expert, sincere, and valuable guidance and encouragement extended to me. Thank you for being patient and responding to my endless emails. You are an excellent mentor and I look forward to our future collaboration.
CHAPTER 1

Introduction

Chronic diseases are the major cause of morbidity and mortality in the United States. Heart disease, stroke, cancer, and diabetes affect millions of people worldwide and cost billions of dollars annually in treatment and loss of productivity. The ACSM’s recommendation for physical activity (PA) is to engage in moderate intensity PA 150 minutes per week. Several studies have shown the importance of engaging in regular PA to attenuate disease in cardiovascular patients and promote healthy aging. In particular, the Harvard Alumni Study showed that people who participate in moderate PA have a lower mortality risk than those who do not. Because of this, researchers and clinicians have suggested that cardiorespiratory fitness and PA should be considered as vital signs. Both aerobic and resistance exercise training have been linked to beneficial effects on disease prevention; however, only 17.8% of middle-aged adults (45-64 years old) are meeting the physical activity recommendations. This number is even worse among adults over the age of 65, where only 11.7% meet both aerobic and muscle strengthening guidelines.

Primary care providers could benefit from knowing their patients’ physical activity levels, particularly older adults. Being able to assess a patient’s cardiorespiratory fitness and/or PA level might prompt physicians to be on the “look out” for age- and inactivity-related declines in cardiovascular health, mental health, and ability to perform normal activities of daily living. Blair et al. emphasize the direct association between physical inactivity, the presence of chronic health conditions, and the role PA can have on enhancing cognitive function. PA can be measured with subjective (self-report) questionnaires, such as the International Physical Activity Questionnaire (IPAQ) and Community Healthy Activities Model Program for Seniors (CHAMPS), or through objective means (i.e. pedometers or accelerometers, etc.). Objective measurements of PA provide more concrete data while subjective assessments rely on recall and can often be biased. Given the brief nature of patient physician visits and the impracticality of obtaining a week’s worth of objective PA measurements, a subjective estimate may need to serve as a proxy for objectively measured PA. Thus, validation of activity questionnaires against objective measures is vital.

Several studies have investigated the validity of subjective measures of physical activity in adults 18 years or older. In a study conducted by Tzetzis and colleagues they found...
that there is discrepancy between the intensity of PA between subjective and objective measures. People often report they are performing moderate-to-vigorous intensity when the accelerometry data shows the activity as light intensity. Studies have also shown that people underreport sedentary behavior through questionnaires when compared to accelerometry data. Hekler et al. suggest that the participants underreported their sedentary behavior due to the ceiling effect of the CHAMPS questionnaire. Subjects could only report a maximum of 9 hours of an activity per week meaning if they spend more time reading, watching television, driving, or any other sedentary activity, they could not report it. Over half of the subjects reported the highest possible response option to at least 1 sedentary activity. In adults, 85 years or older, subjective measures of PA were associated with objective measures of sedentary time and low-intensity PA, but the objective measures of physical activity were significantly different when data was compared to the subjective categories of intensity (low, moderate, and high).

Adults 65 years and older are at high risk for developing dementia a disease which is most successfully prevented in the early stages, commonly indicated by small declines in cognitive function. Thus, research on risk factors for the decline in cognitive function in aging adults is critical. Several studies suggest that physical activity may reduce the risk of cognitive decline. Chu et al. revealed that older adults who engaged in regular physical activity for at least 30 minutes or more per session are likely to reduce the risk of cognitive decline. However, the majority of the previous studies have only looked at the association between cognitive function and subjective measures of PA. A study comparing the strength of association to cognitive function using objective versus subjective measures of PA has not yet been evaluated.

There is little research comparing subjective and objective measures of PA in older adults, 65 years+. Thus, the primary purpose of this study is to examine the validity of the CHAMPS questionnaire and accelerometry data to assess PA in older adults 65 years and older. The secondary purpose of this study is to determine if subjective or objective measures of PA is a better predictor of cognitive function in older adults.
CHAPTER 2

Methods
The proposed project is part of an ongoing research study with community-dwelling older adults in the Oxford, Ohio area. Procedures specific to subject recruitment, inclusion criteria, and measures are described in detail in the following sections.

Recruitment
Older adults, defined as those 65 years or older, were recruited to participate in the study by word-of-mouth and fliers (Appendix A) around the community. Fliers were distributed to staff at a local retirement community and common areas in the community such as grocery stores, shopping locations, recreation centers, and churches. Study investigators attended social events at a local retirement community and senior centers in order to increase participation and awareness of the study.

Participants
Prospective participants were screened for inclusion/exclusion criteria through a telephone conversation. The screening (Appendix B) addressed medical conditions that could pose a threat to their health as well as the data collection. Inclusion criteria included male and females aged 65 years or older. Prospective participants with any of the following exclusion criteria were not permitted to participate in the study: active cancer, alcohol or drug abuse, and smoking or other tobacco use. Subjects who qualified for the study were scheduled for their study day visit. During the study day, the participants were given an informed consent (Appendix C), they obtained their body composition, were asked to complete the CHAMPS questionnaire, and were sent home with instructions and an accelerometer to wear for 7 days.

Height and Body Composition
Following the informed consent process, participant’s baseline data was collected. Each participant’s height was measured using a stadiometer. Their body composition was obtained using bioelectrical impedance (BIA) on a Tanita scale. The scale requires age, build, gender, and height before an analysis of body fat percentage could be determined using the weight measured by the instrument’s scale.
Subjective Measure of Physical Activity

To get a subjective measure of physical activity, the subjects completed the 40-question CHAMPS questionnaire (Appendix D). This is a widely used questionnaire that estimates weekly amount of PA by asking questions related to frequency, duration, and intensity of PA reached by older adults. CHAMPS asks participants to recall the past 4 weeks of PA, ranging from less than 1 hour per week to 9 or more hours per week. Scoring of the questionnaire provides a total weekly estimate of PA in kilocalories per week (kcal/week), and time spent in moderate to vigorous intensity.

