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Role of self-efficacy and anxiety among pre-clinically disabled older adults when using compensatory strategies to complete daily tasks

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Abstract

Classic developmental theory suggests that aging is associated with using compensatory strategies to prolong independence. While compensatory strategies are typically considered positive adaptations, they also signify an early phase in the disablement process — commonly known as pre-clinical disability. To build a better understanding of psychological constructs related to these early signs of disability, we examined the contribution of self-efficacy and state anxiety on using compensatory strategies among pre-clinically disabled older adults. Compensatory strategies were observed during performance of daily activities in 257 pre-clinically disabled older adults (67.6 ± 7.04), and self-efficacy and state anxiety were evaluated prior to performing each task. In univariate models, lower self-efficacy and higher anxiety were associated with more compensation (Spearman correlations: 0.15-0.48, $p < 0.05$). Multivariate logistic regression indicated that low self-efficacy [Odds Ratio (OR): 1.70; 95% Confidence Interval (CI): 1.40-2.08] and high anxiety (OR: 1.34; 95% CI: 1.10-1.63) were positively associated with using 6 compensatory strategies — a level signifying substantial compensation. When considered jointly with self-efficacy, the association with anxiety was reversed— higher anxiety demonstrated a lower likelihood of using compensation (OR: 0.70-0.73; 95% CI: 0.50-0.99). The addition of self-efficacy might remove the self-defeating cognitions characterizing anxiety allowing the remaining arousal component to appear beneficial. In conclusion, lower self-efficacy and higher anxiety are associated with using compensation to complete daily tasks among pre-clinically disabled older adults. Such psychological constructs may contribute to the use of compensatory strategies and represent future intervention targets to help reduce early signs of disability.

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Conflict of interest statement

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Keywords

disablement; confidence; state anxiety; functional task modification

1. Introduction

Successful aging is characterized by using compensatory strategies to cope with impairments and maintain function later in life (Baltes and Baltes, 1997; Freund, 2008). Though various life-span developmental scholars have long presented the use of behavioral compensatory strategies as a positive adaptation in response to functional losses incurred during aging, the medical literature suggests that using compensatory strategies is an early indicator of physical disability (Fried et al., 2001; Wolinsky et al., 2007). Some even assert that using compensatory strategies to complete tasks of daily living is a hallmark sign of pre (sub)-clinical disability—a transitional stage that occurs prior to the onset of disability in some individuals (Guralnik et al., 1995; Manty et al., 2007). Despite compelling research illustrating the significance of behavioral compensatory strategies during this transition, little is known regarding why individuals adopt compensatory strategies to cope with underlying impairments.

Pre-clinical disability was first conceptualized by Fried and colleagues (1991, 1996) who observed that older adults who reported “changing the method or frequency of performing” certain daily tasks were at elevated risk of reporting outright difficulty with the same tasks during follow-up evaluations. This initial evidence, along with additional supporting research, solidified pre-clinical disability as an intermediary stage in the disablement process (Fried et al., 2001; Manty et al., 2007; Petrella and Cress, 2004; Wolinsky et al., 2007). Pre-clinical disability literature advanced beyond the conceptualization phase with the development of objective methods for quantifying the degree of compensatory strategies observed during common daily tasks (Manini, Cook, VanArnam, Marko, & Ploutz-Snyder, 2006; Manini et al., 2007; Naugle et al., 2011). Such developments confirm indices of self-reported compensatory behaviors, which are the most common method employed to identify pre-clinically disabled adults (Wolinsky et al., 2005).

Though empirical findings clearly indicate that pre-clinical disability represents a pivotal transition in the disablement process, a number of key questions regarding the psychology of pre-clinical disability remain unanswered. Gregory and colleagues (2003) suggest that the use of compensatory strategies increases older adults’ perceptions of task difficulty and eventually leads them to report having difficulty. However, we have yet to formally understand the psychology involved with using a compensatory strategy—specifically, whether cognitive and affective factors are associated with the decision to utilize compensatory strategies.

A growing body of evidence suggests that self-efficacy beliefs and anxiety play significant roles in the functional decline of older adults (Foldvari et al., 2000; Rejeski et al., 1996; Rejeski et al., 2001; Seeman et al., 1999). It therefore follows that these psychological constructs are involved in the etiology of pre-clinical disability. For example, low self-efficacy is associated with numerous adverse health outcomes, including increased risk of falls (Andresen et al., 2006), functional limitations (Rejeski et al., 1996, 2001), and physical disability (Rejeski et al., 2001; Seeman et al., 1999). Conversely, Rejeski, et al. (2001) established that when task-specific indices of self-efficacy are implemented, high self-efficacy appears to protect against functional losses, particularly when individuals are coping with impairments (Rejeski et al., 2001). Because self-efficacy affects the persistence and intensity of effort individuals devote to achieving a certain level of performance

(Bandura, 1997), self-efficacy theoretically could have an influential role in determining how older adults cope with physical impairments. In particular, self-efficacy beliefs may govern whether older adults choose to use compensatory strategies to facilitate task performance or attempt to complete daily tasks without them.

