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Abstract

The aim of the present study is to examine the mediating effect of social support on the relationship between internal locus of control (LOC) and engagement in activity, treating general physical activity and deliberate exercise as specific and separate domains. Two models will be investigated: a domain-general model and an exercise-specific model, the former examining the mediating effect of general social support on the relationship between health locus of control and general physical activity and the latter examining the mediating effect of exercise-specific social support on the relationship between exercise LOC and deliberate exercise engagement. Survey responses from 279 college-aged students at a public Midwestern university suggest a mediating role of social support in both models. These findings replicate prior research within the exercise-specific model and indicate that social support is an important factor in deliberate exercise engagement. Within the domain-general model, however, the results suggest that social support may not be as beneficial for individuals with an internal health locus of control in increasing physical activity levels.

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Tables and Figures

Does Social Support Mediate the Relationship Between Social Support and Activity Levels?

In the United States, physical inactivity is increasingly becoming a public health concern. According to the Centers for Disease Control (CDC), physical inactivity is considered a primary risk factor for the development of chronic diseases and thus, has become a primary focus of the CDC's efforts to improve the physical health of Americans (CDC, 2019). Chronic diseases such as heart disease, type 2 diabetes, cancer, and obesity have been linked to physical inactivity, and the pervasiveness of physical inactivity exists throughout the United States (Piercy et al., 2018). According to a self-report survey conducted by the CDC from 2017 to 2020, the Southern region of the United States had the highest rate of physical inactivity, followed by the Midwest, Northeastern, and Western regions (CDC, 2022).

Organizations within and outside the United States have created exercise and physical activity guidelines to encourage Americans to increase physical activity levels. The WHO recommends that adults between 18 and 64 engage in at least 150 minutes of moderate-intensity aerobic physical activity each week or 75 minutes of vigorous-intensity aerobic physical activity each week (World Health Organization, n.d). The American College of Sports Medicine (ACSM) has designed a set of similar guidelines for adults. ACSM recommends 30 minutes of moderate-intensity aerobic exercise five days a week or 20 minutes of vigorous-intensity aerobic exercise three days a week (ACSM, 2011). The WHO and ACSM also recommend two days of muscle-strengthening activities that incorporate the major muscle groups.

According to the American College Health Association (ACHA), only 43.6% of college students in the United States meet the ACSM's guidelines for physical activity, and only 37.6% meet the guidelines for muscular training (ACHA, 2016). Martin et al. (2000) conducted a telephone survey with 2,002 households throughout the United States to determine if individuals met the CDC/ACSM physical activity guidelines. The researchers found that 68% of the participants did not meet CDC/ACSM guidelines. For children 5 to 17 years old, the WHO recommends 60 minutes of moderate to vigorous physical activity each day (World Health Organization, n.d). Unfortunately, about 80% of adolescents worldwide do not meet WHO's physical activity guidelines (Laird et al., 2016). In 2002, in a sample of 680 adults, 55% of males and 65% of females did not meet CDC/ACSM’s guidelines for moderate or vigorous physical activity (Wallace & Buckworth, 2002).

The benefits of physical activity engagement are numerous. Research has identified that adults with high physical activity levels have lower coronary heart disease rates, stroke, high blood pressure, type 2 diabetes, breast cancer, depression, and hip or vertebral fractures (World Health Organization, n.d). Meeting the recommended amounts of physical activity also helps individuals maintain a healthy weight and develop healthy cardiovascular and musculoskeletal systems (World Health Organization, n.d). Warburton and Bredin’s (2017) review concluded that consistent physical activity decreases the risk of premature death and is an effective strategy in preventing at least 25 chronic medical conditions (e.g., cardiovascular disease, type 2 diabetes, breast cancer, colon cancer, and gallstone disease).

For children, appropriate physical activity levels lead to physical, emotional, and social benefits (World Health Organization, n.d). Southern et al. (1999) indicated that children who engaged in moderate-intensity physical activity experienced an increase in overall health, prevented the onset of chronic diseases, decreased back injuries, increased strength, and improved self-esteem and body image. Furthermore, children who engage in physical activity had better control over symptoms of anxiety and depression, developed self-confidence, and were provided with the opportunity to practice self-expression and social interactions (World Health Organization, n.d). Ahn and Fedewa (2011) also indicated that high levels of physical activity in children lead to decreased depression, anxiety, psychological distress, and emotional disturbance. The benefits of increased physical activity levels are even more significant for individuals with cognitive impairments or mental health concerns (Ahn & Fedewa, 2011). Additionally, participation in physical activity has also been linked to healthy behaviors and higher academic performance (Piercy et al., 2018).

It is important to note that, at this time, the organizations structuring physical activity guidelines have not differentiated between behaviors or modalities that make up the activity, apart from references to “moderate” and “vigorous” activities (MVPA when measured together) and to “strength training” compared to “cardiovascular” activities. For example, no distinctions are made between engaging in general, broad activities that are a part of one’s daily, routine behaviors, and those that target deliberate exercise behaviors. While this may be a trivial distinction for constructing recommendations, it is important in the development of interventions targeting increases in MVPA across the general population.

Although the terms “physical activity” and “exercise” share similar underpinnings and are often used interchangeably within the existing literature, they refer to different nuanced constructs. For adults between 18 and 64, the WHO considers activities that enhance cardiovascular and muscular fitness, such as leisure-time physical activity (e.g., walking, swimming, hiking, gardening), transportation (e.g., cycling), occupational (e.g., work), sports, planned exercise, and household chores as physical activity (World Health Organization, n.d). While physical activity and exercise both refer to bodily movement that results in energy expenditure, physical activity is defined as any bodily movement initiated by skeletal muscles that leads to an increase in energy output, and exercise is defined as a deliberate, repetitive bodily movement aimed at increasing physical fitness (Brach et al., 2004). Thus, physical activity is an overarching construct that includes exercise as a subcategory (Garland et al., 2011). For the purposes of the present study, we will examine physical activity and deliberate exercise as two separate constructs.

Studies suggest that physical activity and exercise may result in different outcomes. Brach et al. (2004) investigated the physical function of a sample of 3,075 older adults by collecting data on their level of engagement in physical activity and exercise. The results suggest that deliberate exercise is more beneficial than simply being physically active throughout the day (e.g., yard work) (Brach et al., 2004). The intensity and duration of exercise may also produce varying physical and physiological outcomes (Garland et al., 2004). Nevertheless, this is an understudied area that requires more rigorous scientific investigation.

Review of Literature

Locus of Control

Despite the numerous physical and psycho-physical benefits of physical activity, most Americans do not meet the recommended guidelines (see above). One factor contributing to an individual's likelihood of engaging in physical activity and exercise is locus of control (LOC). LOC, an integral component of Rotter's social learning theory, is the idea that an individual's behavior is influenced by their expectation of how their behavior will result in reinforcements (Burk & Kimiecik, 1994). Thus, LOC is how much individuals believe that they have control over their lives. LOC is further characterized by two subdomains: internal LOC and external LOC (Burk & Kimiecik, 1994). Individuals with an internal LOC believe that behavioral reinforcements are influenced by their behavior. In contrast, individuals with an external LOC believe that behavioral reinforcements are influenced by external factors such as luck, chance, or dominant people (Penk, 1969). Compared to individuals with an external LOC, individuals with an internal LOC have advanced cognitive abilities, obtain and reserve more information, attend to pertinent information, and are more likely to participate in preventative health behaviors (Burk & Kimiecik, 1994; Koivula & Hassmen, 1998).