Objective Measure of Physical Activity

Participants were given an Actical accelerometer, recording form, and instructions (Appendix E) after the study day. Participants were asked to wear the accelerometer for 7 days while they were awake and to take it off for swimming or bathing. The participants mailed back the accelerometers in order to analyze their data. The Actical is a small, electronic device that is worn on the waist and measures activity counts per minute. The counts per minute were added to give a total activity count for the wear time of each participant and the total minutes the accelerometer was worn. The total activity was divided by the number of days and the number of minutes worn to give an average count per day and an average count per minute. From this data, we were able to classify how many minutes were spent in sedentary (<100 counts per minute), light (100>x>431 per minute), and moderate (>431 counts per minute) intensity for the week and per day. With this data, we were able to compute the ratio of sedentary:moderate minutes per day.

Cognitive Function

In order to test the participants cognitive function, they were given the Addenbrooke’s Cognitive Examination (ACER) (Appendix F). ACER includes 5 sub-scores of each cognitive domain: attention and orientation (18 points), memory (26 points), fluency (14 points), language, (26 points) and visuospatial (16 points). The ACER has a maximum score of 100, higher scores indicating better cognitive function. A score of 88 or below is indicative of potential cognitive impairment, while the likelihood of dementia is 100:1 at a score of 82 or below.
Data Analysis

The obtained data was analyzed using a series of procedures. First, a set of data screening procedures was conducted to examine the linearity and normality of all variables and to examine the descriptive profiles of adults in the sample. Second, a series of partial correlations (controlling for age, gender, and BMI) was used to assess the strength of the relationship between the scores obtained from the CHAMPS self-report questionnaire and the more objective accelerometer data. Third, hierarchical regression analyses was employed to determine if the subjective CHAMPS scores and the objective accelerometer data serve as predictors of cognitive function in older adults and which one (if any) is a stronger predictor.
CHAPTER 3

Results

Demographics

Subjects were taken from a larger ongoing study with 95 participants. There were 65 (40 females, 25 males) subjects with usable accelerometer data (Table 1). The mean age of the participants was 77.1±7.9 years with the age at the completion of full-time education being 26.8±8.6. The subject’s BMI was 26.5±4.7 kg/m². All correlations were performed independent of age, gender, and BMI.

Objective vs. Subjective Measures of Physical Activity

Activity counts per minute from the accelerometer were significantly correlated with self-reported total PA from the CHAMPS questionnaire (r=0.498, p < 0.001, Figure 1). Time per day spent in moderate-to-vigorous intensity PA (>431 activity counts/min) was significantly correlated with self-reported moderate-to-vigorous PA from the CHAMPS questionnaire (r=0.64, p < 0.0000001, Figure 2). Average accelerometry data can be found in Table 2.

Objective Measures of Physical Activity and Cognitive Function

Objective measures of PA (accelerometer) were significantly correlated with the ACER score for both the counts/minute (r=0.38, p <0.01, Figure 3) and the measure of time spent per day in moderate-to-vigorous intensity PA (r=0.40, p <0.001, Figure 4). The ACER was also significantly correlated to the ratio of sedentary:moderate minutes per day (r= -0.53, p<0.0001, Figure 5). The ACER score was not correlated to the total minutes of wear-time for the accelerometer (r=0.32, p=0.32).

Subjective Measures of Physical Activity and Cognitive Function

ACER scores were not correlated with either the total (r=0.085, p=0.52, Figure 6), or moderate-to-vigorous PA (r=0.21, p=0.11, Figure 7) from the CHAMPS questionnaire.

Hierarchical Multiple Linear Regression

To further investigate if a self-reported or objective measure of PA is a better predictor of cognitive function in older adults, after controlling for age, a hierarchical linear regression was
computed. (The assumptions of linearity and normally distributed errors were checked and in order to create normality z-scores were used). Means and standard deviations are presented in Table 3. When age was entered alone, it significantly predicted the ACER score $F(1, 61) = 28.66, p < 0.00$, adjusted $R^2 = 0.31$. However, as indicated by the $R^2$, 31% of the variance in ACER score could be predicted by knowing the participants age. When the other variables were added, they significantly improved the prediction, $R^2$ change = 0.21, $F(8, 54) = 4.08, p < 0.01$, and age was no longer a significant predictor. The entire group of variables significantly predicted cognitive function, $F(8, 54) = 4.08, p<0.001$, adjusted $R^2 = 0.46$. This is a moderate effect. The beta weights and significance values, presented in Table 3, indicates which variable(s) contributes most to predicting cognitive function, when age, counts/minutes, sedentary minutes/day, light minutes/day, moderate minutes/day, sedentary:moderate ratio, MVPA, and Total PA are entered together as predictors. With this combination of predictors, the sedentary:moderate ratio, moderate-to-vigorous minutes/day, and the sedentary minutes/day are the variables that contribute significantly ($p < 0.05$) to predicting cognitive function.
CHAPTER 4

Discussion

The current study compared the degree of association between objectively (accelerometer) and subjectively (CHAMPS questionnaire) measured PA, and investigated their relationship to cognitive function in older adults. The primary consideration of physical activity assessment is to ensure appropriate preventative health care to prevent several chronic diseases (cardiovascular disease, diabetes, cancer, hypertension, obesity, depression, etc.) and premature death. Validation of self-report questionnaires is vital given the impracticality of obtaining objective measures of PA from each patient. Our findings suggest moderate to strong correlation between the CHAMPS questionnaire and accelerometer measurements, especially for moderate-to-vigorous physical activity.

Physical activity was analyzed by overall total PA and time spent in moderate-to-vigorous activity. Total PA estimated in kcals/wk from the CHAMPS questionnaire was positively correlated ($r=0.498$) with counts/min from the accelerometer. Moderate-to-vigorous kcals/wk from the CHAMPS questionnaire was positively correlated ($r=0.64$) with moderate-to-vigorous min/day from the accelerometer. These findings suggest that the CHAMPS derived estimates of PA may provide suitable estimates of both total and moderate-to-vigorous intensity physical activity levels in older adults. This confirms the hypothesis that data from self-reported and objective measures of PA are at least moderately correlated, and that the CHAMPS questionnaire may serve as an acceptable measure of PA when time or money precludes the measurement of PA with accelerometry.