Because pre-clinical disability is defined as modifying the method or frequency of daily tasks, an imbalance likely exists between the perception of environmental demands and response capabilities. Such an imbalance is also a distinctive feature of anxiety (Martens et al., 1990). Anxiety represents an affective state characterized by feelings of uncertainty, worry, concern, and tension (Woodman and Hardy, 2001) and alters motor performance (Craft et al., 2003; Janelle, 2002). Subclinical symptoms of anxiety appear to represent a risk factor for the progression of disability and are negatively associated with physical functioning (Brenes et al., 2005; Lenze et al., 2001). Importantly, previous work indicates that somatic and cognitive anxiety differentially influence physical function, with somatic, but not cognitive anxiety predicting poor task performance among adults with varying levels of physical disability (Paukert, 2010). Due to inconsistent methodological approaches and divergent findings regarding whether anxiety correlates with both subjective and objective measures of function, the role of anxiety in the disablement process remains unspecified. Considering anxiety typically elevates in response to accumulated performance failures (Cooke et al., 2010), aging adults likely experience increased anxiety regarding daily tasks as they become aware of performance failures, but such a premise has yet to be empirically tested. Further, researchers have yet to assess how different components of state anxiety (i.e., cognitive and somatic anxiety) are related to functional task performance in pre-clinically disabled older adults.

We sought to determine the association among self-efficacy, anxiety types, and use of compensatory strategies to more fully understand the etiology of pre-clinical disability. We hypothesized higher self-efficacy and/or lower state anxiety would be associated with using fewer compensatory strategies. Support for the current hypothesis would suggest that self-efficacy and/or anxiety may contribute to using compensatory strategies even when they may not be necessitated by poor physical function.

2. Materials and Methods

2.1 Participants

Two hundred fifty seven community dwelling older adults (141 female: average age 67.6 ± 7.04 years, 88.7% white) completed the study assessments. The data in this report represent an ancillary study to a clinical trial in pre-clinically disabled older adults. Potential participants were recruited through advertisements posted in local newspapers and mass mailings sent to residents over the age of 60 years within a 50-mile radius of the testing center.

Figure 1 shows the flow of participants through the study. Potential participants ($n = 446$) were screened by telephone. During the telephone screen, participants were asked whether a doctor had told them they had any of the following conditions in the last six months: coronary, myocardial infarction, heart attack, valvular disease, or stroke. Additionally, participants were asked whether they currently had any of the following conditions: chronic hepatitis, inflammation of the liver, cirrhosis, neurological condition, symptomatic rheumatoid arthritis or osteoarthritis that limits mobility, anemia, serious emotional problems or mental illness, chronic kidney disease, and fracture and joint replacement in the past 6 months. Twenty-six participants were excluded because they had one or more of the aforementioned conditions. Eighty-four participants were excluded for other reasons including: exercising more than 125 minutes/week (i.e., to rule out the effects of chronic

exercise behaviors), moving out of area, and not willing to participate in all of study procedures. The University of Florida Institutional Review Board reviewed and approved the protocol. All participants gave written informed consent prior to their enrollment in the study.

Pre-clinical disability was defined according to Fried et al.'s (Fried et al., 1991; Fried et al., 1996; Miller et al., 2005) established criteria as a change in frequency or modification of daily tasks without having overt difficulty performing a particular task. During the phone interview potential participants were asked if they had difficulty performing or changed the manner or frequency with which they performed five tasks, including walking half a mile, climbing a flight of stairs, stooping, crouching, or kneeling, getting up off the floor, or lifting something as heavy as 10 pounds. An anchor was used for each question by asking, “as compared to when you were 40 years of age”. Those who reported *a little, some or a lot of difficulty* were excluded because they were considered disabled. Specifically, potential participants reporting any difficulty walking half a mile, climbing a flight of stairs, stooping, crouching, or kneeling, getting up off the floor, or lifting something as heavy as 10 pounds were not invited for testing ($n = 52$). Two hundred seventy participants reported no difficulty and changed the frequency or modified daily tasks, 14 participants had no difficulty and did not change the frequency or modify daily tasks.

2.2 Objective measure of pre-clinical disability

Traditionally, self-report has served as the primary method to identify pre-clinically disabled adults. For this study, it was critical to objectively determine the degree and severity of compensatory strategies to effectively examine the association with psychological processes. Therefore, we objectively measured compensatory strategies on 8 daily tasks using a reliable and valid performance scale developed to specifically rank the degree and severity of compensatory strategies – The Task Modification (MOD) Scale (full details of the MOD scale are described in Manini et al., 2006 and Manini et al., 2007). Participants performed a chair rise from three different seat pan heights (43 cm, 38 cm, and 30 cm), a kneel rise, stair ascent, stair descent, a rise from the floor, and lifting then carrying a laundry basket filled with 10% of a participant's body mass. Prior to performing the task, participants were read standardized instructions that encouraged no use of compensatory strategies unless absolutely necessary (e.g., “go down the stairs as fast as comfortably possible. If you do not need the handrail please do not use it...”). Complete task instructions are shown in Appendix A. These instructions were created to promote a conscious decision to perform the task with or without compensatory strategies. The MOD scale ranks each task from 0-5 according to the type of compensatory strategies used to complete the task. Previous research has demonstrated that the MOD scale is sensitive to change during a behavioral intervention, possesses good test-retest reliability (interclass correlation coefficient [ICC] > 0.90), and compares well with established measures of functional and muscular performance (Manini et al., 2006). To provide further evidence of the MOD scale's validity, the score was compared to walking speed over 400 meters— a common and valid test of physical function — in a subset of participants ($N = 69$). We found a significant correlation between walking speed and the total number of compensatory strategies on the MOD scale (Pearson $R = -0.44$, $p < 0.05$), indicating that scores on the MOD scale are a good proxy for physical function and also provide descriptive information about how tasks were performed.