LOC has been studied within particular domains and has been linked explicitly to health outcomes, including physical activity. For example, health locus of control (HLC) refers to how much individuals believe they control their health outcomes (Marr & Wilcox, 2015). Individuals with higher internal HLC believe that they are responsible for and control their health (Luszczynska & Schwarzer, 2005). High levels of internal HLC have been associated with positive dietary habits, a belief in the ability to control the risk of disease, and lower alcohol consumption and smoking (Marr & Wilcox, 2015). Individuals with an external HLC do not believe that their actions will influence their health (Luszczynska & Schwarzer, 2005). High levels of external HLC are associated with low levels of preventative health behaviors and higher stress levels (Marr & Wilcox, 2015).

Norman et al. (1998) recruited 11,632 participants from Wales to investigate the relationship between HLC, health value, and four health behaviors. The participants were asked to complete a shortened version of the Multidimensional Health Locus of Control (MHLC) scale measuring internal HLC, powerful others HLC, and chance HLC. The participants also completed a four-item scale measuring health value and a survey identifying how often they engaged in four health behaviors (smoking, alcohol consumption, exercise, and diet). The results revealed a correlation between each HLC category and health behaviors. Individuals with internal HLC were more likely to engage in healthy behaviors. However, individuals who scored higher on chance and powerful others HLC were less likely to engage in healthy behaviors. Furthermore, health value was shown to moderate the relationship between HLC and health behavior (Norman et al., 1998).

LOC and the domain-specific HLC have been linked to several preventative health behaviors, including increased physical activity. O’Connell and Price (1982) explored the relationship between HLC and physical activity by observing the participation rates in a corporate program for physical fitness. The subjects, who worked at a mid-western insurance corporation, were allowed to participate in a ten-week physical fitness program that included jogging, walking, and aerobic dance. Of the 121 participants, 32 did not participate, 22 dropped out, and the remaining participants completed the program. Individuals who chose to participate in the program scored higher on internal HLC scales than individuals who did not participate or dropped out. Thus, O’Connell and Price (1982) suggest that individuals who participate in work-site physical activity programs may be more internally motivated.

A study conducted by Sonstroem and Walker (1973) found similar results. The authors selected 102 male upperclassmen from a university to participate in their research. The subjects were asked to complete various scales, engage in physical activity, and complete a physical fitness test. Sonstroem and Walker (1973) found that individuals with an internal LOC had better attitudes toward physical activity. They were also more likely to engage in physical activity than those with external LOC. Additionally, Slenker et al. (1985) administered the MHLC scale to 123 individuals who jog regularly and 93 individuals who do not engage in exercise. The researchers found that the joggers scored significantly higher on the internal subscales of the MHLC.

Although HLC is positively associated with physical activity and health behaviors, research suggests that another domain, exercise-specific LOC, may better predict such behaviors. For example, Burk and Kimiecik (1994) conducted a study to investigate how health-specific LOC and exercise-specific LOC scales combined with exercise values predict exercise behaviors. The study consisted of 86 participants recruited from a fitness program at a Midwestern university. The results revealed that exercise LOC, specifically a subscale measuring powerful others exercise LOC, was a better predictor of exercise behavior than the more general HLC. Powerful other external LOC refers to individuals' belief that people in their life, whom they perceive as powerful, are responsible for the outcomes they experience (Burk & Kimiecik, 1994).

Furthermore, Guinn et al. (2006) sought to investigate the relationship between exercise LOC, age, present exercise level, weight status, and gender with the intention to exercise. Among 438 Mexican American youths, the researchers only found a small effect between exercise LOC and exercise behaviors. However, the results indicated that powerful others' exercise LOC became more important as an individual grew older, suggesting that powerful others (parents, authority figures, teachers, coaches) could help individuals increase physical activity levels. Taken together, these studies indicate that powerful others may be an incredibly powerful determinant of exercise engagement. Indeed, Burk and Kimiecik (1994) suggest that researchers investigating physical activity levels should also incorporate an assessment of social support, an understudied construct that may influence the LOC and exercise relationship.

Social Support

In addition to LOC, social support may be another factor that influences an individual’s physical activity engagement. Various definitions exist for social support throughout literature and within organizations. The American Psychological Association (n.d.) defines social support as assisting or comforting other individuals to overcome biological, psychological, and social stressors. According to Maisel and Gable (2009), social support may also be categorized as visible or invisible (Maisel & Gable, 2009). Visible social support refers to support that the individual is aware of receiving. Invisible social support refers to support that the individual is unaware of receiving. However, visible and invisible social support is only practical when the support aligns with the individual's specific needs. Nevertheless, individuals receive and provide social support through interpersonal relationships within their environment. Particular social support sources may include family, spouses, friends, teachers, classmates, co-workers, neighbors, caregivers, or support groups (Malecki & Elliott 1999). The avenues in which social support is delivered also vary. Individuals may provide social support through practical assistance (e.g., cooking), tangible aid (e.g., money), or emotional assistance (e.g., encouraging; American Psychological Association, n.d.).

The avenues in which social support can be provided can also be applied to specific constructs. For example, Laird et al. (2016) used meta-analytic findings to describe five social support categories specific to physical activity. The first category, emotional support, provides social support for physical activity by offering praise or encouragement. Instrumental social support may include financial assistance (e.g., membership to a gym) or equipment (e.g., bicycle) to help an individual become or remain physically active. Informational support may involve instruction (e.g., the proper way to perform a weightlifting technique), advice, or physical activity feedback. Lastly, co-participation and modeling may be used to assist with physical activity. Co-participation is when an individual engages in physical activity with the target individual. Modeling is when an individual demonstrates positive physical activity behaviors to encourage others to participate (Laird et al., 2016).

According to Laird et al. (2016), physical activity levels established during adolescence are likely to continue in adulthood. Therefore, it is vital to encourage children to engage in physical activity at an early age. Providing exercise-specific social support may be one way that parents and other influential figures may help children and adolescents establish strong, healthy habits.

Indeed, family and peer social support, specific to exercise and diet behavior, have been found empirically to influence adolescents' eating and exercise behaviors (Gruber, 2008). A review by Beets et al. (2010) further indicates that exercise-specific parental social support in children 18 and younger is associated with higher physical activity levels.

A recent study by Haidar et al. (2019) found that parental and peer social support, specific to exercise, was associated with positive physical activity habits in 8th and 11th-grade students in Texas. Students who received more social support from their parents and peers were more likely to engage in physical activity and less likely to engage in two or more hours of screen time per day (Haidar et al., 2019). Haidar et al.'s (2019) results align with Hohepa et al.'s (2007) study investigating social support and participation in after-school physical activities, lunchtime activity, and mode of transportation to and from school (e.g., walking). In a sample of 3,471 12 to 18-year-old high school students from South Auckland, New Zealand, low parental and peer support for physical activity was associated with less participation in physical activity after school. Low peer support for physical activity was also associated with less activity during lunchtime and less physical activity during transportation to and from school in juniors (Hohepa et al., 2007).