The results of the present study are in disagreement with many previous studies, which found moderate, low, or no correlation at all between objective and subjective measures of physical activity. However, each of these studies used different objective and subjective measures of PA than our study. Harris et al. used the 17-item Zutphen Physical Activity Questionnaire as their subjective measure of physical activity, and the Actigraph accelerometer for their objective measure of physical activity. The study found that there was weak convergent validity between the accelerometers and the questionnaire, although the questionnaire gave insight on activity type, so a combined approach to PA assessment may be preferable. In another study looking at community dwelling men aged 71-92, the participants also wore the Actigraph accelerometer but their questionnaire included questions directed more at sedentary
time, and comparing their PA to other subjects (much more active/ more active/ similar/ less active)\textsuperscript{15}. Jefferis et al. suggest that questionnaires poorly identify total sedentary time, but there was small correlation between total PA, with questionnaires slightly misclassify intensity. In a study conducted by Sabia and colleagues, the questionnaire used was the Minnesota Leisure Time Physical Activity Questionnaire and the participants wore a wrist accelerometer\textsuperscript{35}. Low correlation between the questionnaire and accelerometer was also seen through this study. An issue with wrist worn accelerometers, especially when worn on the dominant wrist, is that it may not accurately capture activity. In a systematic review by Prince and her colleagues, it was suggested that there is no conclusion on the validity of self-report questionnaires—self-reported measures of physical activity were found to be equally higher and lower than directly measured levels of physical activity\textsuperscript{24}. These findings also pose a problem on how to interpret questionnaire derived physical activity data. The review revealed that there is a need for a more valid, accurate measure of PA through questionnaires. Previous studies examining the validity of self-report questionnaires were using different questionnaires than the CHAMPS questionnaire used in this study, which could be the cause of the disagreement.

Our findings are in agreement with a study performed by Innerd e. al. which compared subjective and objective measures of PA in subjects 85 years and older\textsuperscript{14}. Their subjective measure of PA was a questionnaire that was designed using data from the Newcastle pilot study and they used the Genea accelerometer. The authors suggested that physical activity questionnaires used in the oldest old should be concise and feature age-specific examples of activities\textsuperscript{14}. With age, there is not only a reduction in physical activity intensity, but also a change in activity type\textsuperscript{39}. A large portion of the physical activity in this population includes personal maintenance and resting\textsuperscript{40}. Thus, a questionnaire pertaining to these activities is crucial. Their questionnaire and the CHAMPS questionnaire are both directed towards this age-associated shift in PA, and thus may provide a more accurate representation of PA in older adults.

Several studies support the position that older adults should engage in regular physical activity in order to help prevent loss of cognitive function\textsuperscript{6, 7, 19, 33}. However, each of these previous studies only looked at the association between cognitive function and subjective measures of PA. Only looking at subjective measurements of PA poses a problem because questionnaires often rely on recall, a skill a person with cognitive impairment may not possess.
Our results suggest a strong relationship between cognitive function and objectively measured PA, while showing no correlation between subjective measures of physical activity and cognitive function. Hierarchical regression showed that objective measures of PA from the accelerometer were the better predictors of cognitive function. Sedentary minutes per day, moderate-to-vigorous minutes per day, and the ratio of sedentary:moderate minutes per day were all found to be significant predictors. The moderate-to-vigorous PA from the questionnaire was not significant. These results suggest that objective measures are a better predictor of cognitive function.

Accelerometry is a valid and widely used measure of PA that can measure both the volume and intensity of physical activity. While accelerometers are the gold standard measure of physical activity, there are some limitations. The device alone cannot provide contextual information about the type of activities, nor is it waterproof, limiting the ability to monitor water activities and activities with a weak vertical component such as cycling. These are both activities that the CHAMPS questionnaire accounted for, which could cause the subjective measures to have a higher value than the objective measure could portray. Future studies could find a way to directly measure these water activities in order to incorporate them into the total objective measurement of physical activity. Another possible limitation is our sample size of 65. Although this is a smaller sample size than most studies investigating subjective measures of PA, several studies have been published with similar sample sizes. Another possible limitation could be subject bias, with selection of participants who are physically active or no cognitive impairment. However, 17% of our subjects have an ACER score indicative of potential cognitive impairment. Our sample is more active than the typical older adult populations: 80% of our subjects meet the recommended guidelines of 1000 kcals/wk, while only 11.7% of adults over the age of 65 meet PA guidelines.

In conclusion, our findings demonstrate construct validity between self-report and objective measures of PA in adults 65 years and older. This suggests that the CHAMPS questionnaire may serve as an acceptable, faster, and more time-efficient proxy for accelerometer-derived PA. However, consistent with our second hypothesis, our findings show that objective measurement of PA is superior to self-reported PA for the prediction of cognitive function in older adults.
### TABLE 1. Participant characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
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<tr>
<td>Subjects</td>
<td>65 (40F, 25M)</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>77.1 ± 7.9</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.5 ± 4.7</td>
</tr>
<tr>
<td>Years of Education</td>
<td>26.8 ± 8.6</td>
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Data are mean ± SD. Abbreviations: BMI, body mass index.