2.3 Measurement of state anxiety and self-efficacy

When assessing the effects of anxiety on motor performance, anxiety should be conceptualized as a multi-dimensional construct, with cognitive and somatic elements (Martens, Vealey, & Burton, 1990). Cognitive anxiety refers to negative thoughts, worries, and concerns, while somatic anxiety arises from perceptions of physiological arousal, like

muscle tension. The Mental Readiness Form-Likert (MRF-L; Krane, 1994) measures these multi-dimensional constructs. The MRF-L consists of three-items, which index cognitive anxiety (CA; thoughts are: calm – worried), somatic anxiety (SA; body feels: relaxed – tense), and self-efficacy (SE; I am feeling: confident – scared) on an 11-point Likert scale, with desirable ratings (i.e., high confidence and low anxiety) anchoring the low end of the scale and undesirable ratings (i.e., low confidence and high anxiety) anchoring the high end. Consequently, positive correlations depict low SE and high state anxiety or vice versa. The MRF-L was originally developed and validated as a convenient and reliable alternative to longer indices of state anxiety and self-efficacy, such as the Competitive Sport Anxiety Inventory (CSAI; Martens et al., 1990), which was initially implemented to measure affective changes during sport performance (Krane, 1994) but has since been applied to a wide range of motor performance situations, such as musical performances (Lacaille et al., 2007) and laboratory based motor tasks (Murray and Janelle, 2007). MRF-L items show moderate to strong concurrent validity with corresponding CSAI subscales for cognitive anxiety ($R = 0.60 - 0.74$), somatic anxiety ($R = 0.68 - 0.69$), and self-efficacy ($R = 0.54 - 0.79$) (Krane, 1994). Additionally, the internal consistency of the MRF-L in the current sample of participants was found to be excellent across tasks (Cronbachs Alpha = $0.93 - 0.96$).

The MRF-L was verbally delivered using standardized, task-specific instructions and participants were shown a graphic representation of the Likert scale prior to the performance of each MOD task. Participants were asked to indicate which number on the scale best represented their current feelings about the specific task they were undertaking. Participants submitted their responses verbally and these were recorded for data analysis.

2.4 Data Analysis

The first set of data analyses included univariate statistics to delineate the association between objectively measured compensatory strategies – assessed on the MOD scale- and psychological constructs assessed on the MRF-L. Spearman Rank-Order procedures were performed to examine inter-correlations among CA, SA, SE, and MOD score for each task. CA, SA, SE and MOD scores were then pooled across tasks by summing the MOD scores (total MOD: range is 0-40) and averaging the MRF scores. Next, we wanted to examine the association between a high degree of compensation and psychological constructs. To do this we categorized the highest third (total MOD score ≥ 6 , $N = 82$, coded as one) and lowest two-thirds (total MOD score < 6 , $N = 175$, coded as zero) of the total MOD distribution. This cutoff value not only designates a third of the worst performers, but also allows for individuals who might compensate for reasons not due to underlying functional impairments (e.g. having to compensate when rising from a chair due to shorter leg length) to be categorized as having a low degree of compensatory strategies. Individuals who use six or more modifications demonstrate severe modifications on at least two tasks or moderate modifications on several tasks and can be firmly characterized as pre-clinically disabled. We then performed the multivariate logistic regression analysis. Predictors in the model included gender, age (in years), body mass index (BMI; in kg/m^2), and average anxiety and SE scores across all tasks. Post-hoc analyses were used to calculate the predicted probability of using ≥ 6 compensatory strategies on the MOD scale when anxiety and low SE were fixed at 25% (Lower) and 75% (Higher) of the mean. “Lower” anxiety and self-efficacy refer to MRF-L scores of 1.06 and 1.13, respectively. “Higher” anxiety and self-efficacy denotes MRF-L scores of 3.34 and 4.06, respectively. Statistical significance for all analyses was set at an alpha level of $p = .05$. Statistical analyses were done using STATA SE (Version 10.0; College Station, TX)

3. Results

Two hundred and fifty seven of the 270 participants who visited the laboratory completed the protocol. Of the participants who performed all tasks, 67.7% made at least one modification (see Table 1). Mean MOD and MRF-L scores across all participants demonstrated that rising from a kneeling and supine position elicited the highest number of modifications, lowest SE ratings, and highest CA ratings.

In univariate correlations, lower SE ratings and higher anxiety ratings were associated with a higher number of compensatory strategies on the MOD scale (Table 2). Additionally, when considered as a whole, the total MOD score was significantly associated with CA ($r = 0.21$, $p < .05$), SA ($r = 0.25$, $p < .05$), and low SE ($r = 0.51$, $p < .05$). Significant correlations were found between low self-efficacy and anxiety (CA: $r = 0.67$ and SA: $r = 0.68$, both $p < .05$). CA and SA across all tasks were highly correlated with each other ($r = 0.92$, $p < .05$). Because participants did not appear to differentiate between types of anxiety, CA and SA scores were averaged to create a more reliable indicator of state anxiety for each task.

3.1 Predictors of poor functional task performance

No significant interactions of age, BMI, and gender with MOD score were found. Thus, the models only included these variables as marginal effects.

Table 3 illustrates results from logistic regression that modeled the probability of using 6 compensatory strategies measured on the MOD scale. Following adjustments for age, gender, and BMI, higher state anxiety ratings and lower SE rating were significantly associated with the probability of using 6 compensatory strategies. These data indicate that for every one-point increase in state anxiety participants were 1.34 times more likely to perform 6 task modifications. For every one-point decrease in SE, participants were 1.70 times more likely to perform 6 task modifications. Importantly, inclusion of low SE in the state anxiety model caused the odds ratio to significantly reverse in direction (See Model 3 in Table 3). The effect was further explored in a post-hoc analysis that examined the predicted probability of using 6 compensatory strategies on the MOD scale when anxiety and low SE were fixed at 25% (Low) and 75% (High) of the mean. The results (see Figure 2) demonstrate that after considering self-efficacy, individuals who possess higher levels of anxiety are less likely to use extensive compensatory strategies compared to individuals with lower anxiety.

