CHANGES IN PHYSICAL ACTIVITY IN COMMUNITY-DWELLING OLDER ADULTS
ASSOCIATED WITH THE MATTER OF BALANCE VOLUNTEER LAY LEADER MODEL
PROGRAM

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partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department
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ABSTRACT

Walter Edward Palmer: Changes in physical activity in community-dwelling older adults
associated with the Matter of Balance Volunteer Lay Leader Model program.
(Under the direction of Vicki S. Mercer)

Physical inactivity among older adults is a major public health problem associated with
higher health costs and a variety of negative health outcomes. The Matter of Balance / Volunteer
Lay Leader Model (MOB/VLL) program is specifically designed to "reduce the fear of falling
and increase activity levels among older adults". The purpose of this study was to assess
changes in physical activity (PA) and fear of falling (FOF) among MOB/VLL participants. A
MOB cohort (n = 56) completed a survey before and after participating in a MOB/VLL class.
The survey included demographic, health, and falls information, along with the Rapid
Assessment of Physical Activity scale (RAPA), the Activities-specific Balance Confidence scale
(ABC), Fear of Falling Avoidance Behavior Questionnaire (FFABQ), Self-Efficacy for Increased
Physical Activity scale (SEIPA), and the Outcome Expectations for Increased Physical Activity
scale (OEIPA). A Community cohort (n = 23) was recruited from a local senior center to
complete the same survey on two occasions, four weeks apart (no intervention). These subjects
also wore step counters for seven days at baseline and again four weeks later.

In the MOB cohort, paired samples t-tests assessed changes in ABC, RAPA1, and the
MOB-PA scores from baseline to follow-up. Pearson's *r* correlations were calculated between
MOB-PA and RAPA1 scores at baseline and follow-up for both cohorts. A linear regression
model for change from baseline to follow-up in RAPA1 score was developed with age, gender,

race, sessions attended, ABC, RAPA1, MOB-PA, SEIPA, OEIPA, and FFABQ entered simultaneously.

No evidence was found for an intervention effect of MOB/VLL class participation on PA levels or FOF. No evidence for the construct validity of the MOB-PA, as measured against the RAPA1, was found in the MOB cohort. In the MOB cohort, only baseline RAPA1 score was predictive of post-intervention change in RAPA1 score. These findings, coupled with the levels and distributions of the RAPA1 and ABC scores, suggest that the program may not be effective in increasing PA, or older adults who might benefit most from the MOB/VLL program are not being enrolled.

To Mary, whose unwavering love and support has made this dissertation, and all of my accomplishments, possible.

To William D. Palmer and Frances W. Palmer, for their lifelong encouragement of all of their children in the endeavors and adventures of their lives.

Finally, and most important, all of the older adults who volunteered to participate in this and other studies, who at the most fundamental level make human studies research possible.

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LIST OF ABBREVIATIONS

ABC   Activities-Specific Balance Confidence Scale

ACSM   The American College of Sports Medicine

AMOB   A Matter of Balance (more commonly MOB)

BRFSS   The Behavioral Risk Factor Surveillance System Survey

CDC   Centers for Disease Control and Prevention

CHAMPS-PAQ   Community Healthy Activities Model Program For Seniors - Physical
                        Activity Questionnaire

DHHS   U.S. Department of Health and Human Services

DLW   Doubly labeled water method

DMMPA   Daily minutes of moderate physical activity

FES   Falls Efficacy Scale

FES-I   Falls Efficacy Scale International

FFABQ   Fear of Falling Avoidance Behavior Questionnaire

FMS   Falls Management Scale

ICC   Intraclass Correlation

Icon-FES   Iconographic Falls Efficacy Scale

MDC   Minimal Detectable Change

MOB   A Matter of Balance

MOB/VLL   A Matter of Balance Volunteer Lay-Leader Model Program

MOB-PA   MOB/VLL physical activity measure

OEE   Outcome Expectations for Exercise Scale

OEIPA   Outcome Expectations for Increased Physical Activity

PA	Physical Activity
PACE	Physician-Based Assessment and Counseling on Exercise
PASE	Physical Activity Scale for the Elderly
RAPA	Rapid Assessment of Physical Activity
RAPA1	Rapid Assessment of Physical Activity (Part 1 - Aerobic)
RAPA1Diff	(RAPA1at Follow-up) – (RAPA1 at Baseline)
SAFE	Survey of Activities and Fear of Falling in the Elderly
SD	Standard Deviation
SEE	Self-Efficacy for Exercise Scale
SEIPA	Self-Efficacy for Increased Physical Activity Scale
SF-36	Medical Outcomes Study Short Form 36 Survey
TDSC	Total daily step counts
TUG	Timed Up and Go test
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

Background

Physical inactivity among older adults is a major public health problem(1) that is

associated with higher health costs(2) and a variety of negative health outcomes, including

obesity,(3) sarcopenia,(4, 5) osteopenia,(6, 7) osteoporosis,(6, 7) falls,(8) depression,(9)

loneliness,(10) social isolation,(11) fear of falling,(12-15) frailty,(16) cognitive decline,(17, 18)

and mortality.(19, 20) Although terms such as *sedentary*, *physically inactive*, and *insufficient*

physical activity regularly appear in the literature, they are not uniformly defined; yet they all

take as their referent the concept of *physically active*, which the Centers for Disease Control and

Prevention (CDC) defines as "engaging in moderate-intensity activities in a usual week for

greater than or equal to 30 minutes per day, greater than or equal to 5 days per week; or

vigorous-intensity activities in a usual week for greater than or equal to 20 minutes per day,

greater than or equal to 3 days per week or both".(21) The CDC defines physical *inactivity* as

"less than 10 minutes total per week of moderate or vigorous-intensity lifestyle activities.", and

defines *insufficient physical activity* as "doing more than 10 minutes total per week of moderate

or vigorous-intensity lifestyle activities but less than the recommended level of activity".(21)

Lifestyle activities include household activities (e.g. moving around in your home and doing

housework), transportation activities (e.g. walking to the store or a friend's home) and leisure-

time activities. Leisure-time activities may include intentional exercise or may consist of more

informal activities such as playing tennis, hiking, dancing, etc. Work-related physical activity

(occupational activity) is unaccounted for in these CDC definitions. Exercise is defined by the

CDC as "a subcategory of physical activity that is planned, structured, repetitive, and purposive in the sense that the improvement or maintenance of one or more components of physical fitness is the objective."(22)

Just as inadequate levels of physical activity are associated with multiple morbidities, researchers have reported that increased physical activity by older adults can prevent, delay, or ameliorate specific health conditions and/or their symptoms, including functional status decline,(23) arthritis,(24-26) depression,(27) diabetes,(28) frailty,(29) cognitive dysfunction,(18, 30, 31) and hypertension.(32)

Despite this knowledge, and despite the efforts of many governmental and private health organizations to promote increased physical activity among older adults through the issuing of policies, recommendations, and guidelines,(33-37, 37) the prevalence of physical inactivity among older adults in the US remains high.(38-40) A recent study analyzing data from the 1998–2008 National Health Interview Survey found that over 50% of adults aged 65 and older were physically inactive, and another 19% did not meet minimum physical activity recommendations. Less than 19% were classified as highly active.(40) Among the factors reported to be associated with reduced physical activity among older adults are fear of falling and fear of the consequences of falling.(12-15, 41-46) These fears also rank among the barriers to exercise among older adults.(44, 47)

Howland et al (1993) found that nearly half of community-dwelling older adults experienced some fear of falling, and Tinetti & Speechly (55) found that many older adults with fear of falling responded to this fear by limiting their activity. This limiting of activity is theorized to initiate or continue a downward spiral of neuromuscular deconditioning and reduced

physical capacity, thereby increasing, not decreasing, the risk of falls and fall-related injuries.(15, 48)

Rationale and Significance

The *A Matter of Balance* (MOB) program is an evidence-based cognitive-behavioral intervention program designed to "reduce the fear of falling and increase activity levels among older adults".(49) A volunteer lay-leader adaptation of this program (MOB/VLL) was developed in partnership by Southern Maine's Agency on Aging, Maine's Partnership for Healthy Aging, Maine Medical Center Division of Geriatrics and the University of Southern Maine, School of Social Work. The MOB/VLL program is currently being implemented in over 35 states in the US, and over 20,000 older adults have been through an MOB/VLL program provided by MOB/VLL Coaches, each under the oversight of one of the over 850 Master Trainers throughout the country.(49) The number of Master Trainers and Coaches, along with the number of MOB/VLL graduates, continues to grow.(49)

The evidence for the effect on activity of the original MOB program, as well as the MOB/VLL program, is based on self-reported activity measures and activity intention measures, neither of which are validated activity measures.(50-52) To date, no evaluation of program effectiveness has examined the original MOB program or the MOB/VLL program using validated measures of activity.

Overall Goal

The overall goal for this dissertation research was to evaluate the effectiveness of the MOB/VLL program in achieving its stated goal of increasing activity among program

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participants. This dissertation focused on physical activity, rather than social or other types of activity, as an outcome variable.

The dissertation research involved primary data collection prior to and after an 8-week MOB/VLL class. The theoretical framework for this study (Figure 1) is based on the Theory of Planned Behavior.(53) The MOB/VLL program is a cognitive-based intervention derived from research by Lachman and colleagues.(54) The program is designed to modify multiple factors of the model theorized to influence physical activity level, including fear of falling, outcome expectations, self-efficacy for physical activity, and perceived behavioral control. However, other theorized antecedents to increased physical activity, including attitude toward physical activity, subjective norms for physical activity, perceived behavioral control of increased physical activity, and the intention to increase physical activity, were not measured in this study.

Model-based Measures

Activity Physical Assessment

The MOB/VLL First and Last Session Surveys incorporate a truncated and modified version of Physician-Based Assessment and Counseling on Exercise (PACE), originally based on a Stages of Change model for adopting a new health behavior, adapted to measure physical activity.(51) This measure is referred to as the MOB/VLL physical activity measure (MOB-PA) throughout this dissertation document. The MOB-PA consists of 6 statements of exercise level, only one of which is to be selected (Instructions: "Mark only one circle to tell us how much you are walking or exercising now."). An example item: "I do not exercise or walk regularly, but I have been thinking of starting." Scores range from 1 to 6. The MOB-PA is collected as a means

of ongoing evaluation of the MOB/VLL program. No validation of the MOB-PA has been reported in the literature.

The Rapid Assessment of Physical Activity (RAPA)(55) is a self-administered validated questionnaire that quantifies both the level (i.e. minutes) and intensity (light, moderate, and vigorous) of physical activity. The section of the RAPA that assesses aerobic activity, the RAPA1, was used for this dissertation as the validated outcome measure of physical activity due to its brevity and low-burden characteristics (in comparison to its validation measure, the CHAMPS-PAQ) and the evidence for its moderate reliability and validity in the older adult population. The RAPA1 consists of 7 statement selections in response to the question, "How physically active are you?" An example item: "I do moderate physical activities every week, but less than 30 minutes a day or 5 days a week. Yes No (circle one)". Scores range from 1 to 7. When more than one item is circled, the highest number is used.

Outcome Expectation for Increased Physical Activity Assessment

The Outcome Expectations for Increased Physical Activity (OEIPA) scale was modified for this study from the Outcome Expectations for Exercise (OEE) scale, developed and validated by Resnick and colleagues.(56, 57) The OEIPA is a nine item, 5-point Likert scale tool to measure outcome expectations for exercise in older adults. The OEIPA (see Appendix B) retains the same items and scale as the OEE, but modifies the wording to refer to expectations for increased physical activity rather than for exercise (e.g. "Increasing my physical activity would make me feel more mentally alert.") Examples of ways to increase physical activity are given to help illustrate the general meaning of the term physical activity.

Exercise Self-efficacy for Increased Physical Activity Assessment

The Self-Efficacy for Increased Physical Activity (SEIPA) scale was modified for this study from the Self-Efficacy for Exercise (SEE) scale developed and validated by Resnick and colleagues.(58) The SEIPA is a nine item, 11-point Likert scale tool to measure self-efficacy for exercise in older adults in the presence of specific barriers to exercise. The SEIPA (see Appendix B) retains the same items and scale as the SEE but modifies the wording to refer to self-efficacy for increased physical activity rather than for exercise (e.g. "How confident are you right now that you could increase your regular weekly physical activity if the weather was uncomfortable (or unpleasant)?") As with the OEIPA, examples of ways to increase physical activity are given to help illustrate the general meaning of the term physical activity.

Fear of Falling Assessment

The Activities-Specific Balance Confidence (ABC) scale is a 16-item tool developed by Powell and Meyers(59) to assess fear of falling in community-dwelling older adults. Powell and Meyers developed the ABC as a more situation-specific successor to Tinetti's Falls Efficacy Scale (FES) with a higher end range. Both scales were based on Bandura's theory of self-efficacy, in which fear naturally derives from lack of self-efficacy in a specific domain.(60) Bandura acknowledged that fear may derive directly from experience, but theorized that experience provides the most compelling assessment of self-efficacy. Therefore both the FES and ABC seek to arrive at an overall "fear of falling" measure by an aggregate measure of self-efficacy across multiple specific activities or, as Powell and Meyers(59) expressed it, "by operationalizing 'fear of falling' as a continuum of self-confidence." On the ABC, respondents use an 11-point Likert scale to rate their level of confidence in remaining steady and not losing

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their balance while performing the activity described for each item. Higher scores indicate greater balance confidence or less fear of falling. The ABC was selected for this study because of its reliability and validity among community-dwelling older adults, its validity for postal administration, and its wide use in both clinical and research settings, making the findings of this study directly comparable to other studies. The ABC was used in this study both as an outcome measure in assessing the effectiveness of the MOB/VLL intervention and as a predictor model variable impacting both attitudes toward physical activity and perceived behavioral control.

Activity Restriction Due to Fear of Falling Assessment

The Fear of Falling Avoidance Behavior Questionnaire (FFABQ) is a self-administered 14-item tool recently developed by Landers and colleagues (61) to quantify activity avoidance behavior due to fear of falling. The FFABQ uses a 5-point Likert scale, with higher scores reflecting greater avoidance behavior or activity restriction. The FFABQ has a test-retest reliability of 0.812 and a correlation of -0.678 with the ABC, indicating that the constructs of balance confidence and activity restriction due to fear of falling are related but not the same. Because the MOB/VLL is targeted at community-dwelling older adults who limit their physical activity due to fear of falling, this population would be expected to score high on the FFABQ. Therefore the FFABQ was administered and examined as a possible predictor of physical activity change at follow-up.

Dissertation Manuscripts

This dissertation research is comprised of three studies, described below, and is presented in a three manuscript format, with each manuscript having its own tables, figures and references.

Manuscript 1: The effects of the MOB/VLL program on self-reported physical activity and fear of falling in community-dwelling older adults.

Aim 1: To determine changes from pre-intervention to post-intervention in a) physical activity, as measured by both a standardized, self-report measure of physical activity (RAPA1) and the MOB/VLL program activity measure (MOB-PA), and b) fear of falling, as measured by a standardized self-reported balance confidence measure (ABC).

Hypothesis 1a: Physical activity, as measured by the RAPA1, will change from pre to post intervention.

Hypothesis 1b: Physical activity, as measured by the MOB-PA, will change from pre to post intervention.

Hypothesis 1c: Fear of falling, as measured by the ABC, will change from pre to post intervention.

Manuscript 2: Concurrent validity of the MOB/VLL program activity measure (MOB-PA) in community-dwelling older adults. [Two cohorts were recruited: The MOB cohort was recruited from the rolls of upcoming MOB/VLL classes throughout the state of North Carolina. The Community cohort was recruited from a senior center in Chapel Hill, NC.]

Aim 2.1 To determine relationships between MOB-PA scores and RAPA1 scores at baseline and follow-up in both the MOB and Community cohorts.

Hypothesis 2.1: The MOB-PA will demonstrate concurrent validity (i.e. r > = 0.5)(62) with the RAPA1 at both time points for both cohorts.

Aim 2.2 To establish preliminary evidence of the relationship between MOB-PA scores and total

daily step counts (TDSC), as measured using an accelerometer-based step counter at baseline and

post-intervention follow-up in the Community cohort.

Hypothesis 2.2: The MOB-PA will demonstrate concurrent validity (i.e. r > = 0.5)(62) with

TDSC at both time points in the Community cohort.

Aim 2.3 To establish preliminary evidence of the relationship between MOB-PA scores and

daily minutes of moderate or greater intensity physical activity (DMMPA) as measured using an

accelerometer-based step counter at baseline and post-intervention follow-up.

Hypothesis 2.3: The MOB-PA will demonstrate concurrent validity (i.e. r > = 0.5)(62) with

DMMPA at both time points in the Community cohort.

Manuscript 3: Development of a regression model to predict physical activity change among

community-dwelling older adults following participation in the MOB/VLL program.

Aim 3: To determine the individual MOB/VLL participant (e.g. demographics, self-efficacy,

etc.) characteristics that are correlated with a change from baseline in a self-report measure of

physical activity (RAPA1) post intervention, and to use these variables, along with baseline

RAPA1, to develop a parsimonious linear regression model predicting post-intervention physical

activity change.

Figure 1: Physical Activity Theoretical Framework for Study (based on the *Theory of Planned Behavior*) (highlighted boxes are targets of the MOB/VLL program.)
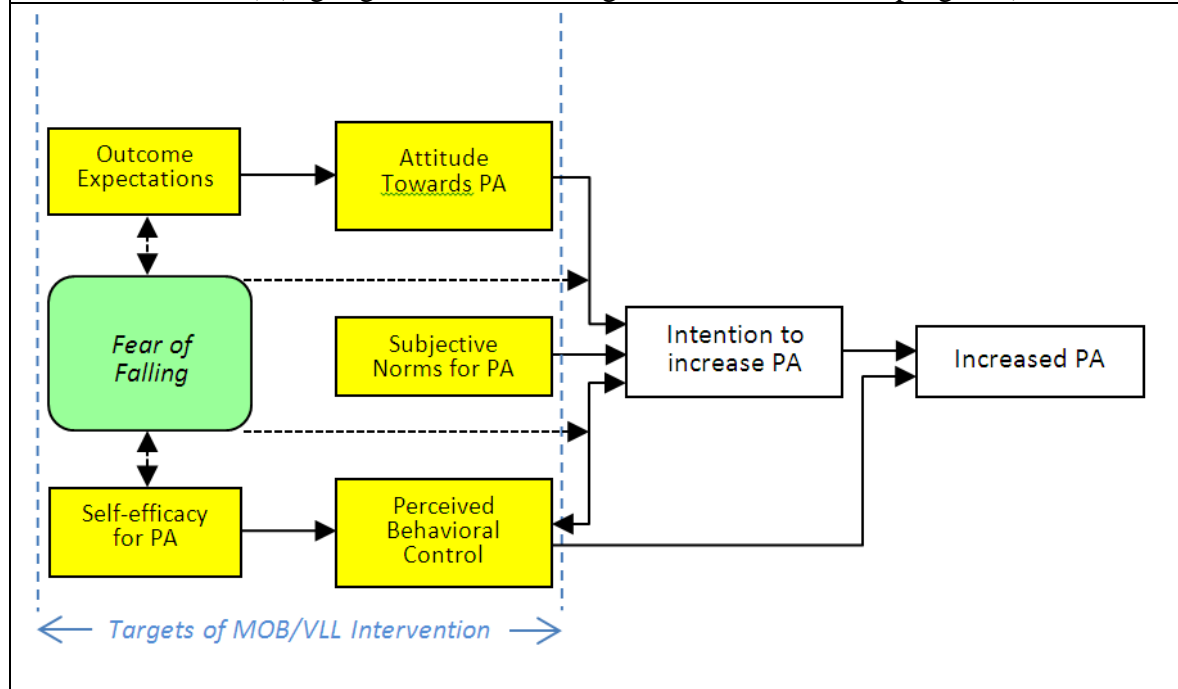
CHAPTER 2: MANUSCRIPTS

Manuscript 1: The effects of the MOB/VLL program on self-reported physical activity and fear of falling in community-dwelling older adults.

OVERVIEW

Physical inactivity in all age segments of the US population is a growing public health concern, and both hastens and exacerbates many common co-morbidities of later life. Increased physical activity in older adults has been shown to delay or ameliorate many of these same co-morbidities. Fear of falling is one of the barriers to increased physical activity, affecting a significant number of older adults, with estimates ranging from 26%(21) to 74%(22). The Matter of Balance program (MOB) was developed by Tennstedt and colleagues to reduce fear of falling and increase activity (functional, physical, and social) in older adults, and was later adapted by Healy and colleagues(1) for delivery by lay volunteers as the Matter of Balance Volunteer Lay Leader (MOB/VLL) model program. The current study evaluated the effectiveness of the MOB/VLL program, in changing physical activity using the MOB/VLL program's activity measure (MOB-PA) and the Rapid Assessment of Physical Activity (RAPA1), and in changing fear of falling as measured by the Activities-specific Balance Confidence (ABC) scale. Subjects (n = 61) were recruited from the rolls of upcoming MOB/VLL classes.

Results: Paired two-tailed t-test statistics and confidence intervals were computed in an available case analysis for the baseline and follow-up MOB-PA, RAPA1, and ABC scores with

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alpha set at 0.05. There were no significant effects of the MOB/VLL intervention on RAPA1,

MOB-PA, or ABC scores from baseline to follow-up.

