AUTONOMY SUPPORT, SATISFACTION OF THE NEED FOR AUTONOMY, AND AUTONOMOUS REGULATION FOR PHYSICAL ACTIVITY IN OLDER ADULTS

by

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ABSTRACT

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Background. Regular physical activity is beneficial for older adults in order to protect against age related injuries and illnesses, and to maintain their independence and quality of life. However, older adults are the least likely age group to meet the physical activity guidelines set forth by the American College of Sports Medicine and World Health Organization. According to the self-determination theory framework, health practitioners and exercise instructors should aim to create and deliver interventions in a way that fosters an autonomy-supportive health care climate (e.g., taking the perspectives of patients, providing choices) to facilitate satisfaction of the basic psychological needs and self-determined motivation. *Purpose*. The specific aims of this study were to (1) determine whether autonomy support is associated with physical activity-related need for autonomy, autonomous regulation, and physical activity behavior; and to (2) determine whether autonomy support moderates the association between physical activity-related need for autonomy and autonomous regulation. *Methods.* The design of the study was longitudinal. A total of 431 adults aged ≥ 55 years completed an online survey (Baseline – Week 0) containing self-determination theory-related predictor variables, along with past month and past week physical activity. Weekly online physical activity recall questionnaires were completed for four weeks (at Week 1, Week 2, Week 3, and Week 4). The product of coefficient $a \times b$ approach was used to test the mediation effect using multiple linear regression analysis. The Monte Carlo 95% confidence interval [95% CI] (5,000 bootstrap samples) for the mediated effects were obtained using Hayes SAS MCMED macro. *Results.* Physical activity-related need for autonomy was found to partially mediate the relationship between autonomy support and autonomous regulation, but only for those who were engaging in physical activity 2 days per week (0.0195 [0.0004, 0.0438]) and ≥ 4 days per week (0.0390 [0.0098, 0.0774]). Additionally, the physical activity-related need for autonomy and autonomous regulation were found to mediate the relationship between autonomy support and physical activity, but only for those who were previously physically active

(≥ 4 days per week in the last month) and younger (e.g. aged 58 years). Autonomy support was not found to moderate the need for autonomy-autonomous regulation relationship. Physical activity-related need for competence was positively associated with autonomous regulation and physical activity behavior. *Conclusion.* In line with the self-determination theory, the current findings suggest that the facilitation of autonomy support and the subsequent fulfillment of the psychological needs; consequently, lead to an increase in autonomous regulation. Future research should consider how the need for competence plays a role in physical activity participation beyond autonomous regulation as adults age.

CHAPTER 1. INTRODUCTION

Physical Activity and Health in Older Adults

Older adults make up a sizeable portion of the population in the United States, and it is estimated that the number of older adults will climb towards 80 million in the future (Ortman & Velkoff, 2014). While the current cohort of older adult population is increasing in size, they tend to be the least physically active of any age group in the United States (Katzmarzyk etl al., 2007). As of 2017, 47.8% of adults aged 55 and over in the state of Indiana do not meet the recommended levels of physical activity set forth by both the American College of Sports Medicine (ACSM) and World Health Organization (WHO) (Center for Disease Control and Prevention [CDC], 2019). Moreover, 33.8% of adults aged 55 and older in the state of Indiana engage in no leisure time physical activity compared to roughly 25% for adults aged 18 and older (CDC, 2019).

Just knowing and understanding the importance of physical activity is often times not enough to motivate an otherwise sedentary and physically inactive individual to engage in and maintain regular physical activity participation (Cress et al., 2005). Older adults who aren't engaging in physical activity are at greater risk of chronic illnesses such as diabetes, heart disease, and high blood pressure, and to suffer from injuries associated with falls. Regular engagement in physical activity helps to protect against these age-related chronic illnesses, preserve their ability to maintain independence and freedom of choice; thereby, enhancing their quality of life (Elavsky et al., 2005; Nelson et al., 2007; Lautenschlager et al., 2008; Chodzko-Zajko et al., 2009). Therefore, it is important to devote more attention to the creation of health promotion strategies that better support older adults in their endeavor to increase and sustain regular engagement in physical activity. One such way, is through the use of the self-determination theory; to create

physical activity interventions that help individuals become more physically active and maintain physical activity over time.

One of the major components of self-determination theory is the concept that humans are growth oriented and investigative creatures, with innate needs that are derived at the psychological level (Deci & Ryan, 2000). While self-determination theory is not the only theory to suggest this, it is the only one to consider that when autonomy as a need is supported, it facilitates more autonomous forms of behavioral regulation (Ng et al., 2012). According to the self-determination theory (Ryan & Deci, 2000), an increase in sense of choice and freedom from external pressure to behave in a certain way will enhance the perception of autonomy and self-determined motivation; thereby, supporting the adoption and maintenance of a given behavior. If physical activity interventions are to focus on increasing an individual's sense of autonomy through the choices they make, the self-determination theory posits that an increase in self-determined motivation would be experienced. This can be achieved by matching program components (e.g., content, format, and pedagogy) to the population's preferences and attributes to maximize program acceptance and increase physical activity participation (Morgan, Young, Smith, & Lubin, 2016). Therefore, the self-determination theory is best suited for understanding how maximizing the fulfillment of the need for autonomy and the factors that enhance that fulfillment (e.g., autonomy support) affect motivation to engage is specific behaviors (e.g., physical activity) and the subsequent actions themselves.

Self-Determination Theory

The self-determination theory is a meta-theory of human motivation, emotion, and personality that focuses on the quality of motivation and the conditions that support people's drive to growth, engagement in and persistence with health-related behaviors, and well-being (Deci &

Ryan, 2000). According to the self-determination theory, "people coherently refine interests, values, and preferences and strive to integrate into the social milieu, partly through [an] internalization process" (Standage, Curran & Rouse, 2018, pp. 290). It is also assumed that the "innate tendencies of growth […] hinges on the provision of necessary nutriments and social supports that either support or thwart" the development of an integrated sense of the self (Deci & Ryan, 2000; Standage, Curran & Rouse, 2018, pp. 290). According to Standage et al. (2018), the self-determination theory consists of six mini-theories and four of them provide the theoretical foundation of this thesis project: (*i*) the basic psychological needs theory, (*ii*) the organismic integration theory, (*iii*) the cognitive evaluation theory, and (*iv*) the causality orientation theory. One key unifying feature of this framework is the concept of basic psychological needs.

Basic Psychological Needs Theory. Needs are defined as "organismic necessities of healthy functioning" and they represent the necessary nutriments for people's drive to growth, engagement in and persistence with health-related behaviors, personal growth, and well-being (Deci & Ryan, 2000, Deci & Vansteenkiste, 2003). Specifically, these include the need for autonomy (i.e., the need to perceive that one has choice and is in control of their own behavior), the need for competence (i.e., need to feel effective at achieving a desired outcome), and the need for relatedness (i.e., the need to feel close, connected, and cared for by important others). According to the basic psychological needs theory, the fulfillment of these three basic psychological needs should lead to an increase in engagement in and persistence with health-related behaviors, personal growth, and well-being, optimal growth and greater life satisfaction (Standage et al., 2018)

The Organismic Integration Theory. The organismic integration theory allows for the conceptualization of the different types of extrinsic motivation within the self-determination theory (Ryan & Deci, 2000)). This theory specifies four extrinsic forms of motivation – all anchored

between amotivation (i.e., no intention or lack of control) and intrinsic motivation (i.e., enjoyment or inherent satisfaction), with amotivation being the least autonomous type of motivation and intrinsic motivation being the most autonomous types of motivation (see Figure 1). From the least to most autonomous forms of extrinsic motivation are external regulation, introjected regulation, identified regulation, and integrated regulation (see Table 1 for examples). One of the critical implications of the organismic integration theory is to move individuals toward a more autonomous type of motivation such that their motivation comes completely from their own volition rather than external factors. More autonomous types of motivation have been shown to be associated with better estimates of exercise adherence (Russel & Bray, 2010; Teixeira, Carraca, Markland, Silva, & Ryan, 2012).

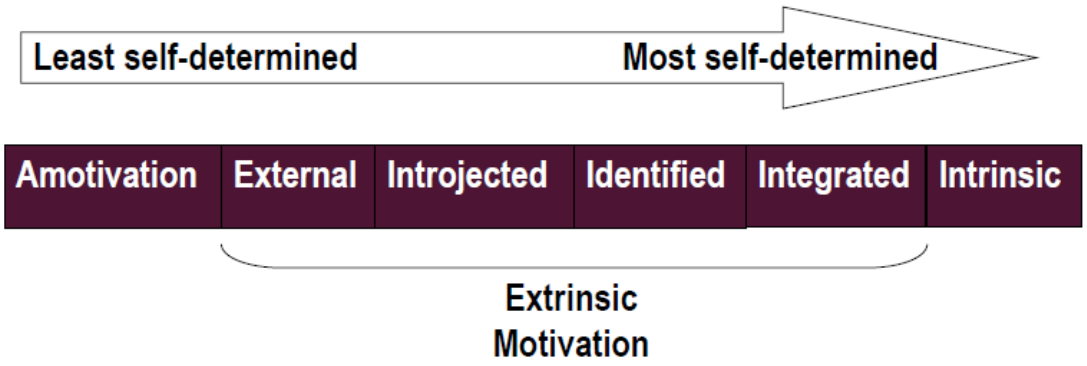


Figure 1. The Organismic Integration Motivation Continuum.

Table 1. The Organismic Integration Motivation Regulations

Type of regulation	Definition	Example
External regulation	Behavior is controlled by external factors	Avoidance of punishment or tangible rewards (e.g. money)
Introjected regulation	Behavior is guided by factors such as shame or guilt	Being physically active because you feel you have to so you won't feel bad about not being active
Identified regulation	Behaviors are autonomously motivated by an identified value, or purpose	Being physically active for an identified health outcome
Integrated regulation	Behavior aligns with a person's identity, values, and goals	Being physically active is part of your sense of self, it's who you are.

Adapted from Ryan & Deci (2000) and Standage et al. (2018).

The Cognitive Evaluation Theory. The cognitive evaluation theory is concerned with the study of intrinsic motivation (Deci & Ryan, 1985), and outlines the ways in which intrinsic motivation can be enhanced or undermined – a critical first step in understanding health behaviors. The cognitive evaluation theory focuses on the effects of the satisfaction of the need for autonomy and competence on intrinsic motivation. However, competence alone without the addition of an autonomous regulation may not be enough to enhance intrinsic motivation (Ryan & Deci, 2000). According to the cognitive evaluation theory, the perception of choice will lead to a greater satisfaction of the need for autonomy and increase intrinsic motivation. In line with this key theoretical proposition, a meta-analysis of 41 studies revealed that offering choice (choice between activities, choice between versions of an activity, choice between instructionally irrelevant aspects of an activity, choice between instructionally relevant aspects, choice between rewards for the task) enhances intrinsic motivation across settings (i.e., traditional laboratory, laboratory within a natural setting, and natural setting) and populations, in addition to other variables such as task-

performance and competence (Patall, Cooper, & Robinson, 2008). Additionally, Thompson & Wankel (1980) found during a 6-week exercise program, that individuals who had a higher perception of choice with regards to the activities of their program, showed statistically significant higher attendance rates than those in the no choice group. Data was collected for all weeks, but statistically significant differences were only observed for weeks 5 and 6, with weeks 1-4 having similar attendance rates for both groups. This observation lends support to the fact that the effects of perception of choice may be less effective initially, but grow stronger as time passes.

The Causality Orientation Theory. The causality orientation theory focuses on the traits of individuals in the form of causality orientations (Standage et al., 2018). This theory proposes that all individuals vary to some extent across three orientations: autonomy orientation (i.e., interpreting the environment as autonomy supportive and to align towards an intrinsic motivation), controlled orientation (i.e., interpreting the environment as being controlling and orienting towards a motivation that results from internal or external controls and constraints), and impersonal orientation (i.e., interpreting the environment as having obstacles that prevent reaching outcome goals and consider themselves to act without intention and competence) (Vallerand, 1997; Standage et al., 2018). Causality orientations describe how contextual and motivational processes are influenced by traits (i.e., orientations) (Vallerand, 1997; Standage et al., 2018). While little research exists examining the effects of causality orientations in physical activity settings, one common theme emerges; controlled orientations are associated with lower levels of autonomous motivation and physical activity (Kwan, Hooper, Magnan, & Bryan, 2011; Richards, McDonough, & Fu, 2017; Rose, Parfitt, & Williams, 2005).

With regards to findings in experimental settings, one study found that in a primary care setting with adults aged 18-65 (mean age = 47.5 years), an experimental condition receiving

autonomy supportive counseling over a 3-month period showed statistically significant associations between six-week autonomous motivation and 12-week physical activity. Whereas the control group did not show a statistically significant association (Fortier, Sweet, O'Sullivan, &Williams, 2007). What's important to note with regards to this study is the autonomy supportive aspect. Zubala et al. (2017) note in their systematic review of reviews that physical activity interventions for older adults tend to be effective but it is not clear which specific component of the interventions are the most effective. They add that factors such as social support and enjoyment from being physically active may be more suitable for older adults rather than purely behavior change techniques and cognitive strategies, which provides some support for the use of autonomy support in promoting physical activity in older adults.