4. Discussion

The purpose of this study was to determine the relationships among self-efficacy, anxiety types, and use of compensatory strategies in older adults. Evidence of associations among these constructs can help clarify why pre-clinically disabled older adults may choose to use compensatory strategies during tasks of daily living. The use of compensatory strategies by individuals who do not report difficulty completing activities of daily living is thought to signify a critical transitional stage in the disablement process. Therefore, examining the association between common psychological constructs of anxiety and self-efficacy with compensatory behavior would elucidate potential psychological factors that are associated with very early signs of disability and would inform future research aimed at preventing disability. Two novel contributions emerged from this investigation: (1) low self-efficacy and high state anxiety were significantly associated with using compensatory strategies, and (2) when simultaneously considering the effect of self-efficacy, state anxiety was associated with a lower likelihood of using compensatory strategies. These findings are elaborated below.

We hypothesized that low self-efficacy and state anxiety would be related to using compensatory strategies. Our findings confirmed these expectations. Low self-efficacy beliefs and higher anxiety levels for each task were associated with a higher level of using compensatory strategies on specific tasks and as a whole. The results were verified in multivariate models adjusting for age, gender, and BMI. Notably, self-efficacy emerged as a more significant predictor of compensatory strategy use than state anxiety, which is in line with meta-analytical data suggesting that self-efficacy predicts performance more accurately than anxiety (Craft et al., 2003). These findings extend current knowledge by illustrating that low self-efficacy beliefs and higher state anxiety are associated with using compensatory strategies in pre-clinically disabled older adults. Our results suggest self-efficacy and state anxiety may influence whether individuals choose to compensate when performing daily tasks and that early use of compensatory strategies may not be entirely driven by physiological factors, such as reductions in muscle strength.

The present findings corroborate previous evidence that self-efficacy is associated with indices of physical function that include: ADL performance, chair rise speed, walking performance, balance performance, and lower-extremity strength in older adults with and without disease conditions (Berkman et al., 1993; Chou and Macfarlane, 2009; Maly et al., 2006, 2007; McAuley et al., 2006; Rejeski et al., 2001; Studenski, 2006). For example, Mendes de Leon and colleagues (1996) found that lower self-efficacy in ambulatory, community dwelling older adults was associated with performance speed after adjusting for sociodemographic factors and health-related factors. They also illustrated that low self-efficacy predicts low physical performance, thus raising the possibility that high self-efficacy may buffer against declining physical function. Subsequent research efforts have further supported claims that self-efficacy modulates the impact of physical impairments on functional status (Marks and Allegrante, 2005; Rejeski et al., 2001; Studenski, 2006). The current study adds to the knowledgebase by providing evidence that self-efficacy is associated with using compensatory strategies — an early indicator of disability in older adults.

Social cognitive theorists assert that self-efficacy influences the performance of health-promoting behaviors, such as coping with physical impairments, by playing an integral role in the regulation of motivation, action, and well-being (Bandura, 1998). Specifically, self-efficacy affects the selection of activities individuals choose to engage in, the degree of challenge they strive for when goal setting, and the amount of persistence and effort exuded in the pursuit of goals (Bandura, 1998). Accordingly, older adults with higher self-efficacy to perform common daily tasks without using compensatory strategies are more likely to be highly motivated and devote more effort to performing the task as instructed, without compensatory strategies. Our finding that self-efficacy was associated with the extent to which individuals compensated on each task supports these theoretical assertions. Further, our results complement Rejeski et al.'s (2001) assertion that high self-efficacy beliefs in disabled older adults may have a protective role by helping to maintain task performance. Together, such evidence indicates that self-efficacy plays a role in both early and late stages of disability.

Our results also indicate state anxiety levels are associated with using compensatory strategies. The present data support prior work demonstrating that poor functional task performance is associated with elevated levels of anxiety (Brenes et al., 2005; DeBeurs et al., 2000). Notably, the anxiety levels reported here are low (~2.5 on an 11 point scale) and would not constitute a high level of anxiety in any context. The finding that state anxiety is positively related to the number of compensatory strategies employed by pre-clinically disabled older adults represents a unique contribution to the literature. While previous studies have reported that sub-clinical anxiety symptoms are associated with self-reported

health and objective indices of physical function (Brenes et al., 2005; DeBeurs et al., 2000), other researchers have argued that anxiety solely affects subjective health measures (Mehta et al., 2007; Paukert et al., 2010). Conflicting results may be attributed to the varying methods used to assess anxiety and a failure to accurately detect early signs of declining physical function. Notably, prior studies did not distinguish somatic and cognitive anxiety components, thus failing to assess potentially distinct aspects of sub-clinical anxiety that could differentially alter performance. Our data suggest that state anxiety levels are significantly, albeit weakly, associated with using compensatory strategies in pre-clinically disabled older adults, with somatic and cognitive anxiety demonstrating a similar magnitude of effect. Notably, reported cognitive and somatic anxiety levels were almost identical, indicating state anxiety components may be more collinear in older adults than in younger adults. Future research is needed to establish whether collinearity accounts for the observed lack of differences between reported cognitive and somatic anxiety levels.

Explanations for the negative effects of anxiety on physical function include activity avoidance due to high levels of worry (Li et al., 2009), interference of smooth muscle coordination, and feelings of fatigue caused by somatic anxiety (Suinn, 2005). A viable explanation for the current results is that high anxious individuals might choose to utilize compensatory strategies to reduce feelings of worry thereby acting to decrease the potentially deleterious effects of muscle tension on task performance. However, we caution this interpretation without systematic manipulations of anxiety as reliable conclusions cannot be drawn regarding the degree to which state anxiety exerts a causal influence on the choice to use a compensatory strategy. Therefore, we propose that future studies experimentally manipulate state anxiety and self-efficacy to evaluate their individual contribution to adopting compensatory behaviors.