### TABLE 2. Physical Activity and Cognitive Function Characteristics

<table>
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<th>Variable</th>
<th>Value</th>
<th>Measure</th>
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<tr>
<td>Counts/min</td>
<td>106.7 ± 83.4</td>
<td>Accelerometer (objective)</td>
</tr>
<tr>
<td>Moderate-to-vigorous (min/day)</td>
<td>51.2 ± 41.2</td>
<td></td>
</tr>
<tr>
<td>Sedentary (min/day)</td>
<td>737.3 ± 160.7</td>
<td></td>
</tr>
<tr>
<td>Sedentary:moderate</td>
<td>129.1 ± 596.3</td>
<td></td>
</tr>
<tr>
<td>Total Days Worn</td>
<td>6.54 ± 0.96</td>
<td></td>
</tr>
<tr>
<td>Minutes Worn a Day</td>
<td>874.41 ± 124.27</td>
<td></td>
</tr>
<tr>
<td>Total PA (kcal/wk)</td>
<td>2826.8 ± 1929.4</td>
<td>CHAMPS questionnaire (subjective)</td>
</tr>
<tr>
<td>Moderate-to-vigorous (kcal/wk)</td>
<td>1486.9 ± 1190.7</td>
<td></td>
</tr>
<tr>
<td>ACER (0-100, &lt;88 = CI)</td>
<td>92 ± 4.5</td>
<td>ACER (cognitive function)</td>
</tr>
</tbody>
</table>

Data are mean ± SD. Abbreviations: min/day, minutes per day; PA, physical activity; kcal/wk, kilocalories per week; CI, cognitive impairment.
TABLE 3. Hierarchical Multiple Regression Analysis Summary Predicting Cognitive Function from Subjective and Objective Measures of PA, When Controlling for Age

<table>
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<th>Variable</th>
<th>β</th>
<th>R²</th>
<th>Δ R²</th>
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<tr>
<td>Step 1</td>
<td>0.32</td>
<td>0.32</td>
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</tr>
<tr>
<td>Age</td>
<td>-0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>0.53</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counts/min</td>
<td>0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary (min/day)</td>
<td>-0.24*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light (min/day)</td>
<td>-0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate-to-vigorous (min/day)</td>
<td>0.37*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary:Moderate</td>
<td>0.32*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate-to-vigorous (kcal/wk)</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PA (kcal/wk)</td>
<td>-0.19</td>
<td></td>
<td></td>
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</table>

* p <0.05; ** p <0.01. Abbreviations: min/day, minutes per day; PA, physical activity; kcal/wk, kilocalories per week.
FIGURE 1. Accelerometer vs. Self-Report Measures of Total PA

FIGURE 2. Accelerometer vs. Self-Report Measures of Moderate-to-Vigorous PA
FIGURE 3. Association Between the Accelerometer Total PA and the ACER Score

FIGURE 4. Association Between the Accelerometer Moderate-to-Vigorous PA and the ACER Score

(r=0.38, p < 0.01)

(r=0.40, p < 0.001)
FIGURE 5. Association Between the Ratio of Sedentary:Moderate Minutes and the ACER Score

FIGURE 6. Association Between the Self-Report Total PA and the ACER Score
FIGURE 7. Association Between the Self-Report Moderate-to-Vigorous PA and the ACER Score

(r=0.21, p=0.11)
References


Appendix A: Recruitment Flyer

MIAMI UNIVERSITY

VOLUNTEERS NEEDED
FOR RESEARCH STUDY ON

Relationships among physical activity level, physical function, dietary intake, and well-being in older adults.

Researchers at Miami University need volunteers for a new study on the relationships among physical activity level, physical function, diet, and well-being in older adults.

To participate in this trial you must be 65+ years old. You will receive assessments of your cardiovascular endurance, muscular strength, balance, and body composition. All testing will be conducted at the Knolls of Oxford.

For more information on this study, or to see if you qualify, please call (513) 529-2930.

Miami University IRB Approval# 00702r
Appendix B: Screening Form

Date of Screening:

SCREENING and MEDICAL HISTORY QUESTIONNAIRE

A Response of “YES” to any of the following = Exclusionary Criteria
Do you have active cancer? YES  NO
Do you struggle with alcohol or drug abuse? YES  NO
Do you smoke or use other tobacco products? YES  NO

A Response of “NO” to the following = Exclude from 6 min Walk Test
Can you walk at your normal speed for > 5min without assistance? YES  NO

Health History Information:

HAVE YOU EVER HAD OR BEEN DIAGNOSED WITH ANY OF THE FOLLOWING?
(YES ≠ Exclusion Criteria From the Entire Study)
Heart Attack during previous 6 months (If YES, exclude from 6-min walk test) YES  NO
Coronary Surgery YES  NO
Chest Discomfort YES  NO
Uncontrolled High blood pressure (If YES, exclude from 6-min walk test) YES  NO
Shortness of breath on light exertion YES  NO
Pulmonary disease YES  NO
Unstable Angina (If YES, exclude from 6-Minute Walk Test) YES  NO
Heart palpitation YES  NO
Heart murmur YES  NO
Diabetes YES  NO
Dizziness on light exertion YES  NO
Swelling of lower extremities YES  NO

ARE YOU ON ANY CURRENT MEDICATIONS? (YES ≠ Exclusion Criteria) YES  NO
## IF YES, WHAT?

<table>
<thead>
<tr>
<th>Medication</th>
<th>Condition</th>
<th>Dose/frequency</th>
<th>How long?</th>
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<table>
<thead>
<tr>
<th>OTC Medications</th>
<th>Condition</th>
<th>Dose/frequency</th>
<th>How long?</th>
</tr>
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<tr>
<th>Vitamins/Supplements/Herbs</th>
<th>Condition</th>
<th>Dose/frequency</th>
<th>How long?</th>
</tr>
</thead>
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</table>

## DO YOU HAVE A PACEMAKER OR IMPLANTABLE DEFIBRILLATOR?  YES NO

(If YES, EXCLUDE FROM BIOELECTRICAL IMPEDANCE TESTING)

OVER THE PREVIOUS YEAR HOW MANY DAYS HAVE YOU BEEN HOSPITALIZED (IF ANY)?

<table>
<thead>
<tr>
<th>NUMBER OF DAYS</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Status of subject:  ____Include  ____Exclude  ____Exclude from BIA

____ Exclude from Six-Minute Walk Test

Collect the following ONLY if the subject passes inclusion/exclusion criteria.

