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TRANSTHEORETICAL MODEL FOR EXERCISE: MEASURE REDEVELOPMENT AND ASSESSING THE ROLE OF BARRIERS IN A DIVERSE POPULATION

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ABSTRACT

Despite its well-documented success in differentiating stage of change (SOC) for readiness for regular exercise among primarily White populations, the Transtheoretical Model (TTM) exercise constructs have shown inconsistent results in understudied populations, such as Black and Hispanic/Latinx adults (Spencer et al., 2006). This cross-sectional study attempts to understand this trend by considering barriers to regular exercise among these populations. This study describes the development and validation of a novel barriers construct, as well as adapted constructs of Self-Efficacy (SE) and Decisional Balance (DB) within the TTM framework. Black and Hispanic/Latinx adults (n = 450) were recruited to complete this study.

Exploratory and confirmatory analyses produced one Pros and two Cons' scales for the DB inventory, two scales for the SE inventory, and three scales for the Barriers inventory. Expected patterns for SE and Pros by SOC were found, while the anticipated results for Cons were not found. It was expected that Barriers would decrease with increasing SOC, however change across SOC was not significant and the opposite trend was found. These findings suggest that barriers to regular exercise might be progressively realized as individuals progress through SOC or may not be important to the sample studied. They also suggest that traditional TTM constructs can be culturally tailored or improved by incorporating barriers to exercise without disrupting the frameworks' expected outcomes.

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INTRODUCTION

Statement of the Problem

Despite concrete evidence supporting the importance of exercise on physical and psychological health, many Americans fail to engage in adequate amounts of exercise. The Transtheoretical Model (TTM) has proven a useful tool in increasing exercise engagement in certain populations (Marshall & Biddle, 2001). However, research has shown that commonly used TTM measures, specifically the Cons scale, have failed to differentiate stages of change (SOC) in understudied populations. Most validation studies for these measures were completed in primarily white, middle-class populations, with little focus on Black or Hispanic/Latinx men and women (Spencer et al., 2006). Given the Cons scale's inconsistency in this population, it appears further research is required to assess for the reasons behind this shortcoming. Considering the prominent inequalities that currently exist in America, it is possible that existing measures are not adequately accounting for contextual or environmental factors that may further affect exercise behavior.

Justification for and Significance of the Study

The Societal Issue

Overwhelming evidence exists that supports the benefits of activity on human health and well-being. Studies have consistently shown that adequate engagement in exercise may prevent many chronic or lifestyle-related diseases, including those most deadly in America and globally, such as heart disease, diabetes, age-related dementia, and some forms of cancer (Reiner et al., 2013). Physical activity has been proven to contribute additional physical benefits, such as improved body composition in the

form of increased lean body mass and decreased fat mass (Drenowatz et al., 2015) and improved cardiovascular health through reducing blood pressure and LDL cholesterol and increasing HDL cholesterol and insulin sensitivity (Myers, 2003). The benefits of exercise and movement are also seen in the psychological realm (Deslandes et al., 2009). Specifically, exercise engagement has been shown to reduce symptoms of depression and anxiety in both clinical (Ravindran & da Silva, 2013) and non-clinical populations (Rebar et al., 2015).

Despite extensive and abundant scientific literature supporting the various benefits of exercise, research has revealed that roughly 77% of American adults do not engage in the recommended amount of weekly exercise to receive such benefits (Blackwell & Clark, 2018). As a result, likely in combination with poor nutrition, American society has become increasingly sick (Raghupathi & Raghupathi, 2018), obese (Hales et al., 2020), and reliant on pharmacological remedies (Kantor et al., 2015).

Defining the Transtheoretical Model

Given the increasing importance of exercise on societal health, ample research has been conducted with the common goal of increasing people's engagement in physical activity. One popular and evidence-based approach in the literature is the use of the Transtheoretical Model.

The Transtheoretical Model (TTM) of behavior change is a framework for understanding, assessing and subsequently guiding intervention to support intentional behavior change. The core concept of the TTM is an assessment of an individual's Stage of Change (SOC) or readiness to engage in a behavior change (Prochaska et al.,

2009). SOC is typically assessed categorically, with individuals being classified into five stages: precontemplation, contemplation, preparation, action, and maintenance (2009). The precontemplation stage indicates that an individual is not considering making an intentional behavior change in the foreseeable future. Individuals in contemplation intend to engage in a behavior change within the next six months, while individuals in preparation intend to begin the behavior change in the next 30 days and are actively taking steps towards doing so. Those in the action stage have initiated engagement in the desired behavior but have done so for less than six months and individuals in the maintenance stage have continuously engaged in the behavior for at least six months.

The theory posits that movement through the stages is initiated by shifts in three core constructs: decisional balance, self-efficacy, and processes of change. Decisional balance considers how individuals view the pros and cons of the given behavior change and how important these are to their decision to engage in or abstain from the behavior. Self-efficacy assesses an individual's confidence in their ability to complete the given behavior under challenging and often relapse-triggering circumstances. Lastly, processes of change reflect overt and covert thoughts, activities, and behaviors that people engage in as they enact health behavior modifications.

The TTM constructs of decisional balance, self-efficacy, and processes of change not only provide a basis for understanding and assessing SOC, but also establish the foundation of TTM-tailored interventions, which aim to accelerate progression through the change process (Prochaska & Velicer, 1997). These tailored interventions involve empirically based strategies for increasing self-efficacy and the

importance of pros, while decreasing the importance of cons. An important strength of the TTM is that these tailored interventions provide a clear framework for accelerating behavior change progression in all populations, not just those ready to change. Rather than including only those most motivated, the TTM aims to accelerate movement through the change process beginning in those not even considering a behavior change.

Transtheoretical Model for Exercise: History and the Problem

The TTM was originally developed with smoking cessation as exemplar (Prochaska & Velicer, 1997). However, numerous studies have concluded that the TTM constructs are a good fit to changing exercise behavior, finding that SOC transitions are accompanied by the expected changes in physical activity behavior, decisional balance, self-efficacy, and processes of change (Marshall & Biddle, 2001; Spencer et al., 2006). Additionally, when TTM constructs have been applied to stage-matched interventions, results have shown promising results in increasing exercise behavior (Romain et al., 2018; Gourlan et al., 2016; Conn et al., 2011).

Despite encouraging initial findings, improvement is necessary to increase the generalizability of instrument success and intervention effectiveness. Specifically, the utility of the TTM constructs in identifying and delineating stage membership for exercise appear to have been readily established, but within a rather specific demographic. In a review of studies applying the TTM to exercise, results showed that of the five U.S.-based population studies included, all were primarily or exclusively white, middle-class populations (Spencer et al., 2006). In the same review, of the non-SOC validation studies cited (Marcus et al., 1992; Marcus et al., 1994; Hausenblas et

al., 2001), two of the studies were at least 70% white, and one did not address race, but was collected in a similar setting (workplace), state (Rhode Island), and under the same research grant as other studies reporting a roughly 90% white sample (Marcus et al., 1994). Similarly, concerning intervention studies, Spencer and colleagues (2006) showed that of the 38 intervention studies reviewed, most populations were 75% or more female and the majority of the samples were primarily white. As a result, researchers were unable to address or verify the utility of TTM interventions in U.S. populations who are low income or ethnically or racially diverse (2006). This is an important limitation, as ethnically diverse populations may be most in need of successful exercise interventions due to the vast health disparities that exist in the U.S. (Adler & Rehkopf, 2008).

In summary, the main samples historically used for measure development of TTM instruments for exercise behavior have been largely homogenous, involving primarily female, White, and oftentimes middle-class populations (Spencer et al., 2006). As a result, some of the measures do not appear to work well in populations of color or those in lower socioeconomic brackets.

Of interest going forward, several decisional balance measures have been constructed and used frequently in this body of research. The two most widely used decisional balance instruments appear to be the 16-item decisional balance questionnaire (DBQ; Marcus et al., 1992) and the 10-item DBQ (Plotnikoff et al., 2001). Although the established decisional balance scales have been validated and found to be reliable, they appear to yield limited generalizability beyond their established samples. For example, the 16-item DBQ was constructed from a sample

that was 95% white and, within which, 70% of the sample worked in white-collar professions (Marcus et al., 1992). Meanwhile, the 10-item DBQ did not address race in its validation study. However, the census data in the year and region it was completed reveal that the region's population was over 80% white, 4.5% Black, and 3.6% Chinese (Statistics Canada, 2001). Given these statistics, it is likely that the sample assessed for this study was primarily White. As a result of these homogenous samples, the literature has revealed numerous occurrences in which the decisional balance construct, specifically the Cons scale, does not differentiate between stage membership or does not change as expected when used with understudied populations.