An unexpected result occurred when self-efficacy and state anxiety were modeled simultaneously. Based on data from Hardy and colleagues (2007) it would be expected that high anxiety would be counterproductive. However, we found that when state anxiety was assessed within the context of self-efficacy, higher levels of anxiety actually reduced the probability of using 6 compensatory strategies. Notably, this finding should be interpreted with caution, as reported anxiety levels remained relatively low across all participants. “Higher” anxiety, in this case, actually refers to an anxiety level of 3.34 on the 1-11 MRF scale, which is within the low range. “Lower” anxiety denotes an anxiety score of 1.06, indicating calm, relaxed feelings and no anxiety. Barlow and colleagues (2002, 2009) assert that the core components of anxiety are negative affect and physiological arousal. As such, our results suggest that by adjusting for self-efficacy beliefs, which in theory removes the effect of self-defeating cognitions aspect of anxiety, the remaining arousal component reduces the likelihood of using compensatory strategies.

Several anxiety theorists agree that the anxiety-motor performance relationship is dynamic, with state anxiety either enhancing or compromising performance as a function of task demands, environmental conditions, or personality characteristics (Janelle, 2002; Murray and Janelle, 2003, 2007), which lends support to the current findings. Similar results have also been reported in athletes whose performance is enhanced when they experience low levels of anxiety (Edwards and Hardy, 1996; Shukla, 2008). Low levels of arousal are thought to motivate individuals to devote more attention to the tasks and “prime” the body for motor activity (Court et al., 2005; Yoshie et al., 2009). In the current population, low levels of arousal may have increased motivation to perform the tasks as instructed, without using compensatory strategies, and primed the muscles to facilitate task performance with fewer modifications. Such postulates are supported herein and are likely a function of the low levels of anxiety reported by our participants.

Compensatory behavior can be purposeful or highly automatized (Backman & Dixon, 1992). The current findings, which suggest psychological characteristics such as self-efficacy and anxiety are associated with compensation, may be limited to strategic use of compensation. Testing conditions, specifically providing detailed instruction on how to perform each task without using a compensatory strategy, enhanced participants' awareness of the strategies they would implement to complete the tasks, thus ensuring that compensatory behavior would be purposeful and not automated. While using compensatory strategies may not always be as purposeful in the real world, by definition, pre-clinically disabled individuals are in the initial stage of adopting these behaviors, therefore a high degree of automaticity within this population remains unlikely. Individuals occupying later stages in the disablement process might demonstrate more automatic compensatory behavior and thus, may be less influenced by feelings of anxiety and low self-efficacy compared to individuals in this study. Further examination of how psychological characteristics influence compensation as automaticity varies is required to determine the scope of the current findings.

The present study is not without limitations. First, participants with severe disease conditions were excluded from the study to help isolate the influence psychological factors as much as possible, thus the sample of older adults should not be considered generalizable to the population. Second, the MRF-L, which was developed as a short version of the CSAI (Krane, 1994; Wilson et al., 2007), has not been well tested in older populations although we found good internal consistency among older adults in this study. Despite these issues, instructions given to participants before answering the MRF-L directed individuals to their feelings of self-efficacy prior to performance of each task, making the self-efficacy item highly task-specific and meeting the criteria for being a strong assessment of self-efficacy as advanced by Bandura (1997). However, using the terms confident-not confident, rather than confident-scared, on the self-efficacy item would have aligned more closely with established self-efficacy scales, as well as provided truly bipolar anchor terms. Though the current wording on the self-efficacy scale represents a potential limitation that should be remedied in future studies, prior studies indicate that the MRF-L self-efficacy item demonstrates strong concurrent validity with scores on the CSAI's self-efficacy sub-scale (Krane, 1994) and that self-efficacy scores derived from the CSAI are strongly and consistently related to performance (Craft et al., 2003). Additionally, based on the current findings, items on the MRF-L reflected the demand of the tasks in this sample of older adults. While acknowledging potential limitations, the MRF-L seems to constitute an appropriate choice for the current assessment. The MRF-L enabled testing of associations among task-specific self-efficacy, state anxiety, and the use compensatory strategies in a performance situation, which represents an important step toward understanding underlying psychological mechanisms driving the progression of disability. Future research efforts dedicated to tracking how self-efficacy and anxiety change over the course of the disablement process, as well as exploring potential mechanisms such as attentional changes underlying the relationship between self-efficacy and compensatory behavior, are required to gain a comprehensive perspective on how psychological constructs influence functional status in older adults.

In conclusion, findings from the current study emphasize the importance of self-efficacy perceptions on the use of compensatory strategies in pre-clinically disabled older adults. Additionally, the use of compensatory strategies is positively associated with state anxiety, although this association is reversed when considering self-efficacy. The current data demonstrate that psychological constructs are associated with compensatory behavior in pre-clinically disabled older adults, suggesting that early use of compensatory strategies may not always constitute a positive adaptation or be driven solely by functional impairments, as conceptualized by life-span developmental theorists (Freund & Baltes, 2002; Fried et al.,

2001). Finally, these results offer insight into the multidimensional changes that are associated with early signs of disability and indicate that variation in key psychological constructs, such as self-efficacy and anxiety, might underlie pivotal transitions in the disablement process.