NAME ___________________________ ID# ____________

ADDRESS

________________________________________________________

________________________________________________________

DATE OF BIRTH ____/_____/____  Age ____

PHONE NUMBER_________________________________________

E-MAIL ADDRESS________________________________________
Appendix C: Informed Consent

INFORMED CONSENT FORM

You are being asked to participate in a research study titled: “Relationships among physical activity level, physical function, dietary intake, and well-being in older adults,” under the direction of Kyle Timmerman, PhD. The following information is provided to help you make an informed decision regarding whether or not you would be willing to volunteer in this research study.

PURPOSE OF THE STUDY

The general purpose of the present study is to determine to what extent habitual physical activity level and your diet influence fitness, mental and physical well-being, and cognitive function. Aging is associated with the loss of physical function, increased depressive symptoms, and decreased cognitive function. Higher levels of physical activity and a healthier diet may protect against these negative outcomes of aging.

You are being invited to participate in this study because you are 65+ years old. Approximately 100+ subjects will participate in this study.

RESEARCH PROCEDURES

If you would like to participate, we will perform the following tests and procedures:

Screening and Assessment (Visit 1; estimated time: 60 to 130 minutes):

Initial Screening (10-15 min screening)

If you are interested in participating in the study, you will conduct a brief screening, either in person or by phone with a member of our research team to determine your eligibility. We are also interested in the relationships among your physical function, health, and mental well-being. Thus, the screening will include questions regarding your health and mental well-being, and will be somewhat similar to the health history questionnaires that your doctor may have you fill out.

Screening/Functional Assessment/Questionnaires (Total Time Estimate: 60-90 minutes)

Test of Cognition (5-10 min): For this test you will complete the Addenbrooke’s Cognitive Examination. You completed this test as part of your screening for enrollment in the study. This test consists of a series of tasks designed to measure orientation, registration, attention, memory, visuospatial ability, calculation, recall, and language.

Physical Activity Questionnaire (5-10 minutes): You will be asked to complete the Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire. This questionnaire allows us to determine how physically active you are. The questions will be related to what kinds of activities you do around the home, and what types of exercise (if any) in which you regularly participate.

Accelerometer (Duration: 5 minutes to explain. You will wear for one week): To objectively measure physical activity, you will be asked to wear an accelerometer for one week. The accelerometer is very small and can be clipped on your belt or pants. The use of an accelerometer is considered the gold-standard for quantifying physical activity. Values will be compared to self-reported physical activity.

Height, Weight, and Body Composition (Duration: <5 minutes): Your height and weight will be measured, and body composition will be determined using bioelectrical impedance. Briefly, your body composition is
estimated based on the time it takes for an imperceptible electric current to pass from one pole to the BIA unit to the other. It is based on the premise that lean tissue (muscle, connective tissue, and bone) conduct electricity more quickly than fat tissue. **If you have a pacemaker or implantable defibrillator we will not measure your body composition (see risks section).**

*Short Physical Performance Battery (SPPB) (Duration 5-10 minutes):* This National Institute of Health (NIH)-developed performance battery will be utilized to determine your lower extremity function. This test can be conducted by a single trained interviewer. It involves tests of standing balance, gait speed, and the ability to rise from a chair multiple times, and has been found to be an independent predictor of long-term survival in older adults.

*Six Minute Walk Test (10-15 min):* For this test, you will be asked to walk as far as you can in six minutes. The distance that you cover in six minutes can be used to estimate your maximal oxygen consumption (VO₂max). VO₂max is the best indicator of cardiorespiratory fitness level. This test has been used safely in clinical populations and older adults. The test will be conducted in a level hallway with a length of approximately 80 feet. You will walk at a self-selected pace around cones set at the ends of the hallway. You will be allowed rest stops as needed. A member of the research team will keep track of your time and lap count. You will be asked to wear a COSMED Spiropalm 6MWT®. This instrument was recently developed specifically for continuous measurement of heart rate, respiration rate, and oxygen saturation during a six minute walk test. Measuring these physiologic variables increases our ability to assess your safety during the six minute walk test as well as improving our ability to make an accurate estimation of your fitness level. The Spiropalm is completely noninvasive. We will conduct a brief breathing test before and after the 6MWT. During the walk test, you will simply wear a plastic mask that fits comfortably over your mouth and nose to measure respiration rate. To measure oxygen saturation, a pulse-oximeter will be worn on your index finger. Self-reported rating of perceived exertion (i.e. using a scale to indicate how hard you feel like you are working) will be collected at minutes 2, 4, and 6. Additionally, your blood pressure will be measured at rest and following the test. **If you have unstable angina, a myocardial infarction in the previous 6 months, a resting heart rate greater than 120 beats per minute, or if your resting systolic blood pressure is greater than 180 mmHg and/or your diastolic blood pressure is greater than 100 mmHg, you will not participate in this portion of the study.**

*Grip Strength Test (<5 min):* For this test you will be seated in a chair with your feet touching the ground. With your arm bent at 90 degrees beside you, you will squeeze a digital handgrip dynamometer as hard as you can for a count of 3. You will first perform a trial test at less than maximal effort. Lower grip strength in older adults has been shown to be predictive of increased risk of falls, disability, impaired health-related quality of life, and mortality.

*Quality of Life Measurement (<5 min):* For this test, you will complete the 5 question Satisfaction with Life Scale. Your response to each question will range from “extremely satisfied” to “extremely dissatisfied”.

*Exercise Self-Efficacy (<5 min):* This 8 question survey is designed to assess your belief in your ability to exercise at moderate intensity 3 times per week.

*Behavioral Regulation in Exercise Questionnaire (BREQ) (< 5 min):* This survey is designed to determine your reasons for engaging or not engaging in physical exercise.

*3-Day Dietary Record (10 minutes/day for 3 days):* You will be asked to record what you eat on three days of the week, including the time, the meal (breakfast, lunch, dinner, or snack), and the portion size. A list of
helpful hints are given to help you estimate the portion size. These dietary records will be utilized to estimate your habitual macro (carbohydrate, protein, fat)- and micro-nutrient (vitamins and minerals).