For example, a validation study of all TTM measures in a sample of 521 Black adults in North Carolina found support for all TTM measures within this sample, except for the Cons scale (Blaney et al., 2012). This study used a 10-item DBQ (Nigg et al., 1998), which includes five cons. In this sample, the Cons did not predict stage and were overwhelmingly under-endorsed, indicating that the given cons were of little importance in this sample's decision whether or not to exercise. Following this finding, authors recommended a re-adaptation of the cons scale that is more culturally relevant to a Black population (2012).

Similarly, in a sample of 168 diverse, older adults, researchers echoed concerns with the Cons scale for exercise (Kosma & Cardinal, 2016). The Cons measure was the only TTM construct that was not significantly correlated with actual physical activity. This indicates that the cons listed on the 10-item DBQ (Plotnikoff et al., 2001) bore little relationship to exercise engagement in this population. Researchers concluded that these perceived cons might not have been realized in this

population of older individuals given the presence of specific barriers that are introduced with increased age (2016). Similarly, in a sample of primarily White older adults, researchers found that cons did not play an important role in predicting exercise adoption (Cheung et al., 2007).

The utility of the Cons scale for exercise has also been questioned in a low-income population (Carmack Taylor et al., 2003). Carmack Taylor and colleagues recruited 545 low-income participants (60% Black, 80% female) from four public, primary-care centers in Louisiana. Much like findings reviewed previously (Blaney et al., 2012), results showed that on four of the six cons listed, roughly 50% of the sample identified the con as unimportant in their decision to exercise (2003). Researchers responded to this finding suggesting that the cons did not adequately assess exercise barriers in this low-income population. They further emphasized the need for a modified Cons scale that better incorporates the environmental barriers that a low-income sample may encounter (2003).

Regarding disability and certain illness, research has further recommended the need for an exercise Cons scale redevelopment due to inadequate predictive utility or differentiation between stages. In a population of primarily white adults with physical disability, despite finding some significant difference between early and late SOC, researchers concluded that the overall SOC contribution from the cons in regard to regular exercise engagement was “negligible” (Kosma et al., 2006). They, too, suggested the need for future studies to observe cons in combination with population-specific barriers in hopes of enhancing the accuracy and validity of this construct

(2006). Similar findings have been reported in samples with severe mental illness (Bezyak et al., 2011) and HIV (Basta et al., 2008).

Based on these numerous findings and researcher recommendations outlined above, it appears that as samples get more socioeconomically, racially, or otherwise sociodemographically diverse, the Cons scale, as it is currently measured, does not appear relevant to the decision to exercise. Researchers have proposed that this outcome may be due to the presence of more influential and inhibitory barriers. This suggests that the Cons and perhaps other TTM construct scales may need to be redeveloped in a more diverse sample, or that research needs to incorporate a measure of barriers that better reflects and considers the important factors impacting exercise engagement that are currently not being captured in the existing scales.

Consideration of Contextual Factors

A broad limitation of the TTM and health behavior change research in general is the overemphasis on individualism (Goldberg, 2012). There exists a widely held belief in personal agency over one's own health status. While personal choice does play a significant role in many health behavior activities, it is a crude simplification to attribute all responsibility to personal will. In doing so, we overlook pervasive flaws in the American food and healthcare systems that disproportionately impact the health of low-income individuals and people of color (Braveman et al., 2010). The danger in this perspective, as Daniel Goldberg (2012) outlines, is that health behavior change strategies based solely on individualism only contribute to health inequalities and stigmatization in America. However, if we, as researchers, are better able to measure variables outside the individual's control, we will get a clearer picture of the issues

preventing exercise engagement and may be better able to address and solve them in future research.

In summary, while considering how to increase exercise in our society, we cannot overlook the role of cultural and contextual factors that impede or aid one's ability to engage in this behavior. In order to engage in adequate exercise, defined as 150-300 minutes a week of moderate intensity physical activity (2008), one must, at a minimum, have the time to engage, the physical ability to do so, knowledge of basic exercise behaviors, and a physical environment that allows for safe and effective activity.

While there is utility in measuring the individualistic construct that is cons of exercise, as evidenced by the scale's success in wealthier, white samples, it fails to address a set of contextual conditions that may further prevent exercise behavior in more disadvantaged populations. Barriers and cons, although often used interchangeably in the literature, are distinct and independent constructs. Cons represent negative consequences of a behavior, in this case exercise. Barriers, however, are obstacles that prevent or inhibit an individual from successfully engaging in a behavior. The clarifying distinction between cons and barriers is that cons simply inhibit people from *wanting to* exercise, whereas barriers inhibit people from *engaging in* exercise. For example, how important sweating (a con) is might matter less when one is unable to safely walk in their own neighborhood (a barrier). While some studies have addressed barriers to exercise in the context of the TTM, many have done so at the expense of measuring cons (Tung & Hsu, 2009; Gorczynski et al., 2010; Fahrenwald & Walker, 2003). Self-efficacy is similar to both cons and barriers, yet

represents its own distinct construct, as well. Self-efficacy measures a person's confidence in their ability to exercise when faced with challenging situations that often lead people to *not* exercise, such as when they are feeling depressed or when it is raining. While a barrier can represent a challenging situation, self-efficacy is distinct because it represents a person's subjective confidence in their ability to overcome that barrier. Here, the clarifying distinction is that self-efficacy measures the degree to which someone might overcome the given barrier, while barriers alone measure the simple presence or absence of that given barrier. While existing self-efficacy scales have shown success, it is possible that because most TTM instruments were adapted and validated in primarily white populations (Marcus et al., 1992; Plotnikoff et al., 2001), barrier situations that are recognized in non-white or understudied populations may have been dropped due to under-endorsement. In other words, the self-efficacy situations that the wealthier, white samples endorsed as relevant may not include situations or barriers to exercise that minority populations may encounter. In fact, literature on barriers to exercise in Black and Hispanic/Latinx individuals highlights numerous barriers that are not addressed in existing self-efficacy scales (King et al., 2000; Juarbe et al., 2000; Bautista et al., 2011; Bantham et al., 2020; Pekmezi et al., 2013; Griffith et al., 2011).

There is only one study in the literature that has assessed self-efficacy, cons, and barriers to exercise, to our knowledge. Cardinal and colleagues measured all core TTM constructs, in addition to exercise barriers commonly identified in adults with physical disabilities (2004). Results showed that adding barriers to a discriminant function analysis marginally increased predictive accuracy of stage. Perceived barriers

were highest in the contemplation stage and lowest in the maintenance stage. Although barriers added only slight statistical predictive utility, results from this study suggest that barriers play an important and independent role in stage of change discrimination in a sample of individuals with physical disabilities.

The Current Study

Given the inconsistent ability of the Cons scale to predict SOC or actual physical activity engagement in understudied populations, it appears the use of existing TTM measures in these populations needs improvement. As recommended in previous studies (Carmack Taylor et al., 2003; Kosma et al., 2006) these measures, particularly the Cons scale and Self-efficacy scale for exercise, could benefit from a consideration of contextual factors that may impede exercise adherence. More specifically, in considering the unique challenges that non-white populations face concerning income (Akee et al., 2019) and health (Adler & Rehkopf, 2008) disparities in the United States, researchers may be able to better understand the implications these disparities have on exercise engagement. Further understanding of these effects may lead to more contextually accurate measures that could lead to improved TTM-tailored interventions.

It is challenging to identify which TTM measures may be better modified to incorporate population-specific barrier content. It is possible that although the existing self-efficacy scales address what many consider barriers to exercise, they are missing important items that may be inhibiting exercise behavior in understudied populations. It is also possible that the Cons scale is inadequate in these populations due to more impactful and prevalent barriers that exist beyond negative aspects of exercise. The

purpose of this research was to investigate and redevelop existing TTM measures to better understand exercise behavior in a non-white, adult population, as well as assess how better incorporating relevant barriers into these measures impacts the accuracy or functionality of the TTM in diverse groups. The proposed study will address the following three hypotheses:

1. Measure development will yield updated self-efficacy and decisional balance scales that demonstrate factor structures similar to previous TTM studies with other behavioral applications with good model fit. The barriers construct is not designed with an a priori factor structure.