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References

- Andresen EM, Wolinsky FD, Miller JP, Wilson MMG, Malmstrom TK, Miller DK. Cross-sectional and longitudinal risk factors for falls, fear of falling, and falls efficacy in a cohort of middle-aged African Americans. *The Gerontologist*. 2006; 46(2):249–257. [PubMed: 16581889]
- Backman L, Dixon RA. Psychological compensation: A theoretical framework. *Psychological Bulletin*. 1992; 11(2):259–283. [PubMed: 1454895]
- Baltes PB. On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist*. 1997; 52(4):366–380. [PubMed: 9109347]
- Bandura, A. *Self-Efficacy: The exercise of control*. W.H. Freeman; New York: 1997.
- Bandura A. Health promotion from the perspective of social cognitive theory. *Psychology and Health*. 1998; 13:623–649.
- Barlow, DH. *Anxiety and its disorders: The nature and treatment of anxiety and panic*. Guilford Press; New York: 2002.
- Berkman LF, Seeman TE, Albert M, Blazer D, Kahn R, Mohs R, Rowe J. High, usual and impaired functioning in community-dwelling older men and women. *Journal of Clinical Epidemiology*. 1993; 46(10):1129–1140. [PubMed: 8410098]
- Brenes GA, Guralnik JM, Williamson JD, Fried LP, Simpson C, Simonsick EM, Penninx BWJH. The influence of anxiety on the progression of disability. *Journal of the American Geriatric Society*. 2005; 53:34–39.
- Brown TA, Barlow DH. A proposal for a dimensional classification system based on the shared features of the DSM-IV anxiety and mood disorders: Implications for assessment and treatment. *Psychological Assessment*. 2009; 21(3):256–271. [PubMed: 19719339]
- Cooke A, Kavussanu M, McIntyre D, Ring C. Psychological, muscular, and kinematic factors mediate performance under pressure. *Psychophysiology*. 2010; 47(6):1109–1118. [PubMed: 20409012]
- Chou KL, Macfarlane DJ. Relationship between performance-based and self-reported measures of lower extremity function in Chinese older women. *Topics in Geriatric Rehabilitation*. 2009; 25(3): 181–190.
- Court M, Bennett S, Williams M, Davids K. Effects of attentional strategies and anxiety constraints on perceptual-motor organization of rhythmical arm movements. *Neuroscience Letters*. 2005; 384:177–22. [PubMed: 15893424]
- Craft LL, Magyar TM, Becker BJ, Feltz DL. The relationship between the Competitive State Anxiety Inventory-2 and sport performance: A meta-analysis. *Journal of Sport and Exercise Psychology*. 2003; 25(1):44–65.
- De Beurs E, Beekman ATF, Deeg DJH, Van Dyck R, Van Tilburg W. Predictors of change in anxiety symptoms of older persons: Results from the Longitudinal Aging Study. *Psychological Medicine*. 2000; 30:515–527. [PubMed: 10883708]
- Edwards T, Hardy L. The interactive effects of intensity and direction of cognitive and somatic anxiety and self-confidence upon performance. *Journal of Sport and Exercise Psychology*. 1996; 18:296–312.

- Foldvari M, Clark M, Laviolette LC, Bernstein MA, Kaliton D, Castaneda C, Singh MAF. Association of muscle power with functional status in community-dwelling elderly women. *Journal of Gerontology: Medical Sciences*. 2000; 55A:M192–M199.
- Freund AM. Successful aging as management of resources: the role of selection, optimization, and compensation. *Research in Human Development*. 2008; 5(2):94–106.
- Freund AM, Baltes PB. Life-management strategies of selection, optimization, and compensation: Measurement by self-report and construct validity. *Journal of Personality and Social Psychology*. 2002; 82(4):642–662. [PubMed: 11999929]
- Fried LP, Bandeen-Roche K, Williamson JD, Prasada-Rao P, Chee E, Tepper S, Rubin GS. Functional decline in older adults: Expanding methods of ascertainment. *Journal of Gerontology: Medical Sciences*. 1996; 51A(5):M206–M214.
- Fried LP, Herdman SJ, Kuhn KE, Rubin G, Turano K. Preclinical disability: Hypotheses about the bottom of the iceberg. *Journal of Aging and Health*. 1991; 3(2):285–300.
- Fried LP, Young Y, Rubin G, Bandeen-Roche K. Self-reported preclinical disability identifies older women with early declines in performance and early disease. *Journal of Clinical Epidemiology*. 2001; 54:889–901. [PubMed: 11520648]
- Gregory PC, Fried LP. Why do older adults decide they are having difficulty with a task? *American Journal of Physical Medicine & Rehabilitation*. 2003; 82(1):9–16. [PubMed: 12510179]
- Guralnik JM, Ferucci L, Simonsick EM, Salive ME, Wallace RB. Lower extremity function in persons over the age of 70 years a predictor of subsequent disability. *New England Journal of Medicine*. 1995; 332:556–561. [PubMed: 7838189]
- Hardy L, Beattie S, Woodman T. Anxiety-induced performance catastrophes: Investigating effort required as an asymmetry factor. *British Journal of Psychology*. 2007; 98:15–31. [PubMed: 17319048]
- Janelle CM. Anxiety, arousal and visual attention: A mechanistic account of performance variability. *Journal of Sports Sciences*. 2002; 20(3):237–251. [PubMed: 11999479]
- Krane V. The Mental Readiness Form as a measure of competitive state anxiety. *The Sport Psychologist*. 1994; 8:189–202.
- Lacaille N, Koestner R, Gadreau P. On the value of intrinsic rather than traditional achievement goals for performing artists: a short-term prospective study. *International Journal of Music Education*. 2007; 25(3):245–257.
- Lenze EJ, Rogers JC, Martire LM, Mulsant BH, Rollman BL, Dew MA, Reynolds CF. The association of late-life depression and anxiety with physical disability: A review of the literature and prospectus for future research. *American Journal of Geriatric Psychiatry*. 2001; 9(2):113–135. [PubMed: 11316616]
- Li KK, Cardinal BJ, Vuchinich S. Health worry, physical activity participation, and walking difficulty among older adults: A mediation analysis. *Research Quarterly for Exercise and Sport*. 2009; 80:12–22. [PubMed: 19408463]
- Maly MR, Costigan PA, Olney SJ. Determinants of self-efficacy for physical tasks in people with knee osteoarthritis. *Arthritis & Rheumatism*. 2006; 55(1):94–101. [PubMed: 16463419]
- Manini TM, Cook SB, VanArman T, Marko M, Ploutz-Snyder L. Evaluating task modification as an objective measure of functional limitation: Repeatability and comparability. *Journal of Gerontology: Medical Sciences*. 2006; 61A(7):718–725.
- Manini T, Marko M, Van Arman T, Cook S, Fernhall B, Burke J, Ploutz-Snyder L. Efficacy of resistance and task-specific exercise in older adults who modify tasks of everyday life. *Journal of Gerontology: Medical Sciences*. 2007; 62A(6):616–623.
- Manty M, Heinonen A, Leinonen R, Tormakangas T, Sakuri-Rantala R, Hirvensalo M, Rantanen T. Construct and predictive validity of self-reported measure of preclinical mobility limitation. *Archives of Physical Medicine & Rehabilitation*. 2007; 88(9):1108–1113. [PubMed: 17826454]
- Marks R, Allegrante JP. A review and synthesis of research evidence for self-efficacy enhancing interventions for reducing chronic disability: Implications for health education practice. *Health Promotion Practice*. 2005; 6:148–156. [PubMed: 15855284]