INTRODUCTION

Background

Humans appear to be built to be active.(2) Engaging in an adequate level of physical activity is one of the most important personal actions that can be taken to improve and maintain health. The definition of "adequate" is not rigid, but rather can vary based on age and co-morbidities. There is general consensus that healthy older adults should get a minimum of 150 minutes of moderate-intensity aerobic physical activity throughout each week in bouts of at least 10 minutes each.(3-5) For healthy older adults, physical activity below this level is generally considered inadequate, although when co-morbidities exist, the need for intensity and/or duration adjustments is acknowledged. Maximum benefits appear to accrue from lifelong physical activity engagement, yet evidence suggests that significant benefits can be obtained from even moderate levels of activity begun and maintained in old age.(4) Physical inactivity in all age segments of the US population is a growing public health concern. Physical inactivity both hastens and exacerbates many common co-morbidities of later life. Increased physical activity in older adults has been shown to delay or ameliorate many of these same co-morbidities.

Many programs targeted at community dwelling older adults are designed to increase physical activity using multiple strategies, including education,(6, 7) social marketing,(8) telephone support programs,(9) group exercise classes,(6) pedometers,(10-15) walking programs,(16, 17) Tai Chi,(18) and individually tailored exercises.(19, 20) Many of these programs provide evidence of improved multiple health outcomes for older adults. However, many older adults, even when referred by a health care provider to a no-cost exercise program, decline participation.(21)

Fear of falling is included among the many barriers to increased physical activity identified in the literature. This fear affects a significant number of older adults, with estimates ranging from 26%(22) to 74%(23), depending on the population and measurement instrument. Approximately one third of older adults develop a fear of falling after experiencing a fall,(23) while others may develop a fear of falling due to their self-perceived physical limitations.(24, 25) For some older adults this fear manifests as a true phobia,(26) and for many it serves to curtail their habitual physical activity and limit their social engagement.(27)

The Matter of Balance program (MOB) was developed by Tennstedt and colleagues to reduce fear of falling and increase activity (functional, physical, and social) in older adults.(28) In assessing the effectiveness of the MOB, the researchers employed a 7-item intended activity measure rather than a direct measure of activity. The MOB, originally developed for delivery by a physical therapist (PT), was later adapted by Healy and colleagues(1) for delivery by lay volunteers as the Matter of Balance Volunteer Lay Leader (MOB/VLL) model program in order to reduce barriers to wide-spread community implementation (primarily the high cost and limited number of available PTs to provide the program.) In their translation study, they used a modified version of the Physician-Based Assessment and Counseling on Exercise (PACE), originally developed as a readiness for exercise measure.

Rationale and Significance

Annually, thousands of community-dwelling older adults take and complete MOB/VLL classes, yet no validated instruments have been developed or used to assess the effectiveness of the MOB/VLL program in increasing physical activity among those who successfully complete the program. Ory and colleagues(29), in their study of the implementation and dissemination of

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the MOB/VLL program in Texas, reported significant improvement (from 3.2 to 3.5 days/week of at least 30 minutes of moderate-intensity physical activity, $p < .001$, Cohen-d $= 0.27$) in physical activity using a variant of the Behavioral Risk Factor Surveillance System (BRFSS) survey items to assess physical activity, but did not report details of the measure for assessment of its validity. They did report significant improvement in falls efficacy, as measured by a modified Falls Efficacy Scale (FES).(28) Ullmann et alt(30), in their study of the implementation and dissemination of the MOB/VLL program in South Carolina(30), did not report on physical activity outcomes, but did report significant improvement in perception of ability to manage fall risk and falls if they occur (FES) and mobility performance (TUG). Neither of these studies reported physical activity using the MOB-PA, although both reported having access to the MOB-PA data. This study is important because, by focusing on validated measures of both fear of falling and physical activity, it provides evidence for the effectiveness of the MOB/VLL program in achieving its intended outcomes of increased activity and reduced fear of falling.

Objectives

The purpose of this study was to evaluate the effectiveness of the MOB/VLL program, as implemented in North Carolina, in increasing physical activity, as measured by both a standardized, self-report measure of physical activity (RAPA1) and the MOB/VLL program activity measure (MOB-PA), and decreasing fear of falling, as measured by a standardized self-reported balance confidence measure (ABC), among class participants. The outcomes of increased functional and social activity, also targeted by the MOB/VLL program, were not assessed.

Aim: To determine changes from pre-intervention to post-intervention in a) physical activity, as measured by both a standardized, self-report measure of physical activity (RAPA1) and the MOB/VLL program activity measure (MOB-PA), and b) fear of falling, as measured by a standardized self-reported balance confidence measure (ABC).

> *Hypothesis a: Physical activity, as measured by the RAPA1, will change from pre to post intervention.*

> *Hypothesis b: Physical activity, as measured by the MOB-PA, will change from pre to post intervention.*

> *Hypothesis c: Fear of falling, as measured by the ABC, will change from pre to post intervention.*

METHODS

Study Participants

This was a non-randomized pre-post intervention study. Participants were community-dwelling older adults ages 60 years or older. Participants were recruited from the registration rolls of MOB/VLL classes scheduled to take place in North Carolina over an 18 month recruitment phase. In order for the sample to be as representative as possible of all MOB/VLL participants, participants were excluded only if they were unable to read or write English well enough to read and complete the study survey. The intervention, the MOB/VLL class, was provided by organizations in the community independent of the researcher.

The study was approved by the University of North Carolina at Chapel Hill Institutional Review Board, and all potential participants were provided with a description of the study prior to participation. An IRB waiver for written informed consent was obtained.

Recruitment

MOB/VLL Master Trainers and other individuals involved in hosting and organizing MOB/VLL classes assisted the research team with recruitment by mailing study recruitment packets to participants enrolled in upcoming MOB/VLL classes. Each recruitment packet included a letter of introduction, an information sheet about the study, multiple data collection instruments bound in a single survey booklet, a gift card selection sheet, and a pre-addressed postage-paid envelope in which to return the survey booklet. Up to $15 in gift card incentives was provided for each subject; $5 for return of the baseline survey and $10 for return of the follow-up survey.

Procedure

Approximately two weeks prior to the beginning of a scheduled MOB/VLL class, individuals enrolled in the class were recruited via mail to participate in the study. These potential subjects received the recruitment packet previously described. Those who consented to be in the study completed the data collection booklet and returned it, along with the card selection form, in the postage-paid envelope.

After the last scheduled session of the MOB/VLL class, subjects received by mail a second packet with a booklet containing the post-intervention data collection instruments and a gift card selection form, both to be completed and returned in the postage-paid envelope also provided.

Data Sources

Data were obtained from two main sources: 1) each subject's pre and post intervention data (collected by mail) and 2) the MOB/VLL program records (collected onsite as part of MOB/VLL class sessions). Program records included attendance records and First and Last Session Surveys administered and collected by the MOB/VLL Coaches as part of the program's established self-evaluation procedures.

Assessment Instruments

Subjects completed the mailed study data collection instruments at a place and time of their own choosing. The data collected directly from subjects included demographics, health and falls history, the Rapid Assessment of Physical Activity (RAPA), and the Activity Specific Balance Confidence Assessment (ABC). Total time to complete all assessments was estimated to be 15 minutes.

Activity Assessment

The MOB/VLL First and Last Session Surveys incorporate a truncated and modified version of the Physician-Based Assessment and Counseling on Exercise (PACE) to measure exercise level.(1) Although the PACE in its original form was developed based on a Stages of Change model for adopting a new health behavior, no validation has been reported in the literature for this modified version's use as a physical activity measure. This measure is referred to as the MOB/VLL physical activity measure (MOB-PA) throughout this manuscript. The MOB-PA consists of 6 statements of exercise level, only one of which is to be selected (Instructions: "Mark only one circle to tell us how much you are walking or exercising now.").

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An example item: "I do not exercise or walk regularly, but I have been thinking of starting."

Scores range from 1 to 6. The MOB-PA is collected as a means of ongoing evaluation of the

MOB/VLL program. No validation of the MOB-PA has been reported in the literature.

The Rapid Assessment of Physical Activity (RAPA)(31) is a self-administered validated

questionnaire that quantifies both the level (i.e. minutes) and intensity (light, moderate, and

vigorous) of physical activity. The RAPA consists of two sections: the RAPA1, an assessment of

aerobic activity, and the RAPA2, an assessment of activity designed to improve strength &

flexibility. These two sections are scored separately. Although the complete RAPA was

administered, only the RAPA1 was used to assess physical activity. The RAPA2 was designed to

assist clinicians in assessing risk factors for falls and was not intended or validated for use in

tracking changes.(32) The RAPA1 was used for this study as the validated outcome measure of

physical activity due to its brevity and low-burden characteristics (in comparison to its validation

measure, the CHAMPS-PAQ) and the evidence for its moderate reliability and validity in the

older adult population. The RAPA1 consists of 7 statement selections in response to the question,

"How physically active are you?" An example item: "I do moderate physical activities every

week, but less than 30 minutes a day or 5 days a week. Yes No (circle one)". Scores range from

1 to 7. When more than one item is circled, the highest number is used.

Fear of Falling Assessment

The ABC scale is a 16-item tool developed by Powell and Meyers(33) to assess fear of

falling in community-dwelling older adults, based in part on Bandura's assertion that low self-

efficacy is a direct cause of fear.(34) Each item on the ABC is rated using an 11-point Likert

scale. Talley and colleagues (35) evaluated the psychometric properties of the ABC when self-

administered via the mail to community-dwelling white women and found good internal

consistency (Cronbach alpha: 0.95), concurrent validity (r = -0.61, p < .001) when measured

against the Survey of Activities and Fear of Falling in the Elderly (SAFE), and construct validity

when compared to the SAFE and Medical Outcomes Study Short Form 36 Survey (SF-36)

subscales and clinical measures including the Berg Balance Scale (r = .57, p < .001), gait speed

(r = .51, p < .001), and the Timed Up and Go Test (TUG) (r = .39, p < .001).

Sample Size

The developers of the MOB, Tennstedt and colleagues,(28) did not directly measure

activity as an outcome, but instead employed a 7-item intended activity measure. The effect size

for intended activity was small (0.20) at six weeks post intervention. In reporting on the

MOB/VLL implementation, Healy and colleagues(1) did not report effect size or the data

required to calculate effect size for physical activity. In a Cochrane review(36) of interventions

for promoting physical activity in adults, the 19 included studies with continuous data for self-

reported physical activity had effect sizes ranging from .15 to .41. As this study measured

physical activity only one week post intervention, when the effect is theorized to be at its

maximum, this study was designed to detect a moderate (r=0.5) effect size (37).

Survey response rates from older adults vary considerably in the literature. Older adults

respond at higher rates than do young adults,(38-40) women at higher rates than men,(40) and

those who receive monetary incentives respond at higher rates than those who do not receive

incentives.(38) Response rates from postal surveys have been as high as 69% (41) and 61%,(42)

for some surveys and as low as 33% for a national postal survey of respiratory health in

Sweden.(40) Given that this study did not recruit from the general population but rather from

among individuals enrolled in an upcoming MOB/VLL course, a conservative 30% response rate was estimated.

Reports of attrition rates also vary considerably. Healy and colleagues(1) found that, of the original subjects agreeing to be in the study, 70% remained in the study at the 6 week follow-up. This study used a more conservative 35% attrition rate estimate. Because multiple subjects were likely to be recruited from the same MOB/VLL class and thus potentially share racial, ethnic, and socio-economic characteristics, in addition to receiving the intervention in the same MOB/VLL course, a sample size calculation adjustment was made to correct for group effect. Smeeth & Ng(43) calculated intraclass correlations (ICC) (how similar patients were to each other) across primary care clinics for a variety of clinical measures for adults aged 75 years or older in the UK. Although no measures of regular physical activity were presented, ICCs for seven items indicating physical capacity (dressing self, washing all over, cooking a hot meal, using stairs, doing light house work, walking 50 yards down the road, and doing shopping) ranged from 0.006 to 0.020, with an average ICC of 0.015. Based on the likelihood of recruiting a similar age and geographically clustered sample, a conservative estimate of 0.025 for the ICC was used for the physical activity outcome variable.

The statistical significance level was set at 0.05 a priori. In order to detect a moderate effect size (0.5)(37) with power at 80% and the estimated design effect (ICC = 0.025)(44), a follow-up sample size of 37 was calculated.(45) Factoring in the above estimates of response rate (30%) and attrition rate (35%), an estimated 190 surveys needed to be mailed to MOB/VLL class participants to obtain data for a sample of 37.

Statistical Analysis

All statistical analyses were conducted using SPSS v16.0 for Windows. Baseline

characteristics were computed (mean, range, and distribution) for all subjects, subjects followed,

and those lost to follow-up. Baseline demographic, self-rated health, and falls variables were

compared using Pearson's chi-square for categorical variables and 2-tailed t-tests for continuous

variables to detect differences between the follow-up and lost to follow-up subjects. Paired t-test

statistics and confidence intervals were computed for the MOB-PA, RAPA1, and ABC scores at

an alpha level of 0.05.

RESULTS

A total of 9 MOB/VLL class provider organizations agreed to assist with subject

recruitment from among those enrolled in their upcoming MOB/VLL class. (Figure 1) A total of

108 recruitment solicitation packets were delivered to the MOB/VLL class provider

organizations for addressing and delivery to potential subjects. Of these packets, 15 were known

to have not been addressed to potential subjects by the provider organizers (fewer enrollees than

packets sent, unknown mailing addresses, and unidentified reasons), resulting in a maximum of

93 recruitment solicitation mailings. A total of 61 Baseline surveys (response rate = 65.6%) were

returned. One survey was completed containing combined information for two people, and was

thus excluded. Four surveys were completed after the date of the first class session attended by

the subjects and were therefore excluded from analysis. Therefore, valid Baseline surveys were

obtained for a total of 56 subjects (valid response rate = 60.2%). All 56 of the baseline surveys

contained valid RAPA1 scores. Fifty five of the 56 baseline contained valid ABC scores.

Missing MOB/VLL first session survey data (MOB-PA), due to lost or incomplete records, resulted in a total of 42 subjects with complete baseline data for all three outcome measures.

All 56 subjects who returned a baseline survey were mailed a follow-up survey. Forty eight (85.7%) of these subjects returned a valid Follow-up survey (attrition rate = 14.3%). All of these subjects had valid RAPA1 and ABC scores. Thirty five of the subjects had valid MOB-PA scores. There were 34 subjects with compete baseline and follow-up RAPA1, ABC, and MOB-PA scores. Figures 2a, 2b, and 2c show respectively the distributions of ABC, RAPA1, and MOB-PA scores at baseline.

The baseline descriptive statistics are shown in Table 1. There were no differences between the followed group (N = 56) and the lost to follow-up (8) group for age, height, BMI, RAPA1, or ABC scores. All 8 subjects lost to follow-up were white and female, compared to 85.4% white and 77.1% female in the followed group. The lost to follow-up group was higher functioning, with higher ($p < 0.001$) MOB-PA scores, lower ($p < 0.01$) number of injurious falls in previous year, and lower ($p = 0.01$) number of medically treated falls in previous year than the followed group.

Effect of the intervention on outcome variables

Paired 2-tailed t-test statistics and confidence intervals were computed in an available case analysis for the baseline and follow-up MOB-PA, RAPA1, and ABC scores at an alpha level of 0.05 (Table 2). There were no significant effects of the MOB/VLL intervention on RAPA1 ($p = 0.37$, Cohen's d = 0.17), MOB-PA ($p = 0.33$, Cohen's d = 0.17), or ABC ($p = 0.33$, Cohen's d = 0.08) scores from baseline to follow-up. The results of a post-hoc analysis in which subjects with RAPA1 scores of 6 and 7 were removed from analysis are presented in

Table 3. The results of a post-hoc analysis in which subjects attending less than 5 sessions were removed from analysis are presented in Table 4.

DISCUSSION:

Our recruitment response rate (65.6%) was higher than we anticipated, and may have been due to our recruiting older adults (who volunteer at higher rates than younger adults(38-40)), targeting of a specific intervention population, and incentive provision. Our attrition rate of 14.3% was considerably lower than that (25%) reported by Healy and colleagues(1) for their six-week follow-up questionnaires. As a group, our baseline sample consisted of a higher percentage of women compared to all adults ages 60 years and older in North Carolina(46) (80.4% vs. 55.8%) but a similar percentages for Whites (83.9% vs. 80.3%) and African Americans (14.3% vs. 16.9%) . The percentage of women in this study was similar to that reported by Healy (86%)(1), Ullmann (86%)(30), and Ory (89.9%)(29). The average age (77.8 years) of the subjects in this study was similar to that reported by Healy (78.7)(1), Ullmann (75.4)(30), and Ory (77.0)(29). Healy and colleagues(1, 29) reported that MOB-PA scores (referred to in their findings as PACE scores) statistically significantly increased from 4.80 at baseline to 5.45 six-weeks post intervention. Ullmann and colleagues did not report on physical activity, but did report that age-adjusted Timed-Up-and-Go scores statistically significantly decreased (improved) from 13.0 seconds at baseline to 11.7 seconds post-intervention. Ory and colleagues(29) reported statistically significant 'modest effects' in number of days physically active as a result of MOB/VLL participation (baseline = 3.2 days, Follow-up = 3.5 days).

Based on Tennstedt and colleagues' original MOB study and the subsequent MOB/VLL studies(1, 28-30), we hypothesized that physical activity, as measured by both the RAPA1 and

the MOB-PA, would change from pre to post intervention. We further hypothesized that fear of falling would change from pre to post intervention. These hypotheses were not supported. These findings cannot be directly compared to findings from previous studies (1, 28-30) of the MOB and the MOB/VLL programs, as different methods and measures were used to assess program outcomes. In Tennstedt and colleagues(28), the closest measure comparable to the ABC, the study's modified falls efficacy scale, had significant but small effect (Cohen's $d = 0.20$) at 6-weeks post-intervention, but only among subjects who completed at least 5 of the 8 sessions. The closest measure to the RAPA1 or MOB-PA, the mobility control score used in the study, had significant but small effect (Cohen's $d = 0.13$) 6-weeks post-intervention for all subjects. The similarity of the effect sizes on these generally related measures suggest we may have found significant small effects with a larger sample size.

There are several possible reasons for our findings. First, this study was small, powered to detect a moderate or larger effect size. Calculations of Cohen's d values for all three outcome variables reveal very small effect sizes. Steffen & Seney calculated minimal detectable change (MDC) values of 18 to 38 from multiple studies reported in the literature, and calculated an MDC of 13 for the ABC among patients with Parkinson's disease, rendering the small change of 1.4 clinically insignificant. It is possible the instruments used in this study may have been inadequate to detect moderate individual changes. In particular, the RAPA1, with a 7 point range, may not have enough sensitivity over the range of scores of the target population. Ten (20.8%) of the baseline RAPA1 scores had a value of 7 (ceiling effect), effectively reducing the sample size to 41, the number who could possibly have shown improvement in RAPA1 scores following the intervention. Similarly, the MOB-PA has only a six point range, and 18 (47.4%) of the followed subjects had MOB-PA scores of 6 (ceiling effect), effectively reducing the sample

size to 20. However, while there was no significant increase in MOB-PA score in the study sample, (Baseline score = 4.6, Follow-up score = 4.9, change = 0.29, p = .33), Healy and colleagues(1) found a significant increase in MOB-PA scores two weeks post-intervention, (Baseline score = 4.8, 2 weeks post intervention score = 5.4, change = 0.6, p < .001). While the lack of significance for 50% smaller MOB-PA score change in this study is not surprising given the small sample size, the 0.47 lower baseline score (despite the ceiling effect for RAPA1 and MOB-PA scores) in this study indicated a larger potential for increased scores, which did not occur. An alternative possibility is that the MOB/VLL program's recruitment and enrollment processes (which are independent of study enrollment) resulted in enrollees with relatively higher levels of physical activity (Mean baseline RAPA1 score = 5.0, where 5 = "*I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week.*") and lower fear of falling, as indicated by higher ABC scores (Mean baseline ABC score = 69.8, which is just beyond the cut point (67) indicative of an increased risk of falling(47). Both activity scores (MOB-PA and RAPA1) display distinctly bimodal distributions. These findings suggest that a significant percentage of the class enrollees may not reflect the intended population for which the MOB/VLL intervention was designed, and thus may not benefit from participation.

Another possibility is that our outcomes were affected by our collection of subject data independent of the MOB/VLL classroom environment (time, setting, instructors), in contrast to the methods described by Healy(1), Ory(29), and Ullmann(30), by which measures were derived from the program fidelity measures administered in the First Session Survey and Last Session Survey(1, 29), or additional measures were administered as part of the first and last MOB/VLL sessions.(30)

Another possibility is that, while the intervention interval in this study for all but two MOB/VLL classes (20 subjects) was eight weeks (1 session/week), in the Texas MOB/VLL implementation and dissemination study reported by Ory (29) the MOB/VLL intervention was more intense, with 2 sessions/week over four weeks. It may be that the intervention is more effective at this higher intensity level. Alternatively, it is possible that the MOB/VLL intervention is not effective in this sample. The bi-modal distribution of RAPA1 scores could support the theory that high-activity level subjects ($N = 25$) inappropriate for the intervention, obscured a true effect with the remaining low activity population. In the post-hoc analysis of lower RAPA1 scoring subjects, the non-significance of scores changes for the ABC and the MOB-PA persisted, while a large (Cohen's $d = 1.17$) significant score change ($p < .001$) was detected for the RAPA1 variable. Although this supports a conjecture of inappropriate enrollment, caution must be exercised in interpreting these results (the mean of the lower half of a normally distributed variable X may be lower than the mean of an uncorrelated variable Y which has the same range and distribution of X, a mathematically deterministic outcome). Further complicating the interpretation of this analysis, the mean baseline ABC score in this low activity sub-population was actually higher (72.0) than that of the full sample (69.8), which indicates the more highly active subjects removed in this analysis had greater fear of falling, not lesser. Although an intention to treat analysis was conducted, the MOB/VLL model has determined the number of sessions attended at 5 for the enrollee to have "completed" the MOB/VLL class. In the post-hoc analysis of subjects who attended 5 or more sessions, 43 of the 48 follow-up subjects met the "completed" definition. In this group, there were no significant effects of the MOB/VLL intervention on RAPA1, MOB-PA, or ABC scores from baseline to follow-up.