2. Cons, barriers, and self-efficacy will be independent, yet moderately correlated constructs.

3. As hypothesized under the strong and weak principles (Prochaska & Velicer, 1997), we expect stage progression to be associated with a 1 SD increase in the importance of pros from precontemplation (PC) to action (A), a .5 SD decrease in the importance of cons from PC to A, and a .8 SD increase in self-efficacy from PC to A. However, we also suspect the cons decrease across SOC will be less than one half standard deviation due to findings previously reported. We anticipate that self-efficacy will increase with stage progression and that, based on results from one article incorporating barriers into the TTM framework (Cardinal et al., 2004), perceptions of barriers will decrease from contemplation (C) to A, and the effect size will be small to medium.

METHOD

Cognitive Interviews

Prior to survey dissemination, individuals (n = 5) who identified as Black (n = 2) or Hispanic/Latinx (n=3) were recruited from social media to participate in cognitive interviewing. Cognitive interviews and all study procedures were approved prior to initiation by the University of Rhode Island Institutional Review Board. Participants who expressed interest were contacted and provided with the consent form prior to the interview. Cognitive interviews were held via Zoom with the first author. Upon providing consent, participants were asked to go through the survey with the author and provide feedback about the readability, understandability, and clarity of the survey instructions and items. Participants were asked to state in their own words what they understood the instructions to be asking, as well as to provide general feedback on the survey items and response options. If a participant expressed confusion about instructions or response items, they were encouraged to suggest changes that might improve clarity. When applicable, changes were incorporated prior to the next cognitive interview for review. Additionally, participants were encouraged to suggest additional barrier items for inclusion. They were first asked to review the existing barrier items in the scale. They were then asked if they or someone they knew had encountered any other barriers to exercise that were not already included. New barrier items were generated with the participant and incorporated into the scale. For a complete list of cognitive interview questions, see Appendix A. Cognitive interviews lasted 30-40 minutes and participants were compensated for their time with a $15

Amazon gift card. Feedback was incorporated when appropriate and interviews were stopped once no additional feedback was being reported.

Participant Recruitment and Survey Administration

Survey construction and data collection management were completed in Qualtrics (www.qualtrics.com), while participants were recruited from the data collection platform, Prolific (www.prolific.co). Prolific is an international data collection platform that recruits participants by word-of-mouth, collects pre-screen information upon participant registration for researchers, and has several effective systems in place to prevent fraudulent accounts. The study was advertised only to individuals who met the self-reported, pre-screen requirements. That is, individuals who listed their race as Black or their ethnicity as Hispanic/Latinx on Prolific and who also reported residence in the United States. All participants were aged 18 years or older. Additionally, to recruit a sufficient sample to provide a wide range of exercise behavior, the study was advertised in two parts, one to those who indicated on Prolific that they did not currently engage in exercise and one to those who indicated that they at least sometimes exercised. This method, although imperfect given that exercise behavior may have changed since the participant initially self-reported this information, aimed to broaden the range of exercise behavior by reducing the likelihood of recruiting only people who are particularly interested in and biased towards exercise. No restrictions were placed on device use; therefore, individuals could complete the study on their respective mobile devices, tablets, or desktops. Participants were provided with a brief description of the study, the estimated time commitment (15 minutes) and the expected payment if completed ($2.50). Interested

participants were asked to read a consent form that detailed the description of the study, limits of confidentiality, potential for harm, and potential benefits of participating. They were also made aware that they had the option to discontinue participation in the survey at any time by closing the survey window on their computer or device. Participants were then required to document that they had read the consent form, that any questions they may have had were answered, and that they agreed to participate by clicking "yes." If they clicked "no," or did not select, they were restricted from continuing to the survey and were not reimbursed.

Measures

This study assessed demographic variables, exercise behavior, and the core TTM constructs of decisional balance, stage of change, and self-efficacy for regular exercise. Constructs were measured using items from existing exercise TTM measures as sources, in addition to novel items that were developed in this project. Barriers to exercise reported in existing barrier scales (Sechrist et al., 1987; Steinhardt & Dishman, 1989) and among these populations as described in qualitative literature were assessed independently and, as relevant, were addressed in the self-efficacy and decisional balance measures. Therefore, barriers were addressed as a scale of their own, and reworded and adapted to reflect the cons and self-efficacy constructs, as well. For example, the barrier item "I do not have a safe place in my neighborhood or community to exercise" was reworded to "Getting exercise would put my safety at risk" to reflect a negative consequence or con of exercise. It was further adapted for self-efficacy by assessing one's confidence in their ability to exercise if they "do not have a safe place to exercise."

Three instructed response items were used as attention checks in this survey to ensure that participants were paying attention and that the final data set was less influenced by random or inconsistent responding (Gummer et al., 2021).

Demographics Questionnaire- A self-report demographics questionnaire (see Appendix B) assessed participant age, gender identity, race, ethnicity, employment status, height in feet and inches and weight in pounds. Participants were also asked about educational attainment and subjective perspective of standing within the U.S social-economic power hierarchy (i.e., poor, working class, middle class, affluent) to serve as a proxy for income (Diemer et al., 2013).

Exercise Behavior- Current **e**xercise behavior was measured using the International Physical Activity Questionnaire- Short Form (IPAQ-SF; Craig et al., 2003). The IPAQ-SF is a self-report questionnaire that assesses physical activity over the past seven days (see Appendix C). Participants were given a description of each category of exercise (vigorous, moderate, and walking) and then asked on how many days in the past seven days and for how long they engaged in that type of activity. For example, for vigorous activity participants were asked "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?" followed by "In minutes, how much time did you usually spend doing vigorous physical activities on one of those days?" Previous literature has established that the IPAQ-SF has good reliability and validity (2003; Silsbury et al., 2015).

Stage of Change- Exercise SOC was assessed using an established staging algorithm. All participants were given the definition of regular exercise according to

the most recent U.S. Department of Health and Human Services physical activity guidelines for Americans (2018). Following this definition, participants were asked "Do you currently engage in regular exercise (at least 150 minutes each week)?" If participants answered "no," indicating that they did not currently engage in regular exercise, they were then asked if they intended to engage in regular exercise in the next six months (Contemplation), in the next 30 days (Preparation) or not at all in the next six months (Precontemplation). If participants answered "yes," they were then asked if they had regularly engaged in exercise for six months or more. Individuals who had engaged regularly for six months or more were placed into Maintenance, and individuals who had engaged in regular exercise for less than six months were placed into Action (See Appendix D). The reliability and validity of this staging algorithm has been established in previous literature (Hellsten et al., 2008; Norman et al., 1998).

Self-Efficacy- Exercise self-efficacy was assessed using a questionnaire comprising items from two existing self-efficacy scales consisting of 13 and eight items, respectively (Marcus et al., 1992; Plotnikoff et al., 2001). The first scale originally had a test-retest reliability of .90 and concluded that self-efficacy scores significantly differentiated people in most stages. The second scale originally had a Cronbach's alpha of $\alpha = .88$ at initial time point, $\alpha = .89$ at 6 months, and $\alpha = .90$ at 12 months (Plotnikoff et al., 2001).

Barrier items were also incorporated as compiled from existing barrier scales (Sechrist et al., 1987; Steinhardt & Dishman, 1989) and from the qualitative literature describing barriers to regular exercise among Hispanic/Latinx and/or Black adults. Relevant items were reworded and adapted to assess one's confidence in their ability

to engage in regular exercise despite encountering the given barrier challenge. In the modified scale, participants were given a list of situations in which some people might choose *not* to exercise when something gets in the way (e.g., I am under a lot of stress, I have other work responsibilities, I feel stiff or sore; See Appendix E). They were asked to rate how confident they were that they would participate in regular exercise in face of the listed challenges from "Not at all confident" to "Extremely confident." The final measure consisted of 35 items.

Decisional Balance- Exercise pros and cons were assessed using a questionnaire involving items from two existing decisional balance scales (Nigg et al., 1998; Plotnikoff et al., 2001). The first questionnaire included five pros and five cons and originally produced internal consistencies of 0.83 and 0.71, respectively (1998). The factor structure of this scale has been confirmed in previous research (Paxton et al., 2008). The second scale also involved five pros and five cons and originally produced good internal consistencies for both pros ($\alpha = .82$) and cons ($\alpha = .72$; Plotnikoff et al., 2001). Construct validity was established following results showing significant differences in the decisional balance scale by stage of exercise adoption (2001). The pros originally produced a test-retest reliability of $r =. 84$ and the cons $r = .74$ (2001). There was item overlap between these two scales, with two of the five pros and two of the five cons repeating, and redundant items were not included.