Even though physical activity levels established during adolescence are likely to continue into adulthood, providing social support to encourage physical activity is also critical during young adulthood. Despite previous exercise habits, a temporary decrease in physical activity usually occurs during the transition from high school to college (Chu et al., 2019). The decline in physical activity may be compounded with the availability of unhealthy foods, sedentary behavior (e.g., sitting in class), and living away from family and friends (Chu et al., 2019). Living away from family and friends and moving to a new environment without social connections may temporarily decrease an individual's social support source. Therefore, it may be particularly important to consider the influences of social support during young adulthood.

Gruber (2008) assessed how college students are criticized or encouraged to exercise, lose weight, or eat healthily through social support forms. The results identified that females were more likely to receive overall social support for diet and exercise behaviors than males. Females also received more encouragement to maintain a healthy weight, eat healthily, and exercise. At the same time, males only reported high social support levels when the majority of their friends were female. Interestingly, however, females received criticism for exercising when their friends were primarily male (Gruber, 2008). Hale et al. (2005) found similar results when investigating the relationship between social support and physical health perceptions and physical symptoms in a sample of 247 college students. The findings indicated that compared to males, females reported higher social support levels and a greater number of physical symptoms (Hale et al., 2005). Nevertheless, when college students receive social support from peers or family, research has indicated that they are more likely to engage in physical activity (Gruber, 2008).

Farren et al. (2017) recruited 453 college students from a public university to identify how sex, exercise self-efficacy, outcome expectations, and social support for exercise habits influenced their ability to meet physical activity guidelines. The students were given a series of questionnaires to identify physical activity and psychosocial factors. To analyze the data, researchers categorized students into four categories: not meeting physical activity guidelines, meeting only aerobic physical activity guidelines, meeting muscle-strengthening physical activity guidelines, or meeting both aerobic and muscle-strengthening guidelines. The results revealed that exercise self-efficacy, outcome expectations, and social support significantly predicted physical activity. Social support, however, was found to be particularly valuable in increasing muscle-strengthening physical activity. Furthermore, it was found that those meeting muscle-strengthening physical activity guidelines were more likely to meet all physical activity guidelines. Thus, social support may increase muscle-strengthening physical activity while also indirectly influencing an individual's ability to meet all physical activity guidelines (Farren et al., 2017).

Although numerous studies have investigated the benefits of social support specific to exercise or physical activity, few studies have explored the relationship between general social support and physical activity. A review by Smith et al. (2017) indicated that only 5 of the 27 studies investigating the relationship between social support and physical activity in older adults (60+) included a measure for general social support. Of the five studies, only two indicated a positive and significant relationship between general social support and physical activity (Smith et al., 2017). Potts (1992) found that older adults with increased social support were more likely to exercise frequently, and Kaplan et al. (2001) found that higher levels of general social support were significantly associated with higher physical activity levels in older adult females; however, not in males. In contrast, Vance et al. (2007) did not find a significant association between an individual's social support network and total physical activity levels. Mowen et al. (2007) also found that a more extensive social support network or social support satisfaction was not associated with an active lifestyle in a sample of older adults. Due to conflicting evidence, more research is needed to determine the relationship between general social support and physical activity.

The Present Study

Although there has been extensive research relating social support and physical activity and LOC and physical activity, few studies have investigated the relationship between all three variables. Furthermore, the strength of these relationships has not been examined in regard to their domain-general (physical activity, health LOC, and general social support) compared to their more domain-specific (exercise, exercise specific LOC, and social support for exercise) counterparts. Marr and Wilcox (2015) investigated whether social support and self-efficacy mediate the relationship between internal HLC and health behaviors in a sample of 838 college students. The participants were recruited from two public universities in the southeastern United States and asked to fill out online surveys measuring HLC, self-efficacy, social support, physical activity, fruit and vegetable intake, and dietary fat intake. The results revealed that self-efficacy and social support mediated the relationship between internal HLC and physical activity, and fruit and vegetable consumption. Thus, the researchers suggest that individuals with high internal HLC are more likely to engage in healthy behaviors (e.g., physical activity) because they believe that they have control over their ability to participate in such behaviors as well as control over their social network (e.g., connecting with individuals who share similar values and habits) (Marr & Wilcox, 2015).

In the present study, we aimed to investigate the relationship between HLC, social support, and physical activity. We provided a conceptual replication of Marr & Wilcox's mediation model examining general health behaviors (Figure 1A). This model examined the mediating effect of social support for physical activity (ISEL-12) on the relationship between HLC (MHLC Form B) and general physical activity (GPAQv2) (Figure 1B). It should be noted that this model is considered a conceptual replication because self-efficacy and diet, two variables examined in Marr and Wilcox’s original study, will not be examined here. Henceforth, this model is referred to as the domain-general model. Furthermore, although the GPAQv2 asks participants to indicate their level of physical activity across work, transportation, and leisure/deliberate exercise engagement, we chose to specifically examine an individual's engagement across work and transportation to not overlap with the second, exercise-specific domain. The exercise-specific model assessed the mediating effect of exercise-specific social support (SSES) on the relationship between exercise-specific LOC (EOLOC) and exercise engagement (WAI) (Figure 1C). Henceforth, this model is referred to as the exercise-specific model and was designed to extend the work provided by Marr and Wilcox (2015) to deliberate exercise. The following specific research questions were addressed:

1. How do emerging adults perceive their domain-general and exercise-specific social support, LOC, and personal engagement in physical activity and exercise? This was an exploratory aim; therefore, no directional hypothesis was generated.
2. What are the relationships between and across the domain-general and domain-specific measures of social support, LOC, and engagement in physical activity and exercise? This was meant an exploratory aim; therefore, no directional hypothesis was generated.
3. Does general social support mediate the relationship between health locus of control and general physical activity? We hypothesized that, as indicated by Marr and Wilcox's findings (2015), social support would mediate the relationship between health locus of control and physical activity.
4. Does exercise-specific social support mediate the relationship between exercise LOC and exercise engagement? In keeping with prior findings (Marr & Wilcox, 2015), we hypothesized that exercise-specific social support would be a statistically significant mediator in the relationship between exercise locus of control and exercise engagement.

Methods

Participants

Participants for this study were recruited from a Midwestern university. Participants were excluded from analysis if they responded to the physical activity and exercise measures inconsistently (i.e., by indicating that they participate in regular exercise but not in physical activity which encompasses exercise) (N = 2), if they did not complete the survey measures (N = 86), or if they did not fall within the targeted age range (N = 1). This left 279 remaining participants whose data were included in the subsequent analyses. Participants were not compensated monetarily but participated to meet a requirement for their academic program. All participants received informed consent prior to their enrollment in the study, and the university's Institutional Review Board approved the study. The majority of the sample was female (N = 205; 73%) and White (N = 205; 73%) or Black/African American (N = 61; 21.7%). Participant characteristics can be viewed in their entirety in Table 1.