Strengths

The strengths of this study were: 1) use of validated measures of physical activity and fear of falling; 2) recruitment of subjects already enrolled in an upcoming MOB/VLL class, thus reducing recruitment bias to participate in the MOB/VLL program. This method of subject recruitment allowed for the assessment of the MOB/VLL *as implemented*, making the findings more generalizable to the MOB/VLL program both statewide and nationwide.

Limitations

The present study had several limitations. First, the sample was small and only powered to find a moderate effect. A larger sample would have provided more power to examine sub-populations in which clinically significant changes may occur. A second limitation was the lack of a control group in this study. In a cohort of older adults assumed to be limiting their activity due to fear of falling, it is possible that the intervention may have been protective of function, serving to maintain activity levels which might otherwise have declined. Myers et al 1998(48) reported stability in ABC scores (baseline = 65.5, SD = 27.1) of higher functioning community-dwelling older adults over one year, although decline in ABC scores was observed in a retirement community cohort over an 11-week period. Given the similarity of our sample to the higher functioning community-dwelling older adults in the Myers study and the short interval between baseline and follow-up, control group decline during the study interval seems unlikely. A third limitation was the low resolution of the RAPA1 measure, making it relatively insensitive to small changes in physical activity levels. Given the low item number (7) and wide activity range covered by the RAPA1, a change in score of 1 arguably represents a clinically significant change, yet clinical significance may exist at a lower level. A review of the literature did not

uncover reports of MDC for the RAPA. Although the RAPA was selected for its relatively low subject burden, an activity measure such as the Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire(49), validated to detect change over time, may be a better measure to detect smaller changes in this population. However, given the absence of clinically significant changes in the ABC also, the use of a more subject-burdensome self-reported physical activity measure like the CHAMPS would need to be justified, and more objective measures of physical activity (e.g. step counters) should be considered. A fourth limitation was the relatively small number (8) of MOB/VLL classes from which subjects were recruited and from which complete records were obtained. The characteristics of the enrollees in MOB/VLL classes in which class organizers were unwilling or unable to provide recruitment assistance may have been significantly different from that of our sample group. A fifth limitation of this study was its dependence on volunteers from among the MOB/VLL class enrollees. Although the subject recruitment response rate was good (63.5%), over a third of the enrollees did not participate. Individuals who volunteered to be in this study may have varied significantly from the non-subjects in the class. A study in which all enrollees participate, as has been previously reported on in Texas(29) and South Carolina(30) would eliminate potential subject volunteer bias.

Conclusions

This study found no evidence to support an increase in physical activity and/or a reduction in fear of falling following participation in the MOB/VLL program.

Further research is needed to determine the magnitude of the intervention effect in this population, in sub-groups of this population, and if improved MOB/VLL program recruitment and enrollment efforts will better attract older adults for which the program has a therapeutic

effect. A larger sample size from the North Carolina population of MOB/VLL enrollees, with participation of all class enrollees, coupled with objective measures of physical activity, would also allow us to determine both the short term and the longer term effects (including falls reduction) of the MOB/VLL program.

RECOGNITION OF SUPPORT

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Table 1: Sample Characteristics					
Variable	Baseline	Participants followed	Participants not followed	Test Statistic	2-tailed Sig.
N	56	48	8	---	---
Age (SD)	77.8 (9.2)[a]	77.6 (9.5)	79 (7.0)	t = -0.4	p = 0.72
Female N (%)	45 (80.4)	37 (77.0)	8 (100.0)	χ^2 = 2.3	p = 0.13
Hispanic (%)	0 (0)[b]	0 (0)[b]	0 (0)[b]	---	---
Non-Hispanic: American Indian or Alaska Native N (%)	1 (1.8)[c]	0 (0)	1 (12.5)	χ^2 = 6.1	p = 0.01[d]
Non-Hispanic: Black or African American N (%)	8 (14.3)	7 (14.6)	1 (12.5)	χ^2 = 0.2	p = 0.88
Non-Hispanic: White N (%)	47 (83.9)	41 (85.4)	7 (87.5)	χ^2 = 0.6	p = 0.46
Height inches (SD)	64.7 (3.6)	64.7 (3.7)	64.6 (2.9)	t = 0.0	p = 0.97
Weight lbs (SD)	168 (45)	172 (45)	145 (46)	t = 1.6	p = 0.12
Health status [range = 0 – 10] (SD)	6.7 (1.7)	6.7 (1.7)	7.0 (1.8)	t = -0.5	p = 0.64
# Falls in Last Year (SD)	1.6 (2.4)	1.7 (2.6)	0.6 (1.1)	t = 1.2	p = 0.24
# Injurious Falls in Last Year (SD)	0.5 (1.3)	0.6 (1.4)	0 (0)	t = 2.7	p = 0.01
# Treated Falls in Last Year (SD)	0.3 (0.8)	0.3 (0.8)	0 (0)	t = 2.7	p = 0.01
Baseline ABC Score (SD)	70.6 (16.2)	69.8 (16.8)	75.7 (10.5)	t = -0.9	p = 0.38
Baseline RAPA1 Score (SD)	5.0 (1.6)[e]	5.0 (1.6)	4.7 (1.9)[e]	t = 1.4	p = 0.17
Baseline MOB-PA Score (SD)	4.8 (1.6)	4.6 (1.6)	6.0 (0)	t = -5.2	p < 0.01

a: Age data missing n = 1
b: Ethnicity data missing n = 30
c: Also identified self as White
d: χ^2 = 6.1
e: RAPA1 data missing n = 1

Table 2: Paired 2-tailed t-tests of Baseline to Follow-up Scores.							
Measure	N	Baseline Mean (SD)	Follow-up Mean (SD)	Change Mean (SD)	t (df)	2-tailed Sig.	Cohen's *d*
ABC	48	69.8 (16.8)	71.3 (17.8)	1.4 (10.1)	0.98 (47)	p = 0.33	0.08
RAPA1	48	5.0 (1.6)	5.3 (1.4)	0.29 (1.7)	0.91 (47)	p = 0.37	0.17
MOB-PA	35	4.6 (1.7)	4.9 (1.4)	0.29 (1.7)	0.98 (34)	p = 0.33	0.17

Note: available case analysis

Table 3: Paired 2-tailed t-tests of Baseline to Follow-up Scores. Cases with RAPA1≤5.							
Measure	N	Baseline Mean (SD)	Follow-up Mean (SD)	Change Mean (SD)	t (df)	2-tailed Sig.	Cohen's *d*
ABC	23	72.0 (14.7)	72.9 (14.4)	0.9 (8.5)	0.5 (22)	p = 0.61	0.06
RAPA1	23	3.6 (0.9)	5.0 (1.5)	1.4 (1.7)	4.0 (22)	p < 0.01	1.17
MOB-PA	17	4.2 (1.8)	4.5 (1.7)	0.3 (1.6)	0.8 (16)	p = 0.46	0.17

Note: available case analysis

Table 4: Paired Samples T-Tests of Baseline to Follow-up Scores. Cases with Days Attended ≥5.							
Measure	N	Baseline Mean (SD)	Follow-up Mean (SD)	Change Mean (SD)	t (df)	2-tailed Sig.	Cohen's *d*
ABC	43	70.8 (16.4)	72.4 (18.0)	-1.6 (10.4)	-0.6 (42)	p = 0.31	-0.15
RAPA1	43	5.1 (1.6)	5.2 (1.4)	-0.2 (1.9)	-1.0 (42)	p < 0.53	-0.11
MOB-PA	33	4.6 (1.7)	4.9 (1.4)	0.3 (1.8)	-1.0 (32)	p = 0.33	0.17

Note: available case analysis

Figure 1: Consort Chart

```
          ┌──────────────────────────────────────────────┐
          │  Baseline surveys mailed to MOB/VLL           │
          │  enrollees (n = 93)                            │
          └──────────────────────────────────────────────┘
                         │
  ┌───────────┐          │        ┌────────────────────────────────────┐
  │ Enrollment│          ├───────►│ Excluded (n = 37)                  │
  └───────────┘          │        │  • Declined to participate (n = 32)│
                         │        │  • Completed for two people (n = 1)│
                         │        │  • Completed survey too late (n = 4)│
                         │        └────────────────────────────────────┘
                         │
          ┌──────────────────────────────────────────────┐
          │  Valid baseline surveys returned (n = 56)     │
          └──────────────────────────────────────────────┘
                         │
                         │        ┌────────────────────────────────────┐
                         ├───────►│ Missing Baseline Data (n = 14)     │
                         │        │  • Missing ABC data (n = 1)        │
                         │        │  • Missing MOB-PA data (n = 14)    │
                         │        └────────────────────────────────────┘
                         │
  ┌────────────┐   ┌┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┐
  │Intervention│   ┊ MOB/VLL class (8 2-hour             ┊
  └────────────┘   ┊ sessions over 4 or 8 weeks)         ┊
                   └┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈┘
                         │
          ┌──────────────────────────────────────────────┐
          │  Follow-up Surveys mailed (n =                │
          └──────────────────────────────────────────────┘
                         │
  ┌───────────┐          │        ┌────────────────────────────────────┐
  │ Follow-Up │          ├───────►│ Excluded (n = 8)                   │
  └───────────┘          │        │  • Declined to return follow-up    │
                         │        │    survey (n = 8)                  │
                         │        └────────────────────────────────────┘
                         │
          ┌──────────────────────────────────────────────┐
          │  Valid follow-up surveys returned (n =        │
          └──────────────────────────────────────────────┘
                         │
                         │        ┌────────────────────────────────────┐
                         ├───────►│ Missing Follow-up Data (n = 14)    │
                         │        │  • Missing MOB-PA data (n = 14)    │
                         │        └────────────────────────────────────┘
                         │
          ┌──────────────────────────────────────────────┐
          │  Valid follow-up surveys returned (n =        │
          └──────────────────────────────────────────────┘
                         │
  ┌───────────┐   ┌──────────────────────────────────────┐
  │  Analysis │   │  Analysed (n = 48)                   │
  └───────────┘   └──────────────────────────────────────┘
```

Subjects with valid RAPA1 and ABC score records at Follow-up = 48
Subjects with valid MOB-PA score records at Follow-up = 35
Subjects with compete RAPA1, ABC, and MOB-PA scores = 34

Figure 2: Histograms of ABC, RAPA1, and MOB-PA Baseline Variables
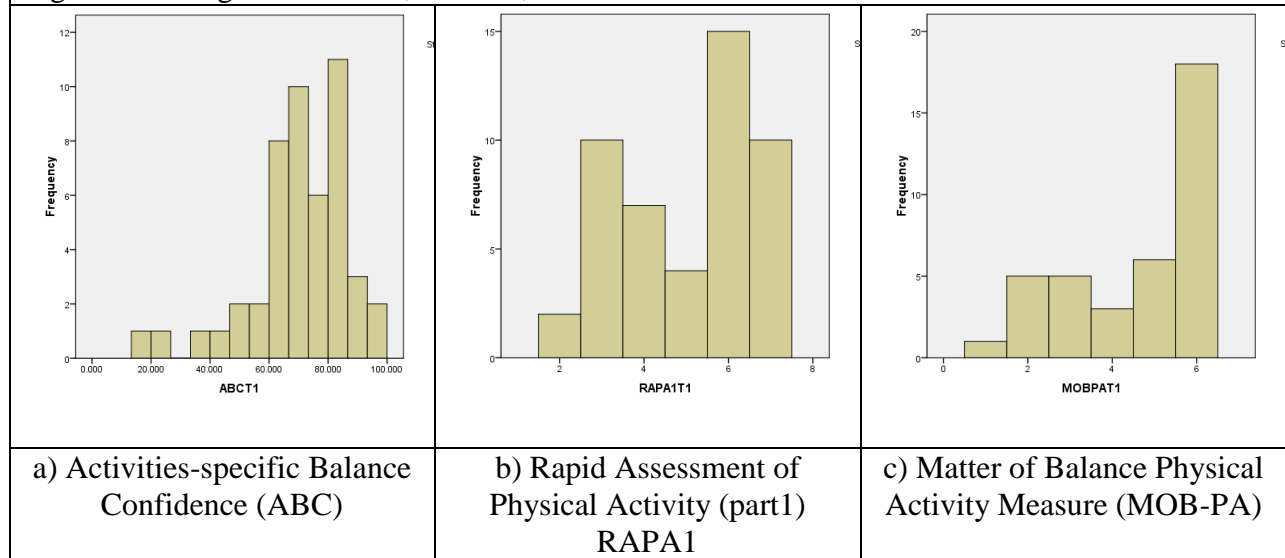
| a) Activities-specific Balance Confidence (ABC) | b) Rapid Assessment of Physical Activity (part1) RAPA1 | c) Matter of Balance Physical Activity Measure (MOB-PA) |

Manuscript 2: Concurrent validity of the MOB/VLL program activity measure (MOB-PA) in community-dwelling older adults.

OVERVIEW

Despite the known benefits of regular physical activity, almost 70% of older adults do not meet the guidelines set by the US Department of Health and Human Services' 2008 Physical Activity Guidelines for Americans. Estimates in the literature of the percentages of older adults who meet physical activity guidelines ranged from 46.9% to 59.7% when measured by self-report, but from only 6.3% to 8.5% when measured by accelerometry. The *A Matter of Balance Volunteer Lay Leader* (MOB/VLL) program was developed in recognition of the downward spiral of deconditioning often associated with fear of falling, and the program is specifically targeted to older adults with a fear of falling and associated activity restriction. The purpose of this study was to determine the concurrent validity of the MOB/VLL program's internal physical activity measure (MOB-PA). Among the MOB/VLL class enrollees (MOB cohort) the MOB-PA concurrent validity was assessed using the aerobic section of the Rapid Assessment of Physical Activity Survey (RAPA1), a validated physical activity measure. Among community-dwelling older adults (Community cohort), the MOB-PA concurrent validity was assessed using both the RAPA1 and StepWatch™ step counters.

Sixty one subjects were recruited from nine classes in North Carolina, 56 of whom completed valid baseline surveys. Incomplete or missing MOB/VLL program records resulted in 42 subjects available for baseline complete-case analysis, of whom 38 (90.5%) responded to the Follow-up Survey. Incomplete or missing MOB/VLL program records resulted in 34 subjects available at follow-up for complete-case analyses.

Twenty three subjects who were recruited from the community to wear step counters completed baseline surveys and wearing of the step counter for at least four out of a total of seven days. Fourteen were later available to participate in the 4 week follow-up portion of the study, all of whom successfully completed the follow-up survey and the second wearing of the step counter.

There were no statistically significant correlations between the MOB-PA scores and RAPA1 scores in the MOB cohort at baseline or follow-up. At baseline, the correlation between the MOB-PA scores and RAPA1 scores in the Community cohort was statistically significant for all subjects (n = 23, r = 0.72, p < .001), as was the relationship between the MOB-PA scores and total daily step counts (TDSC) scores (n = 23, r = 0.44, p = .034). Among the followed subjects, there was no correlation at follow-up between the MOB-PA, the TDSC, or the daily minutes of moderate physical activity (DMMPA). Among the followed subjects, no correlations between the MOB-PA, the TDSC, or the DMMPA at baseline could be computed (all baseline MOB-PA values had the highest possible score of 6). The hypothesis of moderate ($r > = 0.5$) concurrent validity between MOB-PA scores and RAPA1 scores was supported only in the Community cohort (r = 0.72) and only at baseline, not at follow-up. The hypothesis of moderate ($r > = 0.5$) concurrent validity between MOB-PA scores and TDSC scores and DMMPA scores in the Community cohort was not supported at either baseline or follow-up These findings do not provide significant support for the use of the MOB-PA as a measure of physical activity in the MOB/VLL cohort sampled in this study, and cast doubt on previous reports of the efficacy of the MOB/VLL program that have used the MOB-PA measure.

INTRODUCTION

Background

Costs of physical inactivity among older adults are significant and growing in multiple domains, including public health (economics, morbidity, & mortality), family unity (caregiver burden and stress), and the individual (personal finances, mobility, & quality of life).(1) Increased levels of regular physical activity, whether achieved by means of formal structured exercise or leisure and lifestyle activity changes, reverse or reduce multiple comorbidities prevalent in the older adult population, including obesity,(2) diabetes,(3) arthritis,(4) cognitive dysfunction,(5) and hypertension.(6) Despite these known benefits of regular physical activity, almost 70% of older adults do not meet the guidelines set by the US Department of Health and Human Services' 2008 Physical Activity Guidelines for Americans, as measured by self-report(7, 8). A 2011 study of the NHANES 2005-2006 data found that percentages of adults aged 60 years and older who met physical activity guidelines ranged from 46.9% to 59.7% when measured by self-report, but from only 6.3% to 8.5% when measured by accelerometry.(9)

Community-dwelling older adults have been targeted with interventions using a variety of approaches, all with the common goal of increasing their levels of physical activity. These approaches have included group exercise classes,(10) individually tailored exercises, (11, 12) walking programs,(13, 14) Tai Chi,(15) pedometers,(16-21) telephone support programs,(22) education,(10, 23) and social marketing.(24) Many of these programs have been found to improve multiple health outcomes for those older adults who choose to participate. However, many older adults, even when referred by a health care provider to a no-cost exercise program, decline participation.(25)

Among the many factors thought to contribute to this epidemic of inactivity among older adults is fear of falling. Howland and colleagues (26) found that fear of falling was experienced by over half of a sample of older adults in public senior housing, and over half of those who were fearful indicated that they curtailed their activities due to that fear. This self-imposed limiting of activity is theorized to initiate or continue a downward spiral of deconditioning and reduced physical capacity, thereby increasing, not decreasing, the risk of falls and fall-related injuries (27, 28)

Rationale and Significance

Research has demonstrated the short-term efficacy of many interventions designed to increase physical activity among healthy, but inactive, older adults by means of prescribed home-based exercise programs, group-based exercise programs, and 'exercise and encouragement' programs.(29) A wide range of national, regional, and local programs have been created to encourage older adults to be more physically active, often focused on addressing barriers, real or perceived, to exercise by older adults. Public policy programs(30) have been developed to encourage changes in community infrastructure (e.g. roads, sidewalks, crosswalks, public transportation) to create more opportunities for walking for transportation and recreation, as well as better access to exercise facilities. Some community organizations that promote physical activity focus efforts towards multiple segments of society, including older adults.(31) Others focus exclusively on older adult exercise programs.(32, 33)

The *A Matter of Balance Volunteer Lay Leader* (MOB/VLL) program and the original physical therapist-delivered intervention, *A Matter of Balance* (AMOB) program from which it was translated, were developed in recognition of the downward spiral of deconditioning often

associated with fear of falling. The MOB/VLL program is specifically targeted towards older adults with a fear of falling and resultant activity restriction. The goal is to reduce that fear. During the eight, 2-hour sessions of this highly structured cognitive-behavioral intervention, participants are taught to view fear of falls and falls risk as controllable, to set reasonable goals for increased activity, to make environmental changes to reduce falls risk, and to associate increased physical activity with increased strength and balance. This four pronged strategy seeks to reduce fear of falling by increasing self-efficacy for preventing falls and controlling the consequences of a fall.(34)

In 2008, Healy and colleagues (35) reported on measures developed during the AMOB to MOB/VLL translation process to assess fear of falling and level of exercise activity and incorporated into the MOB/VLL fidelity monitoring program. The physical activity measure (MOB-PA) uses a modified version of the first six items of the Physician-Based Assessment and Counseling on Exercise (PACE) instrument developed to measure readiness for exercise. Although MOB-PA scores have been found to increase significantly after participation in MOB/VLL(35), the measure's concurrent validity with standard measures of activity is not known.

The MOB/VLL program has gained popularity in recent years as a low-cost, evidence-based intervention to increase activity and reduce fear of falling among community-dwelling older adults. Over 20,000 older adults across the United States have enrolled in the program since its inception, and more people are being trained as Master Trainers and Coaches each year. Although a low-cost program, it does require personnel and resources from government and private sector organizations that are facing increased budget pressures.

Objectives

The purpose of this study was to determine the concurrent validity of the MOB-PA in community-dwelling older adults using both subjective (RAPA1) and objective (StepWatch™) validated instruments. Subjects were recruited from among enrollees in upcoming MOB/VLL classes (referred to below as the MOB cohort), as the validity of the MOB-PA is most relevant in measuring the outcome of the MOB/VLL intervention. However, due to the purposefully decentralized planning, scheduling, and implementation of MOB/VLL classes in the state of North Carolina, it proved impractical to recruit subjects from among MOB/VLL enrollees to wear StepWatch™ step counters. Therefore, subjects were recruited to wear StepWatch™ step counters from among community-dwelling older adults not currently enrolled in a MOB/VLL class (referred to below as the Community cohort).

The specific aims of this study were to:

1) Determine relationships between MOB-PA scores and RAPA1 scores at baseline and follow-up in both the MOB and Community cohorts.

Hypothesis: The MOB-PA will demonstrate concurrent validity (i.e. r> = 0.5)(36) with the RAPA1 at both time points for both cohorts.

2) Obtain preliminary evidence of the relationship between MOB-PA scores and total daily step counts (TDSC), as measured using an accelerometer-based step counter at baseline and at a four week follow-up in the Community cohort.

Hypothesis: The MOB-PA will demonstrate concurrent validity (i.e. r> = 0.5)(36) with TDSC at both time points for the Community cohort.