Barrier items were also incorporated, if appropriate. As with the self-efficacy scale, barriers were reworded and adapted to reflect negative consequences of exercise in order to reflect the cons construct. For example, a barrier concerning the existence

of an unsafe neighborhood was reformatted to reflect the potential risk for violence or harm while engaging in exercise, such as "Exercise would put my safety at risk."

Participants were asked to rate how important each item was in their decision to exercise or to not exercise from "Not Important" to "Extremely Important." The pros of exercise included positive consequences of exercise. These included items such as "I would feel less stressed if I exercised regularly" and "I would sleep better." The cons of exercise reflected negative consequences of exercise and included items such as "I feel uncomfortable at gyms if not enough people are like me" and "Exercising prevents me from spending time with my friends." The final measure consisted of 32 items (See Appendix F).

Barriers- A barriers inventory consisting of 21 items based on existing barriers scales, cognitive interviews, and the aforementioned qualitative literature was developed and administered. Participants were asked to rate to what extent they perceived the listed barriers to inhibit them from regular exercise engagement from "Not at all" to "Extremely" inhibiting. Items from The Barriers to Habitual Activity Scale (Steinhardt, & Dishman, 1989) and the Exercise Benefits/Barriers Scale (EBBS; Sechrist et al., 1987) were used as sources for item generation. The existing qualitative literature on barriers to exercise in the populations of interest were also used for item generation. Some studies focused only on men or only on women in these studies, but all resources were utilized when appropriate to ensure full inclusion of potential barriers. Barriers included items such as, "I have too many caregiving duties," "I do not have access to facilities or equipment to exercise," and "My job is physically exhausting."

This barriers list (See Appendix G) was not designed with an a priori factor structure. Items were developed based on existing literature and cognitive interviewing only and the exploratory factor analysis was completed to investigate if any factor structure emerged.

Statistical Analyses

To address Hypothesis 1, which hypothesized that measure development would yield updated self-efficacy and decisional balance scales that demonstrated similar factor structures to previous TTM studies, and as described by researchers in the field, a sequential approach to measurement development was used (Redding et al., 2006). Participants were randomly split into two groups for exploratory (N_1=221) and confirmatory (N_2=229) analyses. An exploratory factor analysis (EFA) was conducted on N_1 using principal components analysis (PCA) with varimax rotation on the item intercorrelation matrices for self-efficacy, barriers, pros, and cons. The purpose of the EFA was to determine the number of factors present, estimate the correlation between them, and provide factor loadings of items on each factor. Complex items, those that loaded .40 on two or more components, and items with poor loadings, those with loadings under .40 were eliminated in an iterative sequence of steps that both reviewed factor loadings, breadth of the content of items representing the construct, and fidelity to the TTM construct of reference. Inclusivity of items took priority to scale brevity in this process, as our goal was to ensure that breadth of construct was adequately addressed within these populations. All included items loaded highly (>.4) on their given factor and redundant items were eliminated, yet while further elimination of items would likely increase the resultant internal consistency, item inclusion remained

priority as this study represented the first step in the scale development process. Once the EFA was completed, a Cronbach's Alpha was conducted to provide an estimate of internal consistency of the factors. Next, a confirmatory factor analysis (CFA) was conducted on N_2 to confirm the structure of the EFA. This process involved additional item removal when necessary and ultimately produced a final model with fit indices.

To address Hypothesis 2, which predicted that cons, barriers, and self-efficacy will be independent, yet moderately correlated constructs, a correlation matrix between self-efficacy, barriers, and cons was conducted to assess these correlations.

Lastly, external validation was assessed. A series of ANOVAs was conducted to examine the constructs by stage to evaluate if the expected SOC patterns were sustained (Hall & Rossi, 2008), as well as to assess if exercise self-report, as measured by the IPAQ-SF, changed as expected across SOC.

RESULTS

Participants

Participants (n=486), who identified on Prolific as Black and/or Hispanic/Latinx, residing in the United States, and aged 18 or older were recruited and completed the consent. Two individuals were excluded for failing two or more of the three attention checks, 23 individuals were excluded due to not identifying as Black and/or Hispanic/Latinx, 10 individuals were excluded for reporting conflicting race/ethnicity identities (i.e., stating "yes" for identifying as Black and/or Hispanic/Latinx in the screening portion, but only identifying as White in the demographics portion), and one individual was excluded for not reporting any data. The final sample (N=450) was deemed sufficient to support split-half validation (Redding et al., 2006) and to ensure adequate representation of each SOC. The final sample was majority female (57%) and ranged in age from 18-74 years (M=30.99, SD=11). 46.2% of the sample reported their race as Black and 17.1% reported their race as White. Further, 54.9% of the sample identified their ethnicity as Hispanic/Latinx (see Table 1). 53.5% were employed either full-time or part-time, 23.8% were seeking employment, 16% were not seeking employment, and 6% were retired or receiving disability benefits. The sample ranged in education level, with 13.3% obtaining their high school diploma or GED, 33.6% receiving some college credit, but no degree, and 27.6% obtaining their bachelor's degree. The majority of the sample identified their subjective social class as working class (52.2%), followed by middle class (34.4%), and then poor (12.2%). Further breakdowns of demographic variables are shown in Table 2.

Table 1. Race and ethnicity of entire sample

	Race			
Ethnicity		Black	White	Not Specified
	Hispanic/Latinx	4 (.9%)	77 (17.1)	166 (36.9)
	Not Hispanic/Latinx	204 (45.3)	0 (0)	0 (0)

Table 2: Demographics of entire sample

	N	**Percent**	**Mean (SD)**
Age			30.99 (11)
Gender			
Woman	258	57.3	
Man	171	38.0	
Transgender man	5	1.1	
Transgender woman	1	0.2	
Gender non-conforming	4	0.9	
Not listed	4	0.9	
Prefer not to say	2	0.4	
Missing	5	1.1	
Employment Status			
Employed full-time	163	36.2	
Employed part-time	78	17.3	
Seeking employment	107	23.8	
Not seeking employment	72	16.0	
Retired	8	1.8	
Receiving disability benefits	19	4.2	
Missing	3	0.7	
Education			
Pre-school/Nursery school to 8th grade	0	0.0	
Some high school, no diploma	11	2.4	
High school graduate, diploma or the equivalent (for example: GED)	60	13.3	

Some college credit, no degree	151	33.6
Trade/technical/vocational training	12	2.7
Associate degree	55	12.2
Bachelor's degree	124	27.6
Master's degree	30	6.7
Professional degree	5	1.1
Doctorate degree	1	0.2
Missing	1	0.2
Subjective Social Class		
Poor	55	12.2
Working class	235	52.2
Middle class	155	34.4
Affluent	3	0.7
Missing	2	0.4
Stage of Change		
Precontemplation	56	12.4
Contemplation	65	14.4
Preparation	191	42.4
Action	69	15.3
Maintenance	69	15.3

Regarding SOC, 12.4% of the sample reported no intention of regularly exercising in the next six months (Precontemplation; PC), 14.4% of the sample planned to engage in regular exercise in the next six months (Contemplation; C), and 42.4% of the sample planned to engage in regular exercise in the next 30 days (Preparation; P). About 30% of the sample already engaged in regular exercise, with 15.3% of individuals indicating they have regularly exercised for less than six months (Action; A) and 15.3% indicating that they have exercised regularly for six months or more (Maintenance; M).

Descriptive statistics for all items in each of the three constructs are noted in Appendix H. Of note, mean endorsement levels for the items in the Barriers construct

are low, indicating that many of these Barriers were not seen as inhibiting the sample's exercise abilities.

Exercise Behavior- To verify the construct validity of the SOC algorithm used, a series of ANOVAs were conducted. Results showed that participants in different stages differed significantly in weekly moderate physical activity ($F(4, 449)= 24.88$, $p<.001$), vigorous physical activity ($F(4, 449)= 40.06$, $p<.001$), and walking ($F(4, 449)= 8.99$, $p<.001$). More specifically, participants in A and M completed significantly more days of walking, as well as more days of moderate and vigorous exercise weekly than those in PC, C, and PR (Figure 1).