Measures

Locus of Control Measures

Multidimensional Health Locus of Control (MHLC) Form B. The MHLC Form B was used as the general HLC scale for this study (See Appendix A). It was created by Wallston et al. (1978) and was designed to measure how much an individual believes they are in control of health outcomes. The measure consists of 18 items with a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). Three 6-item subscales are included within the measure: internal, which measures the extent to which a person believes they have control over their health outcomes; chance, which refers to a person's belief that their health outcomes are mostly reliant on chance happenings; and powerful others, which indicates that an individual believes their health outcomes are under the control of other people in their life—scores for each subscale range from 6 to 36. Examples of items include, “It seems that my health is greatly influenced by accidental happenings.” (chance) and “I am directly responsible for my health” (internal). Marr and Wilcox (2015) reported moderately high internal consistencies for each subscale: internal (α = .70), chance (α = .64), and powerful others (α = .69).

Exercise Objectives Locus of Control Scales (EOLOC). The exercise-specific LOC scale for this study was the EOLOC created by McCready (1984) (See Appendix B). The EOLOC was designed to measure LOC specific to exercise. This study will use the revised EOLOC scale with 18 items. Responses for the measure are given on a Likert-type scale ranging from 5 (Strongly Agree) to 1 (Strongly Disagree). Three 6-item subscales are included within the measure, creating a parallel metric to the MHLC: internal, powerful others, and chance. Examples of items include "If I do not attain my exercise goals, other people will be to blame," and "The behavior of other people will greatly influence whether or not I reach my exercise objectives" (both examples from the powerful others subscale). The present study utilized the internal subscale of the EOLOC to investigate participants' level of internal LOC. Importantly, lower scores on the internal subscale reflect higher internal LOC, while higher scores reflect lower internal LOC.

Social Support Measures

Interpersonal Support Evaluation List-12 (ISEL-12). The general social support scale for this study, the ISEL-12, was created by Cohen et al. (1985) (See Appendix C). The ISEL-12 is a short form of the original 40-item ISEL designed to measure functional social support. This measure is a 12-item self-report survey. Responses for the measure are given on a Likert-type scale that ranges from 1 (definitely false) to 4 (definitely true). Composite scores can be obtained by summing all items (0-36). Three social support subscales are also included within the measure: appraisal, which measures advice or guidance; belonging, which measures empathy, acceptance, or concern; and tangible, which measures help or assistance (e.g., financial aid). Examples of the items include "When I need suggestions on how to deal with a personal problem, I know someone I can turn to," and "If I were sick, I could easily find someone to help me with my daily chores." Internal consistency for the total score has been reported as α = .70 or higher (Merz et al., 2014).

Social Support for Exercise Scale (SSES). The exercise-specific social support measure for this study was the SSES created by Sallis et al. (1987) (See Appendix D). The SSES was designed to measure perceived social support specific to health-related eating and exercise behaviors. This measure is a 43 item self-report survey. Responses for the measure are given on a Likert-type scale that ranges from 1 (none) to 5 (very often). Thus, larger scores indicate the individual has more social support. Only two subscales were used from the SESS for this study, as these focus on exercise behaviors. The Friend Support for Exercise Habits subscale consists of 5 items. Examples of items on the subscale include "Exercised with me." and "Gave me helpful reminders to exercise." The Family Support for Exercise Habits subscale consists of 15 items. Examples of items include "Planned for exercise on recreational outings." and "Talked about how much they like to exercise." Internal consistency has been reported as α = .41 with good content and face validity (Noroozi et al., 2011).

Physical Activity Measures

Global Physical Activity Questionnaire-Second Edition (GPAQv2). The general physical activity measure for this study was developed by the World Health Organization (WHO) (Armstrong & Bull, 2006) (See Appendix E). The GPAQ, a self-report survey, was designed to measure valid and reliable estimates of physical activity. There are two versions of the GPAQ: GPAQv1 and GPAQv2. In this study, we will be using the GPAQv2, which consists of 16-items. Participants are asked to indicate "no" "yes" or indicate how often they participate in physical activity to respond to questions. Examples of items include "In a typical week, how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?" and "How much time do you usually spend sitting or reclining on a typical day?” Good test-retest reliability has been reported (0.67-0.81) (Armstrong & Bull, 2006). GPAQ yields three summative scores related to physical activity for the purposes of transportation (e.g., riding one's bike or walking to work), related to work (e.g., having a job that requires strenuous physical lifting or walking), and recreation (e.g., participating in exercise programs or sport for fun). For the purposes of the present study, only two subscales of the GPA were summed and analyzed—those relating to work and transportation. This was done to avoid collinearity with the exercise measure, as the WAI, described below, is a measure specifically gauging time spent in recreational exercise. To further increase the ability to translate between the two models, GPAQ was calculated for total time spent in physical activity per week, although the measure also provides an estimate of METs per week.

Weekly Activities Index (WAI). The WAI, developed by IOX Associates (1988), was used to measure exercise engagement (See Appendix F). The WAI consists of 28 exercise activities (e.g., jogging/running, football, rowing, swimming, tennis), and participants were asked to indicate the frequency, duration, and intensity of the activities they engaged in within the past week. For frequency, participants are asked to identify how many times they engaged in the activity in the preceding week. For duration, participants are asked to specify how long, in minutes, the activity lasted. Lastly, for intensity, participants are asked to categorize the activity as light (small increase in heart and breathing rate), medium (some increase in heart and breathing rate), or heavy (large increase in heart and breathing rate).

Procedure

All survey and questionnaire measures were converted into electronic form for dissemination online. Participants were recruited from the university's undergraduate research subject pool and given access instructions to assess the survey materials remotely. After reading and agreeing to informed consent, participants were asked basic demographic information such as height, weight, age, educational attainment, and family income, and then completed the six surveys measuring LOC, social support, and physical activity, and exercise. Upon completing the survey, participants were debriefed, thanked, and received course credit.

Results

Descriptive Statistics

Data collected in Qualtrics were imported to SPSS version 27 (IBM) for analysis. Statistical assumptions were examined and tested as appropriate. It should be noted that strongly skewed data are anticipated in measures of physical activity and exercise since most Americans do not meet physical activity guidelines, and many report largely sedentary lifestyles. Since physical activity and exercise measures are expected to be skewed, and since both the WAI and the GPAQv2 specifically direct researchers not to remove participants based on time limits as long as the limits are feasible (i.e., not indicating more than 24 hours of activity per day), we statistically adjusted for non-normality and the existence of outliers by using non-parametric analyses and bootstrapped estimates for the correlational and mediation models, respectively. In addition, the Davidson-MacKinnon correction for violation of homoscedasticity was applied to both mediation models. Each research question is addressed specifically below.