3) Obtain preliminary evidence of the relationship between MOB-PA scores and daily

minutes of moderate or greater intensity physical activity (DMMPA) as measured using

an accelerometer-based step counter at baseline and at a four week follow-up in the

Community cohort.

Hypothesis: The MOB-PA will demonstrate concurrent validity (i.e. r> = 0.5)(36) with

DMMPA at both time points for the Community cohort.

METHODS

Study Participants

Participants in this non-randomized repeated measures study were community-dwelling

older adults ages 60 years or older. Subjects were recruited from two sources: for the MOB

cohort, across North Carolina from among individuals who had enrolled in an upcoming

MOB/VLL class; for the Community cohort, from community-dwelling older adults in Chapel

Hill, NC and surrounding communities (see Figure 1).

The only exclusion criteria were being under 60 years of age (and thus outside of the

target age for MOB/VLL recruitment) and an inability to read English to the extent of being

unable to comprehend the recruitment information and survey materials. University of North

Carolina at Chapel Hill Institutional Review Board approval was obtained prior to recruitment.

Recruitment

The registration rolls of MOB/VLL classes were used for recruitment of subjects into the

MOB cohort via methods described in a previous paper. Briefly, researchers provided

recruitment packets to be distributed to participants in upcoming MOB/VLL classes by the

organizations enrolling them. Subjects for the Community cohort were recruited from bulletin board postings and on-site recruitment at a local senior center.

Procedure

The MOB cohort was recruited by mail from among the enrollees of scheduled MOB/VLL classes to participate in the study beginning approximately two weeks prior to the first class session. These enrollees were sent general study information, pre-intervention data collection instruments bound in a single booklet, a gift card selection sheet, and a postage paid envelope for returning the completed survey booklet. Enrollees who consented to be in the study were asked to complete the data collection booklet and the gift card selection sheet and return them in the postage-paid envelope. Gift card incentives of up to $15 ($5 for return of the baseline survey and $10 for return of the follow-up survey) were provided to each subject.

After the end date of the MOB/VLL class, subjects were mailed a second packet with another survey booklet containing the post-intervention data collection booklet and a gift card selection sheet, to be completed and returned in the postage-paid envelope.

The Community cohort, not currently participating in a MOB/VLL class, was recruited from the local community to wear an ankle-attached StepWatch™ step counter for seven full days (37) at baseline and at a 4 week follow-up. Recruitment methods included bulletin board postings and on-site sign-up at a local senior center. Solicitation materials employed recruitment language similar to that of materials the MOB/VLL program used to recruit subjects. Those interested in participating in the study were asked to call or email the principal investigator to learn more and schedule an in-person appointment.

The principal investigator arranged with those interested to meet at the local senior center to obtain their consent, administer the baseline survey and the MOB-PA, configure the step counter, and instruct them in its wear and care. Subjects were instructed to wear the step counter when not sleeping or bathing during the next seven days, and to record in a supplied diary when the step counter was put on and taken off.

Subjects were contacted by phone at least once during the week of recording to promote adherence and answer questions. At the end of the recording interval, the researcher met briefly with each subject to collect the StepWatch™ device and diary. Data were downloaded from the device for analysis. These procedures were repeated after the end of the four week period to obtain the follow-up StepWatch™ measures. Community cohort subjects were provided up to $20 in gift card incentives ($10 at the completion of the baseline data collection and $10 at the completion of the follow-up data collection) for their participation.

Data Sources

The MOB/VLL physical activity measure (MOB-PA) is integral to both the First and Last Session Surveys administered as part of the MOB/VLL class. Within the MOB cohort, access to the First and Last Session Surveys for study subjects was provided by the Be Active North Carolina organization, the central data collection agency for the MOB/VLL program administration records in North Carolina at the beginning of the study, and later the North Carolina Prevention Partners, the interim MOB/VLL data collection agency, or the MOB/VLL hosting organizations. For the Community cohort, the MOB/VLL physical activity measure (MOB-PA) was administered by the researcher at baseline and again at a four week follow-up.

Subjects participated in a seven day step counter data collection following baseline instrument administration and again at a four week follow-up data collection.

Assessment Instruments

The Rapid Assessment of Physical Activity (RAPA)(38) is a questionnaire that quantifies both level and intensity of physical activity and is validated as a self-administered tool. This current study used the aerobic portion of the RAPA (RAPA1) as the outcome measure of physical activity with which the MOB-PA was validated.

The step counter used, the StepWatch™, is validated to provide both average total daily step counts (TDSC) and daily minutes of moderate physical activity (DMMPA). The device is a small smooth ankle-attached water-submergible battery-operated commercial product with no moving or user controls. The StepWatch™ has been found acceptable for long-term wear by older adults in multiple studies.(39-43) Community cohort subjects were asked to wear the device full-time for two seven day intervals,(37, 44) taking it off only to bathe and sleep. The device detects, stores, and retains minute level step counts for up to one month of wear.

Sample Size

Based on the goal of being powered at 80% to detect a moderate correlation ($r = 0.5$), a follow-up sample size of 37 subjects was estimated for the MOB cohort. The aims related to the step-counter study of the Community cohort were exploratory in nature.

Statistical Analysis

Baseline characteristics were computed (mean, range, and distribution) for all subjects, in both cohorts. Comparisons of baseline demographic, self-rated health, and falls variables were made using chi-square for categorical variables and t-tests for continuous variables.

Concurrent validity

Pearson's *r* correlations were calculated between MOB-PA and RAPA1 scores at both baseline and follow-up for both cohorts in a complete case analysis. Additionally, Pearson's *r* correlations were calculated between MOB-PA and TDSC scores and between MOB-PA and DMMPA at both baseline and follow-up for the Community cohort. T-tests for statistical significance with alpha level for each correlation were also calculated.

RESULTS:

MOB Cohort

From the original 93 mailed solicitation packets to enrollees in upcoming MOB/VLL classes, a total of 61 subjects were recruited from nine classes in North Carolina (see Figure 2). Five of these subjects returned invalid First Session Surveys, resulting in a total number of 56 valid First session surveys. MOB/VLL program records, including First Session Surveys (including MOB-PA scores), were incomplete or missing for 14 of these subjects, leaving a total of 42 available for baseline complete-case analysis. Of these initial 42 valid and present MOB-PA subjects, a total of 38 (90.5%) responded to the Follow-up Survey. Last Session Surveys from the MOB/VLL program records were missing for 4 of these responding subjects, leaving a total of 34 subjects available for follow-up complete-case analyses.

Community Cohort

A total of 25 subjects were recruited from the community to wear step counters (see Figure 3). Twenty three of these subjects successfully completed the baseline survey and the wearing of the step counter for at least four out of a total of seven days. Of these baseline subjects, a total of 14 were available to participate in the 4 week follow-up portion of the study. Fourteen subjects successfully completed the follow-up survey and completed the second wearing of the step counter for at least four days out of a total of seven. One of these subjects failed to complete the Follow-up RAPA1.

Sample Characteristics

In comparison to the MOB cohort, the Community cohort was on average 7 years younger (71.7 vs. 78.7 years) and had a higher self-rated health status (7.8 vs. 6.6, scale 0-10). The cohorts did not differ significantly by race, ethnicity, household size, fall history, or baseline RAPA1 scores (see Table 1).

Concurrent validity statistics

MOB Cohort

There were no statistically significant correlations between the MOB-PA scores and RAPA1 scores in the MOB cohort for all subjects at baseline ($n = 42$, $r = 0.24$, p = 0.12) or followed subjects at baseline ($n = 38$, $r = 0.30$, p = 0.06), or for followed subjects at follow-up ($n = 34$, $r = -0.15$, p = 0.94) (see Table 2).

Community Cohort

At baseline, the correlation between the MOB-PA scores and RAPA1 scores in the

Community cohort was found to be statistically significant for all subjects (n = 23, r = 0.72, p <

.001), as was the relationship between the MOB-PA scores and TDSC scores (n = 23, r = 0.44, p

= .03) (see Table 3). Among the followed subjects, there was no correlation at follow-up

between the MOB-PA and the TDSC (n = 14, r = 0.01, p = 0.98) or the DMMPA (n = 14, r = -

0.12, p = 0.67). Among the followed subjects, no correlations between the MOB-PA, the TDSC,

or the DMMPA at baseline could be computed because all baseline MOB-PA values had a score

of 6, the highest possible score.

A post-hoc analysis was conducted in which the correlations between the RAPA1 and the

step counter derived measures of TDSC and DMMPA were calculated. The results are presented

in Table 4. Statistically significant correlations were found between the RAPA1 and both the

TDSC and the DMMPA at baseline. A post-hoc analysis was also conducted of the correlation

from baseline to follow-up of the MOB-PA, RAPA1, TDSC, and DMMPA. The results are

presented in Table 5. The baseline to follow-up correlation of the MOB-PA could not be

computed due to lack of variability in scores at follow-up, The baseline to follow-up correlations

of the RAPA!, TDSC, and DMMPA were significantly correlated (Pearson's r >= 0.66).

Combined Cohort

To assess whether pooling of the two cohorts to increase the power of the analysis was

appropriate, the two cohorts were compared on demographic, falls history, and RAPA1 measures

(see Table 1). The Community cohort was found to be significantly younger (71.7 years) than

the MOB cohort (78.7 years), and rated their health higher (7.8) on an 11-item Likert scale

(range: 0 - 10) than did the MOB cohort (6.6). There were no statistically significant cohort

differences in gender, ethnicity, race, or baseline RAPA1 scores, likely due to both cohorts being

recruited from among community dwelling older adults ages 60 years and above. The

Community cohort subjects were assessed to be similar enough to the MOB cohort, as well as

meeting the eligibility for registering for an MOB/VLL class, that a combined cohort exploratory

MOB-PA and RAPA1 correlational analysis was conducted (see Table 6). At baseline, the

correlation between the MOB-PA scores and RAPA1 scores in the combined cohort was found

to be statistically significant for all subjects (n = *65*, *r* = 0.37, p < .01), as well as for the

followed subjects (n = *52*, *r* = 0.33, p < .02).

DISCUSSION:

The hypothesis of moderate (r> = 0.5) concurrent validity between MOB-PA scores and

RAPA1 scores was supported only in the Community cohort (*r* = 0.72) and only at baseline, not

at follow-up. The hypothesis of moderate (r> = 0.5) concurrent validity between MOB-PA

scores and TDSC scores and DMMPA scores in the Community cohort was not supported at

either baseline or follow-up, although a statistically significant correlation between MOB-PA

scores and TDSC scores was found that approached a moderate level (*r* = 0.44) of concurrent

validity.

In the combined cohort analysis, a statistically significant low concurrent validity was

found between the MOB-PA and the RAPA at baseline for all subjects (*r* = 0.37) and for the

subset of followed subjects (*r* = 0.33). However, as with both of the individual cohorts, there

was no correlation found for the MOB-PA and RAPA1 measures at follow-up.

In all of these analyses, the contrasts between MOB-PA and RAPA1 score correlations and associated p values at baseline vs. follow-up were striking. At baseline, correlations in the MOB, Community, and combined cohorts were $r = 0.24$ ($p = 0.12$), $r = 0.72$ ($p < 0.001$), and $r = 0.37$ ($p < 0.01$), respectively; at follow-up, the correlations were $r = -0.15$ ($p = 0.94$), $r = 0.04$ ($p = 0.67$), and $r = 0.08$ ($p = 0.59$), respectively, suggestive of a fundamentally different relationship between these measures at these two measurement times.

The results of the post-hoc analysis of the correlations between the RAPA1 and the step counter derived measures of TDSC and DMMPA, shown in Table 4, show statistically significant correlations between the RAPA1 and both the TDSC and the DMMPA at baseline, as would be expected for a validated instrument like the RAPA1. However, although the correlations were not statically significant in the follow-up group, possibly due to the smaller sample size (n = 14), the correlations at follow-up ($r = 0.34$ to $r = 0.47$) were consistent with the range at baseline ($r = 0.23$ to $r = 0.57$), affirming the external validity of the RAPA1, and suggesting that the MOB-PA is at best an inconsistent measure of physical activity.

In the Community cohort group, there was no intervention delivered during the four week interval between baseline and follow-up measures, so we expected that all four activity measures (MOB-PA, RAPA1, TDSC, and DMMPA) would be significantly correlated from baseline to follow-up. Calculation of the correlation of baseline to follow-up MOB-PA scores in the Community cohort (no intervention) was not possible due to all baseline MOB-PA scores for followed subjects having a constant value of 6. However, baseline to follow-up scores for all activity measures (RAPA1, TDSC, and DMMPA) were highly correlated. These findings for these activity variables in the no-intervention community cohort, in the absence of correlation data available for the MOB-PA, suggest that the MOB-PA may be a poor instrument for

measuring post-intervention activity levels and/or activity level changes in the MOB/VLL program.

These findings provide new information to allow individual private and public organizations throughout North Carolina (including North Carolina's Area Agencies on Aging, the major funder of the MOB/VLL program in NC) to better assess the value provided by their funded programs, specifically the MOB/VLL program, and inform their future resource allocation decisions.

Strengths

The main strengths of this study were first, the methods which allowed for the recruitment of 'natural' enrollees of upcoming MOB/VLL classes prior to the first session. This method eliminated recruitment bias for participating in the MOB/VLL class, thus drawing the study sample directly from the population of interest. Second was the employment of two validated measures of physical activity in the community cohort with which to assess the concurrent validity of the MOB/VLL program measure of physical activity (MOB-PA).

Limitations

The small sample sizes of the two cohorts, especially the community cohort in which the StepWatch™ step counters were employed, was a significant limitation to the power of the study. Another limitation of each cohort was the skewed distribution of both the MOB-PA and the RAPA1 physical activity measures, with significant ceiling effects observed. Another limitation was the differences in the way in which the MOB-PA was administered in each cohort which may have affected the subjects' responses. In the MOB cohort, the MOB-PA was

administered as an integral component of the MOB/VLL program delivery in the classroom

setting, approximately one week after the completion of the baseline survey, and again one week

prior to the completion of the follow-up survey. In the MOB Community cohort there was no

intervention, so the MOB-PA was administered by the research team immediately after the

completion of the baseline survey, and again immediately after the completion of the follow-up

survey. Another limitation, the lack of a control group in the MOB cohort, eliminated the

opportunity to explore possible explanations for the incongruent correlation findings pre and post

intervention. Similar findings in a control group may have revealed differences in test-retest

properties in the two activity measures. Another limitation was the inability to include in the

study all MOB/VLL class enrollees from each class, thus introducing a study volunteer bias into

the sample.

Conclusions

These findings do not provide significant support for the use of the MOB-PA as a

measure of physical activity in the MOB/VLL cohort sampled in this study, and cast doubt on

previous reports on the efficacy of the MOB/VLL program that have used the MOB-PA

measure. Further study, again using validated measures of physical activity, studying a larger

sample of MOB/VLL enrollees, employing a control group with delayed intervention following a

no-intervention control phase, will provide for a more detailed exploration of the MOB-PA's

reliability, validity, and test-retest characteristics.

RECOGNITION OF SUPPORT

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Table 1: MOB/Community Cohort Baseline Comparisons				
Variable	MOB Cohort	Community Cohort	Test Statistic	2-tailed Sig.
n	42	23	---	---
Age in years (SD)	78.7 (9.9)	71.7 (6.7)	t = 3.05	p < 0.01
Female N (%)	32 (76.2%)	14 (60.8%)	χ^2 = 1.7	p = 0.19
Hispanic N (%)	0 (0%)	0 (0%)	---	---
Non-Hispanic: Black or African American N (%)	7 (16.7%)	1 (4.3%)	χ^2 = 2.1	p = 0.15
Non-Hispanic: American Indian or Alaska Native N (%)	1 (2.4%)	0 (0%)	χ^2 = 2.1	p = 0.15
Non-Hispanic: White N (%)	34 (81.1%)	22 (95.6%)	χ^2 = 2.7	p = 0.10
Health status (mean: 0 – 10)	6.6 (1.6)	7.8 (2.0)	t = -2.5	p = 0.01
Household size (N)	1.8 (0.8)	0.8 (0.8)	t = 0.1	p = 0.92
Fallen (N)	1.5 (2.7)	0.6 (1.2)	t = 1.5	p = 0.14
Injurious Falls (N)	0.5 (1.5)	0.2 (0.7)	t = 0.9	p = 0.37
Baseline RAPA1 Score	5.0 (1.6)	5.5 (1.5)	t = -1.3	p = 0.20

Table 2: MOB Cohort - Concurrent Validity Correlations At Baseline for All Subjects, At Baseline for Followed Subjects, and at Follow-up for Followed Subjects.							
Cohort	Time	Group	Var 1	Var 2	N	Pearson's r correlation	2-tailed Sig.
MOB	Baseline	All	MOB-PA	RAPA1	42	0.24	p = 0.12
MOB	Baseline	Followed	MOB-PA	RAPA1	38	0.30	p = 0.06
MOB	Follow-up	Followed	MOB-PA	RAPA1	34	-0.15	p = 0.94

Table 3: Community Cohort - Concurrent Validity Correlations							
Cohort	Time	Group	Var 1	Var 2	N	Pearson's r correlation	t-tailed Sig.
Community	Baseline	All	MOB-PA	RAPA1	23	0.72	$p < 0.01$*
Community	Baseline	All	MOB-PA	TDSC	23	0.44	$p = 0.04$*
Community	Baseline	All	MOB-PA	DMMPA	23	0.40	$p = 0.06$
Community	Baseline	Followed	MOB-PA	RAPA1	14	---[a]	---[a]
Community	Baseline	Followed	MOB-PA	TDSC	14	---[a]	---[a]
Community	Baseline	Followed	MOB-PA	DMMPA	14	---[a]	---[a]
Community	Follow-up	Followed	MOB-PA	RAPA1	13[b]	0.04	$p = 0.91$
Community	Follow-up	Followed	MOB-PA	TDSC	14	0.01	$p = 0.98$
Community	Follow-up	Followed	MOB-PA	DMMPA	14	-0.12	$p = 0.67$

*: Significant at $p < 0.05$

a: cannot be computed: baseline MOB-PA is a constant value (6) for all followed subjects.

b: 1 missing follow-up RAPA1 score

Table 4: Community Cohort - Concurrent Validity for RAPA1 vs Step Counter measures							
Cohort	Time	Group	Var 1	Var 2	N	Pearson's r correlation	2-tailed Sig.
Community	Baseline	All	RAPA1	TDSC	23	0.57	p < 0.01
Community	Baseline	All	RAPA1	DMMPA	23	0.44	p = 0.04
Community	Baseline	Followed	RAPA1	TDSC	14	0.52	p = 0.06
Community	Baseline	Followed	RAPA1	DMMPA	14	0.23	p = 0.43
Community	Follow-up	Followed	RAPA1	TDSC	13[a]	0.34	p = 0.19
Community	Follow-up	Followed	RAPA1	DMMPA	13[a]	0.47	p = 0.11

a: 1 missing follow-up RAPA1 score

Table 5: Community Cohort – Baseline to Follow-up Activity Measure Correlations						
Cohort	Group	Var 1	Var 2	N	Pearson's r correlation	2-tailed Sig.
Community	Followed	MOB-PA	MOB-PA	14	---[a]	---[a]
Community	Followed	RAPA1	RAPA1	13	0.78	$p < 0.001$
Community	Followed	TDSC	TDSC	14	0.87	$p < 0.001$
Community	Followed	DMMPA	DMMPA	14	0.66	$p = 0.01$

a: cannot be computed . Baseline MOB-PA was a constant value (6) for all followed subjects.