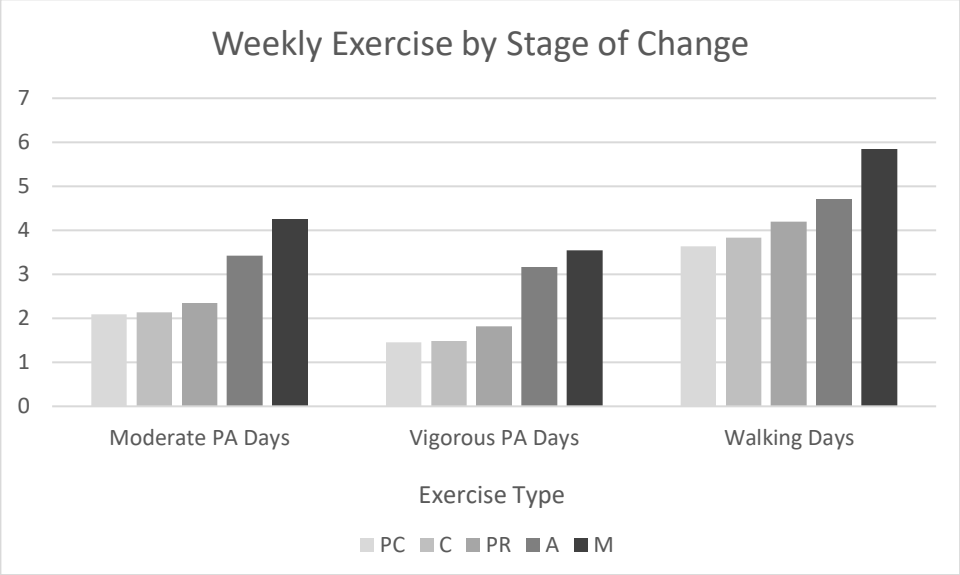

Figure 1. Weekly exercise as reported by the IPAQ-SF by SOC.

Exploratory Phase

Decisional Balance- A series of five iterative Principal Components Analyses (PCA) suggested a three-factor solution, which reduced the original pool of 32 items to 17. Item content evaluation confirmed that the items in the three components represented three distinct contents, one addressing Pros and two addressing markedly

different sets of Cons, therefore a three-factor solution was retained. Item examination showed that the first factor (7 items) reflected Pros of regular exercise (e.g., "I would feel more comfortable with my body if exercised regularly"), while two factors (6 items and 4 items) independently reflected different Cons of regular exercise. The first Cons factor represented cons of exercise associated with safety and taking time away from social, family, and work responsibilities and was labeled *Time and Safety Cons.* This included items such as, "It would take time away from completing my family responsibilities," and "Getting exercise would put my safety at risk." The second Cons factor appeared to represent cons of exercise associated with emotional discomfort (e.g., "I would feel embarrassed if people saw me exercising," "I feel uncomfortable at gyms if not enough people are like me") and was labeled *Discomfort Cons.* All retained item loadings were above .40 and the internal consistencies within N_1 for the *Pros* scale and *Time and Safety Cons* scale were good (α =.85; α =.79) and the internal consistency for the *Discomfort Cons* Scale was adequate (α =.71). The novel, retained items included the following: "It would take time away from completing my family responsibilities," "Exercise would put my health at risk," "Taking time to exercise would take time away from completing my social and community responsibilities," "It would take time away from completing my work responsibilities," "Getting exercise would put my safety at risk," and "I feel uncomfortable at gyms if not enough people are like me."

Self-Efficacy- A series of eight iterative Principal Components Analyses (PCA) were conducted that established a two-factor solution reducing the original pool of 34 items to 16. Item content evaluation confirmed that the two factors represented

distinct content areas. The first factor (12 items) reflected situations involving social challenges (e.g., “Other people might feel I am being selfish if I take time to exercise”), weather (e.g., “It is hot outside”), and other circumstances (e.g., “I do not have childcare”) under which participants would be challenged to exercise and was labeled *General Self-Efficacy.* The second factor (4 items) specifically reflected difficult affective challenges, such as feeling stressed or depressed, and was labeled *Affective Self-Efficacy*. The internal consistency within N_1 of the *General Self-Efficacy* scale was excellent (α = .88) and the internal consistency of the *Affective Self-Efficacy* scale was good (α =.77). The retained novel items included the following: “Other people might feel I am being selfish if I take time to exercise,” “If there are not enough people like me at the gym,” “I do not have childcare,” “I cannot afford a gym membership or equipment,” and “It could ruin my hair.”

Barriers- A series of five iterative Principal Components Analyses (PCA) were conducted that established a three-factor solution reducing the original item pool from 20 to 9. Given that no a priori factor structure was hypothesized and upon visual confirmation that the three factors reflected different content groupings, the three factor-solution was retained. The first factor reflected competing family obligations (e.g., “I have competing family responsibilities”) and was labeled *Family Barriers.* The second factor represented items concerning work demands (e.g., “My work/school schedule is too busy”) and was labeled *Work Barriers.* Lastly, the third factor represented physical or health-related barriers (e.g., “My weight prevents me from safely exercising”) and was labeled *Health Barriers.* The internal consistencies within the exploratory half of the *Family Barriers* scale and *Work barriers* scale were good

(α =.84; α =.77) while the internal consistency of the *Health Barriers* scale was adequate (α =.68).

Confirmatory Phase

Confirmatory factor analysis was completed in R using N_2 (N=229). Four different fit indices were examined on the scales established in the EFA phase. These fit indices included (1) the chi–square test statistic; (2) the comparative fit index (CFI); (3) the root mean square error of approximation (RMSEA); and (4) the standardized root mean squared residual (SRMR). A CFI of .95 or greater is considered an acceptable fit, while a value of .08 for SRMR and a value close to .06 for RMSEA are considered acceptable values indicating good fit (Hu & Bentler, 1999).

Decisional-Balance- The three-factor correlated model showed an adequate fit. The factor loadings remained good, and the CFA produced an adequate model fit, $X^2(116) = 279.5$, CFI=.88, RMSEA=.08, SRMR=.07. The alpha coefficient for the Pros scale was .87 and the alpha coefficients for the *Time and Safety Cons* and *Discomfort Cons* were .76 and .75, respectively. Correlations between *Pros* and *Time and Safety Cons* and *Pros* and *Discomfort Cons* were *r* =.13 and *r* =-.04, respectively. The correlation between *Time and Safety Cons* and *Discomfort Cons* was *r* = .22. See Table 3 for final factor loadings.

Table 3. Decisional balance final factor loadings.

Item	Pros Loading	Time & Safety Cons Loading	Discomfort Cons Loading
I would feel more confident about my health by exercising	0.70		
Regular exercise would help me have a more positive outlook on life	0.80		

I would sleep better	0.69		
I would feel more comfortable with my body if exercised regularly	0.70		
Exercising puts me in a better mood for the rest of the day	0.80		
I would feel less stressed if I exercised regularly	0.70		
I would have more energy for my family and friends if I exercised regularly	0.52		
It would take time away from completing my family responsibilities		0.58	
Exercise would put my health at risk		0.71	
Exercise puts an extra burden on my significant other		0.60	
Taking time to exercise would take time away from completing my social and community responsibilities		0.58	
It would take time away from completing my work responsibilities		0.54	
Getting exercise would put my safety at risk		0.58	
I would feel embarrassed if people saw me exercising			0.71
I feel uncomfortable or embarrassed in exercise clothes			0.82
I feel uncomfortable at gyms if not enough people are like me			0.65
There is too much I would have to learn to exercise			0.47

Self-Efficacy- The two-factor correlated model showed an adequate fit. The factor loadings remained good, and the CFA produced an adequate model fit, $X^2(103) = 359.99$, CFI=.82, RMSEA=.12, SRMR=.09. The alpha coefficients of the two scales were .89 and .78. The correlation among the scales was $r = .36$. See Table 4 for final factor loadings.

Table 4. Self-Efficacy final factor loadings.