In summary, self-determination theory is useful for understanding how the fulfillment of the three basic psychological needs, specifically the need for autonomy, and different types of motivation orientations affect both engagement in and persistence with health behavior. The self-determination theory also posits that an increase in a sense of choice for a given behavior will lead to an increase in a sense of autonomy and self-determined motivation, which in turn, should lead to an increase in participation in that behavior, growth and well-being (Ryan & Deci, 2000).

Autonomy Support and Physical Activity

Autonomy support is described as actions that are characterized by empathy and understanding for an individual's situation and the provision of choices for making health behavior changes (Martire et al., 2013). An example would be an exercise class leader who is supportive of one's choice to become physically active, and affords them the opportunity to have a say in how things are planned (e.g., frequency, type, or intensity). Previous research and the self-determination theory provide support for the use of autonomy support to increase physical activity

participation in the general adult population. For example, a study found that in middle-aged women an autonomy supportive style (e.g., "In today's class the exercise instructor was encouraging me to ask questions") led to greater attendance and higher levels of physical activity at 5-week post intervention exercise versus the lack of autonomy support control group (Moustaka, Vlachopoulos, Kabistis, & Teodorakis, 2012). Additionally, Buman et al. (2011) found that peer volunteers delivering an active-intervention using strategies grounded in social cognitive theory and self-determination theory led to a higher increase in moderate-to-vigorous physical activity for older adults at 18-month follow up than for the non-theory based intervention control group. In addition, provision of autonomy support for caregivers of those with chronic pain was shown to be associated with greater well-being (Ascigil, Uysal, & Cosar, 2019). This suggests that well-being, a key outcome of the self-determination theory, may be attainable by providing an environment that is conducive to fulfilling the basic psychological needs such as autonomy, and in turn autonomy support.

A number of observational studies have examined the effect of perceived autonomy support, reporting somewhat consistent results. One such study found that in elite athletes and young students in physical education, instructors who conveyed high levels of autonomy support led to greater need satisfaction and higher levels of autonomous motivation in the participants (Haerens et al., 2017). Additionally, it has been reported that an exercise class led by autonomy supportive instructors leads to an increase is self-determined motivation (Edmunds, Ntouanis, & Duda, 2006). Likewise, Chatzisarantis & Hagger (2009) noted that students taught by autonomy supportive teachers reported higher levels of leisure-time physical activity as well as intentions to engage in those activities versus a control group. In addition, in a correlational study it was reported

that autonomy support derived from friends can also result in increased levels of self-determined motivation (Wilson & Rogers, 2004).

However, Edmunds, Ntoumanis, & Duda (2007) reported that a higher perceived autonomy support from exercise counselors in a physician-referred exercise scheme (an exercise plan developed by a professional based on the subject's health condition) was not observed for individuals who adhered more vs. those who adhered less. However, some research has observed that perceptions of autonomy support in physical education settings is associated with levels of autonomy support and autonomous motivation in leisure time activity (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Hagger, Chatzisarantis, Barkoukis, & Wang, 2005). It is worth noting that while autonomy support tends to focus mainly on the environment and its support of autonomy, it does include an aspect of making choices. Where the previous literature has yet to expand upon is whether the autonomy support (one's perception of significant others supporting – understanding, respecting, and listening to – her/his choices) or the satisfaction of the need for autonomy (i.e., one's perception that she/he can make choices) is a stronger factor in increasing intrinsic motivation and physical activity levels. The implications of this are that if autonomy support were to be more strongly associated with physical activity, future research and hypotheses would want to build research questions around creating an autonomy supportive atmosphere, rather than focusing solely on the choice aspect of the satisfaction of the need for autonomy. Additionally, in studies assessing the effects of choice and tailoring on motivation and physical activity, partcipants' levels of autonomy support from those helping to administer or create the physical activity is one gap that needs to be addressed. Being one of the most commonly studied component of the basic psychological needs (Wilson, Mack, & Grattan, 2008) and an integral piece to the

cognitive evaluation theory, autonomy support becomes an important factor when considering the impact of tailoring interventions to increase motivation and physical activity.

Satisfaction of the Need for Autonomy and Physical Activity

The satisfaction of the need for autonomy is defined as feeling a sense of personal agency and volition such that one's behavior is perceived to emanate from an internal locus of causality (deCharms, 1968). Research with regards to older adults in long term care settings suggest that there is a significant positive correlation between how much choice they perceive and overall wellbeing (Duncan-Meyres & Heubner, 2000), highlighting the importance of satisfying the need for autonomy in older adults. Likewise, one research group noted qualitatively that one reason older adults may engage in physical activity is to prevent the loss of physical autonomy (Ferrand, Nasarre, Hautier, & Bonefoy, 2012). While the relationship between satisfaction of the need for autonomy and psychological wellbeing seems clear, there are inconsistencies with regards to the relationship between satisfaction of the need for autonomy and physical activity. Teixeira et al. (2012) reported in their systematic review that in studies assessing the relationship between need satisfaction of the need for autonomy and exercise, those using bivariate analyses (twice as many as multivariate analyses), did not report any negative association between autonomy and exercise, but in multivariate analyses the results are inconsistent, meaning there were both negative and positive associations reported. Most of the studies reported in Teixeira et al.'s (2012) review were non-experimental and observed populations of middle aged adults and college students. Conversely, McDonough & Crocker (2007) observed in a cross-sectional study among a sample of dragon boat racers, the relationship between autonomy and self-determined motivation was small with a negative direct effect of autonomy and exercise (r = -.07). One potential reason for this outcome is the role in which the dragon boat racers were participating in, which was a team

based activity. Autonomous aspects (e.g., making choices or satisfaction of the need for autonomy) of individual activities may not necessarily translate to a team environment, especially in dragon boat racing where everyone's movement and performance has to be synched together to obtain a common goal. This distinction may have implications as to how satisfaction of the need for autonomy may differ across contexts, and could be a clue as to why the findings pertaining to the association between satisfaction of the need for autonomy and physical activity are inconsistent.

In an experimental study, Rose & Parfitt (2012) reported when individuals examined in both a self-selected exercise intensity condition and prescribed intensity condition, autonomy (satisfaction of the need) was highest in the self-selected condition. However, they noted that motivational outcomes (e.g., self-efficacy, autonomy, and perceived competence) were dependent upon the order in which they performed each condition. Moreover, simply giving individuals a choice with regards to their exercise has been shown to increase positive attitudes towards physical activity as well as intentions to engage in future exercise as opposed to those who were not given a choice in a stationary bike task (Caplandies, Brown, Murray, Rose, & Geers, 2018).

In an analysis of variance between older adults classified as exercisers versus non-exercisers, a significant difference in level of satisfaction of the need for autonomy was found, along with competence, relatedness, and intrinsic motivation (Kirkland, Karlin, Stellino, & Pulos, 2011). It is worth noting that the effects of autonomy may differ for individuals who are more or less physically active. Floegel, Giacobbi, & Dzierzewski (2015) examined that the effects of satisfaction of the need for autonomy on self-determined behavioral beliefs were stronger for older adults that were more active over the course of a 4 month peer guided self-determination theory based intervention than those that were less active. This may indicate the effects of satisfaction of the need for autonomy become more important as individuals become more active. Considering

the effects of the satisfaction of the need for autonomy can vary across settings and activity levels, perceived autonomy support becomes integral if it is shown to have a moderating effect.

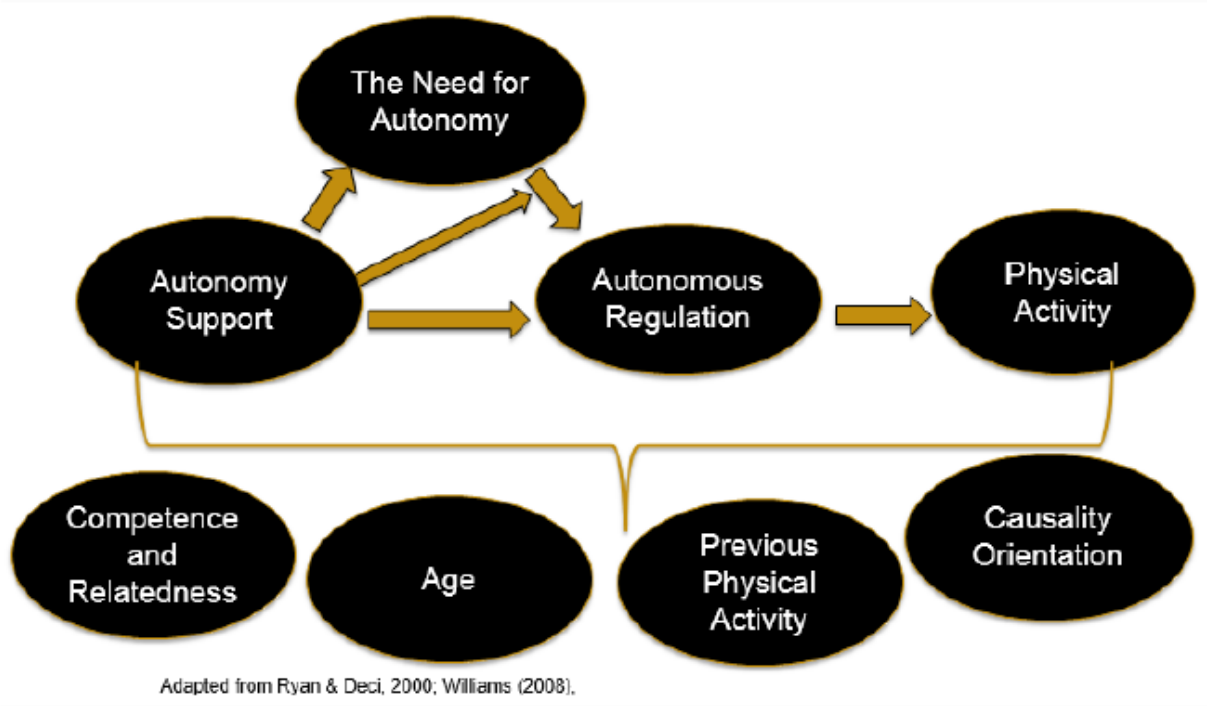


Figure 2. Conceptual Model of the Relationship between Perceived Autonomy Support, Perceived Autonomy, Intrinsic Motivation, and Physical Activity.

Objective

The overall objective of this MSc research project was to examine the association between autonomy support, physical activity-related need for autonomy, autonomous regulation, and physical activity behavior (see Figure 2) among older adults (aged ≥ 55 years). We planned to accomplish our objective by pursuing the following two specific aims:

1- To determine whether autonomy support is associated with physical activity-related need for autonomy, autonomous regulation, and physical activity behavior.

Hypothesis: Autonomy support will be positively associated with physical activity-related need for autonomy, autonomous regulation, and physical activity. More specifically, it is

hypothesized that the association between autonomy support and physical activity behavior will be partially mediated by physical activity-related need for autonomy and autonomous regulation.

2- To determine whether autonomy support moderates the physical activity-related need for autonomy – autonomous regulation association. This would suggest that autonomy support may moderate the mediation effect described in specific aim 1; thereby, indicating that the strength and/or direction of the mediated effect of the physical activity-related need for autonomy and autonomous regulation may change at different values of autonomy support. Hypothesis: Those with higher levels of autonomy support will exhibit a stronger positive association between physical activity-related need for autonomy – autonomous regulation association.

The proposed research will make a significant contribution by considering both autonomy support and physical activity-related need for autonomy, and their association with autonomous regulation and physical activity. The implications extend to the framework suggested by Morgan et al. (2016), and could provide additional empirical support for the necessity to target aspects of health behavior interventions to either increase acceptance of the pedagogy (autonomy support) or the content (satisfaction of the need for autonomy) based on the results from this study. Additionally, by taking a prospective approach, and repeatedly assessing physical activity over time rather than just at baseline and one time point down the line, we can provide a much more reliable measure of physical activity by averaging the scores reported by participants over the course of the study. Finally, by controlling for causality orientations and the other basic psychological needs (e.g., need for competence) variables, we will be able to provide information

as to whether autonomy support or satisfaction of the need for autonomy is the stronger correlate of both autonomous regulation and physical activity. This would provide evidence supporting the conduct of experimental testing to assess whether focusing more on adjusting an individual's environment or their own volition as it pertains to autonomy would be a greater factor in determining physical activity participation. An example being whether fitness centers or community centers would want to focus more on enabling choices within the environment through providing appropriate equipment or classes that may not normally be available versus giving individuals more choices during the classes themselves or asking patrons what type of equipment or classes they would like to see in order to facilitate choices emanating from one's volition.