Table 6: Combined MOB and Community Cohorts - Concurrent Validity Correlations							
Cohort	Time	Group	Var 1	Var 2	N	Pearson's r correlation	2-tailed Sig.
MOB&Com	Baseline	All	MOB-PA	RAPA1	65	0.37	p < 0.01
MOB&Com	Baseline	Followed	MOB-PA	RAPA1	52	0.33	p = 0.02
MOB&Com	Follow-up	Followed	MOB-PA	RAPA1	47	0.08	p = 0.59

Figure 1: Study Timeline - Cohort Measure Collection Sequences

MOB Cohort	PA Instruments: *RAPA1*	MOB/VLL Class *MOB-PA (Session 1)* *MOB-PA (Session 8)*	PA Instruments: *RAPA1*
Community Cohort	PA Instruments: *RAPA1* *MOB-PA* *StepWatch™*		PA Instruments: *RAPA1* *MOB-PA* *StepWatch™*
	Baseline	4 or 8 weeks interval	Follow-up
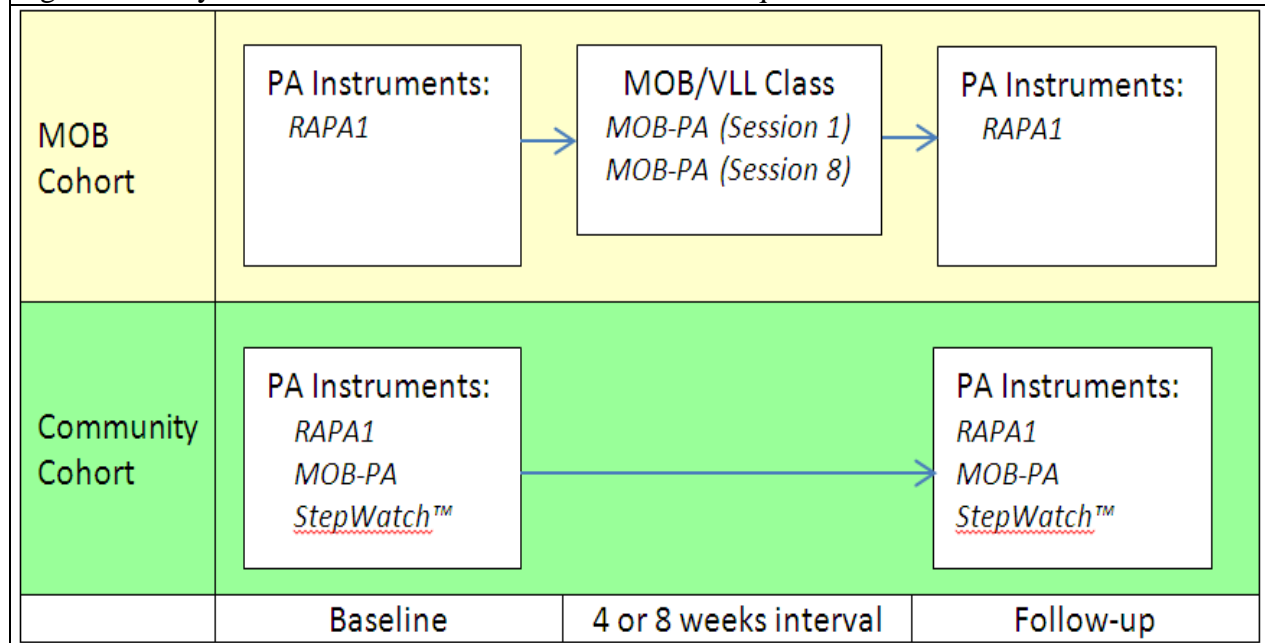
Figure 2: Consort Chart – MOB Cohort