Item	General Self-Efficacy Loading	Affective Self-Efficacy Loading
My friends don't want me to exercise	0.81	
Other people might feel I am being selfish if I take time to exercise	0.75	
My significant other does not want me to exercise	0.75	
If there are not enough people like me at the gym	0.68	
I am alone	0.67	
I do not have childcare	0.65	
I am spending time with friends or family who do not exercise	0.61	
I have not noticed any improvements	0.60	
It's raining or snowing	0.58	
I can not afford a gym membership or equipment	0.55	
It could ruin my hair	0.46	
It is hot outside	0.45	
I am under a lot of stress		0.63
I am depressed		0.80
I am anxious		0.76
I am busy		0.53

Barriers- The three-factor correlated model showed an adequate fit. The factor loadings remained good, and the CFA produced an adequate model fit, $X^2(24) = 62.91$, CFI=.95, RMSEA=.09, SRMR=.07. The alpha coefficients for the *Family Barriers*, *Work Barriers*, and *Health Barriers* scales were .82, .77, and .76, respectively. The correlation between *Family Barriers* and *Work Barriers* was $r = .52$, between *Work Barriers*, and *Health Barriers* was $r = .16$, and between *Family Barriers* and *Health Barriers* was $r = .29$. See Table 5 for final factor loadings.

Table 5. Barrier final factor loadings.

Item	Family Barriers Loading	Work Barriers Loading	Health Barriers Loading
I have competing family responsibilities	0.83		
My family roles are higher priorities than exercising	0.74		
I have too many social and family responsibilities	0.82		
My work/school schedule is too busy		0.79	
My job is physically exhausting		0.56	
I have no spare time in my day		0.82	
I have a physical disability that prevents me from exercising			0.79
I have a health condition that could put my health at risk if I exercised			0.94
My weight prevents me from safely exercising			0.46

Correlations- The correlations between the decisional balance, self-efficacy and barriers scales are shown in in Table 6.

Table 6. Pearson correlations between scales.

	Variable	General Self-Efficacy	Affective Self-Efficacy	Pros	Time and Safety Cons	Discomfort Cons	Family Barriers	Work Barriers	Health Barriers
General Self-Efficacy	Pearson Correlation	1							
	N	450							
Affective Self-Efficacy	Pearson Correlation	.30**	1						
	N	450	450						
Pros	Pearson Correlation	.34**	.18**	1					
	N	449	449	449					
Time and Safety Cons	Pearson Correlation	0.07	-0.03	.15**	1				
	N	449	449	449	449				

Discomfort Cons	Pearson Correlation	-0.13	-0.13	-0.11	.19**	1			
	N	449	449	449	449	449			
Family Barriers	Pearson Correlation	-0.06	0.03	.10*	.41**	0.08	1		
	N	445	445	445	445	445	445		
Work Barriers	Pearson Correlation	-0.05	-0.03	0.08	.19**	.10*	.47**	1	
	N	445	445	445	445	445	445	445	
Health Barriers	Pearson Correlation	0.01	0.01	-0.1	.27**	.22**	.20**	.12**	1
	N	445	445	445	445	445	445	445	445

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

External Validation

Decisional Balance- Multivariate analysis of variance (MANOVA) revealed that individuals at different stages of readiness for regular exercise differed significantly on their subjective importance of the pros and cons of regular exercise ($F(12, 1169) = 7.13$, $p<.001$, $\eta^2 = .06$). Follow up ANOVAs indicated that those in different SOC differed significantly on the *Pros* of exercise ($F(4, 444) = 16.69$, $p<.001$, $\eta^2 = .13$) and the *Discomfort Cons* of exercise ($F(4,444) = 3.05$, $p=.017$, $\eta^2 = .03$). Individuals in different SOC did not differ significantly on *Time and Safety Cons* ($F(4,444) = 1.57$, $p=.180$, $\eta^2 = .01$). Post-hoc analyses showed that those in Precontemplation (PC) and Contemplation (C) endorsed significantly lower *Pros* of exercise than those in Preparation (PR), Action (A), and Maintenance (M). Those in PC and C also reported significantly higher *Discomfort Cons* than those in Maintenance. The *Pros* increased 1.09 standard deviations from PC to A, the *Time and Safety Cons* decreased .18 standard deviations, and *Discomfort Cons* decreased by .29

standard deviations from PC to A (Figure 2). Item descriptive statistics are noted in Table 7.

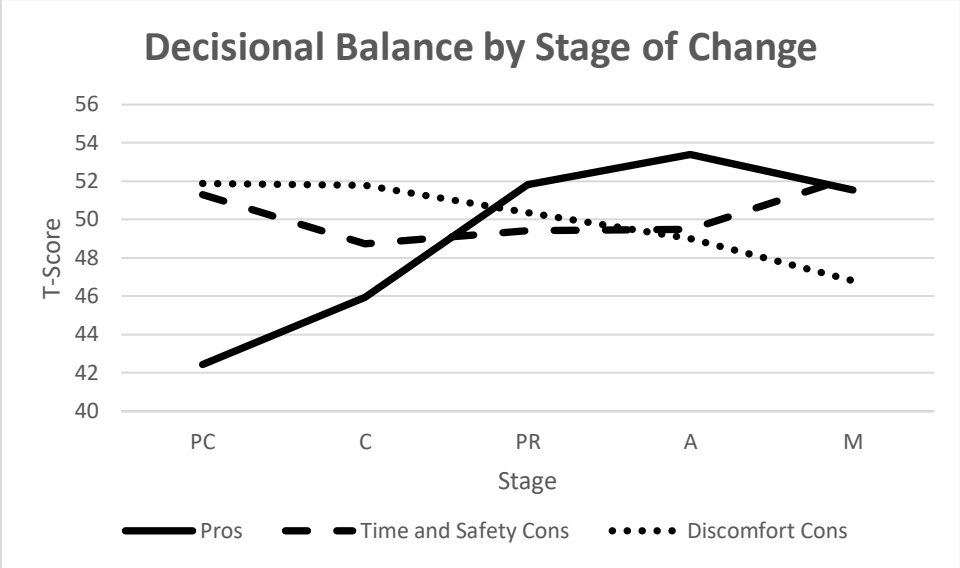

Figure 2. Decisional balance scales by stage of change.

Table 7. Decisional balance retained item descriptive statistics of entire sample.

Item	N	Range	Mean	SD	Skewness	Kurtosis
PROS						
I would feel more confident about my health by exercising	449	1-5	4.09	1.12	-1.14	0.39
Regular exercise would help me have a more positive outlook on life	447	1-5	3.76	1.24	-0.73	-0.48
I would sleep better	449	1-5	4.05	1.11	-1.03	0.24
I would feel more comfortable with my body if exercised regularly	449	1-5	4.07	1.13	-1.12	0.46
Exercising puts me in a better mood for the rest of the day	448	1-5	3.7	1.18	-0.73	-0.22
I would feel less stressed if I exercised regularly	448	1-5	3.55	1.27	-0.52	-0.76

I would have more energy for my family and friends if I exercised regularly	449	1-5	3.24	1.29	-0.22	-1.01
TIME & SAFETY CONS						
It would take time away from completing my family responsibilities	449	1-5	2.49	1.29	0.47	-0.86
Exercise would put my health at risk	449	1-5	2.2	1.42	0.85	-0.68
Exercise puts an extra burden on my significant other	446	1-5	1.72	1.13	1.48	1.13
Taking time to exercise would take time away from completing my social and community responsibilities	449	1-5	1.92	1.05	1.06	0.48
It would take time away from completing my work responsibilities	449	1-5	2.39	1.21	0.52	-0.71
Getting exercise would put my safety at risk	449	1-5	2.49	1.46	0.49	-1.17
DISCOMFORT CONS						
I would feel embarrassed if people saw me exercising	449	1-5	2.06	1.30	1.02	-0.16
I feel uncomfortable or embarrassed in exercise clothes	448	1-5	1.78	1.17	1.40	0.90
I feel uncomfortable at gyms if not enough people are like me	449	1-5	2.06	1.22	0.95	-0.10
There is too much I would have to learn to exercise	449	1-5	1.68	1.07	1.63	1.91

Self-Efficacy- A second MANOVA revealed that individuals at different stages of readiness to engage in regular exercise differed significantly on their endorsed self-efficacy ($F(8, 888) = 9.55$, $p < .001$, $\eta^2 = .08$). Follow-up ANOVA's showed that those in different stages of readiness differed significantly on both the *General Self-Efficacy* scale ($F(4, 445) = 8.96$, $p < .001$, $\eta^2 = .08$), as well as the *Affective Self-Efficacy* scale ($F(4, 445) = 14.96$, $p < .001$, $\eta^2 = .12$). Post-hoc analyses

revealed that both *General Self-Efficacy* and *Affective Self-Efficacy* were significantly lower in PC, C, and PR, than they were in A and M. Overall, *General Self-Efficacy* increased .81 standard deviations from PC to A and *Affective Self-Efficacy* increased .87 standard deviations from PC to A (Figure 3). Retained item descriptive statistics are noted in Table 8.