CHAPTER 2. METHOD

Participants

Participants in this study included 431 adults aged ≥ 55 years and over that reside in the state of Indiana (US) correspond to the targeted population. Eligibility criteria included: (*i*) be age 55 years or older; (*ii*) reside in Indiana, (*iii*) be able to read and understand English, and (*iv*) do not suffer from severe cognitive impairment (e.g., dementia, including Alzheimer's disease). Older adults were recruited from the Indiana CTSI voluntary registry. Older adult members of this registry provided their health information for the purposes of being matched to appropriate research studies, and signed electronic consent/authorization in the database so that their information can be used. The study was approved by the local ethics committee (IRB protocol number: 1902021778), and all participants provided informed consent.

Study Design

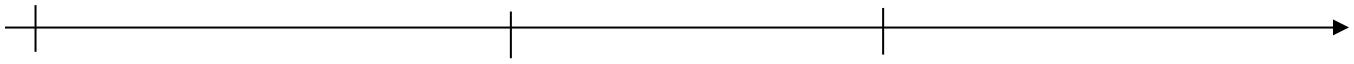
The study was observational in design, with physical activity, quality of motivation for physical activity, physical activity - related need for autonomy, competence, and relatedness, and level of autonomy support along with socio-demographics measured at baseline (T1). Additionally, physical activity was assessed prospectively, at the end of each week for four consecutive weeks. Lastly, a monthly physical activity recalls, causality orientations, and indicators of well-being were measured in a one-month follow-up survey (T2).

Procedures

Recruitment Strategy and Timeline. Eligible participants were contacted via email, and invited to complete online surveys. The online surveys were developed using Qualtrics Experience

Management^{TM} platform for Purdue University. Participants were assigned a unique ID number in the initial Qualtrics survey, and were required to enter that number to complete any of the surveys.

Baseline Survey (T1- Week 0): There were a total of three (3) email contacts (see Figure 3). First, a CTSI manager sent out a personalized invitation email containing the recruitment letter and a survey link (Appendix A). Second, a thank-you reminder email was sent by our research team five (5) days later to all eligible participants (Appendix B). Third, a second and final thank-you reminder email was sent by our research team 9 days after the sending of the invitation email to all eligible participants (Appendix C). For each email contact, a URL link to the online survey was provided.



May 15th	**May 20th**	**May 22nd**
Invitation email by CTSI manager (at T1)	First thank-you reminder email by our research team	Second and final thank- you reminder email by our research team
Contact #1	Contact #2	Contact #3

Figure 3. Recruitment Strategy and Timeline

Measures

Baseline Survey (T1 – Week 0). The baseline survey (Week 0) included socio-demographic characteristics (age, sex, educational level, race/ethnicity, marital status, and employment), self-

determination framework-related constructs, and physical activity (monthly and weekly frequency) recalls.

Specifically, the physical activity-related need for autonomy, relatedness, and competence were measured using the Psychological Need Satisfaction in Exercise Scale (Wilson, Rogers, & Rodgers, 2006). Autonomy support was assessed by using questions from a previous pilot study that were adapted from Martire et al. (2013).

Type of motivation was assessed using the Behavioral Regulation in Exercise Questionnaire 2 (BREQ-2; Markland and Tobin, 2004). One of the primary outcomes was autonomous regulation. Autonomous regulation encompasses intrinsic motivation performing a behavior for the pure enjoyment of it) and identified regulation (performing a behavior motivated by an identified value or purpose).

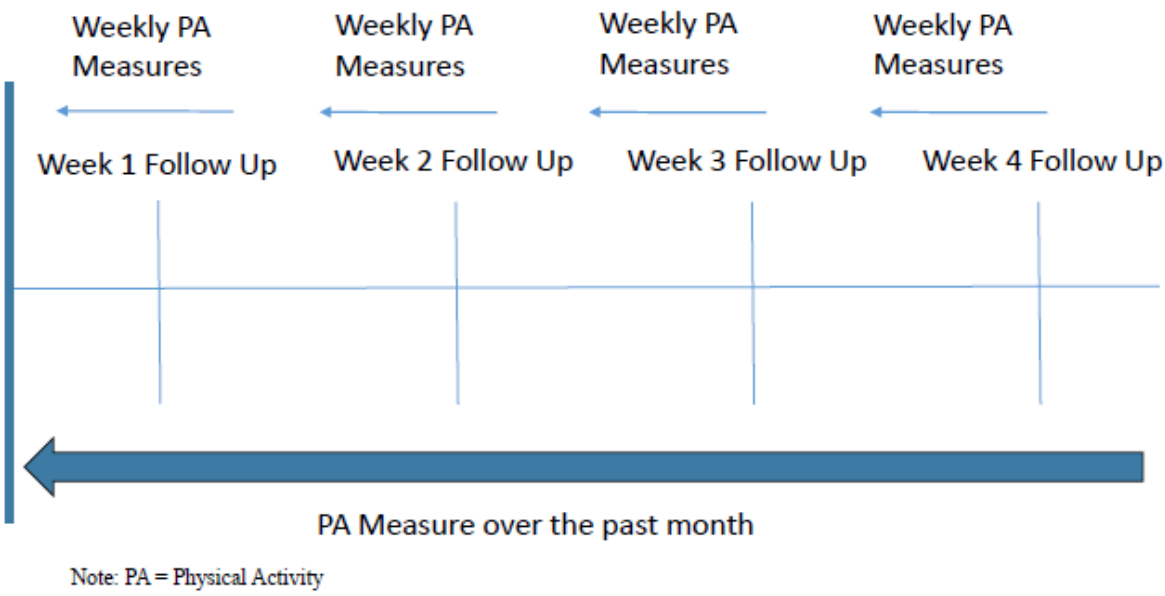
Past physical activity behavior (frequency of physical activity participation in the last month) was assessed using another self-report questionnaire which was validated for the measurement of leisure time physical activity (Godin, Jobin & Bouillon, 1986).

Lastly, variables that could potentially serve as good auxiliary variables for multiple imputation analyses and account for missing data at follow-ups (Amireault, 2014). Therefore, a measure of intention to complete all four follow-up surveys was taken (e.g., "How likely is it that you will complete the additional 4 (four) online surveys related to this research project in the next month?" assessed on a 5-point Likert scale from very unlikely to very likely). Moreover, another measure of past physical activity behavior (frequency of physical activity participation in the last week) was assessed (Milton et al., 2011).

Weekly Physical Activity Surveys (Week 1, Week 2. Week 3, and Week 4). At completion of the baseline survey (Week 0), an email trigger (Appendix E) through Qualtrics sent an email that

included a link to complete an online weekly physical activity surveys at 7, 14, 21, and 28 days after completion of the baseline survey. A weekly physical activity survey was sent to all participants completing the Baseline survey (Week 0). Our primary physical activity outcome was assessed using the Physical Activity Scale for the Elderly (PASE; Washburn et al., 1993). The PASE has been evaluated for construct validity with self-assessed health status, strength, and balance, and has also been validating for classifying older adults into different levels of physical activity. Additionally, an evaluation of intra-rate reliability for the use of the PASE resulted in an intra-class coefficient of .91 (Washburn et al., 1993; Schuit, Schouten, Westerterp, & Saris, 1997; Dinger, Oman, Taylor, Vesely, & Able, 2004). The initial goal was to assess change in PASE scores over time; however, analysis revealed that PASE score remained similar during the four weeks of data collection. Therefore, PASE score at from Week 1 to 4 were averaged to represent the physical activity behavior outcome. Additionally, the 1-week leisure-time physical activity om item (Milton et al., 2011) used at baseline was used at each follow-up time points. This measure demonstrated concurrent validity with a Global Physical Activity Questionnaire (r = .53) and strong agreement classifying individuals into groups of whether or not they meet physical activity guidelines (kappa = .63, 95% CI 0.54 to .72) (Milton et al., 2011). Please see Appendix F for details.

Follow-Up Survey (T2 – Week 4). In addition to the weekly physical activity measures, the follow-up survey at Week 4 included measures of causality orientation. Please see Appendix G for details. Causality orientations was measured using the Exercise Causality Orientations Scale (Rose, Parfitt, & Markland, 2001). The data collection plan is depicted in Figure 4.



Note. PA: Physical Activity.

Figure 4. Data Collection Strategy and Timeline

Analysis

Data were downloaded from Qualtrics and converted into a SAS file. Multiple Linear regression was performed to assess the relationship between autonomy support, physical activity-related need for autonomy, physical activity-related need for competence, autonomous regulation (all assessed at baseline; Week 0), and physical activity behavior (assessed at Week 1, Week 2, Week 3 and Week 4 follow-ups), and physical activity. Data was checked for univariate outliers (observations that were greater than the mean +/- (4 × standard deviation)). Descriptive statistics (mean, standard deviation) as well as a Cronbach's alpha were calculated for all self-determination theory constructs.

Covariates Analyses

Prior to conducting the mediation and moderation analyses, the association between self-determination theory constructs, physical activity behavior, and their covariates were investigated. In addition, interaction terms were tested prior to statistical adjustment for all covariates (i.e., age, past behavior, autonomous orientation, controlled orientation, impersonal orientation) using the three-step procedures suggested by Aiken and West (1991). First, model outcome variables were regressed on predictors (i.e., independent variables). Second, the moderator (i.e., the covariate) was added. Third, the interaction term (i.e., independent variable × moderator variable) was added. A moderator effect was detected if the explained variance (R^2) from step 1 to step 3 was significantly increased ($p < .05$). If a moderator effect was detected, simple slopes for each level of moderator variable were computed (i.e., *low* level; one standard deviation [SD] below the mean, *medium* level; at the mean, and *high* level; one SD above the mean). All variables included in interaction terms were mean-centered. Unless otherwise stated, no interaction effects were found. All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Specific Aim #1

Mediation models were built using multiple linear regression analyses, controlling for age, past physical activity behavior and causality orientations. The product of coefficient $a \times b$ approach was used to test the mediation effect (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). More specifically, the unstandardized beta coefficient of the *a*, *b*, *c*, and *c′* paths represents, respectively, the effect of autonomy support on the mediator (autonomy support → physical activity – related need for autonomy), the effect of the mediator on the outcome (physical activity – related need for autonomy → autonomous regulation), the total effect of autonomy support on autonomous regulation, and the partial effect of autonomy support, adjusting for the mediator

variable (e.g., physical activity-related need for autonomy), on autonomous regulation. The Monte Carlo 95% confidence interval [95% CI] (5,000 bootstrap samples) for the mediated effect were obtained using Hayes SAS MCMED macro (Hayes, 2012). Significant mediation was detected if the Monte Carlo confidence interval did not include the zero value.

Specific Aim #2- Moderation Analyses

First, autonomous regulation was regressed on physical activity-related need for autonomy. Second, autonomy support and the interaction terms autonomy support × physical activity-related need for autonomy was added in a block. A moderator effect was detected if the explained variance (R^2) from step 1 to step 2 was significantly increased ($p < .05$; Aiken and West, 1991). If moderator effect for autonomy support was detected, physical activity-related need for autonomy simple slope for each level of autonomy support will be computed (i.e., *low* level; one standard deviation [SD] below the mean, *medium* level; at the mean, and *high* level; one SD above the mean). All variables included in an interaction terms were mean-centered.

CHAPTER 4. RESULTS

A total of 118 older adults completed the survey at every time point. The total number of eligible participants who have started the survey (recorded at least one response) was 431 (at baseline), 235 (at Week 1 follow-up), 216 (at Week 2 follow-up), 227 (at Week 3 follow up), 241 (at Week 4 follow up). The reasons for exclusion are reported in Figure 5.

Descriptive statistics of the sample at baseline (N = 431) are presented in Table 2. More than three quarter (77.7%) of the sample was female, and the mean age was 64.9 years (SD = 7.45). Participants were primarily white, retired, and married or in a domestic relationship, and had

postsecondary education at the bachelor's level. One univariate outlier for physical activity behavior was identified, as the average score of the four PASE assessments was 546, superior to the mean (*M*) + 4 times its standard deviation (*SD*). Consequently, this observation was put at missing and removed from the complete case analysis.

Table 3 shows the Pearson correlation coefficients between self-determination theory constructs and past physical activity behavior (frequency of physical activity in the past month). The strongest correlation was between autonomous regulation and the need for competence (r = .67). It is worth noting that our sample had a rather high mean score for satisfaction of the need for autonomy (M = 5.5; SD = 0.76) on a scale compared to the satisfaction of the need for competence (M = 3.9; SD = 1.51). This observation highlights the fact that this sample of older adults may not feel as competent to perform physical activity in their most challenging circumstances, but feel a high degree of choice as it pertains to them. The Cronbach alpha coefficient was computed for each theoretical construct, and all constructs assessed at baseline were found to be satisfactory ($\alpha \geq .88$). All analyses were performed controlling for age, past physical activity behavior, autonomous orientation (α = .70, n = 232), controlling orientation (α = .67, n = 234), and impersonal orientation (α = .51, n = 229).