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                    ┌─────────────────────────────────────────────┐
                    │ Baseline surveys mailed to MOB/VLL enrollees │
                    │                  (n = 93)                    │
                    └─────────────────────────────────────────────┘
                                        │
                                        │        ┌──────────────────────────────────────┐
                                        │        │ Excluded (n = 37)                    │
  ┌──────────────┐                      │        │  • Declined to participate (n = 32)  │
  │  Enrollment  │                      ├───────▶│  • Completed for two people (n = 1)  │
  └──────────────┘                      │        │  • Completed survey too late (n = 4) │
                                        │        └──────────────────────────────────────┘
                                        ▼
                    ┌─────────────────────────────────────────────┐
                    │ Valid baseline surveys returned (n = 56)     │
                    └─────────────────────────────────────────────┘
                                        │
                                        │        ┌──────────────────────────────────────┐
                                        │        │ Missing Baseline Data (n = 14)       │
                                        ├───────▶│  • Missing ABC data (n = 1)          │
                                        │        │  • Missing MOB-PA data (n = 14)      │
                                        │        └──────────────────────────────────────┘
                                        ▼
  ┌──────────────┐      ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
  │ Intervention │         MOB/VLL class (8 2-hour
  └──────────────┘      │  sessions over 4 or 8 weeks)              │
                        └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
                                        ▼
                    ┌─────────────────────────────────────────────┐
                    │ Follow-up Surveys mailed (n =                │
                    └─────────────────────────────────────────────┘
                                        │
                                        │        ┌──────────────────────────────────────┐
  ┌──────────────┐                      │        │ Excluded (n = 8)                     │
  │  Follow-Up   │                      ├───────▶│  • Declined to return follow-up      │
  └──────────────┘                      │        │    survey (n = 8)                    │
                                        ▼        └──────────────────────────────────────┘
                    ┌─────────────────────────────────────────────┐
                    │ Valid follow-up surveys returned (n =        │
                    └─────────────────────────────────────────────┘
                                        │
                                        │        ┌──────────────────────────────────────┐
                                        ├───────▶│ Missing Follow-up Data (n = 14)      │
                                        │        │  • Missing MOB-PA data (n = 14)      │
                                        ▼        └──────────────────────────────────────┘
                    ┌─────────────────────────────────────────────┐
                    │ Valid follow-up surveys returned (n =        │
                    └─────────────────────────────────────────────┘
                                        ▼
  ┌──────────────┐    ┌───────────────────────────────────────────────────────────────┐
  │   Analysis   │    │                      Analysed (n = 48)                         │
  └──────────────┘    │ Excluded from some analyses due to incomplete data (n = 14)    │
                      └───────────────────────────────────────────────────────────────┘
```

Figure 3: Consort Chart – Community Cohort

Enrollment

Subjects initially recruited (n = 25)

Excluded (n = 2)
- Unable to comprehend/complete survey (n = 2)

Valid baseline surveys completed (n = 23)

Step counters configured, attached, sent out, and returned (n = 23)

Excluded (n = 2)
- Failed to meet minimum days of step counter wear. (n = 2)

Intervention

4 week interval (no intervention)

Contacted for follow-up (n = 21)

Excluded (n = 7)
- Unable to schedule. (n = 7)

Follow-Up

Valid follow-up surveys completed. Step counters configured, attached, sent out, and returned (n = 14)

Analysis

Analysed (n = 14)
Excluded from some analyses due to incomplete data (n = 1)

Manuscript 3: Development of a regression model to predict physical activity change among community-dwelling older adults following participation in the MOB/VLL program.

OVERVIEW

Only 30% of community dwelling adults 65 years of age and older are physically active, 19% are insufficiently active, and 51% are classified as inactive. Fear of injury, intimidation, and boredom, along with insufficient time, self-discipline, and motivation, have all been identified as barriers to participating in regular physical activity. Physical inactivity among older adults, which is prevalent, is associated with a multitude of co-morbidities.

The A Matter of Balance Volunteer Lay Leader Model (MOB/VLL) program is a cognitive restructuring intervention based on the work of Lachman and colleagues, with the goals of reducing fear of falling and increasing functional, physical, and social activity in older adults. The program is targeted at adults in the community 60 years of age and older who are ambulatory, able to problem-solve, and are "concerned about falling." No explicit screening for admission based on activity level or fear of falling is required. The purpose of this study was to develop a regression model, based on individual subject characteristics, to predict physical activity change (RAPA1Diff) among community-dwelling older adults following participation in the MOB/VLL program. Pearson's product moment and point-biserial correlations for the individual factors were considered for model entry. The only variable significantly correlated with the change in physical activity from baseline to follow-up (RAPA1Diff) was the baseline physical activity (RAPA1) ($r = -0.74$, $p < 0.001$). The regression model ($Y = b_0 + b_1*x = 4.39 - 0.82*RAPA1$) accounted for almost half of the variance ($r^2 = 47.9\%$) in the RAPA1Diff scores, with high significance ($df = 47$, $F = 42.25$, $p < 0.001$).

The regression model developed indicates that the only significant predictor of changes in physical activity level as a result of participation in an MOB/VLL class was baseline physical activity. This regression model is of limited value, providing no guidance to program implementers regarding which enrollees may derive the most benefit from participating in the program. Using the model to justify denial of enrollment to highly active older adults would at this point be an over interpretation of the model, as the model may only reflect a regression to the mean of physical activity scores.

INTRODUCTION

Background

The concluding sentence of the summary of the Position Stand of the American College of Sports Medicine regarding "Exercise and Physical Activity for Older Adults" published in 2009 reads; 'All older adults should engage in regular physical activity and avoid an inactive lifestyle'.(1) This recommendation reflects the mounting body of evidence that physical inactivity among older adults, which is prevalent and growing,(2) is associated with a multitude of co-morbidities, including arthritis,(3-5) cognitive dysfunction,(6-8) depression,(9) diabetes,(10) frailty,(11) functional status decline,(12) hypertension,(13) and obesity.(14) The World Health Organization (WHO),(15) the U.S. Department of Health and Human Services (DHHS),(16) the Centers for Disease Control and Prevention (CDC), and the American College of Sports Medicine (ACSM)(1) are among the multiple national and international organizations that have issued recommendations and guidelines for physical activity for older adults. These recommendations share common fundamental characteristics, primarily that engaging in 150 minutes of moderate-intensity or greater physical activity per week is a threshold for adequate physical activity among older adults, and that this activity should be engaged in for bouts of 10 minutes or longer.(16, 17) Older adults engaging in less than this are considered insufficiently physically active, and those engaging in less than 10 minutes of moderate-intensity or greater physical activity per week are considered physically inactive.

Carlson and colleagues(18) analyzed 10 years of National Health Interview Survey data, and found that by the criteria cited above only 30% of community dwelling adults 65 years of age and older were physically active, 19% were insufficiently active, and over half (51%) were classified as inactive. Fear of injury, intimidation, and boredom, along with insufficient time,

self-discipline, and motivation, were all identified as barriers to participating in regular physical activity among inactive older adults interviewed in focus groups at a continuing care retirement community.(19) Other researchers have provided more quantitative measures of the prevalence of fear of falling among older adults, providing estimates ranging from 26%(20) to 74%.(21) Although one third of older adults who experience a fall develop a fear of falling,(21) fear of falling may develop in the absence of a fall based on a personal perception of fall risk.(22, 23) Although some older adults with a fear of falling remain physically active,(19) for many the fear of falling leads to a gradual discontinuation of regular physical activity and reduced social activity.(24)

Rationale and Significance

The A Matter of Balance Volunteer Lay Leader Model (MOB/VLL) program is based on Tennstedt and colleagues' A Matter of Balance (MOB) program,(25) which was developed as a cognitive restructuring intervention based on the work of Lachman and colleagues.(26) Both programs have the goals of reducing fear of falling and increasing functional, physical, and social activity in older adults.(25, 27)

The MOB/VLL program is targeted at adults in the community 60 years of age and older who are ambulatory, able to problem-solve, and are "concerned about falling."(27) No explicit screening for admission based on activity level or fear of falling is required. Its multi-modal intervention approach, including, didactic presentation, video testimonials, lecture materials, group discussion, group problem-solving, and exercise demonstration and practice has proven popular with many older adults, as evidenced by its growing level of implementation. Over

20,000 community-dwelling older adults in the United States and Canada have enrolled in an MOB/VLL program(10), and enrollment continues.

Objective

The purpose of this study was to develop a regression model, based on individual subject characteristics, to predict physical activity change among community-dwelling older adults following participation in the MOB/VLL program. Our expectation was that identification of single and combined predictors of activity change would enable targeting of MOB/VLL recruitment efforts to facilitate enrollment of older adults most likely to benefit from program participation.

The regression model used was based on a physical activity model developed for this study (see Figure 1) based on the Theory of Planned Behavior, (28). In addition to instruments measuring fear of falling and physical activity restriction due to fear of falling, new measures for outcome expectations for increased physical activity and self-efficacy for increased physical activity, modified for this study from measures reported in the literature(29, 30), were among the predictor variables. Other model components, including attitude toward physical activity, subjective norms for physical activity, perceived behavioral control of increased physical activity, and the intention to increase physical activity, were not measured in this study.

METHODS

Study Participants

The design of this study was a pre-post intervention observation with no control group. The study included community-dwelling older adults 60 years of age and older enrolled in

upcoming regular MOB/VLL classes offered throughout the state of North Carolina. As this study's aim was to determine the characteristics of the enrollees that best predicted participation success, as measured by increased physical activity, only participants who were younger than 60 years of age or unable to read or write English were excluded. This study was approved by the University of North Carolina at Chapel Hill Institutional Review Board prior to subject recruitment. Subjects were provided information about the study along with the data collection survey. Informed consent was implied by return of the survey.

Recruitment

Recruitment was based on the registration rolls of upcoming regular MOB/VLL classes offered throughout the state of North Carolina. The instructors in the MOB/VLL classes, known as Coaches, were asked to assist with subject recruitment by directly addressing and mailing subject recruitment packets to the class enrollees. This process maintained confidentiality and privacy of MOB/VLL enrollees to the investigators prior to recruitment.

Procedure

The recruitment packets, mailed approximately two weeks prior to the first session, contained a letter outlining the focus of the study and describing the steps for consent and participation in the study, a survey booklet containing all of the questionnaires and survey tools required for the baseline data collection of the study, a gift card selection form, and a pre-paid pre-addressed return envelope. After reviewing the study information, subjects indicated consent by completing and returning the survey. As an incentive for their participation, subjects in this study were offered a gift card ($5 for the baseline survey and $10 for the follow-up survey) from

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one of four national merchants. Potential recruits were unknown to the research team unless and until they responded affirmatively by mail to the research solicitation mailing.

Data Sources

Data were obtained directly from subjects by means of the Baseline Survey (pre-intervention) and the Follow-up Survey (post-intervention) booklets. The Baseline Survey booklet contained a general demographic, health, and falls survey, and the multiple assessment instruments described below. The Follow-up Survey booklet contained the same assessment instruments as the baseline survey booklet.

Additionally, data were obtained from the MOB/VLL program records collected and maintained in the State of North Carolina by *Be Active NC*, a 501(c)(3) corporation, and subsequently, *North Carolina Prevention Partners* a 501(c)(3) corporation, which had assumed, on an interim basis, *Be Active NC*'s MOB/VLL data repository functions. These records included attendance records and the First and Last Session Surveys administered and collected by the MOB/VLL Coaches as part of the program's established self-evaluation procedures.

Assessment Instruments

Included in both surveys was the Activities-specific Balance Confidence (ABC) scale which, as Powell and Meyers(31) expressed it, assesses fear of falling "by operationalizing 'fear of falling' as a continuum of self-confidence." The ABC uses an 11-point Likert scale to rate an individual's level of confidence in remaining steady and not losing balance while performing the 16 different activities listed. Also included in both surveys was the Rapid Assessment of Physical Activity (RAPA) scale for assessing physical activity level(32). The RAPA1 (the

aerobic portion of the RAPA) consists of 7 statement selections in response to the question,

"How physically active are you?" An example item: *I do 30 minutes or more a day of moderate physical activities, 5 or more day a week. Yes No (circle one)"*. Possible scores range from 1 to 7, based on the highest numbered item circled. Both the ABC and the RAPA have been validated for self-administration in the population and well described in the literature.(33, 34)

Also included was the Fear of Falling Avoidance Behavior Questionnaire (FFABQ), a self-administered 14-item tool recently developed by Landers and colleagues (35) to quantify activity avoidance behavior due to fear of falling. The FFABQ uses a 14 item 5-point Likert scale, with higher scores reflecting greater avoidance behavior or activity restriction. The FFABQ has a test-retest reliability of 0.81 and a correlation of -0.68 with the ABC, indicating that the constructs of balance confidence and activity restriction due to fear of falling are (inversely) related but not perfectly. In addition, two measures modified from existing measures were administered and are described below.

Outcome Expectation Assessment for Increased Physical Activity (OEIPA)

The OEIPA scale is based on the Outcome Expectations for Exercise (OEE) scale, a nine item 5-point Likert scale tool developed(36) and validated(30) by Resnick and colleagues to measure outcomes expectations for exercise in older adults.(30, 36) The OEIPA (see Appendix A) retains the same items and scale as the OEE but modifies the wording to refer to expectations for increased physical activity rather than for exercise (e.g. "Increasing my physical activity would make me feel more mentally alert.") Examples of ways to increase physical activity are given to help illustrate the general meaning of the term physical activity.

Exercise Self-efficacy Assessment for Increased Physical Activity (SEIPA)

The SEIPA scale is based on the Self-Efficacy for Exercise (SEE) scale, a nine-item tool developed and validated by Resnick and colleagues(29) to measure self-efficacy for exercise in older adults in the presence of specific barriers to exercise presented in the items. The SEIPA (see Appendix B) retains the same items and 11-point Likert scale as the SEE but modifies the wording to refer to self-efficacy for increased physical activity rather than for exercise (e.g. "How confident are you right now that you could increase your regular weekly physical activity if the weather was uncomfortable (or unpleasant)?") As with the OEIPA, examples of ways to increase physical activity are given to help illustrate the general meaning of the term physical activity.

Sample Size

Details of sample size calculations are presented in an earlier manuscript. In summary, as this study sought to develop a regression model for increased physical activity immediately (within two weeks) following completion of the MOB/VLL program (when motivation for activity is theorized to be at or near maximum), the study was designed with a sample large enough to detect a moderate effect size ($r> = 0.5$) at 80% power. Based on the literature, we estimated a conservative intra-class correlation of 0.025 for the physical activity outcome variable (RAPA1), resulting in a sample size estimate of 37 subjects at follow-up. Anticipating a conservative 35% attrition rate from baseline to follow-up, the target baseline recruitment sample size was estimated to be 57. Using a conservative recruitment estimate of 30%, the recruitment effort was designed for a maximum of 194 solicitation mailings.

Statistical Analysis

All statistical analyses were conducted using SPSS v16.0 for Windows. Pearson's product moment correlations were computed for age and baseline RAPA1, ABC, SEIPA, OEIPA, and the FFABQ with the primary outcome variable of physical activity change as measured by the difference in RAPA1 scores (RAPA1Diff) from baseline to follow-up. Point-biserial correlations were computed for gender, race (white/other), and experiencing one or more falls in the last year with the primary outcome variable of physical activity as measured by the RAPA1Diff. Variables with statistically significant (2-tailed) correlations were entered into a simultaneous linear regression analysis to develop a model for predicting increase in post-intervention physical activity level. The alpha level was set at 0.05 for all statistical analyses.

RESULTS

A total of 93 baseline survey packets were delivered to enrollees of upcoming MOB/VLL classes (see Figure 2). Sixty one surveys (response rate = 65.6%) were returned, 56 of which were valid (one was filled out for two people, and four were completed after the beginning of the intervention). Of the 56 follow-up surveys mailed out at the completion of the intervention, 48 (attrition rate = 14.3%) were received, all of them valid. The data from these 48 subjects were used for the regression analysis.

Table 2 presents the results of the Pearson's product moment and point-biserial correlations for the individual factors to be considered for model entry. The only variable significantly correlated with RAPA1Diff was baseline RAPA1 ($r = -0.74$, $p < 0.001$). In order to uncover any possible suppressor variables, all variables were forced into the linear regression

model. (see Table 2). Although the RAPA1 and the RAPA1Diff are ordinal, not interval or ratio data, an ordinal regression was not used due to excessive number of cells (57.4%) with zero frequencies. The linear relationship between the RAPA1Diff with baseline RAPA1 was verified by scatterplot inspection (see Figure 3), as was the absence of significant outliers. The Durbin-Watson statistic value was 2.0, indicating no linear residual correlation. Homoscedasticity was confirmed by ANOVA (Levine's Statistic = 1.08, p = 0.38). Examination of the Normal P-P plot of regression standardized residuals (see Figure 4) shows non-random scatter with a moderately constant spread with no outliers; therefore the residuals appeared to be normally distributed. After the validity of the linear regression assumptions was confirmed, the linear regression model was run. The regression model ($Y = b_0 + b_1*x = 4.39 -0.82*RAPA1$) accounted for almost half of the variance ($r^{2 =} 47.9\%$) in the RAPA1Diff scores, with significance (F = 42.25, p < 0.001). Post-hoc correlation and regression analyses were conducted on three subsets of this dataset: a) subjects who had attended 5 or more sessions (the MOB/VLL program's definition of successful completion(25)) ; b) subjects with lower levels of baseline physical activity (RAPA1<= 4); and c) subjects with greater self-reported fear of falling (ABC < 67, the cut point for increased falls risk(34)). In none of these post-hoc analyses (see Tables 3, 4, & 5) were baseline variables other than the RAPA1 correlated with the RAPA1Diff. Specifically, each of the three instruments tested for inclusion in the regression model, the Outcome Expectations for Increased Physical Activity (OEIPA) scale, the Self-Efficacy for Increased Physical Activity (SEIPA) scale, and the Fear of Falling Avoidance Behavior Questionnaire (FFABQ), was expected to detect changes in factors affecting physical activity engagement that were the specific targets of the MOB/VLL intervention. Not only did each variable fail to be correlated with changes in physical activity levels from baseline to follow-up, there were no statistically

significant changes between baseline and follow-up in any of the three measures (OEIPA: Mean = 17.2, SD = 4.6, t = -0.27, p = 0.79; SEIPA: Mean = 45.7, SD = 19.4, t = 1.10, p = 0.28; FFABQ: Mean = 20.0, SD = 14.3, t = 0.95, p = 0.35).A scatter plot of baseline RAPA1 scores and follow-up RAPA1scores was generated (see Figure 5). Post-hoc correlation analysis of the baseline RAPA1 scores and follow-up RAPA1scores was also conducted (Pearson's Correlation = 0.20, p = 0.16).   A paired sample t-test comparison of the baseline RAPA1 scores and follow-up RAPA1scores found no significant difference. (n = 48, t = 0.91, df = 47, p = 0.37).

DISCUSSION

The regression model developed indicates that the only significant predictor of changes in physical activity level as a result of enrollment in an MOB/VLL class was baseline physical activity. The lower a subject's physical activity at baseline, the more likely that subject was to have increased physical activity at the completion of the class. Conversely, the higher a subject's physical activity at baseline, the more likely that subject was to have decreased physical activity at the completion of the class. This apparent "regression to the mean" suggests a low correlation between baseline RAPA1 scores and follow-up RAPA1scores, confirmed by a visual inspection of their scatter plot (see Figure 5) and the correlation analysis. The paired t-test comparison of the baseline RAPA1 scores and follow-up RAPA1scores found no evidence to support a change in physical activity levels from baseline to follow-up. This was in contrast to the finding of Tennstedt and colleagues(25) (see Table 7), who reported increased "activity level' based on the Social Behavior and the Mobility Range scores of the Sickness Impact Profile (SIP) and on an Intended Activity scale developed for their study, although the effect sizes were reported as

small. The current study was powered to detect a moderate or greater effect and used a different activity measure, which may account for the differences in the findings.

Strengths

The primary strength of this study was the direct recruitment of older adults who had already made the decision to enroll in an MOB/VLL class. This improved the likelihood that the sample was more representative than one from a study that recruited and selected subjects, based on the theoretical basis of the MOB/VLL intervention, who were most likely to benefit from the intervention. A second strength was the use of a validated measure of physical activity administered outside of the MOB/VLL class environment, eliminating the risk of subject bias due to setting.

Limitations

One limitation of this study was the incomplete measurement and inclusion of our theorized antecedent constructs of increased physical activity (attitude toward physical activity, subjective norms for physical activity, perceived behavioral control of increased physical activity, and the intention to increase physical activity). It is possible that one or more of these factors, had they been measured, would have been correlated with change in physical activity.

A significant limitation in this study was the use of a self-report measure for physical activity (subject to recall and response biases), rather than more objective instrumented methods, such as accelerometers and step counters. Efforts to recruit a subset of this sample to wear step counters pre and post intervention were not successful due to the longer lead time needed for recruitment and in-person assessment and step counter configuration, which was in conflict with