**Exercise Testing to Volitional Exhaustion at Miami University's Department of Kinesiology and Health (1 hour)**

We are also seeking volunteers for an additional functional measure that would be conducted by you at Miami University's Department of Kinesiology and Health if you are interested. If you check "yes" below to indicate your interest, then we will schedule you for a "stress test" at Phillips Hall. For this test, you would arrive at Phillips Hall between 8-10am at least a week after your test day at the Knolls of Oxford. You will be asked to fast for at least 4 hours prior to this test. This is to avoid potential stomach discomfort (i.e. "exercising on a full stomach"). Following 15 minutes of seated rest, your resting heart rate and blood pressure will be measured. Electrodes will then be placed on the your chest to monitor the electrical activity of your heart during exercise, and to monitor for dysrhythmias during exercise that may indicate that the test should be stopped. In the unlikely event that any unusual electrical activity is detected during rest or exercise, you would be given a copy of your resting and exercise ECG to share with your physician. In addition to ECG, blood pressure and heart rate will be monitored throughout the exercise test to monitor for abnormal heart rate or blood pressure responses. The exercise test will be conducted on a treadmill using a modified Balke protocol. This is a graded (multi-stage) test conducted to volitional exhaustion (i.e. you feel that you cannot continue). The speed will range from 2.0-3.0 miles per hour and the treadmill grade will range from 0 – 15% grade. Your oxygen consumption will be measured using a metabolic cart. Your breath will be collected through a mouth piece during the test. Upon reaching volitional exhaustion (typically within 9-12 minutes, you will perform an active cool down for at least 5 minutes. This protocol is similar to “stress tests” commonly performed in older adults to screen for cardiovascular disease. We will report any abnormal findings to you with a suggestion that you share these results with your primary care provider. This type of test is also the “gold standard” for measuring cardiorespiratory fitness level, and will provide you with an accurate measurement of your exercise capacity. If you do not walk regularly for exercise or indicated any of the following during your health history screening you would be excluded from this test: unstable angina, uncontrolled high blood pressure, or heart attack in the past 6 months. Additionally, if you scored less than 8 out of 12 on the short physical performance battery you would be excluded from this portion of the test.

Are you interested in participating in this additional portion of the study:

- YES____
- NO____

Indicating “no” will not affect your participation in the portion of the study conducted at the Knolls of Oxford.

**POTENTIAL RISKS**

In this section the potential risks for each assessment test and procedure are outlined. Additionally, the steps that will be taken to minimize risk are addressed.

Height, Weight, and Body Composition: Body composition assessment utilizing bioelectrical impedance is considered to have minimal risk. Our unit utilizes a current of less than 1 milli-Amp which is imperceptible. While there is minimal risk of complications, the National Institute of Health cautions against using BIA in those with pacemakers or implantable cardio-defibrillators. **If you have either of these two devices you will be excluded from this test.**
Short Physical Performance Battery (SPPB): There is a slight risk of falling during the SPPB. During this test your balance, gait speed, and ability to rise from a chair multiple times will be measured. You will be asked to do such things as balance on one foot, walk at your normal speed from point A to B, and rise from a chair multiple times. Prior to each SPPB assessment activity, the activity will be described in detail by a trained member of the research team, and you will be asked if you feel comfortable/safe to proceed. If either you or a member of our research team have concerns about conducting a portion of the test, that portion will not be performed. Additionally, during each portion of the test, a research team member will be within arm’s length to assist you if you become unstable or begin to fall.

Six Minute Walk Test (6MWT): This test of cardiorespiratory fitness is commonly used in older adults and clinical populations. There is a very minimal risk of a sudden cardiac event during exercise. The absolute risk of a cardiac-related death during vigorous exercise in adults has been estimated at one event per year for every 15,000 to 18,000 people. To minimize the risk of a cardiac event, if you report or have any of the following you will be excluded from participation in the six-minute walk test: 1) unstable angina; 2) a myocardial infarction during the previous 6-months; 3) resting heart rate > 120 beats per minute; 3) resting systolic blood pressure > 180 mmHg; 4) resting diastolic blood pressure > 100 mmHg. Additionally, all exercise tests will be performed by team members that are CPR trained. The risk will further be minimized by using the self-paced 6MWT rather than a maximal intensity exercise test.

Grip Strength Test: This test is commonly performed to assess muscular strength in older adults. There is minimal risk, other than the slight risk of muscular soreness for 1-2 days following the test.

Questionnaires: The only obvious risk associated completing the SWLS, the Geriatric Depression scale, the MMSE, exercise self-efficacy and BREQ scales is that sensitive data may be misplaced and/or viewed by unauthorized personnel. The procedures to protect the confidentiality of information are discussed in the CONFIDENTIALITY portion of this document.

Exercise Testing to Volitional Exhaustion: As with the 6MWT, there is a very minimal risk of a sudden cardiac event during a graded exercise test to volitional exhaustion. The absolute risk of a cardiac-related death during vigorous exercise in adults has been estimated at one event per year for every 15,000 to 18,000 people. To minimize the risk of a cardiac event, persons with any of the following will be excluded from participation in this exercise test: 1) unstable angina; 2) a myocardial infarction during the previous 6-months; 3) resting heart rate > 120 beats per minute; 3) resting systolic blood pressure > 180 mmHg; 4) resting diastolic blood pressure > 100 mmHg. Volitional exhaustion exercise procedures for older subjects will be conducted at times when the Miami Health Services Center is open and have been notified that the research is taking place. Additionally, all exercise tests will be performed by team members that are trained in CPR and the use of an automatic external defibrillator. There is an AED located just outside of the exercise testing room at Phillips Hall. There is additionally a slight risk of losing your balance during this test. As such, you would be excluded from this study if you scored less than 8 out of 12 on the short physical performance battery—a score that would suggest that you have balance or gait speed impairments. If you feel uncomfortable or worried about maintaining your balance during the first stage of this test, we would not continue. During the test, one of our technicians will be within arm’s reach of you the entire time. Their exclusive task would be to monitor your gait and balance during the test, and to assist you if you should lose your balance. There are hand rails on our treadmills that you may use during testing, and a tether that immediately stops the treadmill in the unlikely event that you stumble.
PHOTOGRAPHY DURING RESEARCH
Would you be willing to be photographed during your participation in this research study?