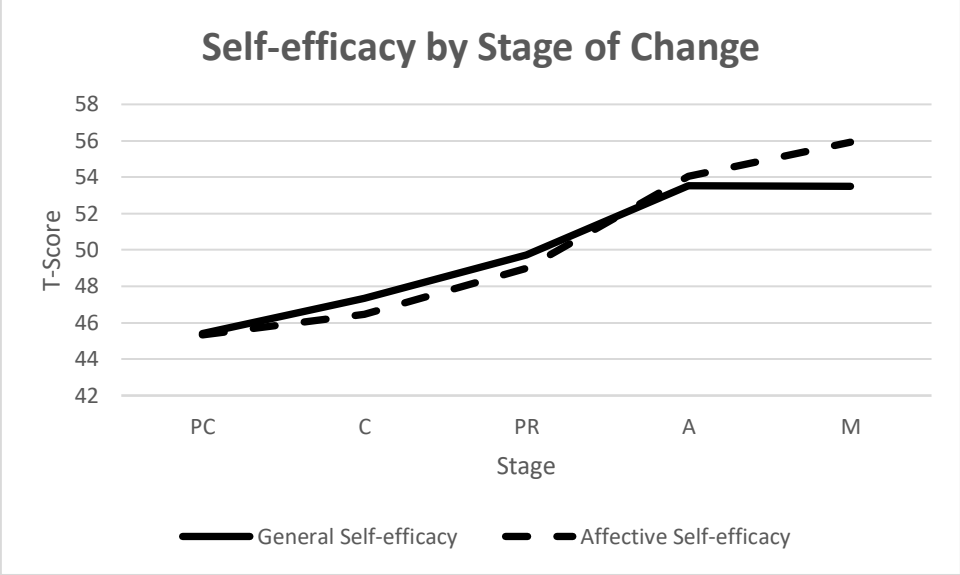

Figure 3. Self-efficacy scales by stage of change.

Table 8. Self-efficacy retained item descriptive statistics of entire sample.

Item	N	Range	Mean	SD	Skewness	Kurtosis
GENERAL SELF-EFFICACY						
My friends don't want me to exercise	450	1-5	3.25	1.55	-0.24	-1.44
Other people might feel I am being selfish if I take time to exercise	450	1-5	3.26	1.51	-0.23	-1.37
My significant other does not want me to exercise	450	1-5	2.98	1.55	0.06	-1.48
If there are not enough people like me at the gym	450	1-5	3.1	1.48	-0.05	-1.39
I am alone	447	1-5	3.52	1.42	-0.56	-0.99

I do not have childcare	448	1-5	2.74	1.68	0.27	-1.60
I am spending time with friends or family who do not exercise	448	1-5	2.58	1.42	0.45	-1.11
I have not noticed any improvements	449	1-5	2.63	1.26	0.39	-0.83
It's raining or snowing	448	1-5	2.42	1.40	0.58	-0.95
I cannot afford a gym membership or equipment	449	1-5	2.83	1.45	0.20	-1.30
It could ruin my hair	449	1-5	3.14	1.58	-0.15	-1.50
It is hot outside	450	1-5	2.55	1.37	0.44	-1.01
AFFECTIVE SELF-EFFICACY						
I am under a lot of stress	450	1-5	2.09	1.24	0.96	-0.12
I am depressed	450	1-5	1.63	1.05	1.77	2.38
I am anxious	450	1-5	2.15	1.18	0.87	-0.07
I am busy	449	1-5	1.84	1.07	1.36	1.30

Barriers- A final MANOVA showed that individuals at different stages of readiness for regular exercise did not differ significantly on their endorsement of Barriers ($F(12,1159) = 1.46$, $p=.131$, $\eta^2 = .013$). However, a visual trend revealed a nonsignificant increase in *Family Barriers* and *Work Barriers* from PC to A by .4 and .33 standard deviations, respectively. Additionally, *Health Barriers* decreased .35 standard deviations from PC to PR before increasing from PR to A (Figure 4). Retained item descriptive statistics can be found in Table 9.

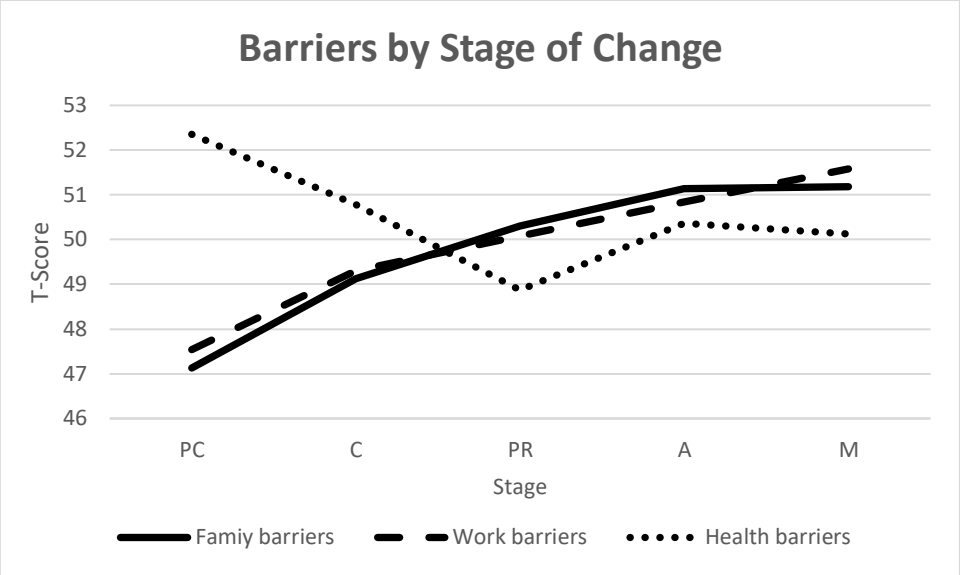

Figure 4. Barrier scales by stage of change.

Table 9. Retained barrier item descriptive statistics

Item	N	Range	Mean	SD	Skewness	Kurtosis
FAMILY BARRIERS						
I have competing family responsibilities	443	1-5	1.85	1.12	1.24	0.68
My family roles are higher priorities than exercising	445	1-5	2.23	1.36	0.77	-0.67
I have too many social and family responsibilities	445	1-5	1.83	1.05	1.18	0.62
WORK BARRIERS						
My work/school schedule is too busy	444	1-5	2.27	1.33	0.66	-0.80
My job is physically exhausting	443	1-5	1.90	1.20	1.19	0.34
I have no spare time in my day	445	1-5	2.40	1.30	0.48	-0.91
HEALTH BARRIERS						
I have a physical disability that prevents me from exercising	444	1-5	1.53	1.10	2.12	3.38

I have a health condition that could put my health at risk if I exercised	444	1-5	1.47	1.05	2.40	4.78
My weight prevents me from safely exercising	445	1-5	1.42	0.86	2.24	4.61

DISCUSSION

To our knowledge, this is the first study to incorporate barrier content into the TTM framework and into existing TTM exercise scales. It was hypothesized that updated self-efficacy and decisional balance scales would yield factor structures similar to previous scales, which was not supported. It was also hypothesized that the updated instruments would change across SOC as expected under the Strong and Weak Principles (Prochaska & Velicer, 1997). This finding was partially supported for self-efficacy and Pros, but not for Cons.

This study also confirmed the construct validity of the SOC algorithm in representing actual exercise behavior as measured by the IPAQ-SF. This result was expected given the staging algorithm's success in predicting exercise behavior in previous studies using different exercise measurements (Hausenblas et al., 2003; Cardinal et al., 2004b; Hellsten et al., 2008: Dannecker et al., 2003). However, to our knowledge, this is the first study to use the IPAQ-SF to provide support for the external validity of the exercise staging algorithm.

The self-efficacy (SE) item pool consisted of items used in previous research, in addition to 12 novel items reflecting common barriers to exercise, five of which were retained in the final scales. Whether these newly developed items would have been endorsed sufficiently to be retained in a wealthier or majority White sample is a question for a future empirical study, but it seems unlikely that at least a few of the items would have been retained on a final scale from such a sample. For example, the item concerning haircare likely would not be as important an obstacle for most White individuals compared to Black individuals. Haircare has consistently been noted as a

barrier to exercise for Black women in the literature (Hall et al., 2013; Huebschmann et al., 2017) given the increased time, cost, and effort associated with hair styling and management (Quinn et al., 2003; Joseph et al., 2017). Additionally, the item concerning childcare may be of less importance and less inhibitory for individuals of higher socioeconomic status than the present sample because they may be able to readily afford childcare. The novel items that were retained add breadth to the scales assessing the self-efficacy construct and increase the scales' inclusivity for Black and Hispanic/Latinx populations.