Inspection of missing data patterns using PROC MI revealed that there were 186 complete cases (43.16%), with 13 different patterns of missing and observed data. Among these 13 patterns, there were three patterns (1- complete cases, 43.1%; 2- physical activity outcome missing, 10.9%; and 3- controlled orientation constructs and physical activity outcome missing, 34.8%) that accounted for 88.86% of all cases. It is also worth noting that there are no cases missing all values for model variables and outcomes. None of the key study variables were associated with one or more of these three missing data patterns (p > .05). However, ordinal logistic regression [Odds

Ratio (OR) with 95%CI] revealed that higher intention to complete all four follow-up surveys (OR 95%CI = 1.14 [1.00, 1.31]) and higher physical activity-related need for autonomy (OR 95%CI = 1.31 [1.02, 1.69]) were associated with higher odds of completing physical activity questions at subsequent follow-up time points. Furthermore, level of education (r = .13; p = .009) and past physical activity behavior (frequency of physical activity in the past week; r = .30; p < .0001) were both associated with physical activity-related need for autonomy. Therefore, intention to complete follow-up survey, level of education and past physical activity behavior (frequency of physical activity in the past week) were identified as auxiliary variables for multiple imputation analyses.

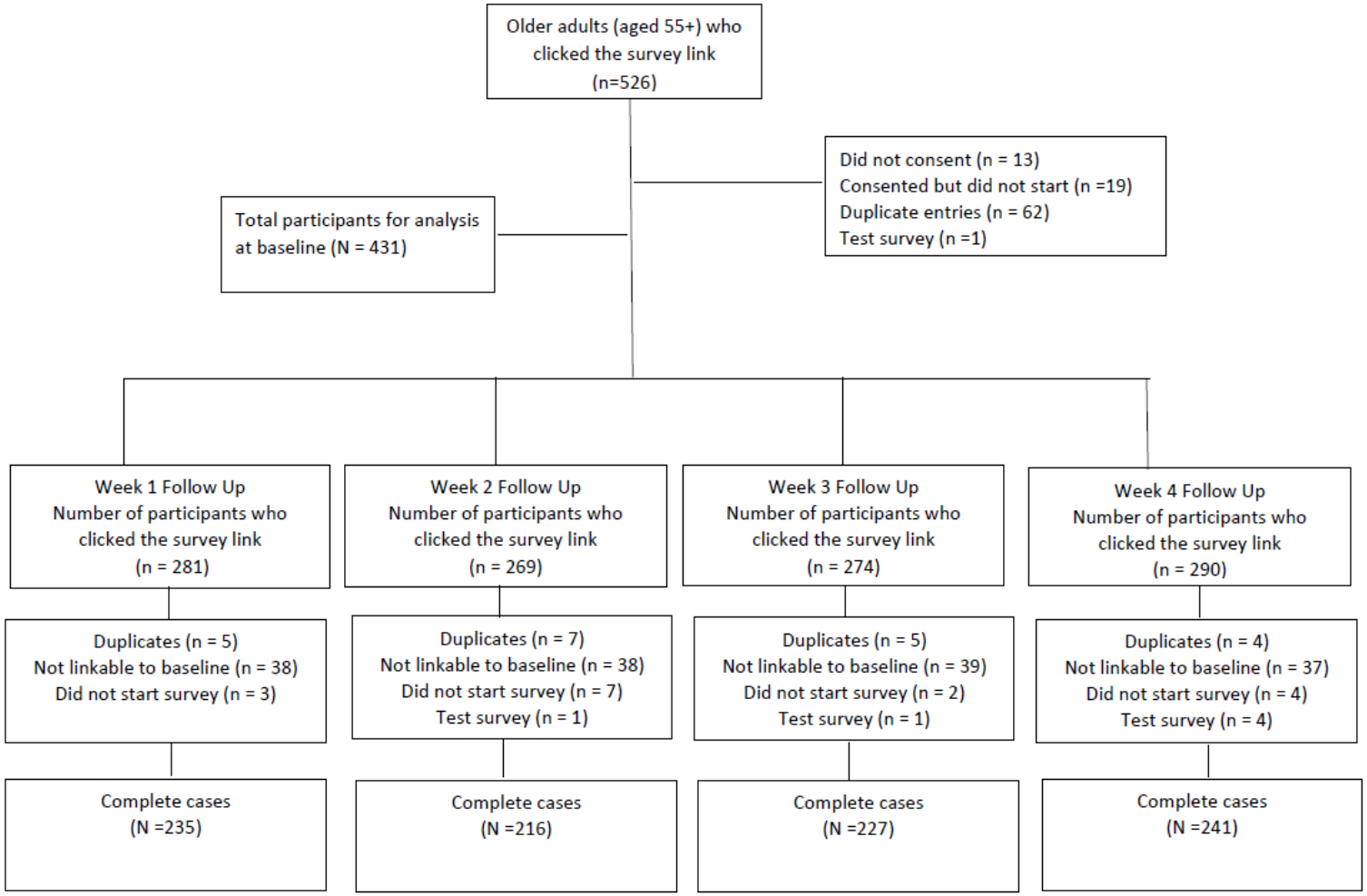


Figure 5.Participant Flow Chart

Table 2. Demographic Characteristics of Study Sample (N = 431)

	Number of Participants	Percentage
Gender		
Female	335	77.7
Male	75	17.4
Age		
55-64	230	53.4
65-74	138	32
75-88	37	8.6
Race/Ethnicity		
White	357	82.8
Black or African American	28	6.5
Other	14	3.2
Prefer not to answer	11	2.6
Education		
Bachelor's degree	133	30.9
Master's degree	79	18.3
Some college credit, no degree	78	18.1
Trade/technical/vocational training	46	10.7
High school graduate, diploma or the equivalent (for example: GED)	38	8.8
Professional degree	17	3.9
Doctorate degree (PhD)	16	3.7
Some high school, no diploma	3	0.7
Marital Status		
Married or domestic partnership	231	53.6
Divorced	104	24.1
Widowed	33	7.7
Single, never married	32	7.4
Separated	10	2.3
Employment		
Retired	171	39.7
Unable to work	27	6.3
Out of work and looking for work	11	2.6
Out of work but not currently looking for work	7	1.6
A student	1	0.2

Note. GED: General Education Development

Table 3. Correlations Matrix and Reliability of Self-Determination Theory Constructs (n = 426)

Variables	Autonomy Support	Need for Competence	Need for Autonomy	Autonomous Regulation	Mean	*SD*
Autonomy Support	.88				3.75	0.88
Need for Competence	.37**	.96			3.89	1.51
Need for Autonomy	.27**	.43**	.93		5.48	0.76
Autonomous Regulation	.37**	.67**	.362**	.89	3.46	0.96
Past PA Behavior	.28**	.52**	.40**	.61**	4.18	0.88

Note. Cronbach alpha denoted on the horizontal. Sample size for physical activity-related need for autonomy and competence is 410 due to missing data.
**p < .01 (2-tailed).

Physical Activity-Related Need for Autonomy Regression Model. The complete cases regression analysis (Model $F(6,226) = 8.39$, $p < .0001$) indicated that autonomy support was positively associated with physical activity-related need for autonomy. Additionally, controlled orientation (negative) and past physical activity behavior (positive) were also associated with physical activity-related need for autonomy. Table 4 shows that the results from the multiple imputation analysis were similar to those of the complete cases analysis. The complete cases analysis and multiple imputation analysis model accounted for 16.1% and 23.5% of the variance in physical activity-related need for autonomy, respectively.

Table 4. Multiple Linear Regression of Autonomy Support on Physical Activity-Related Need for Autonomy

	Complete Cases (n = 233)			Multiple Imputation (N = 431)		
	B	*SE B*	*p*	*B*	*SE B*	*p*
Autonomy support	.11	.05	.02	.15	.04	.002
Autonomous orientation	.05	.06	.38	.05	.06	.41
Controlling orientation	-.12	.05	.01	-.12	.05	.008
Impersonal orientation	-.06	.05	.26	-.08	.05	.11
Past PA behavior	.11	.03	<.0001	.13	.02	<.0001
Age	.005	.007	.45	.005	.05	.28

Note. PA: Physical Activity.

Physical Activity-Related Need for Competence Model. The complete cases regression analysis (Model $F(6,226) = 20.48$, $p < 0.0001$) revealed that autonomy support was positively associated with physical activity-related need for competence. Past physical activity behavior and autonomous orientation were found to be positively associated with physical activity-related need for competence for competence. Table 5 shows that the results from the multiple imputation analysis were similar to those of the complete cases analysis. The complete cases analysis and multiple imputation analysis model accounted for 33.5% and 37.0% of the variance in physical activity-related need for competence, respectively.

Table 5. Multiple Linear Regression of Autonomy Support on Physical Activity-Related Need for Competence

	Complete Cases (n = 233)			Multiple Imputation (N = 431)		
	B	*SE B*	*p*	*B*	*SE B*	*p*
Autonomy support	.46	.09	<.0001	.42	.07	<.0001
Autonomous orientation	.30	.12	.01	.28	.10	.008
Controlling orientation	.025	.09	.77	.02	.05	.83
Impersonal orientation	-.03	.10	.76	-.01	.09	.87
Past PA behavior	.30	.05	<.0001	33	.04	<.0001
Age	-.016	.01	..19	-.016	.01	.11

Note. PA: Physical Activity

Physical Activity-Related Autonomous Regulation Model. The complete cases regression analysis (Model $F(6,226) = 35.44$, $p < 0.0001$) revealed that autonomy support was positively associated with autonomous regulation. Moreover, physical activity-related need for competence and autonomous orientation were positively associated with autonomous regulation. Table 6 shows that the results from the multiple imputation analysis were similar to those of the complete cases analysis. The complete cases analysis and multiple imputation analysis model accounted for 57.2% and 61.6% of the variance in autonomous regulation, respectively.

Table 6. Multiple Linear Regression of Autonomy Support on Physical Activity-Related Autonomous Regulation

	Complete Cases (n = 233)			Multiple Imputation (N = 431)		
	B	*SE B*	*p*	*B*	*SE B*	*p*
Autonomy support	.03	.047	.51	.093	.038	.01
Need for Autonomy	.084	.078	.28	.129	.064	.047
Need for Competence	.25	.034	<.0001	.25	.023	<.0001
Autonomous orientation	.24	.06	<.0001	.24	.058	<.0001
Controlling orientation	.005	.04	.90	.01	.045	.81
Impersonal orientation	-.06	.05	.20	-.05	.04	.20
Past PA behavior	.14	.03	<.0001	.14	.04	<.0001
Age	.004	.006	.56	.003	.004	.54
Need for Autonomy × Past PA	.084	.029	.005	.072	.02	<.0001

Note. PA: Physical Activity

Furthermore, past physical activity behavior moderated the physical activity-related need for autonomy – autonomous regulation association. Therefore, the physical activity-related need for autonomy – autonomous regulation association was verified at three levels of past PA behavior: *low* (at the mean – 1 *SD*); *medium* (at the mean), and *high* (at the mean + 1 *SD*). Based on the multiple imputation analysis findings, the simple slope analysis revealed that the physical activity-related need for autonomy – autonomous regulation association was stronger for older adults who were engaging in physical activity in the past month 2 days (B = .13, p = 0.048) and ≥ 4 days (B = .26, p = 0.004) per week. As reported in Table 7, this resulted in the physical activity-related need for autonomy partially mediating the association between autonomy support and autonomous

regulation, but only for older adults who were engaging in physical activity in the past month ≥ 2 days per week. Contrary to the second hypothesis, autonomy support did not modify the strength or direction of the physical activity-related need for autonomy – autonomous regulation association (p = 0.66). It is worth noting that the $a \times b$ indirect effect for the physical activity-related need for competence was 0.10 (0.675, 0.1459).

Table 7. Indirect Effects of Autonomy Support on Autonomous Regulation as a Function of Past Physical Activity Behavior

Level of Past Physical Activity Behavior	$a \times b$ indirect effects[1]	Monte Carlo 95% confidence interval (5000 samples)	
		Lower	Upper
Low (engaging in physical activity 2-3 days/month):	-0.0002	-0.0140	0.0141
Medium (engaging in physical activity 2 days/week):	0.0195	0.0004	0.0438
High (engaging in physical activity ≥ 4 days/week):	0.0390	0.0098	0.0774

Note: [1]We used the raw beta coefficient from the multiple imputation analyses (N = 431).

Predicting Physical Activity (PASE) Model. The complete cases regression analysis (Model $F(10,175) = 5.82$, $p < .0001$) revealed that autonomy support was not associated with physical activity behavior (Average of PASE weekly scores). Moreover, physical activity-related need for competence (positive) and age (negative) were associated with physical activity behavior. Furthermore, age moderated the autonomous regulation – physical activity association. Therefore, the autonomous regulation – physical activity association was verified at three levels of age: *low* (at the mean – 1 *SD*); *medium* (at the mean), and *high* (at the mean + 1 *SD*). The simple slope analysis revealed that the autonomous regulation – physical activity association was stronger for the youngest adults of this sample (58 years; B = 20.41, p = 0.04) compared to the oldest (B =

10.25, p = .17; B = 1.41, p = .88 at *medium* (64 years) and *high* (71 years) values of age, respectively). Table 8 shows that the results from the multiple imputation analysis were similar to those of the complete cases analysis. The complete cases analysis and multiple imputation analysis model accounted for 20.7% and 23.2% of the variance in physical activity behavior, respectively.