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the short interval between organizational decisions to hold MOB/VLL classes and the first MOB/VLL session. The inability to recruit entire MOB/VLL class cohorts introduced the possibility of subject volunteer bias. Because of the need for recruitment cooperation and assistance from MOB/VLL hosting organizations, sampling frame access bias may have been present.

Conclusions

The developed regression model is of limited value, providing no guidance to program implementers regarding which enrollees may derive the most benefit from participating in the program. Although the regression model may be used to argue for the denial of enrollment of highly active older adults, this would seem to be an over interpretation of the model, as the model may only reflect a regression to the mean of physical activity scores, and other benefits from program participation that were not the subject of this study may accrue to MOB/VLL graduates. Further research is needed using a larger sample, a more objective measure of physical activity, and multiple follow-up intervals to better determine the personal and program factors related to the achievement of MOB/VLL outcome goals.

RECOGNITION OF SUPPORT

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Table 1: Descriptive Statistics				
Variable	n	Value	SD	Range
Age	42	78.4	9.9	60 - 97
Female N (%)	42	32 (76.2)	---	---
Hispanic (%)	27	0 (0%)	---	---
Non-Hispanic: American Indian or Alaska Native N (%)	42	1 (2.4%)	---	---
Non-Hispanic: Black or African American N (%)	42	7 (16.7%)	---	---
Non-Hispanic: White N (%)	42	34 (81%)	---	---
Height inches	42	64.8	3.6	57 - 74
Weight lbs	42	168.0	46.4	100 - 350
Health status [range = 0 – 10]	40	6.6	1.6	2 - 9
# Falls in Last Year	41	1.5	2.7	0 - 13
# Injurious Falls in Last Year	41	0.5	1.5	0 – 8
# Treated Falls in Last Year	41	0.3	0.8	0 – 4
Baseline RAPA1 Score	42	5.0	1.6	2 - 7
Baseline ABC Score	42	68.1	16.5	14.4 – 90.6
Baseline SEIPA Score	41	44.1	19.8	6 - 85
Baseline OEIPA Score	42	17.0	4.4	9 - 27
Baseline FFABQ Score	41	19.8	12.9	2 - 56

Table 2: Pearson's product moments and point-biserial correlations between Predictor and Dependent Variables			
Variable	N	Correlation Coefficient	Significance (2-tailed)
Age	48	-0.17	p = 0.26
RAPA1	48	-0.69	p < 0.001
ABC	48	-0.06	p = 0.67
SEIPA	47	-0.11	p = 0.45
OEIPA	48	0.00	p = 0.99
FFABQ	46	0.01	p = 0.95
Gender	48	0.18	p = 0.22
1 or more falls in past year	48	0.16	p = 0.28
Race (White vs. non-white)	48	-0.01	p = 0.96
Sessions Attended (0 – 8)	48	-0.12	P = 0.43

Table 3: Linear regression model for RAPA1Diff					
Model	Unstandardized Coefficients		Standardized Coefficients	t	2-tailed Sig.
	Beta	Std. Error	Beta		
(Constant)	4.39	0.67	------	6.58	$p < 0.001$
RAPA1	-0.82	0.13	-0.69	-6.50	$p < 0.001$
$Y = b_0 + b_1*x = 4.39\ -0.82*RAPA1$					

Table 4: Post-hoc Analysis of subjects completing 5 or more classes. Pearson's product moment and point-biserial correlations with RAPA1Diff			
Variable	N	Correlation Coefficient	Significance (2-tailed)
Age	43	-0.19	= 0.23
RAPA1	43	-0.71	P < 0.001
ABC	43	-0.11	p = 0.50
SEIPA	42	-0.09	p = 0.59
OEIPA	43	-0.04	p = 0.82
FFABQ	41	-0.01	p = 0.96
Gender	43	0.17	p = 0.27
1 or more falls in past year	42	0.20	p = 0.21
Race (White vs. non-white)	43	-0.02	p = 0.88
Sessions Attended (0 – 8)	43	-0.03	p = 0.88

Table 5: Post-hoc Analysis of subjects with low baseline activity scores. Pearson's product moment and point-biserial correlations with RAPA1Diff			
Variable	N	Correlation Coefficient	Significance (2-tailed)
Age	23	0.14	p = 0.52
RAPA1	23	-0.46	p = 0.03
ABC	23	-0.33	p = 0.12
SEIPA	22	-0.01	p = 0.98
OEIPA	23	-0.06	p = 0.79
FFABQ	21	0.05	p = 0.84
Gender	23	0.38	p = 0.07
1 or more falls in past year	23	0.04	p = 0.84
Race (White vs. non-white)	23	0.02	p = 0.92
Sessions Attended (0 – 8)	23	-0.09	p = 0.68

Table 6: Post-hoc Analysis of subjects with increased fear of falling (ABC $<= 67$) Pearson's product moment and point-biserial correlations with RAPA1Diff			
Variable	N	Correlation Coefficient	Significance (2-tailed)
Age	16	-0.43	p = 0.12
RAPA1	16	-0.70	P < 0.01
ABC	16	0.06	p = 0.84
SEIPA	16	0.14	p = 0.60
OEIPA	16	-0.18	p = 0.51
FFABQ	15	-0.23	p = 0.41
Gender	16	0.08	p = 0.77
1 or more falls in past year	15	0.34	p = 0.22
Race (White vs. non-white)	16	-0.34	p = 0.20
Sessions Attended (0 – 8)	16	-0.12	p = 0.65

Table 7: Comparison of key characteristics and demographics of MOB & MOB/VLL studies					
Author	Tennstedt	Healy	Ory	Ullmann	Palmer
Year	1998	2008	2010	2012	2013
Baseline N	434	335	2690	150	56
1 week post-intervention Follow-up N (%)	388 (89.4%)	243 (72.5%)	1577 (58.6%)	113 (75.3%)	48 (85.7%)
4 week post-intervention Follow-up N (%)	388 (89.4%)	243 (72.5%)	1577 (58.6%)	113 (75.3%)	48 (85.7%)
Age (SD)	77.8 (7.7)	78.7 (8.3)	77	75.4 (9.7)	77.8 (9.2)
Range	60-100	51-95	---	---	60-97
Female	89.60%	89.90%	83%	86%	80.40%
White	90.80%	88%	70%[a]	40%	83.90%
Fell in last 3 months	25%	28%	---	---	---
Fell in last year	---	---	---	---	58%

Figure 1: Physical Activity (PA) Theoretical Framework for Study (based on the *Theory of Planned Behavior*) (highlighted boxes are targets of the MOB/VLL program.)
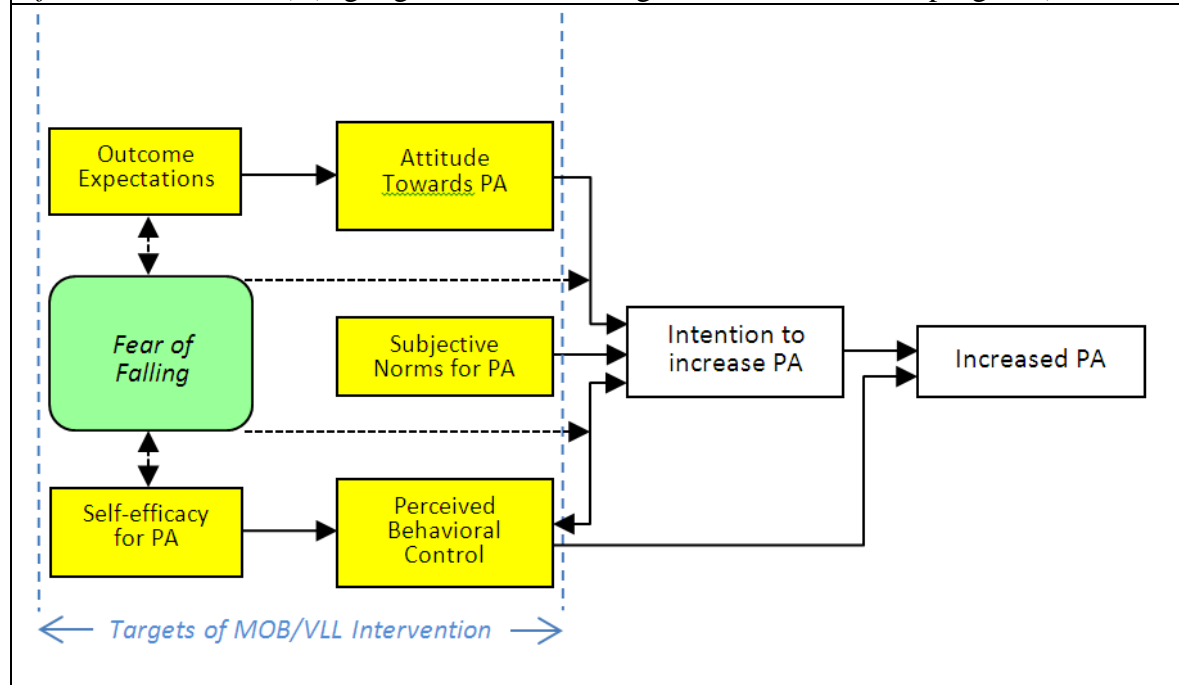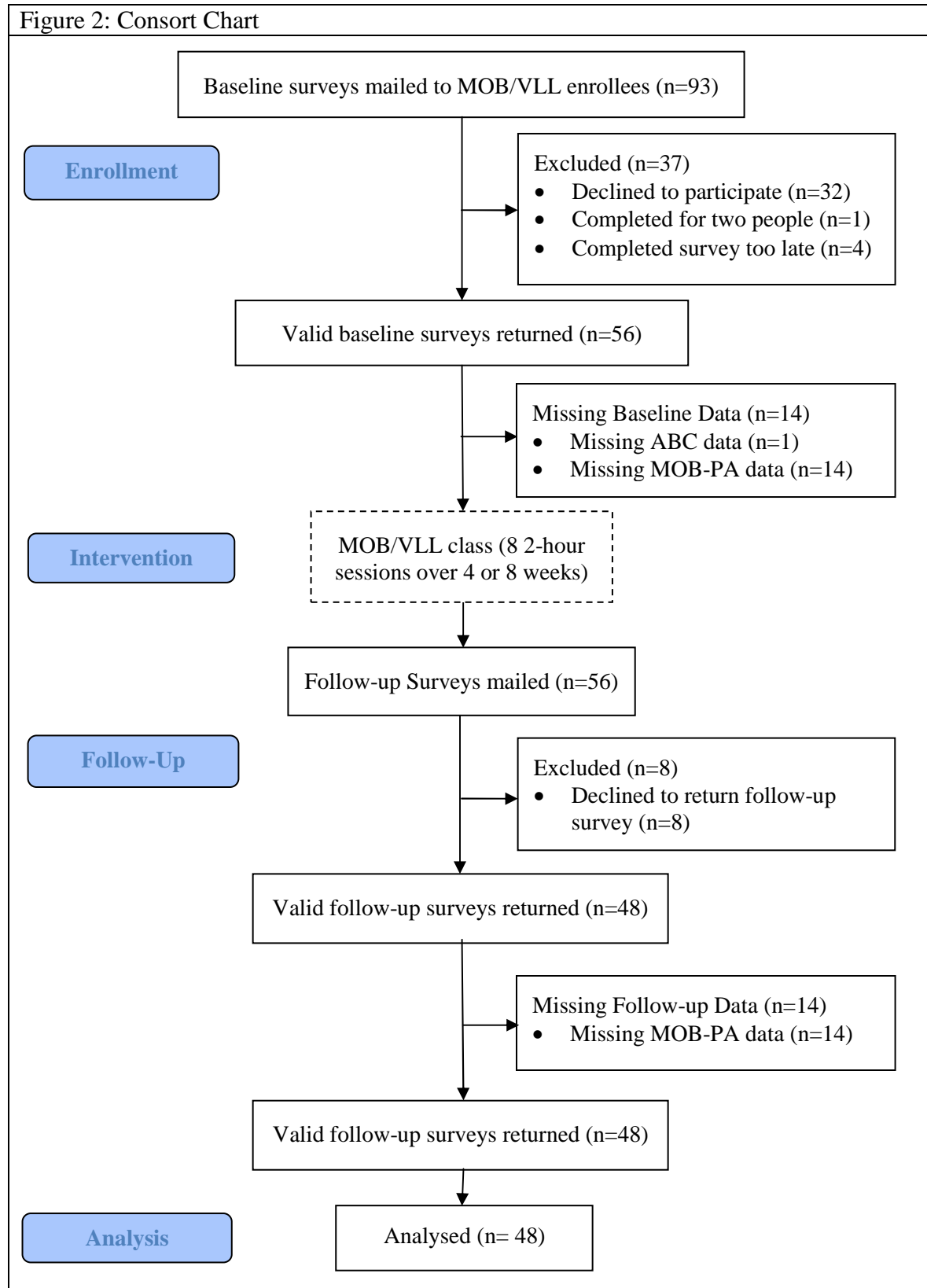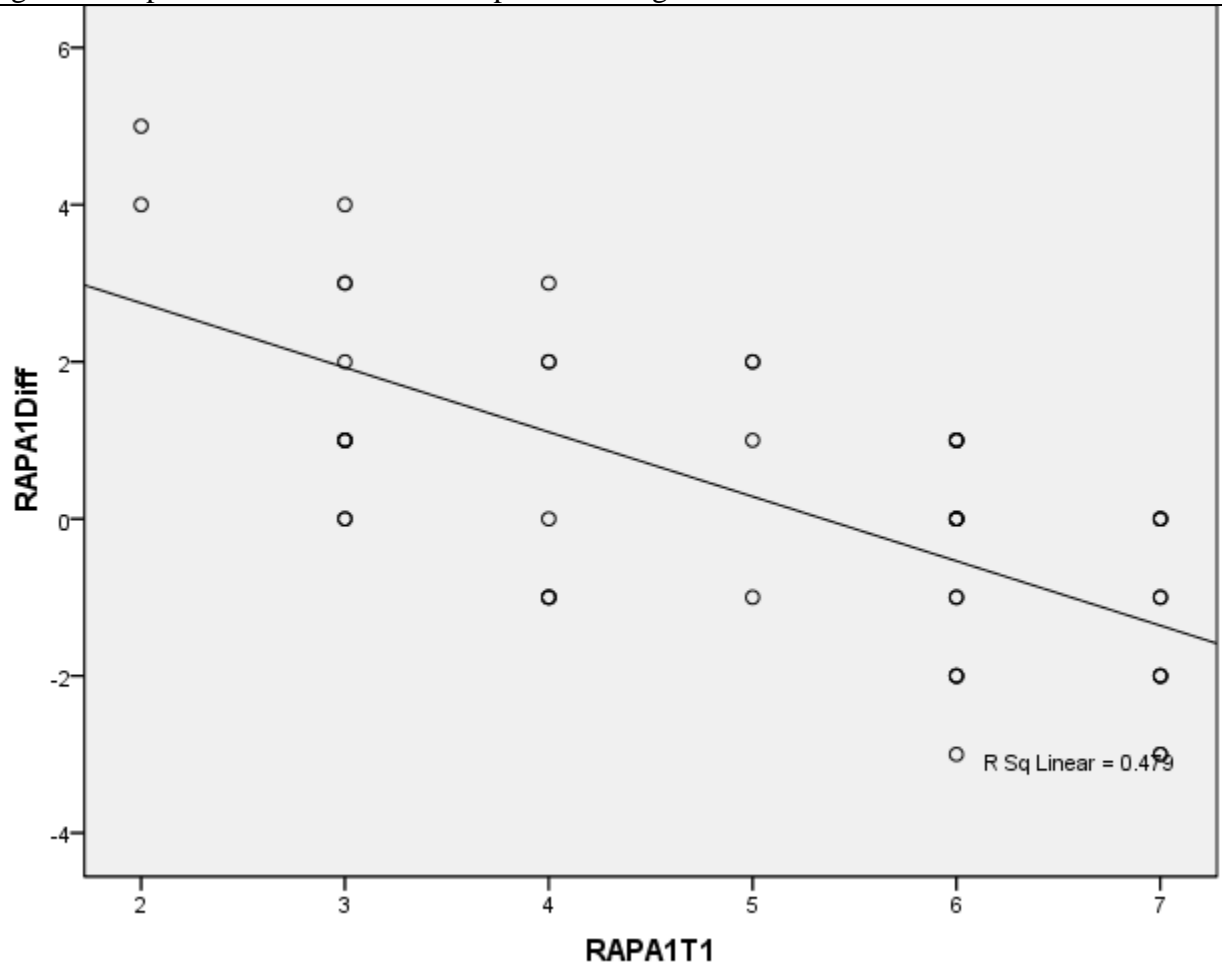
Figure 2: Consort Chart

Baseline surveys mailed to MOB/VLL enrollees (n=93)

Enrollment

Excluded (n=37)
- Declined to participate (n=32)
- Completed for two people (n=1)
- Completed survey too late (n=4)

Valid baseline surveys returned (n=56)

Missing Baseline Data (n=14)
- Missing ABC data (n=1)
- Missing MOB-PA data (n=14)

Intervention

MOB/VLL class (8 2-hour sessions over 4 or 8 weeks)

Follow-up Surveys mailed (n=56)

Follow-Up

Excluded (n=8)
- Declined to return follow-up survey (n=8)

Valid follow-up surveys returned (n=48)

Missing Follow-up Data (n=14)
- Missing MOB-PA data (n=14)

Valid follow-up surveys returned (n=48)

Analysis

Analysed (n= 48)

Figure 3: Dependent x Predictor Scatterplot with Regression Plot

Y = 4.39 -0.82*RAPA1

Figure 4: Normal Probability-Probability Plot of Regression Standardized Residual
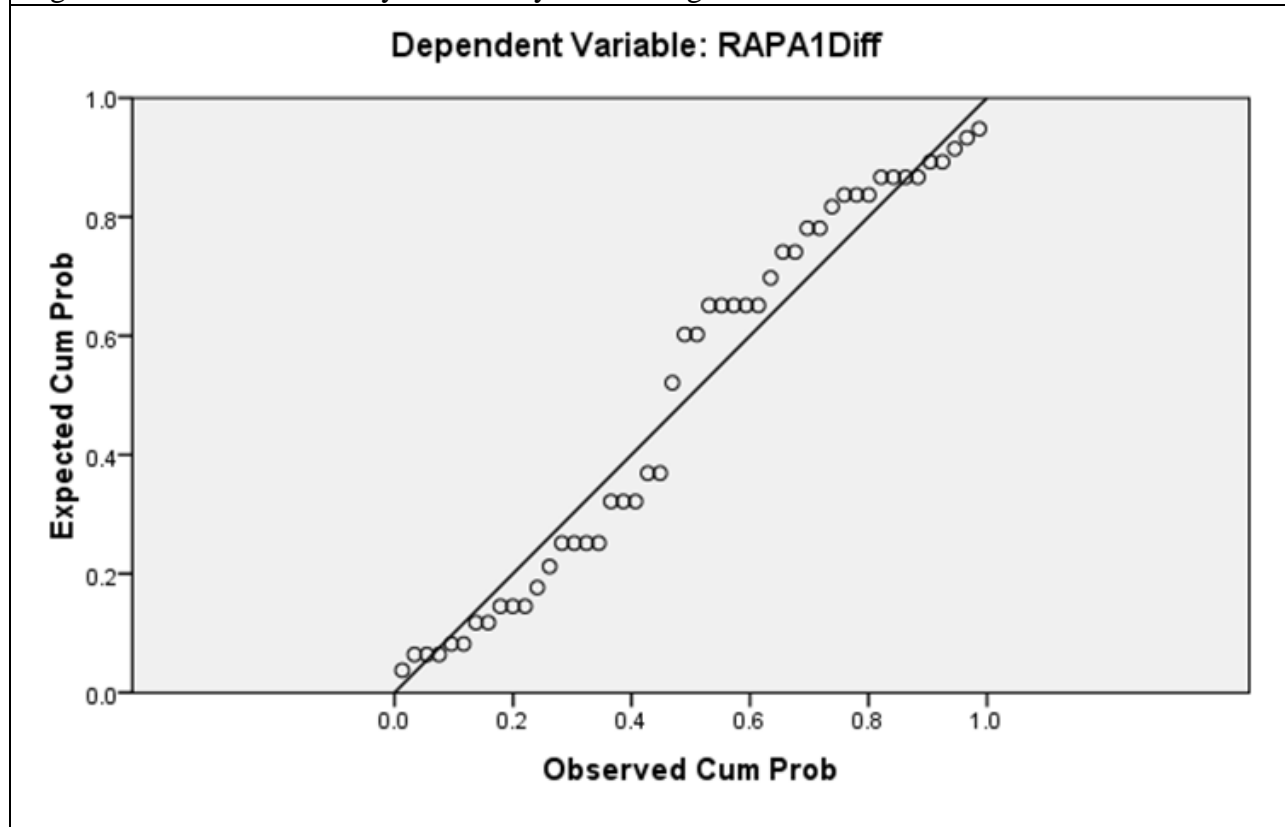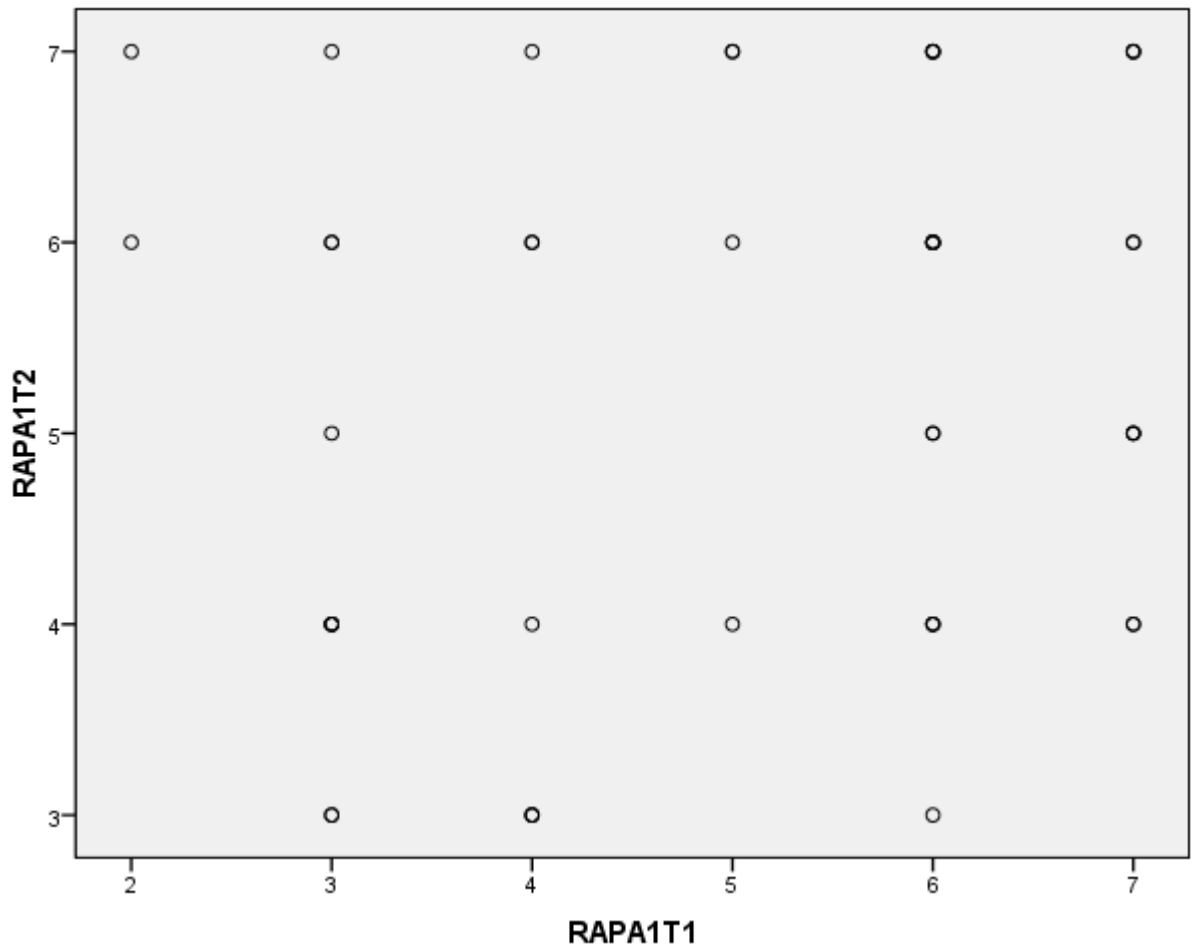
Figure 5: Baseline RAPA1 x Follow-up RAPA1 Scatterplot

CHAPTER 3: SYNTHESIS

Major Findings

This study sought to recruit a representative sample of the older adults enrolling in

MOB/VLL classes in North Carolina. Our sample had an average age of 77.8 years (SD: 9.2,

Range : 60 – 97), was mostly female (80.4%), and mostly White (83.9%). Their average

physical activity level, as measured by the RAPA1, was 5.0 (SD: 1.6, Range = 0 – 7, where 5 =

"I do 30 minutes or more a day of moderate physical activities, 5 or more days per week".), and

their average fear of falling score as measured by the ABC (which is negatively correlated with

fear of falling) was outside of the range reported by Lajoie and Gallagher(63) for classifying

older adults at increased falls risk. Histogram inspection of both baseline physical activity

measures, the RAPA1 and the MOB-PA, reveals distinct bimodal distributions in this sample.

The ABC histogram reveals an approximately normal distribution of scores.

In the analyses presented in Manuscript 1, neither the MOB/VLL program's internal

measure of physical activity (MOB-PA), nor the validated measure of physical activity

(RAPA1), nor fear of falling (ABC) demonstrated a statically significant change from pre to post

MOB/VLL intervention. In the analyses presented in Manuscript 2, the concurrent validity of the

MOB-PA with the RAPA1 could not be established in the MOB cohort, either at baseline or at

follow-up. In the Community cohort, which included older adults who were comparatively

younger (Mean age = 71.7 years) than those in the MOB cohort, moderate concurrent validity (r

= 0.72) of the MOB-PA was established with the RAPA1 at baseline, but not at follow-up, and

modest concurrent validity ($r = 0.44$) was established for the MOB-PA with total daily step counts (TDSC) at baseline, but not at follow-up.

In the regression analyses presented in Manuscript 3, only the baseline RAPA1 was significantly correlated with changes in RAPA1 scores from baseline to follow-up (RAPA1Diff). However, upon closer examination, this finding seems to stem from the simple fact that in a finite range measure, the lower the baseline score, the more range exists for increase (and the less for decline) at follow-up, and the higher the baseline score, the less range exists for increase (and the more for decline). The X-Y plot of the baseline and follow-up RAPA1 scores illustrates this well. This phenomenon, coupled with the lack of significant change in physical activity levels from MOB/VLL class participation, makes the regression equation developed of little value.

Strengths

A major strength of this study was the direct recruitment of current MOB/VLL enrollees, thus eliminating research recruitment bias for enrolling in the MOB/VLL program. All subjects came to enroll based on their own self-perceived needs and the advertising and other methods of the MOB/VLL program. Subjects recruited in this manner are more representative of the population of interest in this study than one in which subjects were recruited into a study which required participation in a researcher provided MOB/VLL class. This method provided for the evaluation of the MOB/VLL program as implemented in North Carolina, making the findings more generalizable at the state and national levels. Another major strength of this study was the administration, outside of the MOB/VLL class environment, of a validated measure of physical activity (RAPA1), thus eliminating the risk of subject bias introduced by the group setting of the class. Another strength was the use of multiple measures of physical activity, two of them

validated, the third being the MOB-PA, in a population similar to the MOB/VLL class enrollees but unassociated with MOB/VLL participation.

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Limitations

A significant limitation of this study was the small sample size of the MOB cohort, powered to find a moderate or larger effect, and the even smaller exploratory Community cohort. The limited size of these cohort samples made sub-population examination underpowered to discover all but very large effects. Another limitation was the absence of a control group in the MOB cohort, which could be accomplished using a randomized delayed start or cross-over design coupled with normal recruitment by existing MOB/VLL provider organizations. Having a control group would allow for the detection of a protective effect from intervention, or of an observer effect due to participation in the study. Another limitation was the inherent insensitivity to small changes in individual subjects of the RAPA1 due to its small number of items (7) and the wide range of activity it covers. Although the RAPA1 is a validated measure with low subject burden, measurement of physical activity may be more reliably assessed using accelerometry or a step counter. Visser and colleagues (64) have found significant levels of misperception of adherence to physical activity recommendations when measured by accelerometry. The small number of classes from which subjects were recruited and complete MOB/VLL records obtained limited our ability to examine the degree to which class level characteristics influenced RAPA1 and ABC score changes. Additionally, the volunteer biases of both the MOB/VLL class organizers and the recruited subjects limited the study, as class organizers unwilling to assist with subject recruitment may have differed from those who did assist, and those who agreed to be subjects may have differed from those who did not. One

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method of overcoming this limitation would be to have this study's data instruments and their collection "embedded" in the MOB/VLL class by adding a pre and a post session, implemented through an entire geographical region, similar to the approach used in Texas by Ory and colleagues(29) and South Carolina by Ullmann and colleagues(30). Another limitation of the study was the skewed distribution of baseline physical activity levels in both the MOB cohort and the Community cohort, with significant ceiling effects, that reduced the effective number of subjects with the potential for physical activity measure increase. Finally, the inability to recruit a subset of the MOB cohort to wear step counters pre and post intervention did not allow us to assess the external validity of the MOB-PA, as well as assess the MOB/VLL intervention, using a more objective physical activity measure.

Conclusions

Taken together, the findings of these studies do not support previous findings (Table 1) of the efficacy of the MOB/VLL program to reduce fear of falling and increase physical activity. The distribution of physical activity level in the sample was bimodal. Half of the sample had baseline RAPA1 scores of 6 or 7, indicating these subjects were likely not restricting their physical activity due to fear of falling or any other factor. Furthermore, there were no statistical differences ($p = 0.72$) in the ABC scores of the high RAPA1 score group (ABC = 69.8) compared to the lower RAPA1 score group (ABC = 71.4), indicating that those with lower activity levels were not restricting activity due to fear of falling either. Of special note is the absence of changes between baseline and follow-up in the three factors most directly targeted by the MOB/VLL program: the Outcome Expectations for Increased Physical Activity (OEIPA) scale, the Self-Efficacy for Increased Physical Activity (SEIPA) scale, and the Fear of Falling

Avoidance Behavior Questionnaire (FFABQ). Each instrument was theorized to detect, directly, or indirectly, changes in factors in our conceptual model (Figure 1) antecedent to changes in physical activity level.

If the sample in this study is representative of the current population of MOB/VLL enrollees, these findings indicate that the current MOB/VLL recruitment methods are not attracting the desired target population, older adults who have a fear of falling and are restricting their activity due to that fear. Not surprisingly, as a result, no clinically significant changes in activity levels or fear of falling, or their antecedent factors, are achieved, and the financial, facility, and human resources expended in the provision of MOB/VLL classes are potentially being wasted.

The implications of the concurrent validity of the MOB-PA at baseline, but not at follow-up, are less clear, but certainly concerns are raised for the use of the MOB-PA to detect changes in physical activity level as a result of MOB/VLL class participation. A larger sample validation study using objective physical activity measures (accelerometry, step counter, or other instrumented measure) and a randomized delayed start study design is needed. However, the moderate concurrent validity detected for the MOB-PA in the Community cohort provides support for a new study to analyze the MOB-PA scores in the MOB/VLL national database maintained by MaineHealth to characterize the baseline physical activity levels of MOB/VLL enrollees. Questions to be asked include: *What levels of physical activity do the recent enrollees of MOB/VLL classes have? Are these levels characteristic of the population for which the MOB/VLL intervention was designed? Has the level of physical activity changed since the inception of the program? Are there differences in activity level by geographic region, hosting organization, class, or individual characteristics? How do other internal program measures,*

both baseline and outcome, vary by baseline activity measures? The results of such studies may reveal the need to enhance program fidelity adherence guidelines, modify program recruitment methods, and/or screen potential enrollees for the appropriateness of MOB/VLL program participation. In the meantime, with many alternative activity promotion / fall prevention programs to choose to implement with their often limited resources, organizations considering or currently offering MOB/VLL classes should carefully consider the findings of this study.

Table 1: Comparison of key characteristics and demographics of MOB & MOB/VLL studies					
Author	Tennstedt	Healy	Ory	Ullmann	Palmer
Year	1998	2008	2010	2012	2013
Baseline N	434	335	2690	150	56
4 week post-intervention Follow-up N (%)	388 (89.4%)	243 (72.5%)	1577 (58.6%)	113 (75.3%)	---
1 week post-intervention Follow-up N (%)	---	---	---	---	48 (85.7%)
Age: Mean (SD)	77.8 (7.7)	78.7 (8.3)	77	75.4 (9.7)	77.8 (9.2)
Age: Range	60-100	51-95	---	---	60-97
Female	89.60%	89.90%	83%	86%	80.40%
White	90.80%	88%	70%[a]	40%	83.90%
Fell in last 3 months	25%	28%	---	---	---
Fell in last year	---	---	---	---	58%

APPENDIX A

LITERATURE REVIEW

Introduction

Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure."(1) For much of mankind's existence, regular physical activity has been the means by which it has ensured its safety and procured food for its very survival.(2) In some parts of the world today this is still true, but in many industrialized societies, plentiful nutrient-dense foods obtained with relatively low energy expenditure have resulted in drastically lower levels of daily physical activity demand and consequently, lower levels of physical activity in the population.(3)

Regardless of its causes, physical inactivity among older adults is a widely recognized major public health problem in our society (4) that is associated with higher health costs(5) and a variety of negative health outcomes, including obesity,(6) sarcopenia,(7-9) osteopenia,(10, 11) osteoporosis,(10, 11) falls,(12) depression,(13) loneliness,(14) social isolation,(15) fear of falling,(16-19) frailty,(20) cognitive decline,(21, 22) and mortality.(23, 24) Just as inadequate levels of physical activity are associated with multiple morbidities, researchers have reported that increased physical activity by older adults can prevent, delay, or ameliorate specific health conditions and/or their symptoms, including functional status decline,(25) arthritis,(26-28) depression,(29) diabetes,(30) frailty,(31) cognitive dysfunction,(22, 32, 33) and hypertension.(34)

However, despite this knowledge, and despite the efforts of many governmental and private health organizations to promote increased physical activity among older adults through

the issuing of policies, recommendations, and guidelines,(35-40, 40) the prevalence of physical

inactivity among older adults in the US remains high.(41-43)

The focus of this literature review is to examine the terminology, measurements,

methods, and interventions related to increasing physical activity among community-dwelling

older adults. Particular emphasis is placed on current knowledge of the efficacy of the *Matter of*

Balance / Volunteer Lay Leader program.

Terminology

Despite general agreement across research studies that older adults do not engage in

enough physical activity, multiple terms such as *sedentary*, *physically inactive*, and *insufficient*

physical activity regularly appear in the literature but are not uniformly defined. However, they

all take as their referent the concept of *physically active*, which the Centers for Disease Control

and Prevention (CDC) defines as "engaging in moderate-intensity activities in a usual week for

greater than or equal to 30 minutes per day, greater than or equal to 5 days per week; or

vigorous-intensity activities in a usual week for greater than or equal to 20 minutes per day,

greater than or equal to 3 days per week or both".(44) The CDC defines *inactivity* as "less than

10 minutes total per week of moderate or vigorous-intensity lifestyle activities", and defines

insufficient physical activity as "doing more than 10 minutes total per week of moderate or

vigorous-intensity lifestyle activities but less than the recommended level of activity".(44)

Lifestyle activities include household activities (e.g. moving around in your home and doing

housework), transportation activities (e.g. walking to the store or a friend's home) and leisure-

time activities. Leisure-time activities may include formal exercise or may consist of more

informal activities such as playing tennis, hiking, dancing, etc. Work-related physical activity

(occupational activity) is unaccounted for in these CDC definitions. Exercise is defined by the CDC as "a subcategory of physical activity that is planned, structured, repetitive, and purposive in the sense that the improvement or maintenance of one or more components of physical fitness is the objective".(45)

Fear of Falling

Among the factors reported to be associated with reduced physical activity are fear of falling and fear of the consequences of falling.(16-19, 46-51) These fears also rank among the barriers to exercise among older adults.(49, 52) Early research into fear of falling simply asked subjects if they were fearful of or afraid of falling.

Both Tinetti and colleagues(53) and Howland and colleagues et al(54) found that nearly half of community-dwelling older adults experienced some fear of falling. Tinetti & Speechly(55) found that many older adults with fear of falling responded to this fear by limiting their physical activity. This limiting of activity is theorized to initiate or continue a downward spiral of deconditioning and reduced physical capacity, thereby increasing, not decreasing, the risk of falls and fall-related injuries.(19, 56)

The construct of fear of falling has long been a subject of interest in the literature. While simply asking individuals if they have a fear of falling(51, 57) seems the most straight-forward measure, Mischel(58) as reported by Tinneti,(59) reported that the variability in individual definitions of fear, coupled with the poor predictive ability of self-assessed global traits, limits the clinical utility of this initially appealing simple measure. Grounded in the work of Bandura(60), Tinetti and colleagues (59) looked at fear of falling as an activity-dependent emotional response based largely on perceptions of self-efficacy. They developed the Falls

Efficacy Scale (FES), a 10 item, 10-point Likert scale with total scores ranging from 10 to 100, with the goal of "determining the extent to which fear of falling exerts an independent effect on functional decline among the elderly". The Falls Efficacy Scale International (FES-I)(61) was later adapted from the FES, as was the Falls Efficacy Scale (Icon-FES)(62) employing illustrations ("iconographs") of potentially fearful scenarios and designed to assess fear of falling in higher functioning older adults. Powell and Meyers,(63) seeking to address some of the limitations of the FES, developed the Activities-specific Balance Confidence(ABC) scale. The ABC is a 16 item, 11-point Likert scale summed and averaged to create a 0 to 100% score. In comparison to the FES, the ABC uses more specificity in the activity for each item and includes a wider range of activity difficulty.

The concepts of fear of falling, self-efficacy, and balance confidence are not identical, yet there is considerable overlap. Tinetti and colleagues indicated their belief in the virtual equivalence of the terms "confidence" and self-efficacy" when they stated "Confidence in accomplishing each activity without falling was assessed on a 10-point continuum with a higher score equivalent to lower confidence or efficacy."(59) Powell and colleagues designed the ABC as an improved self-efficacy measure, not a measure based on an alternative construct.

The literature argues against the single item assessment of fear of falling. The choice between the FES and the ABC is best made by assessing the overall level of activities engaged in by the individual or populations of interest.

Measurement Methods

Researchers and clinicians employ a variety of measures, both objective and subjective, to assess physical activity. The "gold standard" objective measure for quantifying physical

activity, derived from its definition, is the measure of the "extra" energy expended as a result of engaging in a specific dose of physical activity. The doubly labeled water method (DLW) utilizes the ingestion of isotopic water (the term "doubly" refers to the use of isotopes of both hydrogen and oxygen) and the measurement of the relative excretion rates of each isotope to determine total energy expenditure over a 5 to 14 day period. DLW, when combined with indirect calorimetry to measure resting metabolic rate and diet induced energy expenditure, can provide a long-term measure of average physical activity. These methods are complex, expensive, subject-burdensome, and time-consuming, and thus are rarely utilized in research measuring change in activity levels in "free-living" adults.(64)

The measurement of body motion via body-worn devices is commonly employed as a proxy for the measurement of metabolic energy expenditure.(64) The simplest devices use mechanical registration of vertical movement to obtain a cumulative count of stepping activity. Their main advantage is their low cost, but they tend to undercount low intensity activity, are unable to assess intensity of activity, and cannot provide any information regarding temporal variability.(65) Additionally, an intervention effect on physical activity levels from step counters displaying current and/or cumulative measures has been reported(66-68) and may preclude their use. More technologically sophisticated devices use one, two, or three axis piezoelectric accelerometers to qualify and quantify acceleration activity due to body movement during the measurement period. Some of these devices report dimensionless acceleration counts, while others perform algorithmic integration and conversion of tri-axial readings directly into step counts. Most of these devices store and report data with minute-level resolution. The use of these types of accelerometer-based devices, referred to as *accelerometry*, is widely employed by

researchers to obtain objective(69) measures of physical activity in the general population,(70) and has been well tolerated in use with older adults.(71, 72)