To assess the results of the first research question, “How do early adults perceive their domain-general and exercise-specific social support, LOC, and personal engagement in physical activity and exercise?” descriptive analyses were computed. Means, standard deviations, and score ranges for all outcome measures are presented in Table 2. On average, the participants within our sample reported relatively high internal LOC (Internal MHLC M = 26.28; Internal EOLOC M = 9.90) and general social support (ISEL-12 M = 37.42). However, on average, social support specific to exercise was reported as somewhat low (SESS M = 51.01). Within the general physical activity questionnaire (GPAQv2), participants reported the highest engagement in recreational physical activity (minutes per week) (*M* = 419.15), followed by work (*M* = 374.46) and transportation (*M* = 286.70). Lastly, on average, participants reported a similar amount of time spent engaging in deliberate exercise compared to recreational physical activity reported on the GPAQv2 (WAI *M* = 491.68).

Correlation Analyses

To address the second research question, "What are the relationships between and across the domain-general and exercise-specific measures of social support, LOC, and engagement in physical activity and exercise?" Spearman Rho correlation analyses were conducted. Due to these analyses' exploratory nature, all participant characteristics and their domain-general and exercise-specific estimates of social support, LOC, and physical activity and exercise measures were analyzed in a single correlation table. An alpha threshold of .05 was used to determine statistical significance. The results of this correlation analysis can be viewed in Table 3. As expected, the measures were highly correlated. Specifically, MHLC significantly related to all other measures, positively with ISEL-12, SESS, and WAI, and negatively with GPAQv2 and EOLOC. WAI also correlated with all other measures, positively with all except EOLOC. It is important to note that a lower score on the EOLOC means an individual has a higher internal LOC. Thus, this relationship suggests that individuals who engage in more domain-specific exercise engagement also have a higher internal locus of control specific to exercise. Additionally, ISEL-12 related negatively with EOLOC and positively with SESS, while EOLOC and SESS related negatively to each other. Therefore, individuals with more general and exercise-specific social support had higher levels of internal LOC.

Mediation Analyses

To assess the third and fourth research questions, "Does general social support mediate the relationship between HLC and general physical activity?” and “Does exercise specific social support mediate the relationship between exercise LOC and exercise engagement?” we used mediation models based on the assumptions outlined in Hayes (2012). Hayes' method works off of the traditional assumptions outlined in Baron and Kenny (1986) and MacKinnon, Fairchild, and Fritz (2007), but allows for more flexibility in modeling. For example, PROCESS can handle statistical controls within a mediation analysis, whereas the traditional Sobel's test cannot. In this method, a series of relationships are examined among an outcome variable (Y), an independent variable (X), and a mediator (M). The relationship between X and M forms Path a; the relationship between M and Y forms Path b. The relationship between X and Y is examined in two ways, first directly (Path c) and second accounting for the mediator (Path c'). In our models, X is internal LOC, M is the measure of social support, and Y is the measure of activity/exercise in keeping with whether the model tested was domain-general or exercise-specific. The model's significance is established by comparing the difference in Path c and Path c', or the indirect effect. We tested these assumptions using the PROCESS macro for SPSS (Hayes, 2017). Importantly, the significance of the indirect effect is examined via the bootstrapped confidence intervals, with 95% upper and lower bound confidence intervals that do not subtend zero indicating significance. Sex was included as a control variable since it was significantly correlated with one of the outcome variables. It was included in both models for the sake of consistency in interpretation. The full results, including standardized beta coefficients, can be seen in Figures 1B and 1C.

Domain General Model

The domain-general model showed significance for both Paths A and B, indicating that MHLC directly predicted ISEL ($p \leq .001$) and that ISEL-12 directly predicted GPAQv2 ($p = .027$). Path C, or the direct effect between MHLC and GPAQv2 was not significant ($p = .054$), nor was

Path C' (p = .2534). However, the indirect effect was statistically significant (95% CI -0.0859, -0.0067), which suggests that while MHLC did not predict GPAQv2 in our sample, the relationship was significantly altered due to the introduction of ISEL-12 as a mediator. Thus, at least partial mediation can be assumed.

Exercise-Specific Model

The exercise-specific model showed that all paths in the model were significant. Thus, EOLOC predicted SESS (p= .023), SESS predicted WAI (p = .002), and EOLOC predicted WAI both without accounting for the mediator of SESS (p = .002) and when accounting for the mediator (p = .006). Furthermore, the indirect effect was statistically significant (95% CI -0.055, -0.002), suggesting that the mediator of SESS accounts for meaningful variance in the relationship between EOLOC and WAI.

Discussion

The psychological and physical health impacts of the rising inactivity rates among the youth and adult population in the United States have become increasingly concerning. Consequently, many researchers have explored how various factors influence physical activity engagement to better understand physical activity motivation and create appropriate interventions. Existing literature has provided evidence that internal LOC and social support are two factors that positively influence physical activity levels (Beets et al., 2010; Gruber, 2008; Slenker et al., 1985; Sonstroem & Walker, 1973). However, the relationship among all three variables has been seldom studied. Thus, the purpose of the present study was to investigate the relationship among all three variables via the role of social support as a possible mediator between internal LOC and physical activity. We accomplished this by examining two models, one domain-general and one exercise-specific, which allowed us to provide a conceptual replication of Marr and Wilcox's (2015) mediation model examining general health behaviors and extend this finding to the realm of specific exercise engagement.

In both models, social support was found to play a mediating role in the relationship between internal LOC and engagement in activity. Interestingly, in the domain-general model, internal HLC was not related directly to physical activity engagement, although the indirect effect suggests that mediation occurred. The results of our mediation model also implied that individuals with internal HLC and higher levels of general social support were less likely to engage in physical activity. The lack of a direct relationship between HLC and physical activity as well as a decrease in physical activity levels was unexpected, given that other studies have found such a relationship (Marr & Wilcox, 2015; O'Connell & Price, 1982; Sonstroem & Walker, 1973). However, the lack of relationship could be due to our use of a composite score comprising only two of the GPAQv2 sub-scores- those relating to work and transportation. It is possible that some of the variance accounted for by HLC in the prior studies was that involving recreation. This is logical, given that recreation is often more within an individual's control and that work and transportation are necessary features of many individuals' lives. The mediation evident in our results may also suggest that individuals with internal HLC are not positively influenced by their social network to engage in more physical activity. Rather, it is possible that individuals who score high on measures of powerful others HLC and external HLC are more influenced by their social network to engage in physical activity due to their belief that other people and extraneous circumstances are responsible for the events that occur in their lives.

An important feature of the present work was the extension of this relationship to an exercise-specific domain. This distinction is important. While increases in general physical activity, such as those behaviors that one performs as part of daily routines (i.e., walking to work or taking the stairs) or specific exercise (e.g., engaging in a session of aerobics or going for a run) can benefit overall health by increasing cardiovascular fitness, the distinction is vital in measurement and intervention. There is concern over the effectiveness of interventions aimed at improving activity (Baranowski et al., 1998; Love et al., 2019). While many of these interventions run on a relatively small scale and target exercise behaviors, there is evidence to suggest that targeting a broader base of behaviors in an entire population by encouraging daily physical activity habits (e.g., taking the stairs) may be more effective (Sallis, Bauman, & Pratt, 1998) and could be more easily targeted in public health campaigns.