Along with the linear regression findings provided in Table 6, it can be suggested that the that physical activity-related need for autonomy and autonomous regulation sequentially mediated the association between autonomy support and physical activity, especially for younger older adults (those aged 58 years) who were engaging in physical activity at least four days per week in the past month. The $a \times b$ indirect effects for various levels of past physical activity behavior and ages are reported in Table 9. Of note, the $a \times b$ indirect effect for the physical activity-related need for competence – mediating the autonomy support – physical activity behavior association – was 5.527 (1.430, 10.310).

Table 8: Multiple Linear Regression of Self-Determination Theory Constructs on Physical Activity Participation

	Complete Cases (n = 186)			Multiple Imputation (N = 431)		
	B	*SE B*	*p*	*B*	*SE B*	*p*
Autonomy support	3.945	5.38	.46	3.76	5.45	.49
Need for Autonomy	-8.79	7.49	.24	-7.21	7.18	.32
Need for Competence	14.24	4.57	.002	13.16	4.77	.008
Autonomous Regulation	8.84	7.54	.24	10.25	7.43	.17
Autonomous orientation	-10.09	7.01	.15	-8.66	6.59	.19
Controlling orientation	6.46	5.34	.23	7.94	4.92	.11
Impersonal orientation	7.79	5.57	.16	8.01	5.70	.17
Past PA behavior	4.83	3.29	.14	3.09	3.31	.36
Age	-2.09	.76	.007	-2.15	.74	.005
Age x Autonomous Regulation	-1.86	.83	.02	-1.89	.721	.009

Note. PA: Physical Activity.

Table 9. Indirect Effects of Physical Activity Related need or autonomy on physical activity participation as a function of past physical activity behavior and age

Past Physical Activity Behavior	Age	$a \times b$	Monte Carlo 95% confidence interval (5000 samples)	
			Lower	Upper
Low (2-3 days/month)	*Low* (58 years)	-0.0204	-2.2084	2.1470
Low (2-3 days/month)	*Medium* (64 years)	-0.0103	-1.2510	1.2566
Low (2-3 days/month)	*High* (71 years)	-0.0014	-0.9374	0.9053
Medium (2 days/week)	*Low* (58 years)	2.6533	-0.2265	7.2638
Medium (2 days/week)	*Medium* (64 years)	1.3325	-0.6045	4.2457
Medium (2 days/week)	*High* (71 years)	0.1833	-2.5974	3.1734
High (≥ 4 days/week)	*Low* (58 years)	**5.3066**	**0.3046**	**12.6440**
High (≥ 4 days/week)	*Medium* (64 years)	2.6650	-0.9356	7.7827
High (≥ 4 days/week)	*High* (71 years)	0.3666	-5.0680	5.7958

Summary

Figure 6 illustrates a summary of the study findings. Autonomy support was found to impact future physical activity participation via three main pathways. The influence of autonomy support on physical activity behavior is likely to be sequentially mediated by physical activity-related need for autonomy and autonomous regulation, especially for younger older adults who were regularly engaging in physical activity in the past month (*hypothesis 1*). Autonomy support did not modify the strength or direction of the association between physical activity – related need for autonomy and autonomous regulation (*hypothesis 2*).

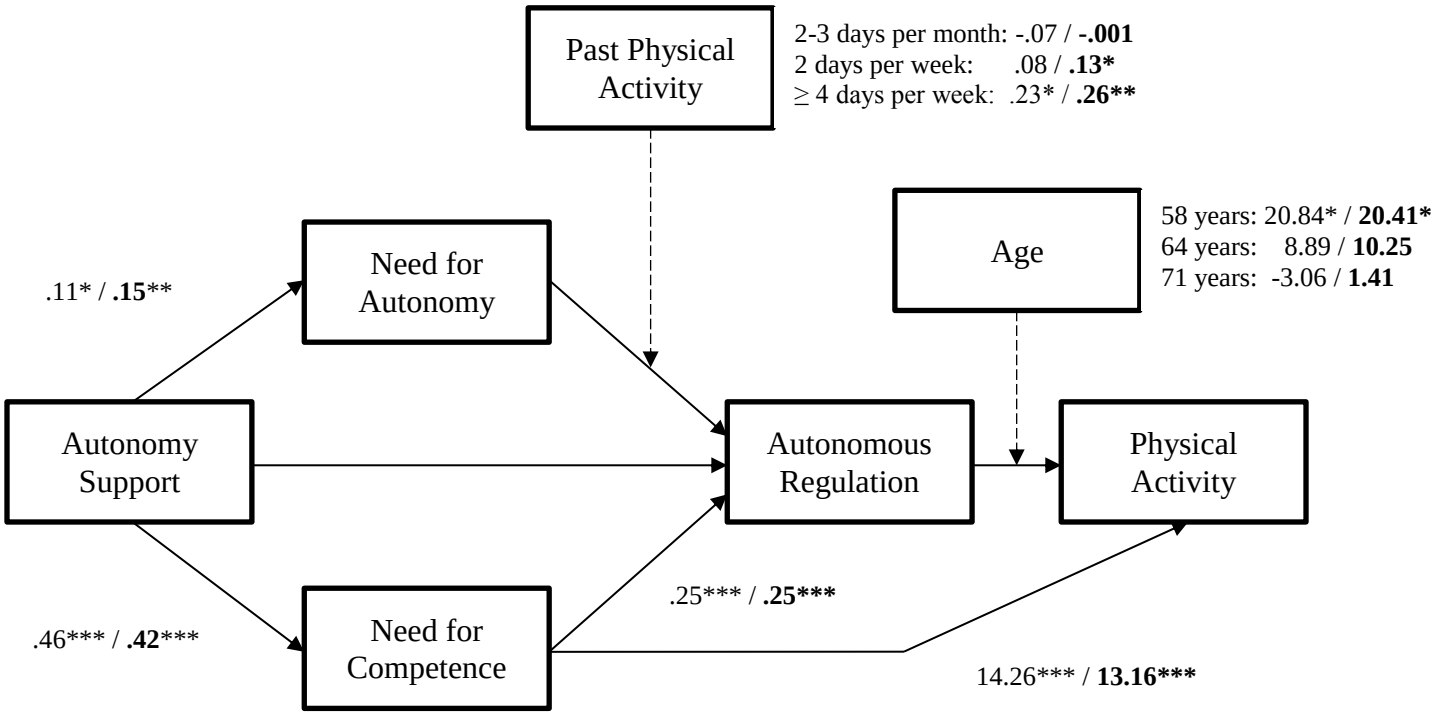


Figure 6. Association between Autonomy Support and Physical Activity within the Self-Determination Theory Framework among Older adults.

Note. Raw beta coefficients from regression models estimated from complete cases (n = 233 for the autonomous regulation model; n = 186 for the physical activity regression model) and multiple imputation (bolded coefficient; N = 431) analysis are reported. Raw beta coefficients at *low* (at the mean – 1 standard deviation), *medium* (at the mean), and *high* (at the mean + 1 standard deviation) levels for each of the moderator variables (past physical activity behavior and age) are reported. All models and beta coefficients are adjusted for past physical activity behavior, age, autonomous, controlled and impersonal orientations.

*p < .05; **p < .01; ***p < .001.

CHAPTER 5. DISCUSSION

The purpose of this study was to test the potential mediation effect of satisfaction of the need for autonomy on the relationship between autonomy support and autonomous regulation and the subsequent relationship with physical activity over time. Additionally, to also test the potential moderating effect of autonomy support on the relationship between satisfaction of the need for autonomy and autonomous regulation.

The impact of autonomy support on physical activity behavior was found to be mediated by physical activity-related autonomy and autonomous regulation, but only for the youngest adults of the sample (e.g., aged 58 years) who regularly engaged in physical activity during the past month (e.g., 4 days per week). This finding partially supports our first hypothesis. As past physical activity behavior increased, the relationship between physical activity-related need for autonomy and autonomous regulation becomes stronger. The moderating effect of past physical activity on the relationship between the satisfaction of the need for autonomy and autonomous regulation was not fully surprising, however, as findings from previous research support the notion that as individuals become more physically active, the effect of satisfaction of the need for autonomy on self-determined behavioral beliefs become stronger (Floegel, Giacobbi, & Dzierzewski, 2015). Perhaps due to the nature that individual's needs may change as they become more experiences or competent with activity. Once a person has become comfortable with an activity, their needs may shift towards wanting autonomy. Moreover, current literature supports the notion that older adults who are physically active exhibit higher levels of psychological need satisfaction, autonomy support, and intrinsic forms of motivation (Peddle, Plotnikoff, Wild, Au, & Courneya, 2008; Kirkland et al., 2011). This is the first to test the mediational effect of the need for autonomy between autonomy support and autonomous regulation in older adults.

Physical activity-related need for competence partially mediated the influence of autonomy support on physical activity, but these effects held for the entire sample. When looking at how to explain these findings with respect to the need for competence – physical activity relationship, the similarities with self-efficacy come to the forefront. Self-efficacy is described by Bandura as "people's beliefs in their capabilities to organize and execute the courses of action required to deal with prospective situations" (Bandura, 1995). In a study conducted among older Australians it was shown that 48% of active respondents reported high levels of self-efficacy compared to only 28% of inactive participants. (Booth, Owen, Bauman, Clavisi, & Leslie, 2000). What is important to note about the measurement of the need for competence is that the measure asks participants if they feel confident to perform the activity in the *most challenging* scenarios. While self-efficacy may not encompass the most challenging situations, the need for competence may result in being a stricter factor when relating to physical activity resulting in better explaining. In fact, Teixeira et al. (2012) make it clear that the need for competence positively predicts exercise participation in a range of different samples. However, no current study has examined how the need for competence mediates the relationship between autonomy support and physical activity in older adults.

The self-determination theory contributes in helping to understand physical activity behavior in older adults. While the self-determination theory seems best suited for describing the effects of autonomous related needs and their relations to physical activity and intrinsic motivation, it may also be wise to consider other theories jointly with the self-determination theory to describe the relationship between the satisfaction of the need for competence and physical activity. Perhaps through self-efficacy as it may be a less extreme measure of competence in physical activity related settings for older adults whose capabilities may decrease with age. The current study provides

supportive evidence for the key role of autonomy support in facilitating physical activity through the fulfillment of the basic psychological needs (satisfaction of the need for autonomy and competence) and development of self-determined motivation in older adults. When considering how the fulfillment of the basic psychological needs affects autonomous regulation and physical activity, older adult's support systems appear to be key to optimizing physical activity participation. Additionally, these results have revealed that it may be more important to ensure that older adults feel confident in their abilities before targeting their need to make choices in promoting physical activity

Limitations and Strengths

Although this study utilized a longitudinal design, it is still correlational in nature. As a result, causal mediation effects cannot be inferred, and findings cannot be applied yet to make clinical recommendations. Additionally, our sample was primarily white, highly educated, and female, making it difficult to generalize our findings to all members of the older adults population (e.g., men, African-American and Hispanic/non-white, and less educated older adults). Moreover, there was no way to ensure that the older adult volunteers in the CTSI database were truly representative of the older adults population in the state of Indiana. Another limitation involved the delivery of the weekly surveys where some of our participants mentioned not knowing how to copy and paste the link to access it. It is likely that this issue may have resulted in a slight increase in attrition compared to providing a clickable hyperlink text. Future research using online surveys with older adults will want to ensure that they use clickable links rather than copy and paste.

One of the major strengths of this study was the longitudinal design and measurement of physical activity behavior, four times over a four-week period. By having multiple physical activity measures and averaging the scores, we were able to obtain a more reliable monthly

physical activity score for our main analyses. Additionally, being able to provide information as to how previous physical activity and age both moderate the mediation effect of the need for autonomy and autonomous regulation between autonomy support and physical activity is a key contribution. It allows future research to consider in more detail how the roles of the psychological needs, specifically the need for competence and autonomy, may change in predicting physical activity as people age.

Conclusion

This was the first study to test the mediation effect of physical activity-related need for autonomy for the association between autonomy support and physical activity in older adults. Additionally, the findings provided with regards to the mediational effect of physical activity-related need for competence between autonomy support and physical activity in older adults is a novel contribution. It seems clear that the place to start when considering the self-determination theory in trying to explain physical activity behavior in older adults is with autonomy support and the need for competence. Since our findings suggest as adults age, the need for competence may become more important than autonomous regulation, future experimental studies in the older adult population should consider how the fulfillment of the need for competence with and without a function of autonomy support impacts groups of older adults. It would help to solidify the role autonomy support plays in the facilitation of physical activity in older adults and provide information on how fulfilling the need for competence in the absence of autonomy support could still help promote physical activity in older adults. Taking this information into account, the self-determination theory does a good job of explaining how the fulfillment of psychological needs mediate the relationship between autonomy support and physical activity in older adults.