- Martens, R.; Burton, D.; Vealey, RS.; Bump, LA.; Smith, DE. Development and validation of the Competitive State Anxiety Inventory-2.. In: Martens, R.; Vealey, RS.; Burton, D., editors. Competitive anxiety in sport. Human Kinetics; Champaign, IL: 1990. p. 117-190.
- McAuley E, Konopack JF, Morris KS, Motl RW, Hu L, Doerksen SE, Rosengren K. Physical activity and functional limitations in older women: Influence of self-efficacy. *Journal of Gerontology: Psychological Sciences*. 2006; 61B(5):P270–P277.
- Mehta KM, Yaffe K, Brenes GA, Newman AB, Shorr RI, Simonsick EM, Covinsky KE. Anxiety symptoms and decline in physical function over 5 years in the Health, Aging, and Body Composition Study. *Journal of the American Geriatric Society*. 2007; 55(2):265–270.
- Mendes de Leon CF, Seeman TE, Baker DI, Richardson ED, Tinetti ME. Self-efficacy, physical decline, and change in functioning in community-living elders: A prospective study. *Journal of Gerontology: Social Sciences*. 1996; 51B:S183–S190.
- Miller DK, Wolinsky FD, Malmstrom TK, Andresen EM, Miller JP. Inner city, middle-aged African Americans have excess frank and subclinical disability. *Journal of Gerontology, Medical Sciences*. 2005; 60A(2):207–212.
- Murray NP, Janelle CM. Event-related potential evidence for the processing efficiency theory. *Journal of Sports Sciences*. 2007; 25(2):161–171. [PubMed: 17127591]
- Murray NP, Janelle CM. Anxiety and performance: A visual search examination of the processing efficiency theory. *Journal of Sport & Exercise Psychology*. 2003; 25:171–187.
- Naugle KM, Higgins TJ, Manini TM. Obesity and use of compensatory strategies to perform common daily activities in pre-clinically disabled older adults. *Archives of Gerontology and Geriatrics*. 2011; 54(2):134–138.
- Paukert AL, Pettit JW, Kunik ME, Wilson N, Novy DM, Rhoades, Stanley MA. The roles of social support and self-efficacy in physical health's impact on depressive and anxiety symptoms in older adults. *Journal of Clinical Psychology in Medical Settings*. 2010; 17:387–400. [PubMed: 21110074]
- Petrella JK, Cress ME. Daily ambulation activity and task performance in community-dwelling older adults aged 63-71 years with preclinical disability. *Journal of Gerontology: Medical Sciences*. 2004; 59A(3):264–267.
- Rejeski WJ, Craven T, Ettinger WH, McFarlane M, Shumaker S. Self-efficacy and pain in disability with osteoarthritis of the knee. *Journal of Gerontology: Psychological Sciences*. 1996; 51B:P24–P29.
- Rejeski WJ, Miller ME, Foy C, Messier S, Rapp S. Self-efficacy and the progression of functional limitations and self-reported disability in older adults with knee pain. *Journal of Gerontology, Social Sciences*. 2001; 56B:S261–S265.
- Seeman TE, Unger JB, McAvay G, Mendes de Leon CFM. Self-efficacy beliefs and perceived declines in functional ability: MacArthur studies of successful aging. *Journal of Gerontology: Psychological Sciences*. 1999; 54B:P214–P222.
- Shukla, R. Anxiety: As a tool to enhance performance.. In: Singh, S., editor. *Psychology of sports performance: Applications, interventions, and methods*. Global Vision; New Delhi, India: 2008.
- Studenski, S. Gait, mobility, and function: A review and proposed classification scheme.. In: Hausdorff, JM.; Alexander, NB., editors. *Gait disorders evaluation and management*. Taylor & Francis; New York: 2006. p. 1-14.
- Suinn RM. Behavioral intervention for stress management in sports. *International Journal of Stress Management*. 2005; 12(4):343–362.
- Wilson M, Smith NC, Holmes PS. The role of effort in influencing the effect of anxiety on performance: Testing the conflicting predictions of processing efficiency theory and the conscious processing hypothesis. *British Journal of Psychology*. 2007; 98:411–428. [PubMed: 17705939]
- Wolinsky FD, Miller DG, Andresen EM, Malmstrom TK, Miller JP. Further evidence for the importance of subclinical functional limitation and subclinical disability assessment in gerontology and geriatrics. *Journal of Gerontology: Social Sciences*. 2007; 60B(3):S146–S151.
- Wolinsky FD, Miller DG, Andresen EM, Malmstrom TK, Miller JP, Miller TR. Effect of subclinical status in functional limitation and disability on adverse health outcomes 3 years later. *Journal of Gerontology: Medical Sciences*. 2007; 62A:101–106.