YES _____

YES _____ (but only if my face is obscured)

NO _____

Photographs would potentially be used in scientific presentations or on our website or brochures to promote our research. Indicating no, will not adversely affect your participation in this study.

POTENTIAL BENEFITS

Benefits to You: You will receive knowledge related to your health-related fitness, including body composition, cardiorespiratory fitness, and physical function. These health-related components of fitness are associated with risk of developing chronic diseases such as heart disease, type II diabetes, and sarcopenia. The health relevance of your data will be described to you in detail by Dr. Timmerman or a member of the research team.

Benefits to Society: The data from this study will provide important information regarding the connections among physical activity, physical function, dietary habits, and indicators of mental well-being. Our findings will be presented at scientific meetings and submitted to scientific journals for publications. We welcome you to stay in touch with us. We would gladly share the results of our research study with you at the completion of this project.

CONFIDENTIALITY

All of your data will be treated as confidential. Only Dr. Timmerman and members of the research team will have access to personal information obtained on questionnaires or during testing. All of your data will be kept in a locked file cabinet in Dr. Timmerman’s office, and any electronic data generated will not be associated with your name. Upon enrollment, we will assign you a subject code that will allow us to identify data without using your name.

VOLUNTARY PARTICIPATION

Your participation in this study is strictly voluntary. You are free to withdraw from participation for any reason, at any time without penalty or loss of benefits. You are also free to refuse to participate in any portion of this research study. Please be advised that this may result in the investigator discontinuing your participation in the remainder of the study.

ALTERNATIVES

An alternative would be to not participate in this study. Not participating in this study will not adversely affect you.

REIMBURSEMENT FOR EXPENSES

There is no monetary reimbursement for participation in this study.

COMPENSATION FOR INJURY
In the unlikely event that you are injured during the course of your participation, we will follow the Knoll’s of Oxford emergency procedures. Once the emergency situation is controlled, you will be directed to contact your primary care provider if needed. You will not receive compensation for medical bills.

**CONTACT INFORMATION**
If you have any complaints, concerns, input or questions regarding your rights as a subject participating in this study you may contact the Office for the Advancement of Research and Scholarship at (513) 529-3600 or humansubjects@miamioh.edu.
If you have additional questions regarding the specifics of the study, please contact Dr. Kyle Timmerman at (513) 529-2930 or timmerkl@miamioh.edu.

**SIGNATURES**
Informed consent is required of all participants in this research study. Whether or not you provide informed consent for this research study will have no effect on your current or future relationship with Miami University. By signing below, you acknowledge that the purpose, procedures, and risks/benefits of participation in this study have been described to you, and that any questions you may have had were adequately addressed by a member of Dr. Timmerman’s research team.

______________________________  __________________________
Date                                Signature of Subject

______________________________  __________________________
Date                                Signature of Person Obtaining Consent
### CHAMPS Physical Activity Questionnaire

**Date:** ________________

This questionnaire is about activities that you may have done in the past 4 weeks.

<table>
<thead>
<tr>
<th>In a typical week during the past 4 weeks, did you ...</th>
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<tbody>
<tr>
<td>7. Dance (such as square, folk, line, ballroom) (do not count aerobic dance here)?</td>
<td>YES How many TIMES a week? _____</td>
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<td>9. Play golf, carrying or pulling your equipment (count walking time only)?</td>
<td>YES How many TIMES a week? _____</td>
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<td>10. Play golf, riding a cart (count walking time only)?</td>
<td>YES How many TIMES a week? _____</td>
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<td>14. Play singles tennis (do not count doubles)?</td>
<td>YES How many TIMES a week? _____</td>
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<tr>
<td>15. Play doubles tennis (do not count singles)?</td>
<td>YES How many TIMES a week did</td>
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</tbody>
</table>
16. Skate (ice, roller, in-line)?
   **YES** How many TIMES a week? ____ →
   **NO**
   How many TOTAL hours a week did you usually do it? →  
<table>
<thead>
<tr>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
</tr>
</thead>
</table>

19. Do heavy work around the house (such as washing windows, cleaning gutters)?
   **YES** How many TIMES a week? ____ →
   **NO**
   How many TOTAL hours a week did you usually do it? →  
<table>
<thead>
<tr>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
</tr>
</thead>
</table>

20. Do light work around the house (such as sweeping or vacuuming)?
   **YES** How many TIMES a week? ____ →
   **NO**
   How many TOTAL hours a week did you usually do it? →  
<table>
<thead>
<tr>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
</tr>
</thead>
</table>

21. Do heavy gardening (such as spading, raking)?
   **YES** How many TIMES a week? ____ →
   **NO**
   How many TOTAL hours a week did you usually do it? →  
<table>
<thead>
<tr>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
</tr>
</thead>
</table>

22. Do light gardening (such as watering plants)?
   **YES** How many TIMES a week? ____ →
   **NO**
   How many TOTAL hours a week did you usually do it? →  
<table>
<thead>
<tr>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
</tr>
</thead>
</table>

23. Work on your car, truck, lawn mower, or...
- other machinery?
  - YES: How many TIMES a week? ____
  - NO

- a week did you usually do it? _____

- hour
- hours
- hours
- hours
- hours
- hours

**Please note: For the following questions about running and walking, include use of a treadmill.**

<table>
<thead>
<tr>
<th>24. Jog or run?</th>
<th>YES: How many TIMES a week? ____</th>
<th>How many TOTAL hours a week did you usually do it?</th>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
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<td>NO</td>
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<table>
<thead>
<tr>
<th>25. Walk uphill or hike uphill (count only uphill part)?</th>
<th>YES: How many TIMES a week? ____</th>
<th>How many TOTAL hours a week did you usually do it?</th>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
</tr>
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<td>NO</td>
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<table>
<thead>
<tr>
<th>26. Walk fast or briskly for exercise (do not count walking leisurely or uphill)?</th>
<th>YES: How many TIMES a week? ____</th>
<th>How many TOTAL hours a week did you usually do it?</th>
<th>Less than 1 hour</th>
<th>1-2 1/2 hours</th>
<th>3-4 1/2 hours</th>
<th>5-6 1/2 hours</th>
<th>7-8 1/2 hours</th>
<th>9 or more hours</th>
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Appendix E: Actical Accelerometer Instructions and Recording Form