The previously described objective measures of physical activity employ methods that are impractical to implement in many research settings. In both clinical research and clinical practice, subjective measurement of physical activity by patient self-report is the overwhelming choice due to the simplicity, low cost, speed, and ease of administration. Many self-report measures of physical activity have been developed,(73) but few have been validated for self-administration by older adults. The Patient-centered Assessment and Counseling for Exercise (PACE)(74-76) was developed as a combined measure of level of and stage of readiness to engage in physical activity to be administered by physicians in practice and not targeted specifically at older adults. The Physical Activity Scale for the Elderly (PASE) (77) was developed for clinical assessment of physical activity for older adults and designed for self-administration or interviewer administration in person or by telephone. The PASE solicits seven-day activity information by domain (leisure, household, and work-related) and takes approximately 5 minutes to administer. The Community Healthy Activities Model Program for Seniors Physical Activity Questionnaire (CHAMPS-PAQ) (78) was developed specifically for older adults and designed for self-administration or interviewer administration in person or by telephone. Developed for the research environment to measure metabolic energy expenditure, the CHAMPS-PAQ solicits detailed activity information for the preceding four weeks and takes approximately 15 minutes to complete. The Rapid Assessment of Physical Activity (RAPA) (79) was developed as a self-administered clinical measure for older adults. Based on the CDC physical activity guidelines, the RAPA solicits responses regarding 'usual' weekly activity and takes approximately 2 minutes to administer.

The measurement of associated metabolic energy expenditure, although the gold standard, is neither practical or necessary for assessment of physical activity among older adults, particularly when used to measure an intervention's effectiveness in changing levels of physical activity. Obtaining absolute values of pre and post intervention metabolic energy expenditure involves a significant subject burden and is likely to have a significant intervention effect, while adding nothing to the assessment of degree of change in activity. Acceleratory based step counters, although more burdensome than metabolic measurement methods, are well tolerated and provide for the most accurate "free-range" assessment possible. For low-burden cost effective measurement in the clinical and research environments, questionnaires and surveys will be the instruments of choice in most cases, despite the reduced accuracy and risk of subject bias compared to objective measures.

Interventions

Many interventions have been developed to promote increased physical activity in the general population. A recently published Cochrane Review(80) found no evidence for the general effectiveness of community-level interventions, although specific programs, such as the media-based 'Wheeling Walks" program(81) and the CHAMPS II program,(82) have shown statistically significant increases in walking minutes/week among some groups of older adults. Multiple individual-based programs to increase physical activity among older adults have been developed using a variety of approaches. Most typically, these have been group exercise programs such as aerobics, Tai Chi, and other programs. There are fewer interventions specifically designed to address cognitive barriers to exercise. Calfas and colleagues(75) reported on the PACE program, which employed brief physician office counseling followed up with a

health educator phone call two weeks later. The PACE increased self-assessed physical activity levels four to six weeks after the initial counseling. A program in Australia employing group education and goal setting sessions(83) did not increase pedometer-measured step counts among culturally and linguistically diverse older adults. The *Active for Life*$^©$ program(84) investigated the translation of two lifestyle behavior change programs grounded in social cognitive theory and the transtheoretical model: Active Choices (telephone-based) and Active Living Every Day (group-based). Both programs proved effective in increasing levels of physical activity, based on pedometer-measured step counts, when translated into community settings.

The challenges of effective community-level interventions include stakeholder buy-in, community-specific strategy development, coalition consensus, organizational cohesion, and financial resources. In the previously cited Cochrane Review(80), evidence for these programs was equivocal due to the lack of good studies. The authors stated that "Future research is needed with improved designs, measures of outcomes and larger samples of participants."

A Matter of Balance

The *A Matter of Balance* (MOB) program is an evidence-based cognitive-behavioral intervention program specifically designed to "reduce the fear of falling and increase activity levels among older adults".(85) This group-based intervention, delivered by physical therapists, uses the Intended Activity scale as the distal outcome measure of activity. This scale asks subjects their surety (1 = not at all sure, 4 = very sure) of engaging in various activities in the coming week. Among the activities were "light and heavy housework, home repairs, lawn or yard care, walking outside the home, light sport, and strenuous sport or recreational activities". A volunteer lay-leader adaptation of this program (MOB/VLL) was developed in partnership by

Southern Maine's Agency on Aging, Maine's Partnership for Healthy Aging, Maine Medical Center Division of Geriatrics and the University of Southern Maine, School of Social Work.(86) While physical activity was not a distal outcome measure of the translated program's effectiveness study, a related measure of exercise level, consisting of a truncated and modified version of the PACE assessment, was used. The original 11-item PACE assessment was developed to "determine current interest in and level of activity",(75) was based on the Stages of Change Model, and categorized subjects into one of three states (pre-contemplation, contemplation, and active). The PACE was not validated as a measure of activity, nor was the truncated and modified version developed by Healy and colleagues(86). Ory and colleagues(87) reported on the implementation and dissemination of the MOB/VLL program in Texas. They used a "variant of Behavioral Risk Factor Surveillance System survey items to assess the number of days in the previous week the participant was engaged in moderate-intensity physical activity for at least 30 minutes." The Behavioral Risk Factor Surveillance System (BRFSS) survey, developed for telephone administration in the adult population, has not been validated as a self-administered in-class survey among older adults. In South Carolina, Ullmann and colleagues reported on the dissemination of the MOB/VLL program and reported outcomes for the Falls Management Scale (FMS) and the Timed Up and Go (TUG), but no validated physical activity measures were reported. To date, no evaluation of program effectiveness has examined the original MOB program or the MOB/VLL program using either validated self-report measures of activity or validated objective measures of activity.

Conclusion

The MOB/VLL is a community based intervention that has successfully addressed many of the challenges cited in the Cochrane Review(80) of community wide interventions to improve physical activity. The highly structured program has been standardized and made available for wide-spread implementation at a relatively low cost. Fidelity is maintained through a centralized training organization and contractual agreement with Master Trainers and Coaches. The program has developed targeted marketing materials to attract the older adults thought to benefit most. Its multi-modal intervention approach, including didactic presentation, video testimonials, lecture materials, group discussion, group problem-solving, and exercise demonstration and practice has proven popular with many older adults, as evidenced by its growing level of implementation. Additionally, Healy and colleagues(86) found a significant reduction in both fear of falling (falls efficacy) and self-reported falls at six and 12 months post intervention. However, what remains to be measured with validated instruments is the degree to which the MOB/VLL program actually achieves its stated goal of increasing physical activity among older adults. If fear of falling is reduced in the absence of an increase in physical activity, or physical activity is increased with no reduction in fear of falling, then the mechanism by which the program has been theorized to reduce falls in previous studies is called into question.

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BASELINE SURVEY BOOKLET

Title: Changes in PA associated with the MOB/VLL program   IRB Study # 12-0431

Baseline Survey Booklet

NOTE: THIS SURVEY *MUST* BE COMPLETED BEFORE YOUR FIRST MOB CLASS

Thank you for agreeing to fill out this survey booklet. All of the information you supply here is confidential. No one will know of your participation in this research unless you choose to tell them.

This booklet takes about 15 to 20 minutes to complete. Please read all instructions carefully and feel free to call me if any of the questions are unclear.

Walter E. Palmer, MSCS
3022 Bondurant Hall, CB# 7135
The University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-7135
wepalmer@email.unc.edu
919-451-3223

Today's Date: ____/____/_____

Name:	
Address:	
City:	
State:	
Zip code:	

Date of your first Matter of Balance class:	____/_____/ 2012
Town/City/Area where class will be held:	
Facility/Building where class will be held:	

Please be sure you have responded to every item before going on to the next page.

Health and Mobility Survey

What is your age (in years)? _____	What is your gender? (circle one): Female　　Male

Circle the number below that best describes your current physical health: Poor --- Excellent 0　1　2　3　4　5　6　7　8　9　10

Circle the number below that best describes how often you use an assistive device (cane, walking stick, ambulator, walker, etc.) when you walk: Never --- Always 0　1　2　3　4　5　6　7　8　9　10

How many people live with you at your current address? ___

How many times have you fallen in the past year? ___	How many of these falls has resulted in an injury? ___	How many falls needed medical attention? ___

Ethnicity: 1. Do you consider yourself to be Hispanic or Latino? (See definition below.) Select one. *Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. The term, "Spanish origin," can be used in addition to "Hispanic or Latino."*
☐　Hispanic or Latino
☐　Not Hispanic or Latino

Race: What race do you consider yourself to be? Select one or more of the following:
☐　**American Indian or Alaska Native**. *A person having origins in any of the original peoples of North, Central, or South America, and who maintains tribal affiliation or community attachment.*
☐　**Asian**. *A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam. (Note: Individuals from the Philippine Islands have been recorded as Pacific Islanders in previous data collection strategies.)*
☐　**Black or African American**. *A person having origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black" or African American."*
☐　**Native Hawaiian or Other Pacific Islander**. *A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.*
☐　**White**. *A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.*
☐　Check here if you do not wish to provide some or all of the above information.

Please be sure you have responded to every item before going on to the next page.

Health and Mobility Survey (continued)

Indicate whether or not you currently have the following conditions by circling 'Yes' or 'No' for each item below:

Yes	No	Arthritis (rheumatoid and osteoarthritis)
Yes	No	Osteoporosis
Yes	No	Asthma
Yes	No	Chronic obstructive pulmonary disease (COPD), acquired respiratory distress syndrome (ARDS), or emphysema
Yes	No	Angina
Yes	No	Congestive heart failure (or heart disease)
Yes	No	Heart attack (myocardial infarct)
Yes	No	Neurological disease (such as multiple sclerosis or Parkinson's)
Yes	No	Stroke or transient ischemic attack (TIA)
Yes	No	Peripheral vascular disease
Yes	No	Diabetes types I and II
Yes	No	Upper gastrointestinal disease (ulcer, hernia, reflux).
Yes	No	Depression
Yes	No	Anxiety or panic disorders
Yes	No	Visual impairment (such as cataracts, glaucoma, macular degeneration)
Yes	No	Hearing Impairment (very hard of hearing, even with hearing aids)
Yes	No	Degenerative disc disease (back disease, spinal stenosis, or severe chronic back pain)

Height _____ (cm or inches)	Weight _____ (kg or lbs)

Please be sure you have responded to every item before going on to the next page.

Fear of Falling Avoidance-Behavior Questionnaire (FFABQ)

Please answer the following questions that are related to your balance. For each statement, please check <u>one box</u> to say how the **fear of falling** has or has not affected you. If you do not currently do the activities in question, try and imagine how your **fear of falling** would affect your participation in these activities. If you normally use a walking aid to do these activities or hold onto someone, rate how your **fear of falling** would affect you as if you were not using these supports. If you have questions about answering any of these statements, please ask the questionnaire administrator.

*Please check **one box** for each question*

Due to my fear of falling, I avoid…	Completely disagree	Disagree	Unsure	Agree	Completely agree
1. Walking	☐	☐	☐	☐	☐
2. Lifting and carrying objects (e.g., cup, child)	☐	☐	☐	☐	☐
3. Going up and downstairs	☐	☐	☐	☐	☐
4. Walking on different surfaces (e.g., grass, uneven ground)	☐	☐	☐	☐	☐
5. Walking in crowded places	☐	☐	☐	☐	☐
6. Walking in dimly lit, unfamiliar places	☐	☐	☐	☐	☐
7. Leaving home	☐	☐	☐	☐	☐
8. Getting in and out of a chair	☐	☐	☐	☐	☐
9. Showering and/or bathing	☐	☐	☐	☐	☐
10. Exercise	☐	☐	☐	☐	☐
11. Preparing meals (e.g., planning, cooking, serving)	☐	☐	☐	☐	☐
12. Doing housework (e.g., cleaning, washing clothes)	☐	☐	☐	☐	☐
13. Work and/or volunteer work	☐	☐	☐	☐	☐
14. Recreational and leisure activities (e.g., play, sports, arts and culture, crafts, hobbies, socializing, travelling)	☐	☐	☐	☐	☐

Please make sure you have checked <u>one box for each question</u>. Thank you!

The Fear of Falling Avoidance-Behavior Questionnaire. Reproduced by written permission from the author.

Please be sure you have responded to every item before going on to the next page.

Rapid Assessment of Physical Activity

Physical Activities are activities where you move and increase your heart rate above its resting rate, whether you do them for pleasure, work, or transportation.

The following questions ask about the amount and intensity of physical activity you usually do. The intensity of the activity is related to the amount of energy you use to do these activities.

Examples of physical activity intensity levels:

Light activities • your heart beats slightly faster than normal • you can talk and sing	Walking Leisurely Stretching Vacuuming or Light Yard Work
Moderate activities • your heart beats faster than normal • you can talk but not sing	Fast Walking Aerobics Class Strength Training Swimming Gently
Vigorous activities • your heart rate increases a lot • you can't talk or your talking is broken up by large breaths	Stair Machine Jogging or Running Tennis, Racquetball, Pickleball or Badminton

Please be sure you have responded to every item before going on to the next page.

How physically active are you? *(Check one answer on each line)*

		Does this accurately describe you?	
		Yes	No
RAPA 1 — 1	I rarely or never do any physical activities.	☐	☐
2	I do some **light** or **moderate** physical activities, but not every week.	☐	☐
3	I do some **light** physical activity every week.	☐	☐
4	I do **moderate** physical activities every week, but less than 30 minutes a day or 5 days a week.	☐	☐
5	I do **vigorous** physical activities every week, but less than 20 minutes a day or 3 days a week.	☐	☐
6	I do 30 minutes or more a day of **moderate** physical activities, 5 or more days a week.	☐	☐
7	I do 20 minutes or more a day of **vigorous** physical activities, 3 or more days a week.	☐	☐
RAPA 2 3 = Both 1 & 2 — 1	I do activities to increase muscle **strength**, such as lifting weights or calisthenics, once a week or more.	☐	☐
2	I do activities to improve **flexibility**, such as stretching or yoga, once a week or more.	☐	☐

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Indicate whether or not you currently engage in any of the following activities:

Yes No	Housework.	
	If yes, estimate hours per week: ___	
Yes No	Gardening.	
	If yes, estimate hours per week: ___	
Yes No	Volunteer activities (not at your home).	
	If yes, estimate hours per week: ___	
Yes No	Social activities (not at your home).	
	If yes, estimate hours per week: ___	

Please be sure you have responded to every item before going on to the next page.

Outcome Expectations for Increased Physical Activity

There are many ways you can increase your regular physical activity, including, but not limited to, taking a walk around the yard or the block, working in your garden, participating in more church or social events, starting an exercise program, walking instead of driving to a neighbor's house, shopping every isle of the grocery store, jogging, parking at the far end of the parking lot at the store, taking the stairs more often, volunteering at a charity, helping a friend with a chore, etc.

The following statements ask you to imagine what you might expect to happen if you decided to increase you regular physical activity.

For example, the first statement reads _"Increasing my physical activity would make me feel better physically."_

For each statement circle the number on the scale (Range: 1 = Strongly Agree, 5 = Strongly Disagree) that best matches your level of agreement with that statement.

Increasing my physical activity …

1   … would make me feel better physically.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
        1   2   3   4   5

2   … would make my mood better in general.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
        1   2   3   4   5

3   … would help me feel less tired.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
        1   2   3   4   5

4   … would make my muscles stronger.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
        1   2   3   4   5

Please be sure you have responded to every item before going on to the next page.

Increasing my physical activity …

5   … is something I would enjoy doing.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
1   2   3   4   5

6   … would give me a sense of personal accomplishment.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
1   2   3   4   5

7   … would make me more alert mentally.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
1   2   3   4   5

8   … would improve my endurance in performing my daily activities.

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
1   2   3   4   5

9   … would help to strengthen my bones

Strongly Agree - Agree - Neither Agree nor Disagree - Disagree - Strongly Disagree
1   2   3   4   5

Adapted by permission of author from the Outcome Expectations for Exercise Scale. {{1022 Resnick,B. 2000}}

Self-Efficacy for Increased Physical Activity

The following questions on the next page ask you to imagine you are considering increasing your regular physical activity.

For example, the first question reads *"How confident are you right now that you could increase your regular weekly physical activity if the weather was uncomfortable (or unpleasant)?"*

Carefully consider what it would be like for you to engage in some type of physical activity during weather that was uncomfortable, and circle the number on the scale that best describes your level of confidence in doing that physical activity (Range: 0 = Not Confident, 10 = Very Confident) under those conditions.

Please be sure you have responded to every item before going on to the next page.

Please circle the number that best describes your level of confidence (0 = Not Confident, 10 = Very Confident) for each of the following questions:

SEIPA (Self-Efficacy for Increased Physical Activity)

How confident are you right now that you could increase your regular weekly physical activity if:

1 The weather was uncomfortable (or unpleasant)?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

2 You were bored by the activities?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

3 You felt pain during the activities?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

4 You had to engage in the activities alone?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

5 You did not enjoy the activities?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

6 You were too busy to do the activities?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

7 You felt tired?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

8 You felt stressed?

Not Confident -- Very Confident
            0 1 2 3 4 5 6 7 8 9 10

9 You felt depressed?

Not Confident -- Very Confident
             0 1 2 3 4 5 6 7 8 9 10

Adapted by permission of author from the Self-Efficacy for Exercise Scale. {{1025 Resnick,B. 2000}}
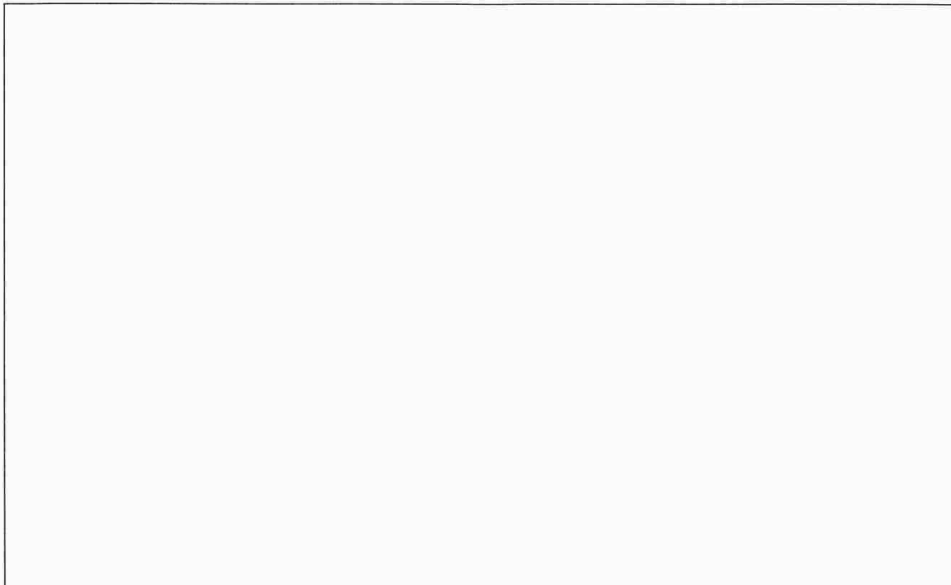
Please be sure you have responded to every item before going on to the next page.

-------------------------------------- End of Survey   --------------------------------------

Thank you for agreeing to be in this study and completing this survey booklet. Please use the enclosed postage paid envelope to return it to me at the research office.

If you have lost or cannot find the postage-paid return envelope, please call me at 919-451-3223 and I will send you a replacement.

If you have any comments or suggestions regarding this survey that you think might help improve it, please provide them in the space below.

Thank you!

Please be sure you have responded to every item before going on to the next page.

APPENDIX C

MATTER OF BALANCE PHYSICAL ACTIVITY MEASURE

Matter of Balance Physical Activity Measure (MOB-PA) items
Check only one box to tell us how much you are walking or exercising now: 1. I do not exercise or walk regularly now, and I do not intend to start. 2) I do not exercise or walk regularly now, but I have been thinking of starting. 3) I am trying to start to exercise or walk. 4) I have exercised or walked infrequently for over a month. 5) I have been doing moderate exercise less than three times per week. 6) I have been doing moderate exercise three or more times per week.

The Step Counter and the Multi-Day Diary

Thank you for agreeing to wear the step counter device and record its use in this Multi-Day Diary. Your assistance will help the research team better understand activity patterns in the study population.

Wearing the Step Counter:

The Step Counter is a rugged waterproof instrument that counts the steps you take while wearing it. There are no controls to worry about: you just put it on and go about your normal activities. Many people forget it is there after wearing it for a while.

Things you need to remember:

1) The device should always be attached "ROUNDED END UP. (see image above)

2) You can wear the device on the inside or the outside of the ankle of either leg. However, once you choose a position please try to wear it in the same location each time you put it on.

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3) Attach the device to your ankle every morning before or as soon as you get out of bed.

4) Remove the device before going to bed at night.

5) Remove the device when bathing, showering, or swimming. The device can be submerged in water without damage, but a wet strap may not be comfortable.

6) Please make a note in this Multi-Day Diary each time you put on or take off the device.

If you develop pain or discomfort from wearing the step counter please immediately stop wearing it and report the problem by calling the research team at 919-451-3223.

Using the Multi-Day Diary:

The main purpose for this Multi-Day Diary is to record each time you put on or take off the device. This should only take a few minutes of your time each day.

Another purpose for this diary is to record information about the kind of activities you are engaged in while wearing the device.

Note: Your activity entries do not need to be detailed. Typical entries might read: 9am-11am, housework; 11am-1pm lunch out with friends; 5pm-8pm, watched TV. You do not need to fill every entry in the diary.

Title: Changes in PA associated with the MOB/VLL program IRB Study # 12-0431

Below is an example of a single day diary entry:

****************** Beginning of Example ******************

Day _X_ Date: _XX_ / _XX_ /2013

Circle the current day of week:

Sunday   Monday   Tuesday   Wednesday   Thursday   (Friday)   Saturday

Time	Time	Description of action or activity
7:30 am	------	Awoke and put on device
9:30 am	10:30 am	Took a long walk with friend
10:30 am	11:00 am	Removed device while showering
6:45 pm	7:30 pm	Did light housework
-----	9:00 pm	Removed device and went to bed

Comments:
Had a very active day. Almost forgot to take the device off

****************** End of Example ******************

Title: Changes in PA associated with the MOB/VLL program IRB Study # 12-0431

Day _1_ Date: __/__/2013

Circle the current day of week:

Sunday   Monday   Tuesday   Wednesday   Thursday   Friday   Saturday

Time	Time	Description of action or activity

Comments:

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Day _2_ Date: __/__/2013

Circle the current day of week:

Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Time	Time	Description of action or activity

Comments:

Day _3_ Date: __/__/2013

Circle the current day of week:

Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Time	Time	Description of action or activity

Comments:

Day _4_ Date: __/__/2013

Circle the current day of week:

Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Time	Time	Description of action or activity

Comments:

Day _5_ Date: __/__/2013

Circle the current day of week:

Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Time	Time	Description of action or activity

Comments:

Day __6__   Date: __/__/2013

Circle the current day of week:
Sunday   Monday   Tuesday   Wednesday   Thursday   Friday   Saturday

Time	Time	Description of action or activity

Comments:

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Day __7__   Date: __/__/2013

Circle the current day of week:
Sunday   Monday   Tuesday   Wednesday   Thursday   Friday   Saturday

Time	Time	Description of action or activity

Comments:

Title: Changes in PA associated with the MOB/VLL program IRB Study # 12-0431

Day __8__   Date: __/__/2013

Circle the current day of week:
Sunday   Monday   Tuesday   Wednesday   Thursday   Friday   Saturday

Time	Time	Description of action or activity

Comments:

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Title: Changes in PA associated with the MOB/VLL program IRB Study # 12-0431

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