REFERENCES

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.

Amireault, S. (2014). Doing more than just acknowledging attrition at follow-up: a comment on Lu, Cheng, and Chen (2013). *Psychological reports*, *115*(2), 419-426.

Ascigil, E., Uysal, A., & Saracgil Cosar, S. N. (2018). Longitudinal Associations Between Provision of Autonomy Support and Well-Being in Spouses of Individuals With Chronic Pain. *Annals of Behavioral Medicine*.

Bandura, A. (Ed.). (1995). *Self-efficacy in changing societies*. Cambridge university press.

Buman, M. P., Giacobbi Jr, P. R., Dzierzewski, J. M., Morgan, A. A., McCrae, C. S., Roberts, B. L., & Marsiske, M. (2011). Peer volunteers improve long-term maintenance of physical activity with older adults: a randomized controlled trial. *Journal of Physical Activity and Health*, *8*(s2), S257-S266.

Booth, M. L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social–cognitive and perceived environment influences associated with physical activity in older Australians. *Preventive medicine*, *31*(1), 15-22.

Caplandies, F. C., Brown, J. A., Murray, A. B., Rose, J. P., & Geers, A. L. (2018). Choice and perceptions of exercise: A test of three moderating variables. *Psychology of Sport and Exercise*.

Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps [online]. [accessed Nov 29, 2018]. URL: https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html

Chatzisarantis, N. L., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology and Health*, *24*(1), 29-48.

Cress, M. E., Buchner, D. M., Prohaska, T., Rimmer, J., Brown, M., Macera, C., ... & Chodzko-Zajko, W. (2005). Best practices for physical activity programs and behavior counseling in older adult populations. *Journal of Aging and Physical Activity*, *13*(1), 61-74.

deCharms, R. (1968) Personal causation: The internal affective determinants of behavior. New York: Academic Press

Deci, E.L. & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenum.

Deci, E. L., & Vansteenkiste, M. (2003). Self-determination theory and basic need satisfaction: Understanding human development in positive psychology.

Dinger, M. K., Oman, F., Taylor, E. L., Vesely, S. K., & Able, J. (2004). Stability and convergent validity of the Physical Activity Scale for the Elderly (PASE). *Journal of Sports Medicine and Physical Fitness*, *44*(2), 186.

Duncan-Myers, A. M., & Huebner, R. A. (2000). Relationship between choice and quality of life among residents in long-term-care facilities. *The American Journal of Occupational Therapy*, *54*(5), 504-508.

Edmunds, J., Ntoumanis, N., & Duda, J. L. (2006). A test of self-determination theory in the exercise domain. *Journal of Applied Social Psychology*, *36*(9), 2240-2265.

Edmunds, J., Ntoumanis, N., & Duda, J. L. (2007). Adherence and well-being in overweight and obese patients referred to an exercise on prescription scheme: A self-determination theory perspective. *Psychology of Sport and Exercise*, *8*(5), 722-740.

Elavsky, S., McAuley, E., Motl, R. W., Konopack, J. F., Marquez, D. X., Hu, L., ... & Diener, E. (2005). Physical activity enhances long-term quality of life in older adults: efficacy, esteem, and affective influences. *Annals of Behavioral Medicine*, *30*(2), 138-145.

Ferrand, C., Nasarre, S., Hautier, C., & Bonnefoy, M. (2012). Aging and well-being in French older adults regularly practicing physical activity: A self-determination perspective. *Journal of Aging and Physical Activity*, *20*(2), 215-230.

Floegel, T. A., Giacobbi Jr, P. R., Dzierzewski, J. M., Aiken-Morgan, A. T., Roberts, B., McCrae, C. S., ... & Buman, M. P. (2015). Intervention markers of physical activity maintenance in older adults. *American Journal of Health Behavior*, *39*(4), 487-499.

Fortier MS, Sweet SN, O'Sullivan TL, Williams GC: A self-determination process model of physical activity adoption in the context of a randomized controlled trial. Psychology of Sport and Exercise 2007, 8:741–757

Godin, G., Jobin, J., & Bouillon, J. (1986). Assessment of leisure time exercise behavior by selfreport:A concurrent validity study. *Canadian Journal of Public Health, 77*, 359-361

Haerens, L., Vansteenkiste, M., De Meester, A., Delrue, J., Tallir, I., Vande Broek, G., ... & Aelterman, N. (2018). Different combinations of perceived autonomy support and control: identifying the most optimal motivating style. *Physical Education and Sport Pedagogy*, *23*(1), 16-36.

Hagger, M. S., Chatzisarantis, N. L., Culverhouse, T., & Biddle, S. J. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: a trans-contextual model. *Journal of educational psychology*, *95*(4), 784.

Hagger, M. S., Chatzisarantis, N. L., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: a cross-cultural evaluation of the trans-contextual model. *Journal of educational psychology*, *97*(3), 376.

Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling.

Horn, T. S. & Smith, A. L. (2018). *Advances in sport and exercise psychology.* Champaign, IL: Human Kinetics

Katzmarzyk, P. T., Lee, I. M., Martin, C. K., & Blair, S. N. (2017). Epidemiology of physical activity and exercise training in the United States. *Progress in Cardiovascular Diseases*, *60*(1), 3-10.

Kirkland, R. A., Karlin, N. J., Stellino, M. B., & Pulos, S. (2011). Basic psychological needs satisfaction, motivation, and exercise in older adults. *Activities, adaptation & aging*, *35*(3), 181-196.

Kwan, B. M., Hooper, A. E. C., Magnan, R. E., & Bryan, A. D. (2011). A longitudinal diary study of the effects of causalityorientations on exercise-related affect. *Self and Identity*, *10*(3), 363-374.

Lautenschlager, N. T., Cox, K. L., Flicker, L., Foster, J. K., van Bockxmeer, F. M., Xiao, J., ... & Almeida, O. P. (2008). Effect of physical activity on cognitive function in older adults at risk for Alzheimer disease: a randomized trial. *Jama*, *300*(9), 1027-1037.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological methods*, *7*(1), 83.

Markland, D., & Tobin, V. (2004). A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology*, *26*(2), 191-196.

Martire, L. M., Stephens, M. A. P., Mogle, J., Schulz, R., Brach, J., & Keefe, F. J. (2012). Daily spousal influence on physical activity in knee osteoarthritis. *Annals of Behavioral Medicine*, *45*(2), 213-223.

McDonough, M. H., & Crocker, P. R. (2007). Testing self-determined motivation as a mediator of the relationship between psychological needs and affective and behavioral outcomes. *Journal of Sport and exercise Psychology*, *29*(5), 645-663..

Milton, K., Bull, F.C., & Bauman, A. (2011). Reliability and validity testing of a single-item physical activity measure.(Report). *British Journal of Sports Medicine*, *45*(2), 203.

Morgan, P. J., Young, M. D., Smith, J. J., & Lubans, D. R. (2016). Targeted health behavior interventions promoting physical activity: a conceptual model. *Exercise and sport sciences reviews*, *44*(2), 71-80.Moustaka, F. C., Vlachopoulos, S. P., Kabitsis, C., & Theodorakis, Y. (2012). Effects of an autonomy-supportive exercise instructing style on exercise motivation, psychological well-being, and exercise attendance in middle-age women. *Journal of Physical Activity and Health*, *9*(1), 138-150.

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., ... & Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation*, *116*(9), 1094.

Ng, J., Ntoumanis, N., Thogersen-Ntoumani, C., Deci, E., Ryan, R., Duda, G., & Williams, J. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Psychology & Health, 27*, 289.

Ortman, J. M., Velkoff, V. A., & Hogan, H. (2014). *An aging nation: the older population in the United States* (pp. 25-1140). United States Census Bureau, Economics and Statistics Administration, US Department of Commerce.

Patall, E. A., Cooper, H., & Robinson, J. C. (2008). The effects of choice on intrinsic motivation and related outcomes: a meta-analysis of research findings. *Psychological bulletin*, *134*(2), 270.

Peddle, C. J., Plotnikoff, R. C., Wild, T. C., Au, H. J., & Courneya, K. S. (2008). Medical, demographic, and psychosocial correlates of exercise in colorectal cancer survivors: an application of self-determination theory. *Supportive Care in Cancer*, *16*(1), 9-17.

Richards, E. A., McDonough, M., & Fu, R. (2017). Longitudinal examination of social and environmental influences on motivation for physical activity. *Applied Nursing Research*, *37*, 36-43.

Rose, E. A., Markland, D., & Parfitt, G. (2001). The development and initial validation of the Exercise Causality Orientations Scale. *Journal of Sports Sciences*, *19*(6), 445-462.

Rose, E. A., and G. Parfitt (2012). "Exercise experience influences affective and motivational outcomes of prescribed and self-selected intensity exercise." *Scandinavian Journal of Medicine & Science in Sports 22(2)*, 265-277.

Rose, E. A., Parfitt, G., & Williams, S. (2005). Exercise causality orientations, behavioural regulation for exercise and stage of change for exercise: exploring their relationships. *Psychology of Sport and Exercise*, *6*(4), 399-414.

Russell, K. L., & Bray, S. R. (2010). Promoting self-determined motivation for exercise in cardiac rehabilitation: The role of autonomy support. *Rehabilitation Psychology*, *55*(1), 74.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, *55*(1), 68.

Schuit, A. J., Schouten, E. G., Westerterp, K. R., & Saris, W. H. (1997). Validity of the Physical Activity Scale for the Elderly (PASE): according to energy expenditure assessed by the doubly labeled water method. *Journal of clinical epidemiology*, *50*(5), 541-546.

Thompson, C. E., & Wankel, L. M. (1980). The effects of perceived activity choice upon frequency of exercise behavior. *Journal of Applied Social Psychology*, *10*(5), 436-443.

Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: a systematic review. *International journal of behavioral nutrition and physical activity*, *9*(1), 78.

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In *Advances in Experimental Social Psychology* (Vol. 29, pp. 271-360). Academic Press.

Washburn, R. A., Smith, K. W., Jette, A. M., & Janney, C. A. (1993). The Physical Activity Scale for the Elderly (PASE): development and evaluation. *Journal of clinical epidemiology*, *46*(2), 153-162.

Williams, D. M. (2008). Exercise, affect, and adherence: an integrated model and a case for self-paced exercise. *Journal of Sport and Exercise Psychology*, *30*(5), 471-496.

Wilson, P M., and Rodgers, W.M. (2004). "The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women." *Psychology of Sport and Exercise* 5, no. 3 (2004): 229-242.

Wilson, P. M., Rogers, W. T., Rodgers, W. M., & Wild, T. C. (2006). The psychological need satisfaction in exercise scale. *Journal of Sport and Exercise Psychology*, *28*(3), 231-251.

Wilson, P. M., Mack, D. E., & Grattan, K. P. (2008). Understanding motivation for exercise: A self-determination theory perspective. *Canadian Psychology/Psychologie Canadienne*, *49*(3), 250.

Zubala, A., MacGillivray, S., Frost, H., Kroll, T., Skelton, D. A., Gavine, A., & Morris, J. (2017). Promotion of physical activity interventions for community dwelling older adults: A systematic review of reviews. *PloS one*, *12*(7), e0180902.

APPENDIX A. INVITATION EMAIL

Dear [«CONTACT_FIRST_NAME»],

Thank you for your participation in ALL IN for Health's Volunteer Registry!

We are contacting you because you may be interested in participating in a study being conducted by Purdue University College of Health and Human Sciences Department of Health and Kinesiology. The study, called Autonomy Support, Satisfaction of the Need for Autonomy, and Intrinsic Motivation for Physical Activity in Older Adults, wants to learn more about people's thoughts about physical activity.

In order to participate in the study, you must:

a. be age 55 or older
b. reside in Indiana
c. be English-speaking
d. have not being diagnosed with dementia – including Alzheimer's disease.

If you are interested in participating, please click the following link to answer a few questions to see if you are qualified: [survey link]**.**

If you are eligible, you will be asked **to complete a short, anonymous survey (15 minutes) online.** You will also be asked to complete a **similar survey (15 minutes) in about 1 month**. You will also have the option to complete additional surveys **asking about your physical activity (5 minutes) for the first four (4) weeks**. You will be compensated for your time (**$10**).

If you have any questions or would just like more information, please call John Baier, graduate student at Purdue University, at Phone number 765-496-2231 or email jbaier@purdue.edu. You may also contact Dr. Steve Amireault, Assistant Professor in Health Kinesiology at Purdue University, at Phone number 765-496-0568 or email samireau@purdue.edu.

Thank you for your time and continued interest and support of our research.