Accelerometer Instructions

1. Please wear your accelerometers beginning
2. Clip the accelerometer on first things in the morning.
   a. Should be worn at your hip.
   b. Secure with the supplied safety pin.
3. Remove the accelerometer only when you sleep, shower, or swim.
4. Please wear every day until the end of the day on
   a. Please do one of the following: 1) drop off accelerometer to the front desk of Phillips Hall, 2) leave with Vicky Troestel at the Knolls Clubhouse, or 3) mail to Kyle Timmerman at 420 S. Oak St. Oxford, OH.

<table>
<thead>
<tr>
<th>Date</th>
<th>On/Off Times</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>On: 7:30am (woke up) Off: 9:30am (Showered) On: 9:40am (After Shower) Off: 10:00pm (Went to bed)</td>
<td>I wore the accelerometer the majority of the day. I only removed during my shower and when I went to bed.</td>
</tr>
</tbody>
</table>
### Appendix F: Addenbrooke’s Cognitive Examination - Revised (ACE-R)

#### ADDENBROOKE’S COGNITIVE EXAMINATION - ACE-R
**Final Revised Version A (2005)**

<table>
<thead>
<tr>
<th>Subject ID</th>
<th>Date of testing:</th>
<th>Tester's name:</th>
<th>Age at leaving full-time education:</th>
<th>Occupation:</th>
<th>Handedness:</th>
</tr>
</thead>
</table>

#### ORIENTATION
- **Ask: What is the Day, Date, Month, Year, Season?**  
  - [Score 0-5]
- **Ask: Which Building, Floor, Town, Country?**  
  - [Score 0-5]

#### REGISTRATION
- **Tell: 'I'm going to give you three words and I'd like you to repeat after me: lemon, key and ball'.**  
  - After subject repeats, say 'Try to remember them because I'm going to ask you later'. Score only the first trial (repeat 3 times if necessary).  
  - Register number of trials .......

#### ATTENTION & CONCENTRATION
- **Ask the subject: 'could you take 7 away from a 100? After the subject responds, ask him or her to take away another 7 to a total of 5 subtractions. If subject make a mistake, carry on and check the subsequent answer (i.e. 93, 84, 77, 70, 63 -score 4)**  
  - Stop after five subtractions (93, 86, 79, 72, 65): ......... ......... ......... ......... .........  
- **Ask: 'could you please spell WORLD for me? Then ask him/her to spell it backwards:**  
  - ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... ......... 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### Verbal Fluency - Letter 'P' and animals

**Letters**

Say: 'I'm going to give you a letter of the alphabet and I'd like you to generate as many words as you can beginning with that letter, but not names of people or places. Are you ready? You've got a minute and the letter is P'

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**Animals**

Say: 'Now can you name as many animals as possible, beginning with any letter?'

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### Language - Comprehension

- Show written instruction:
  
  **Close your eyes**

- 3 stage command:
  
  'Take the paper in your right hand. Fold the paper in half. Put the paper on the floor'

### Language - Writing

- Ask the subject to make up a sentence and write it in the space below:
  
  Score 1 if sentence contains a subject and a verb (see guide for examples)
LANGUAGE - Repetition

➤ Ask the subject to repeat: ‘hippopotamus’; ‘eccentricity; ‘unintelligible’; ‘statistician’
Score 2 if all correct; 1 if 3 correct; 0 if 2 or less.

➤ Ask the subject to repeat: ‘Above, beyond and below’

➤ Ask the subject to repeat: ‘No ifs, ands or buts’

LANGUAGE - Naming

➤ Ask the subject to name the following pictures:

LANGUAGE - Comprehension

➤ Using the pictures above, ask the subject to:
   • Point to the one which is associated with the monarchy
   • Point to the one which is a marsupial
   • Point to the one which is found in the Antarctic
   • Point to the one which has a nautical connection

Score 0-4]

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**LANGUAGE - Reading**

- Ask the subject to read the following words: [Score 1 only if all correct]
  - sew
  - pint
  - soot
  - dough
  - height

**VISUOSPATIAL ABILITIES**

- Overlapping pentagons: Ask the subject to copy this diagram: [Score 0-1]

![Overlapping pentagons diagram](image)

- Wire cube: Ask the subject to copy this drawing (for scoring, see instructions guide) [Score 0-2]

![Wire cube diagram](image)

- Clock: Ask the subject to draw a clock face with numbers and the hands at ten past five. (for scoring see instruction guide: circle = 1, numbers = 2, hands = 2 if all correct) [Score 0-5]
Ask the subject to count the dots without pointing them.

[Score 0-4]
RECALL
➢ Ask “Now tell me what you remember of that name and address we were repeating at the beginning”

Tim Barnes
410 South Maple St.
Cedar Rapids, Iowa

[Score 0-7]

RECOGNITION
➢ This test should be done if subject failed to recall one or more items. If all items were recalled, skip the test and score 5. If only part is recalled start by ticking items recalled in the shadowed column on the right hand side. Then test not recalled items by telling “ok, I’ll give you some hints: was the name X, Y or Z?” and so on. Each recognised item scores one point which is added to the point gained by recalling.

Jim Barnes
210
South Oak St.
Celina
Iowa

[Score 0-5]

MEMORY

General Scores

MMSE/30
ACE-R /100

Subscores

Attention and Orientation /18
Memory /26
Fluency /14
Language /26
Visuospatial /16

Normative values based on 63 controls aged 52-75 and 142 dementia patients aged 46-86
Cut-off <88 gives 94% sensitivity and 89% specificity for dementia
Cut-off <82 gives 84% sensitivity and 100% specificity for dementia

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