The finding that social support was an important factor within the exercise-specific model is not surprising. Existing literature has demonstrated that social support positively influences health and exercise behaviors (Graham et al., 2011; Peacock, 2022). For example, Condliffe et al. (2017) designed an intervention to increase college-aged students' gym attendance by providing a lottery incentive, assigning participants to a gym partner, and providing teams information on the progress of other teams. Incentives alone were not effective in increasing gym attendance. However, participants who were assigned a gym partner and received information on the progress of other teams demonstrated a significant increase in gym attendance and continued to have elevated levels of gym attendance after the intervention concluded (Condliffe et al., 2017). Thus, their findings highlighted the importance of social support and its role in improving engagement in exercise behaviors. However, our study demonstrates not only that social support is important but that it appears to impact people differentially based upon their level of internal LOC. In our exercise-specific model, those with greater internal LOC were impacted more through social support. In our domain general model, those with greater internal LOC did not experience an increase in physical activity levels through their social support networks. Thus, future intervention studies may benefit from differentiating intervention techniques based upon individualized features, LOC among them.

Overall, our results suggest that individuals who believe they have control over their health outcomes may not benefit from a social support network to engage in increased levels of general physical activity. However, those with exercise-specific LOC, who believe they have control over their exercise outcomes, and a strong social support network are more likely to engage in deliberate exercise. The mechanism in which social support mediates internal LOC and exercise may occur in various ways. As suggested by Marr and Wilcox (2015), it is possible that individuals with higher internal LOC are impacted by the motivation, resources, or general support provided by their social support networks which positively affects their ability to engage in activity. It may also be possible that individuals with higher internal LOC seek out and choose to be around other individuals who share similar beliefs or habits, resulting in more exercise engagement (Marr & Wilcox, 2015). Within our exercise-specific model, individuals with a higher internal LOC may have a social network who may simply encourage them to engage in exercise, provide resources to allow them to access opportunities for exercise, or engage in the exercises with them.

Translation to School Psychology Practice

Although our sample focused on college-aged students, more research is needed to generalize our findings to varied populations. However, our general findings have important implications for children and adolescents. Increasing evidence suggests that greater engagement in physical activity impacts learning and school performance (Khan & Hillman, 2014). Notably, physical fitness has been associated with the hippocampus and prefrontal cortex functions (Khan & Hillman, 2014). Neuroimaging has revealed that physically fit children produce different brain activity patterns than children who are not physically fit when they perform tasks controlled by the prefrontal cortex. Tasks related to the prefrontal cortex and hippocampus are also commonly associated with learning. Furthermore, physically fit children have demonstrated an enhanced ability to learn under difficult circumstances (Khan & Hillman, 2014). Thus, suggesting that increased physical activity provides advantages beyond general health benefits.

The impact of physical activity on learning and school performance is further supported by Srikanth et al. (2015), who investigated the relationship between physical activity, psychosocial constructs, and math and reading achievement test scores in adolescents. The sample comprised 1,211 6th through 8th graders who were asked to complete self-report scales regarding levels of physical activity, academic self-beliefs, general self-esteem, and perceived social support, as well as objective measures to gather body composition and cardiorespiratory fitness. One to five months later, the participants completed annual standardized reading and math tests. After controlling for SES, the results indicated that cardiorespiratory fitness was associated with higher scores on reading and math achievement tests (Srikanth et al., 2015). Thus, Srikanth et al. (2015) suggested that schools incorporate physical activity opportunities into their daily schedules.

Consistent with Srikanth et al. (2015), Burdette and Whitaker (2005) also advocated increasing children's physical activity opportunities within the school setting or the community and a child’s home. In addition to increasing physical activity, active and free play may provide school-aged children with the opportunity to problem-solve, think creatively, refine social interactions, and increase emotional well-being or feelings of happiness (Burdette & Whitaker, 2005). Comprehensively, active play helps children develop and refine skills (e.g., executive functioning, self-regulation, and flexibility) that assist children in overall functioning and within the learning process (Burdette & Whitaker, 2005).

The ability for active and free play to provide an opportunity for a child to participate in physical activity and social interactions is noteworthy when examining the results of the present study. Active and free play may provide an opportunity for children to develop and maintain social connections to create a social network. Although the results of our present study do not directly generalize to young children, our findings suggest that social support is a crucial component of increasing activity engagement. Thus, increasing opportunities for active and free play within the educational setting may provide a foundation for the relationship between social support and exercise to develop. In addition to active and free play, the significance of our findings suggests that it is important to consider additional ways in which social support networks may be developed or maintained within the school setting to increase the likelihood of activity engagement.

Kulik et al. (2015) examined the role of social support in increasing physical activity levels within the school setting for elementary aged students. Their results suggested that simply talking to children about physical activity was most associated with higher physical activity engagement within the school setting compared to demonstrating social support through exercising with the children or deliberately encouraging them to engage in activity. Furthermore, social support from classroom teachers and classmates were influential in increasing physical activity engagement within the school setting. However, for boys, the school principal had an even more influential role in increasing physical activity engagement. Thus, school principals may be an important, yet often overlooked, influence in establishing physical activity levels in elementary aged children.

Kulik et al. (2015) also highlighted the importance of implementing interventions during early elementary school years when health behaviors are being established and habits are forming. More specifically, Fahlman & Gutuskey's (2015) proposed tying nutrition and activity interventions to a school's core curriculum, implementing school-based nutrition interventions, and implementing school-based interventions that successfully increase activity levels as a means to begin forming healthy habits in school-age children. In addition to school principals, classroom teachers, and classmates, school psychologists may be another source of social support for increasing physical activity engagement among school-aged children. In addition to contributing to a culture of activity within the school setting by speaking with children about physical activity, school psychologists may help implement additional interventions aimed at increasing general social support levels or physical activity engagement.

Lastly, our results suggest the importance of considering how children view their health behaviors and health and exercise outcomes. The differences in the role of social support on activity levels across domains may suggest the importance of tailoring interventions for students with various levels of LOC. Individuals with a higher internal LOC typically believe they have the power to control their health and exercise behaviors and outcomes and thus, had a positive relationship with social support and deliberate exercise. Empowering students who believe they are responsible for their health and have the power to make healthy life decisions may be a critical step in increasing exercise engagement. On the other hand, developing and maintaining social networks for students with an external and powerful others LOC framework may be beneficial to increasing their levels of physical activity engagement.

Limitations and Future Directions

While the findings reported herein are novel, our study was not without limitations. All of the measures employed were based upon participant self-report. When specifically examining the use of self-reported measures for general physical activity and deliberate exercise, it is possible that individuals overreported or underreported their true engagement and reliability of these estimates in comparison to direct measures has varied (Prince et al., 2008, 2020). Future work would benefit from examining the roles of social support and LOC on physical activity and exercise using more objective metrics like accelerometry. Future work may also benefit from examining the role of social support on physical activity and exercise behaviors for measures of powerful others LOC and external LOC. It is possible that individuals who do not believe they are in control of their lives may be more influenced by social support to engage in various health behaviors.