Warm regards,

The All IN for Health Team

www.allin4health.info

chat@allin4health.info

1-888-264-0005

Follow us on Facebook, Instagram and Twitter: @beallin4health

APPENDIX B. FIRST THANK YOU REMINDER

PURDUE
UNIVERSITY

***Subject**: Voice your opinions about physical activity*

Dear [Name of the participant],

Earlier this week, The All IN for Health Team sent you an email asking for your participation in a survey about physical activity (IRB protocol number: 1902021778). If you have already completed this survey, we would like to thank you very much.

If you have not answered the questionnaire yet, we invite you to do so. We hope that providing you with a link to the survey website makes it easy for you to respond. To complete the survey, simply click on this link:

URL link

Your response is voluntary and we appreciate your consideration of our request.

Sincerely,

Steve Amireault
Assistant Professor
Department of Health and Kinesiology
College of Health and Human Sciences
Purdue University
Lambert Fieldhouse, Room 311A
800 West Stadium Avenue
West Lafayette, IN 47907-2046
P: 765-496-0568

APPENDIX C. SECOND AND FINAL THANK YOU REMINDER

PURDUE
UNIVERSITY

***Subject**: Voice your opinions about physical activity*

Dear [Name of the participant],

Recently, we sent you an email asking to complete a survey about physical activity (IRB protocol number: 1902021778). If you have already completed this survey, we would like to thank you very much. We truly appreciate your help.

If you have not answered the questionnaire yet, we'd like to urge you to do so. It should only take about 15 minutes to complete. Simply click on the link bellow to begin answering questions:

URL link

If you have any questions or comments, please contact Dr. Steve Amireault by telephone at 765-496-0568 or by email at samireau@purdue.edu. Thank you for your help.

Sincerely,

Steve Amireault, PhD
Assistant Professor
Department of Health and Kinesiology
Purdue University
P: 765-496-0568
samireau@purdue.edu

APPENDIX D. BASELINE SURVEY (T1)

Autonomy Support

Q88 Please answer the questions below regarding your relationship with people who are important to you about physical activity.

Q63 Most people who are important to me listen to how I would like to do things with regards to my physical activity participation.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Q69 I feel that most people who are important to me have provided me with choices and options about my physical activity.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Q65 Most people who are important to me show understanding for how physically active I want to be.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Q134 Most people who are important to me respect my decision about regularly engaging in physical activity.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Adapated from Martire et al., 2013

Exercise Regulation Questionnaire (BREQ-2)

Q69 Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions.

	Not at all true for me	Slightly true for me	Moderately true for me	Very true for me	Definitely true for me
I engage in physical activity because my friends/family/partner say I should	○	○	○	○	○
I feel ashamed when I miss an exercise session	○	○	○	○	○
It's important to me to regularly engage in physical activity	○	○	○	○	○
I can't see why I should bother engaging in physical activity	○	○	○	○	○
I enjoy my exercise sessions	○	○	○	○	○

Q135 Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions.

	Not at all true for me	Slightly true for me	Moderately true for me	Very true for me	Definitely true for me
I engage in physical activity because other people say I should	○	○	○	○	○
I feel guilty when I don't engage in physical activity	○	○	○	○	○
I value the benefits of engaging in physical activity	○	○	○	○	○
I engage in physical activity because it's fun	○	○	○	○	○
I don't see why I should have to engage in physical activity	○	○	○	○	○

Q136 Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions.

	Not at all true for me	Slightly true for me	Moderately true for me	Very true for me	Definitely true for me
I think engaging in physical activity is a waste of time	○	○	○	○	○
I get pleasure and satisfaction from engaging in physical activity	○	○	○	○	○
I get restless if I don't regularly engage in physical activity	○	○	○	○	○
I feel under pressure from my friends/family to engage in physical activity	○	○	○	○	○

Markland & Tobin (2004)

The Psychological Need Satisfaction in Exercise Scale

PNSE-Perceived Competence

I feel that I am able to complete exercises that are personally challenging

I feel confident I can do even the most challenging exercises

I feel confident in my ability to perform exercises that personally challenge me

I feel capable of completing exercises that are challenging to me

I feel like I am capable of doing even the most challenging exercises

I feel good about the way I am able to complete challenging exercises

PNSE-Perceived Autonomy

I feel free to exercise in my own way

I feel free to make my own exercise program decisions

I feel like I am in charge of my exercise program decisions

I feel like I have a say in choosing the exercises that I do

I feel free to choose which exercises I participate in

I feel like I am the one who decides what exercises I do

PNSE-Perceived Relatedness

I feel attached to my exercise companions because they accept me for who I am

I feel like I share a common bond with people who are important to me when we exercise together

I feel a sense of camaraderie with my exercise companions because we exercise for the same reasons

I feel close to my exercise companions who appreciate how difficult exercise can be

I feel connected to the people who I interact with while we exercise together

I feel like I get along well with other people who I interact with while we exercise together

Participants will respond to a 6 point Likert from 1 = False to 6 = True

Wilson et al., 2006

Physical Activity Scale for Elderly (PASE)

1- Over the **past 7 days**, how often did you participate in **sitting** activities such as reading, watching TV, or doing handcrafts?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

2- On average, how many hours did you engage in these **sitting** activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

3- Over **the past 7 days**, how often did you **take a walk outside your home or yard** for any reason? For example, for fun or exercise, walking to work, or walking the dog.

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

4- On average, how many hours did you spend walking?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

5- Over the **past 7 days**, how often did you engage in **light sport or recreational activities** such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

6- On average, how many hours did you engage in these light sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

7- Over the **past 7 days**, how often did you engage in **moderate sport and recreational activities** such as doubles tennis, ballroom dancing, hunting, ice skating, golf without a cart, softball or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

8- On average, how many hours did you engage in these moderate sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

9- Over the **past 7 days**, how often did you engage in **strenuous sport and recreational activities** such as jogging, swimming, cycling, singles tennis, aerobic dance, skiing (downhill or cross-country) or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

10- On average, how many hours did you engage in these strenuous sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

11- Over the **past 7 days**, how often did you do any **exercises specifically to increase muscle strength and endurance**, such as lifting weights or pushups, etc.?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

12- On average, how many hours did you engage in exercises specifically to increase muscle strength and endurance?

❍ Less than 1 hour

❍ 1 but less than 2 hours

❍ 2 - 4 hours

❍ more than 4 hours

13- During the **past 7 days**, have you done any light housework, such as dusting or washing dishes?

1. NO
2. YES

14- During the **past 7 days**, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows, or carrying wood?

1. NO
2. YES

15- During the **past 7 days**, did you engage in any of the following activities? Please answer YES or NO for each item.

a. Home repairs like painting, wallpapering, electrical work, etc.

b. Lawn work or yard care, including snow or leaf removal, wood chopping, etc.

c. Outdoor gardening

d. Caring for another person, such as children, dependent spouse, or another adult

16- During the past 7 days, did you work for pay or as a volunteer?

1. NO
2. YES (go to questions 17.a and 17.b)

17a. How many hours per week did you work for pay and or as a volunteer? ____ hours

17b. Which of the following categories best describes the amount of physical activity required on your job and or volunteer work?

1. Mainly sitting with some slight arm movement (Examples: office worker, watchmaker, seated assembly line worker, bus driver, etc.)
2. Sitting or standing with some walking (Examples: cashier, general office worker, light tool and machinery worker)
3. Walking with some handling of materials generally weighing less than 50 pounds (Examples: mailman, waiter/waitress, construction worker, heavy tool and machinery worker)
4. Walking and heavy manual work often requiring handling of materials weighting over 50 pounds (Ex: lumberjack, stone mason, farm or general laborer)

Washburn et al. (1993)

Leisure-Time Physical Activity (past week)

In the **past week**, on how many days have you done a total of **30 minutes** or more of physical activity, which was enough to raise your breathing rate. This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job.

O	O	O	O	O	O	O	O
0 day	1	2	3	4	5	6	7 days

Milton K, Bull FC, Bauman A. Reliability and validity testing of a single-item physical activity measure. *British Journal of Sports Medicine* 2011;**45:**203-208.

Monthly Physical Activity Recall

REGULAR PHYSICAL ACTIVITY DURING YOUR LEISURE TIME

- **Regular** physical activity refers to engaging in one or more activities at least **3 days** a week, every week.
- **Physical activity** refers to activities that get your body moving. Such activities result in increased physical effort, accelerated heart rate and breathing, or sweating. For example, leisure-time physical activity may include:
  a) *Walking or rolling* (e.g., brisk walking, hiking, walking the dog, wheelchair rolling)
  b) *Play, games, sports or exercises* (e.g., biking, dancing, golf without using a power cart, jogging or running, swimming, seated volleyball, tennis, water aerobics, working out using machines or weights)
  c) *Around-the-house activities* (e.g., gardening, continuous digging and hoeing)
- **Leisure time** refers to time that can be spent on one's own discretionary time rather than principal work, volunteering, or business.

1. In **the last month**, how often have you participated in one or more physical activities, for at least 30 minutes in a same day, during your leisure time?

   O Never
   O About once in the last month
   O About 2 or 3 times in the last month
   O About once per week
   O About 2 days per week
   O About 3 days per week
   O 4 days or more per week

Godin et al. (1986)

Socio-Demographic Characteristics

Socio-Demographic Questionnaire

Please indicate how often you experienced each of the following in the **last month**:

	Never (0 times)	**Rarely** (Once a month or less)	**Sometimes** (2-4 times per month)	**Often** (2-3 times per week)	**Almost Always** (4 or more times per week)
A. Have trouble falling asleep	**O**	**O**	**O**	**O**	**O**
B. Wake up during the night and have difficulty going back to sleep	**O**	**O**	**O**	**O**	**O**
C. Wake up too early in the morning and be unable to get back to sleep	**O**	**O**	**O**	**O**	**O**
D. Feel unrested during the day, no matter how many hours of sleep you had	**O**	**O**	**O**	**O**	**O**
E. Take sleeping pills to help you sleep	**O**	**O**	**O**	**O**	**O**

Please indicate how often you had fallen in the **past 12 months**.

A fall is defined as an unexpected event in which the participants come to rest on the ground, floor, or lower level". For instance, your foot or shin contacted the ground or other object unexpectedly.

Have you had a fall in the **past 12 months**?

1. NO -→ go to question 21
2. YES -→ go to question 20

If YES, how many falls have you had in the **past 12 months**?"

- ❍ One (1)
- ❍ Two (2)
- ❍ Three (3)
- ❍ Four (4)
- ❍ A lot [more than five (5)]

Sex

- ❍ Male
- ❍ Female
- ❍ Other
- ❍ Prefer not to answer

Age: _____ Date of Birth: _____

What is the highest degree or level of school you have completed? *If currently enrolled, highest degree received.*

- □ Some high school, no diploma
- □ High school graduate, diploma or the equivalent (for example: GED)
- □ Some college credit, no degree
- □ Trade/technical/vocational training
- □ Bachelor's degree

- ☐ Master's degree
- ☐ Professional degree
- ☐ Doctorate degree (PhD)

Are you currently…?

- ☐ Employed
- ☐ Out of work and looking for work
- ☐ Out of work but not currently looking for work
- ☐ A student
- ☐ A Military
- ☐ Retired
- ☐ Unable to work

What is your current marital status?

- ☐ Single, never married
- ☐ Married or domestic partnership
- ☐ Widowed
- ☐ Divorced
- ☐ Separated

Would you like to tell us your racial and ethnic background?

21a. Are you of Hispanic, Latino, or Spanish origin?

- ❍ No, not Hispanic, Latino, or Spanish origin
- ❍ Yes, Mexican, Mexican American, Chicano
- ❍ Yes, Puerto Rican
- ❍ Yes, Cuban
- ❍ Yes, another Hispanic, Latino, or Spanish origin – Print origin, for example, Argentinean, Colombian, Dominican, Nicaraguan, Salvadorian, Spaniard and so on:

  _____

- ❍ Prefer not to answer
- ❍ I don't know

21b. Which category best describe your race?

- ❍ White
- ❍ Black or African American
- ❍ Asian
- ❍ American Indian/Alaska Native
- ❍ Hawaiian Native & Pacific Island
- ❍ Multiracial (two or more races)
- ❍ Other
- ❍ Prefer not to answer
- ❍ I don't know

Are you a current smoker?

- ❍ Yes
- ❍ No

Are you a past smoker?

❍ Yes
❍ No

Current weight:

Weight (pounds) _____ lbs

Current height:

Height (feet and inches) _____ Feet and _____ inches

In general, would you say your health is (Check only one):

 Excellent

 Very good

 Good

 Fair

 Poor

Number of prescription medications?

- ❍ 0
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5+

Do you use a walking aid such as a cane, walker or other?

- ❍ No
- ❍ Cane
- ❍ Walker
- ❍ Wheelchair
- ❍ Other (please specify): _____

Regarding your vision, has your doctor ever told you that you have, or have had, the following (select all that apply)?

- ❍ Glaucoma
- ❍ Macular degeneration
- ❍ Cataracts
- ❍ Other (please specify): _____
- ❍ None of the above

Do you wear corrective lenses (either glasses or contacts) most of the time when walking around?