- Woodman, T.; Hardy, L. Stress and anxiety.. In: Singer, RN.; Hausenblas, HA.; Janelle, CM., editors. Handbook of sport psychology. Wiley; New York: 2001. p. 290-318.
- Yoshie M, Kudo K, Murakoshi T, Ohtsuki T. Music performance anxiety in skilled pianists: Effects of social-evaluative performance situation on subjective, autonomic, and electromyographic reactions. *Experimental Brain Research*. 2009; 199:117–126.

Figure 1.
Participant flow through the study

Figure 2.

Predicted probabilities of using > 6 compensatory strategies fitted with logistic regression models that included self-efficacy, anxiety (somatic and cognitive anxiety models fit separately), body mass index, gender and age. For illustrative purposes, the predicted values were fixed at percentiles of anxiety and self-efficacy with lower representing the 25th (Lower) and higher representing the 75th (Higher) percentile. Lower anxiety and lower self-efficacy refer to scores of 1.06 and 1.13, respectively, on the 1-11 MRF scale, while higher anxiety and higher self-efficacy denote scores of 3.34 and 4.06, respectively. The figure illustrates that having higher levels of anxiety reduces the probability of using greater than 6 compensatory strategies when simultaneously considering the association with self-efficacy.

Table 1

Descriptive statistics of total sample's scores on MOD scale and MRF-L items

Task	MOD score <i>M(SD)</i>	MOD > 1 [*]	CA <i>M(SD)</i>	SA <i>M(SD)</i>	SE <i>M(SD)</i>
43 cm chair rise	0.38 (0.71)	10.5	2.28 (1.63)	2.62 (1.72)	2.30 (1.70)
38 cm chair rise	0.61 (0.82)	16.7	2.30 (1.77)	2.45 (1.71)	2.66 (1.89)
30 cm chair rise	0.78 (1.00)	20.6	2.52 (2.05)	2.61 (1.97)	3.36 (2.37)
Kneel Rise	.94 (1.15)	37.4	2.72 (2.13)	2.74 (2.07)	3.66 (2.62)
Stair Ascent	0.35 (0.86)	9.3	2.28 (1.67)	2.40 (1.73)	2.66 (1.99)
Stair Decent	0.61 (1.10)	17.1	2.29 (1.77)	2.39 (1.83)	2.75 (2.12)
Supine to Stand	1.19 (1.23)	37.0	2.64 (2.24)	2.71 (2.22)	3.55 (2.71)
Lift & Carry	0.16 (0.65)	5.5	1.96 (1.55)	2.04 (1.57)	2.22 (1.87)
Total MOD	5.51 (5.70)	67.3	---	---	---
Average MRF	---	---	2.38 (1.61)	2.50 (1.59)	2.90 (1.77)

Notes. *M* = mean; *SD* = standard deviation; CA = cognitive anxiety; SA = somatic anxiety; SE = self-efficacy; MOD = number of modifications used during task performance; MOD Total = summed number of modifications performed during all tasks

^{*} denotes scores expressed as percentages; dashes indicate data not applicable.

Table 2

Spearman rank correlations (r) between performance (MOD score) and SE, CA, and SA ratings across tasks

MOD score	43 cm Chair	38 cm Chair	30 cm Chair	Kneel Rise	Ascend Stair	Descend Stair	Supine to Stand	Lift & Carry
SE rating	0.24 *	0.24 *	0.47 *	0.48 *	0.29 *	0.33 *	0.46 *	0.36 *
CA rating	0.09	0.16 *	0.26 *	0.32 *	0.15 *	0.17 *	0.32 *	0.26 *
SA rating	0.06	0.16 *	0.24 *	0.31 *	0.16 *	0.19 *	0.34 *	0.22 *

Note.

High MRF-L scores represent higher ratings of CA and SA but lower ratings of SE.

* denotes $p < .05$.

Table 3
Logistic regression models predicting high task modification (6 compensatory strategies)

	Model 1 b (95% CI)	P-value	Model 2 b (95% CI)	P-value	Model 3 b (95% CI)	P-value
Model predictors						
Age (yrs)	1.16 (1.10, 1.22)	<0.001	1.14 (1.08, 1.20)	<0.001	1.13 (1.07, 1.19)	<0.001
Female	3.88 (1.97, 7.64)	<0.001	3.31 (1.59, 6.90)	<0.001	3.30 (1.57, 6.95)	0.002
BMI	2.25 (1.60, 3.16)	<0.001	1.14 (1.07, 1.21)	<0.001	2.12 (1.47, 3.05)	<0.001
Anxiety [*]	1.34 (1.10, 1.63)	0.004	NA		0.70 (0.50, 0.99)	0.044
SE [^]	NA		1.70 (1.40, 2.08)	<0.001	2.19 (1.57, 3.05)	<0.001

Note.

Bolded values denote $p < .05$; NA indicates the predictor was not included in the model

^{*} indicates average MRF score across all tasks

[^] high SE scores on the MRF reflect being less confident.