Furthermore, since the surveys were also completed online, it is possible that respondents were influenced by other factors when completing the surveys. Generalizing our results to different populations is limited due to the participation of college-age students within our sample. There are many factors specific to students attending college that may influence our results and are not relevant to different populations of society. For example, some college students may not own a car and thus, are more likely to walk or bus to their destination. Finally, cross-sectional data is, by nature, limited when determining causality. To fully investigate the differences in the mechanisms and effectiveness of targeting general physical activity compared to exercise outcomes, randomized controlled intervention studies are needed.

Conclusion

In summary, the present study provides a conceptual replication of Marr and Wilcox's (2015) findings within our exercise-specific model and is consistent with previous literature that demonstrated the importance of social support to physical activity levels. Importantly, we found social support to mediate the relationship between internal LOC and activity levels across both domains suggesting that social support is especially beneficial for those with an exercise-specific internal LOC; however, less beneficial for those with an internal health LOC. Thus, an important consideration in the future investigation of and interventions in physical activity engagement.

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Table 1

Sample Characteristics

Characteristics	*n*	%	*M*	*SD*
Sex				
Male	75	26.9		
Female	203	72.8		
Prefer not to answer	1	.4		
Age	278		18.91	1.23
BMI				
Male	71		25.47	4.93
Female	186		26.11	5.92
Race/ethnicity				
White	204	73.1		
Black/African American	61	21.9		
Other	9	3.2		
Prefer not to answer	5	1.8		
Highest Level of Education				
Less than high school or diploma	1	.4		
High school diploma or GED	112	39.9		
Some college, but no degree	162	57.7		
Associates Degree	3	1.1		
Bachelor’s Degree	3	1.1		

Table 2

Descriptive Statistics for All Outcome Measures

Variable	N	Mean(SD)	Range
Internal MHLC	279	26.28(4.56)	6-36
ISEL-12	279	37.42(6.40)	18-48
GPAQ-2	279	1072.62(1190.72)	0-6440
Work	279	374.46(630.58)	0-4320
Transportation	279	286.70(506.44)	0-4235
Recreational	279	419.15(691.95)	0-5220
Internal EOLOC	279	9.90(3.67)	6-36
SSES	279	51.01(14.16)	28-100
WAI	279	491.68(554.96)	0-4660

Table 3

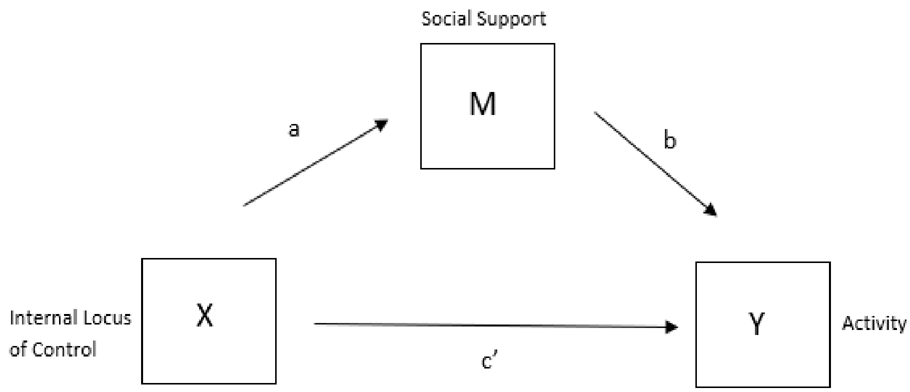
Correlation Matrix for All Scales Used in Study

Variables	ISEL	GPAQ-2	EOLOC	SSES	WAI	Age	Sex	Race	BMI
MHLC	.282** (p = .000)	-.125** (p = .037)	-.366** (p = .000)	.185** (p = .002)	.140* (p = .020)	.097 (p = .107)	-.168** (p = .005)	-.028 (p = .638)	-.106 (p = .088)
ISEL		-.092 (p = .124)	-.293** (p = .000)	.313** (p = .000)	.156** (p = .009)	-.115 (p = .055)	-0.53 (p = .376)	.180** (p = .003)	-.100 (p = .108)
GPAQ-2			.078 (p = .191)	-.003 (p = .957)	.189** (p = .001)	-.005 (p = .932)	-.060 (p = .316)	-.057 (p = .341)	.018 (p = .770)
EOLOC				-.145** (p = .016)	-.185** (p = .002)	-.034 (p = .577)	-.010 (p = .866)	-.158** (p = .008)	.058 (p = .355)
SSES					.299** (p = .000)	-.025 (p = .683)	-.107 (p = .075)	-.052 (p = .387)	-.254** (p = .000)
WAI						-.001 (p = .982)	-.198** (p = .001)	.027 (p = .653)	-.085 (p = .172)

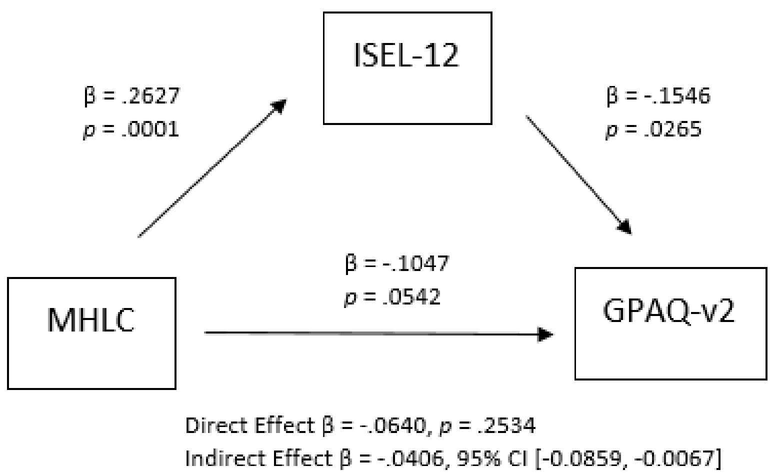
**p < .05

Figure 1

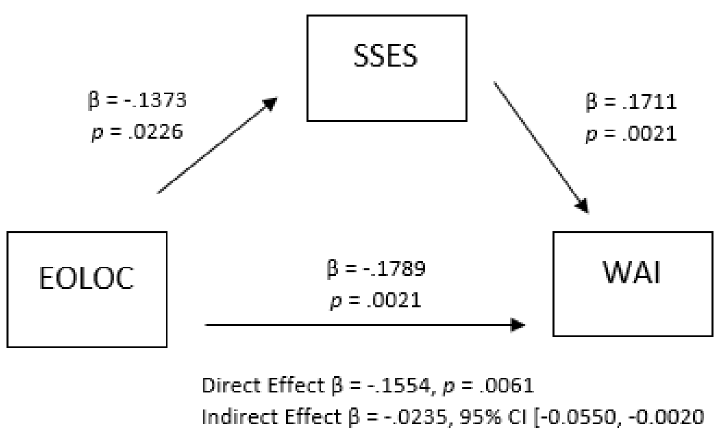
A. *Conceptualized mediation models*



B. *Measures and standardized coefficients for the domain-general model*



C. *Measures and standardized coefficients for the exercise-specific model*



Appendix A

Multidimensional Health Locus of Control (MHLC Form B)

Below is the measure for health locus of control.

1. a. If I become sick, I have the power to make myself well again.