- ❍ Yes, I wear single correction lenses (that is, not bifocals)
- ❍ Yes, I wear bifocals (can be blended or not blended (visible line))
- ❍ Yes, I wear trifocals, or progressive lenses (also called progressive addition lenses)
- ❍ No
- ❍ Other (please specify): _____

How would you describe your housing?

- ❍ Independent living – you live in a private residence (owned or rented), and no health services or meal preparation are provided
- ❍ Assisted living – you live in a private residence (owned or rented), and you receive nursing care, housekeeping and/or prepared meals in your home as needed
- ❍ Nursing home or rest home – you live in a facility that is not a private residence and your medical and general care needs are provided on a daily basis
- ❍ Other (please specify): _____

Do you receive help from others (either family or other caretakers) for the following (check all that apply):

- ❑ Nursing care
- ❑ Housekeeping
- ❑ Transportation
- ❑ Meal Preparation (for example, Meals on Wheels)
- ❑ Other (please specify): _____
- ❑ No help from others

Using a scale from 0 to 10, where 0 means "the worst possible life overall" and 10 means "the best possible life overall," how would you rate your life overall **THESE DAYS**?

Worst										Best
0	1	2	3	4	5	6	7	8	9	10

How often do you feel that you lack companionship?

- ❍ Hardly ever
- ❍ Some of the times
- ❍ Often

How often do you feel left out?

- ❍ Hardly ever
- ❍ Some of the times
- ❍ Often

How often do you feel isolated from others?

- ❍ Hardly ever
- ❍ Some of the times
- ❍ Often

Has your doctor ever told you that you have, or have had, the following (select all that apply)?

- ❑ Alzheimer’s disease
- ❑ Arthritis
- ❑ Cancer
- ❑ Chronic obstructive pulmonary disease
- ❑ Dementia
- ❑ Depression
- ❑ Diabetes
- ❑ Gout
- ❑ Heart disease
- ❑ HIV/AIDS
- ❑ Insomnia
- ❑ Multiple sclerosis
- ❑ Osteoarthritis
- ❑ Osteoporosis
- ❑ Parkinson's disease
- ❑ Renal (kidney) disease
- ❑ Stroke
- ❑ Traumatic Brain Injury
- ❑ Vestibular or inner ear disorder, such as Meniere's disease
- ❑ Other (please specify): _____
- ❑ None of the above
- ❑ I don’t know
- ❑ I prefer not to answer

APPENDIX E. EMAIL TRIGGER

PURDUE
UNIVERSITY

***Subject**: Voice your opinions about physical activity*

Dear Participant (ID: XXXXX),

Earlier this week you were sent an email asking for your participation in a survey about physical activity (IRB protocol number: 1902021778), and we would like to thank you very much for completing that survey.

Please follow the link provided to complete the next survey. You can copy and paste the link below into the search bar or simply click on it if you are on a mobile phone or tablet.

Your ID is XXXXX

URL link

Your response is voluntary and we appreciate your consideration of our request.

Sincerely,

Steve Amireault, PhD
Assistant Professor
Department of Health and Kinesiology
Purdue University
P: 765-496-0568
samireau@purdue.edu

APPENDIX F. WEEKLY PHYSICAL ACTIVITY QUESTIONNAIRES

Physical Activity Scale for Elderly (PASE)

17- Over the **past 7 days**, how often did you participate in **sitting** activities such as reading, watching TV, or doing handcrafts?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

18- On average, how many hours did you engage in these **sitting** activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

19- Over **the past 7 days**, how often did you **take a walk outside your home or yard** for any reason? For example, for fun or exercise, walking to work, or walking the dog.

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

20- On average, how many hours did you spend walking?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

21- Over the **past 7 days**, how often did you engage in **light sport or recreational activities** such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

22- On average, how many hours did you engage in these light sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

23- Over the **past 7 days**, how often did you engage in **moderate sport and recreational activities** such as doubles tennis, ballroom dancing, hunting, ice skating, golf without a cart, softball or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

24- On average, how many hours did you engage in these moderate sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

25- Over the **past 7 days**, how often did you engage in **strenuous sport and recreational activities** such as jogging, swimming, cycling, singles tennis, aerobic dance, skiing (downhill or cross-country) or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

26- On average, how many hours did you engage in these strenuous sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

27- Over the **past 7 days**, how often did you do any **exercises specifically to increase muscle strength and endurance**, such as lifting weights or pushups, etc.?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

28-On average, how many hours did you engage in exercises specifically to increase muscle strength and endurance?

❍ Less than 1 hour

❍ 1 but less than 2 hours

❍ 2 - 4 hours

❍ more than 4 hours

29-During the **past 7 days**, have you done any light housework, such as dusting or washing dishes?

1. NO
2. YES

30- During the **past 7 days**, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows, or carrying wood?

1. NO
2. YES

31- During the **past 7 days**, did you engage in any of the following activities? Please answer YES or NO for each item.

a. Home repairs like painting, wallpapering, electrical work, etc.

b. Lawn work or yard care, including snow or leaf removal, wood chopping, etc.

c. Outdoor gardening

d. Caring for another person, such as children, dependent spouse, or another adult

32- During the past 7 days, did you work for pay or as a volunteer?

1. NO
2. YES (go to questions 17.a and 17.b)

17a. How many hours per week did you work for pay and or as a volunteer? ____ hours

17b. Which of the following categories best describes the amount of physical activity required on your job and or volunteer work?

5. Mainly sitting with some slight arm movement (Examples: office worker, watchmaker, seated assembly line worker, bus driver, etc.)
6. Sitting or standing with some walking (Examples: cashier, general office worker, light tool and machinery worker)
7. Walking with some handling of materials generally weighing less than 50 pounds (Examples: mailman, waiter/waitress, construction worker, heavy tool and machinery worker)
8. Walking and heavy manual work often requiring handling of materials weighting over 50 pounds (Ex: lumberjack, stone mason, farm or general laborer)

Washburn et al. (1993)

Leisure-Time Physical Activity (past week)

In the **past week**, on how many days have you done a total of **30 minutes** or more of physical activity, which was enough to raise your breathing rate. This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job.

O	O	O	O	O	O	O	O
0 day	1	2	3	4	5	6	7 days

Milton K, Bull FC, Bauman A. Reliability and validity testing of a single-item physical activity measure. *British Journal of Sports Medicine* 2011;**45:**203-208.

APPENDIX G. FOLLOW-UP SURVEY (T2)

Physical Activity Scale for Elderly (PASE)

33- Over the **past 7 days**, how often did you participate in **sitting** activities such as reading, watching TV, or doing handcrafts?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

34- On average, how many hours did you engage in these **sitting** activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

35- Over **the past 7 days**, how often did you **take a walk outside your home or yard** for any reason? For example, for fun or exercise, walking to work, or walking the dog.

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

36- On average, how many hours did you spend walking?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

37- Over the **past 7 days**, how often did you engage in **light sport or recreational activities** such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

38- On average, how many hours did you engage in these light sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

39- Over the **past 7 days**, how often did you engage in **moderate sport and recreational activities** such as doubles tennis, ballroom dancing, hunting, ice skating, golf without a cart, softball or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

40- On average, how many hours did you engage in these moderate sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

41- Over the **past 7 days**, how often did you engage in **strenuous sport and recreational activities** such as jogging, swimming, cycling, singles tennis, aerobic dance, skiing (downhill or cross-country) or other similar activities?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

42- On average, how many hours did you engage in these strenuous sport or recreational activities?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

43- Over the **past 7 days**, how often did you do any **exercises specifically to increase muscle strength and endurance**, such as lifting weights or pushups, etc.?

- ❍ Never (0 day)
- ❍ Seldom (1 – 2 days)
- ❍ Sometimes (3 – 4 days)
- ❍ Often (5 – 7 days)

44- On average, how many hours did you engage in exercises specifically to increase muscle strength and endurance?

- ❍ Less than 1 hour
- ❍ 1 but less than 2 hours
- ❍ 2 - 4 hours
- ❍ more than 4 hours

45- During the **past 7 days**, have you done any light housework, such as dusting or washing dishes?

1. NO
2. YES

46- During the **past 7 days**, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows, or carrying wood?

1. NO
2. YES

47- During the **past 7 days**, did you engage in any of the following activities? Please answer YES or NO for each item.

a. Home repairs like painting, wallpapering, electrical work, etc.

b. Lawn work or yard care, including snow or leaf removal, wood chopping, etc.

c. Outdoor gardening

d. Caring for another person, such as children, dependent spouse, or another adult

48- During the past 7 days, did you work for pay or as a volunteer?

1. NO
2. YES (go to questions 17.a and 17.b)

17a. How many hours per week did you work for pay and or as a volunteer? ____ hours

17b. Which of the following categories best describes the amount of physical activity required on your job and or volunteer work?

9. Mainly sitting with some slight arm movement (Examples: office worker, watchmaker, seated assembly line worker, bus driver, etc.)
10. Sitting or standing with some walking (Examples: cashier, general office worker, light tool and machinery worker)
11. Walking with some handling of materials generally weighing less than 50 pounds (Examples: mailman, waiter/waitress, construction worker, heavy tool and machinery worker)
12. Walking and heavy manual work often requiring handling of materials weighting over 50 pounds (Ex: lumberjack, stone mason, farm or general laborer)

Mullen et al. (2011)

Leisure-Time Physical Activity (past week)

In the **past week**, on how many days have you done a total of **30 minutes** or more of physical activity, which was enough to raise your breathing rate. This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job.

O	O	O	O	O	O	O	O
0 day	1	2	3	4	5	6	7 days

Milton K, Bull FC, Bauman A. Reliability and validity testing of a single-item physical activity measure. *British Journal of Sports Medicine* 2011;**45:**203-208.

THE EXERCISE CAUSALITY ORIENTATIONS SCALE

Below are a series of situations that people can find themselves in with regard to exercising. Each situation is followed by three responses (a, b and c) that represent different ways in which people could react. Please imagine yourself in each situation and circle a number on the scale below EACH response (a, b AND c) to indicate the extent to which EACH response would be characteristic of you in that situation. There are no right or wrong answers and no trick questions. We simply want to know the extent to which you think you would react in these different ways to each situation.

1 You are beginning a new exercise programme. You are likely to:

a) Attend a structured exercise class where an exercise leader is telling you what to do.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Decide for yourself which type of exercise you would like to complete.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Tag along with your friends and do what they do.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

2 You are asked to keep a record of all the weekly exercise you have completed in an exercise diary. You are likely to view the diary:

a) As a reminder of how incapable you are at fulfilling the task.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) As a way to measure your progress and to feel proud of your achievements.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) As a way of pressurising yourself to exercise.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

3 **In order to monitor how well you are doing in an exercise programme you are likely to want to:**

a) Be given a lot of praise and encouragement from others.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Evaluate your own performance and provide yourself with positive feedback.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Just hope that what you are doing is correct.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

4 **You have been exercising regularly for 6 months but recently you have been missing sessions and are finding it hard to get motivated to exercise. You are likely to:**

a) Approach someone to help motivate you.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Ignore the problem, nothing can be done to improve your motivation.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Employ your own strategies to motivate yourself.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

5 You have been told that setting goals is a good way to motivate yourself to exercise. You would likely:

a) Set your own realistic but challenging goals.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Make someone important to you set goals for you to aim for.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Not set goals because you may not be able to live up to them.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

6 During a discussion with an exercise counsellor he/she presents many options on the best way for you to exercise to achieve fitness and health benefits. It is likely that your first thought would be:

a) What do you (the exercise leader) think I should do?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) What do I think is the best option for me?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) What has everyone else done in the past?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

7 During an exercise session how hard you are working out is likely to be governed by:

a) The intensity you have been told to exercise at.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) What everyone around you is doing.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) How you are feeling whilst exercising at the intensity you choose.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

Rose, Markland, & Parfitt. (2001)

Monthly Physical Activity Recall

REGULAR PHYSICAL ACTIVITY DURING YOUR LEISURE TIME

- **Regular** physical activity refers to engaging in one or more activities at least **3 days** a week, every week.
- **Physical activity** refers to activities that get your body moving. Such activities result in increased physical effort, accelerated heart rate and breathing, or sweating. For example, leisure-time physical activity may include:
  d) *Walking or rolling* (e.g., brisk walking, hiking, walking the dog, wheelchair rolling)
  e) *Play, games, sports or exercises* (e.g., biking, dancing, golf without using a power cart, jogging or running, swimming, seated volleyball, tennis, water aerobics, working out using machines or weights)
  f) *Around-the-house activities* (e.g., gardening, continuous digging and hoeing)
- **Leisure time** refers to time that can be spent on one's own discretionary time rather than principal work, volunteering, or business.

2. In **the last month**, how often have you participated in one or more physical activities, for at least 30 minutes in a same day, during your leisure time?

O Never
O About once in the last month
O About 2 or 3 times in the last month
O About once per week
O About 2 days per week
O About 3 days per week
O 5 days or more per week

Godin et al. (1986)