2. b. Often I feel that no matter what I do, if I am going to get sick, I will get sick.

3. c. If I see an excellent doctor regularly, I am less likely to have health problems.

4. b. It seems that my health is greatly influenced by accidental happenings.

5. c. I can only maintain my health by consulting health professionals.

6. a. I am directly responsible for my health.

7. c. Other people play a big part in whether I stay healthy or become sick.

8. a. Whatever goes wrong with my health is my own fault.

9. b. When I am sick, I just have to let nature run its course.

10. c. Health professionals keep me healthy.

11. b. When I stay healthy, I'm just plain lucky.

12. a. My physical well-being depends on how well I take care of myself.

13. a. When I feel ill, I know it is because I have not been taking care of myself properly.

14. c. The type of care I receive from other people is what is responsible for how well I recover from an illness.

15. b. Even when I take care of myself, it's easy to get sick.

16. b. When I become ill, it's a matter of fate.

17. a. I can pretty much stay healthy by taking good care of myself.

18. c. Following doctor's orders to the letter is the best way for me to stay healthy.

a. Internal Subscale

b. Chance Subscale

c. Powerful Others Subscale

Appendix B

Exercise Objectives Locus of Control Scales (EOLOC)

Below is the measure for exercise specific locus of control.

1. a. My own actions will determine whether or not I achieve my exercise objectives.

2. b. If it's meant to be, I will reach my exercise objectives.

3. a. Whether or not I obtain my exercise objectives depends mostly on my own behavior.

4. b. Whether or not I achieve my exercise objectives is largely a matter of good or bad fortune.

5. a. The encouragement I give myself will greatly affect whether or not I reach my exercise objectives.

6. c. If I do not attain my exercise goals, other people will be to blame.

7. c. For the most part, other people are in control over whether or not I attain my exercise goals.

8. b. Whether or not I achieve my exercise objectives is largely a matter of fate.

9. c. It is entirely up to other people whether or not I accomplish my exercise goals.

10. b. Whether or not I accomplish my exercise goals depends on how lucky I am.

11. a. I am directly responsible for whether or not I reach my exercise goals.

12. b. Achieving my exercise objectives will depend on how fortunate I am.

13. a. Whether or not I accomplish my exercise goals is entirely up to me.

14. c. Whether or not I reach my exercise objectives depends on the actions of certain other people.

15. c. Other people have the power to make certain that I accomplish my exercise objectives.

16. b. Not achieving my exercise objectives will be a matter of bad fortune.

17. c. The behavior of other people will greatly influence whether or not I reach my exercise objectives.

18. a. I am primarily in control over whether or not I reach my exercise objectives.

a. Internal Subscale

b. Chance Subscale

c. Powerful Others Subscale

Appendix C

Interpersonal Support Evaluation List-12 (ISEL-12)

Below is the measure for general social support.

1. b. If I wanted to go on a trip for a day (for example to the beach, the country or mountains), I would have a hard time finding someone to go with me.

2. a. I feel that there is no one I can share my most private worries and fears with.

3. c. If I were sick, I could easily find someone to help me with my daily chores.

4. a. There is someone I can turn to for advice about handling problems with my family.

5. b. If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me.

6. a. When I need suggestions on how to deal with a personal problem, I know someone I can turn to.

7. b. I don’t often get invited to do thing with others.

8. c. If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc.).

9. b. If I wanted to have lunch with someone, I could easily find someone to join me.

10. c. If I was stranded 10 miles from home, there is someone I could call who could come and get me.

11. a. If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it.

12 c. If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me.

a. appraisal subscale

b. belonging subscale

c. tangible subscale

Appendix D

Social Support for Exercise Scale (SESS)

Below is the measure for exercise specific social support.

Friend Support For Exercise Habits Scale

1. Exercised with me.
2. Offered to exercise with me.
3. Gave me helpful reminders to exercise.
4. Gave me encouragement to stick with my exercise program.
5. Changed their schedule so we could exercise together.

Family Support for Exercise Habits Scale

1. Exercised with me.
2. Gave encouragement to stick with my exercise program.
3. Changed their schedule so we could exercise together.
4. Offered to exercise with me.
5. Gave me helpful reminders to exercise.
6. Planned for exercise on recreational outings.
7. Discussed exercise with me.
8. Talked about how much they like to exercise.
9. Helped plan activities around my exercise.
10. Asked me for ideas on how they can get more exercise.
11. Took over chores so I had more time to exercise.
12. Made positive comments about my physical appearance.

Rewards and Punishments

13. Got angry at me for exercising.
14. Criticized me or made fun of me for exercising.
15. Gave me rewards for exercising.

Appendix E

Global Physical Activity Questionnaire-Second Edition (GPAQv2)

Below is the measure for general physical activity.

P. 1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like (carrying or lifting heavy loads, digging, or construction work) for at least 10 minutes continuously?

If no, go to P3.

P. 2. a. In a typical week, on how many days do you do vigorous-intensity activities as part of your work?

P. 2. b. How much time do you spend doing vigorous-intensity activities at work on a typical day?

P. 3. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking (for carrying light loads) for at least 10 minutes continuously?

If no, go to P5.

P. 4. a. In a typical week, on how many days do you do moderate-intensity activities as part of your work?

P. 4. b. How much time do you spend doing moderate-intensity activities at work on a typical day?

The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example, to work, for shopping, to market, to place of worship.

P. 5. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?

If no, go to P7.

P. 6. a. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?

P. 6. b. How much time do you spend walking or bicycling for travel on a typical day?

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness, and recreational activities (leisure).

P. 7. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like (running or football) for at least 10 minutes continuously?

If no, go to P9.

P. 8. a. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?

P. 8. b. How much time do you spend doing vigorous-intensity sports, fitness, or recreational activities on a typical day?

P. 9. Do you do any moderate-intensity sports, fitness, or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking, (cycling, swimming, volleyball) for at least 10 minutes continuously?

If no, go to P11.

P. 10. a. In a typical week, on how many days do you do moderate-intensity sports, fitness, or recreational (leisure) activities?

P. 10. b. How much time do you spend doing moderate-intensity sports, fitness, or recreational (leisure) activities on a typical day?

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent (sitting at a desk, sitting with friends, traveling in a car, bus, train, reading, playing cards, or watching television), but do not include time spent sleeping.

P. 11. How much time do you usually spend sitting or reclining on a typical day?

Appendix F

Weekly Activities Index (WAI)

Below is the measure for exercise engagement.

Activity	**Frequency (number/week)**	**Average Duration (minutes)**	**Intensity (L, M, H)**
Badminton			
Baseball/softball			
Basketball			
Bicycling			
Bowling			
Calisthenics (general exercises)			
Dancing (Type:________)			
Football			
Golf (with a cart?_____)			
Handball/racquetball/squash			
Hiking			
Jogging/running			
Judo/karate			
Rope skipping			
Rowing			
Skating			
Skiing (Type:________)			
Soccer			
Stretching			
Swimming			
Tennis			
Volleyball			
Walking (for exercise)			
Weight training			
Wrestling			
Yoga			
Other:________________			
Other:________________			