A correlated two-factor solution for SE was retained, which was not consistent with the anticipated one-factor outcome generated in most general (Rossi & Redding, 2001) and exercise-specific TTM studies (Marcus et al., 1994; Marcus et al., 1992). The confirmatory fit indices were marginal, with the CFI falling below the desired .95 goal and the RMSEA and SRMR falling just above their anticipated levels. These results might be explained by the low endorsement of the adapted barrier items mentioned previously. Results may also be a product of our goal to be more inclusive with items given that this is the first step of scale development incorporating these more contextually relevant self-efficacy challenges. Given that further research must be done on this topic, inclusion of items was prioritized over improving fit for now.

A meta-analysis of 25 health behaviors found that self-efficacy regularly increased significantly across SOC (Rossi & Redding, 2001). Equivalent results were found in the current study, with both *General Self-Efficacy* and *Affective Self-Efficacy* increasing significantly across SOC. Further, it was anticipated that exercise self-efficacy would increase .8 standard deviations (SD) from Precontemplation (P) to

Action (A). This hypothesis was supported, as results showed that *General Self-Efficacy* increased by .81 SD from PC to A while *Affective Self-Efficacy* increased by .87 SD from PC to A. These results are encouraging as they indicate that barrier items, when conceptualized within the self-efficacy construct, do not disrupt the expected self-efficacy cross-sectional stage progression within the TTM. With future work improving the fit of these items, the TTM might be able to better account for environmental or cultural factors that impact exercise behavior among Black and Hispanic/Latinx adults in the United States within the SE construct.

The measure development process for decisional balance (DB) yielded a three-factor solution, with one Pros scale and two Cons scales. Of the 11 adapted barrier items incorporated into the Cons construct and scales, six were retained in the final scales. Much like the resultant SE items, one can see how many of the retained items may have been dropped if developed with a white or wealthier sample. For example, the item concerning discomfort at gyms would likely not be an issue for white people given that some gyms are primarily staffed or visited by other white individuals. Additionally, the item about putting one's safety at risk might only be pertinent to those who do not have safe or adequate access to exercise space and equipment, which may be socioeconomically influenced.

Most DB measure development studies have yielded two-factor solutions: one Pros and one Cons (Prochaska & Velicer, 1997); however, a three-factor solution is not unusual. For example, Burditt et al. (2009), in their measure development research investigating DB for blood donation among Black adults found a similar three factor (1 Pros, 2 Cons) solution, while DB measure development for changing nonsuicidal

self-injury among adolescents has also yielded three distinct factors (2 Pros, 1 Cons; Kruzan et al., 2020). The three-factor, two Cons scale solution in the current study is also not surprising given that we added significantly more Cons items than we did Pros items. Further, the two resultant scales; *Time and Safety Cons* and *Discomfort Cons* represent two distinct, yet equally demanding consequences of exercise. The time and environmental demands of exercise are somewhat unique to regular exercise compared to other health behaviors as regular exercise requires an appropriate location and space, as well as enough designated time to meet the recommended health requirements. Additionally, the items in the *Discomfort Cons* scale also represent a distinct set of consequences of exercise for some. Exercise often involves clothing that non-regular exercises may not be used to wearing that can lead to discomfort. Also, exercise frequently involves physical movements that some might perceive as awkward or uncomfortable and may lead to further feelings of self-consciousness or unease. The unique clothing, physiological reactions (i.e., sweating, becoming flushed), and movements associated with exercise might lead to feelings of discomfort, hence the unique applicability of this scale. The fit of the DB scales was also adequate and slightly better than the SE scales. The confirmatory fit approached but did not meet the standard for acceptable fit. Once again, this might be due to the relatively low endorsement of barrier-adapted items in the sample or the inclusive approach that was taken with item retainment.

It was hypothesized that individuals in A and M would endorse the importance of Pros significantly higher than those in PC, C, and PR and endorse the importance of Cons significantly lower. This result was supported for *Pros* and *Discomfort Cons*, but

not for *Time and Safety Cons*. This finding suggests that the subjective importance of the time and environmental consequences of regular exercise were similarly important across SOC. It was also hypothesized under the strong and weak principles (Prochaska & Velicer, 1997) that stage progression would be associated with a 1 standard deviation (SD) increase in the importance of Pros from PC to A and a .5 SD decrease in the importance of Cons from PC to A. It was also anticipated, however, that the importance of cons might be associated with a smaller change given the inconsistency of the Cons scale to meet this expectation in many exercise studies outlined previously. These hypotheses were partially supported. The Pros scale increased as expected (1.08 SD) from PC to A, while the *Time and Safety Cons* and *Discomfort Cons* decreased from PC to A to a lesser degree than expected; .18 SD and .29 SD, respectively. This finding, that cons did not change a great deal from PC to A, was anticipated, although it was hoped that the new scales would demonstrate more change by stage than previously, a result which was not found. These findings contribute to a growing body of evidence that suggests that the Cons construct does not vary significantly across SOC for exercise. Considering that many of the studies outlined prior, in addition to the present study, were completed cross-sectionally, it is possible that this result is specific to cross-sectional research only. Some longitudinal studies have found Cons to be an important construct in preventing relapse, specifically (Lipschitz et al., 2015), while others have echoed concerns that the Cons scale did not change as expected under the strong and weak principles (Findorff et al., 2007; Plotnikoff et al., 2001). Therefore, although the Cons scales scores did not change as predicted across SOC, one cannot conclude that this construct is not applicable for

exercise given the cross-sectional nature of this research. Further research should evaluate the conditions that may impact cons relevancy in SOC for exercise, such as its role in relapse prevention or other longitudinal changes.

It is also possible that the DB scale instructions are not being accurately understood. Currently, participants are asked *how important* each Pro or Con is in their decision to exercise regularly. Therefore, if someone frequently exercises despite bad weather, they should rate the Con concerning weather as "not important" to their decision to exercise. However, it is possible that individuals are not rating the *importance* of that variable, but rather rating the validity of the fact that exercising in poor weather *can be* inhibiting. Additional focus groups and cognitive interviewing should be completed to assess if instructions are being accurately interpreted and understood.

Given the novel measurement of barriers within the TTM framework, no hypotheses were made regarding the factor structure of the Barriers construct. The resultant three-factor solution encompassed three distinct barriers involving family, work, and health challenges. Based on one known study that investigated both barriers to exercise and traditional exercise TTM constructs in individuals with disabilities (Cardinal et al., 2004), it was anticipated that perceptions of barriers would decrease from C to A. This finding was not supported. Barriers did not differ significantly by stage. There were change patterns that suggested the opposite trend, in which *Family Barriers* and *Work Barriers* instead *increased* from PR to A by .4 and .33 SD, respectively, while *Health Barriers* declined from PC to PR, and then increased. This pattern is interesting as it suggests that some Barriers to exercise within these

populations may not be important obstacles hindering individuals in early stages from progressing. Rather, it is possible that as some individuals increase in SOC for readiness to regularly exercise, barriers to the behavior are progressively realized. That is, as someone begins to pursue their goal behavior or engage more regularly, they may encounter barriers that were previously not recognized. Although this pattern makes sense, it is simply preliminary because the scales did not differ significantly by stage and there were low endorsement means for many of the barrier items.

In this sample, the low barrier item endorsement appears to suggest that the addressed barriers were not relevant to many participants. It is possible that the given sample did not adequately represent the populations for which these barriers are most impactful. However, a number of other variables might account for this result. First, there are many factors that were not accounted for that could also impact the prevalence of barriers. For example, this present survey did not assess urban versus rural residency which might influence the barriers associated with individuals experience with space, access, or safety to exercise. Additionally, although much of the sample identified as working class, perhaps the assessed barriers are only relevant to very low-income individuals who might not have been sufficiently represented in this sample. Afterall, participants on Prolific must have access to a computer or mobile device with internet capabilities, leading to the exclusion of people who may not be able to afford this luxury.

It is also crucial to note that although items for the barriers scale were drawn from literature on Hispanic/Latinx and Black participants' barriers to exercise, these represent two distinct populations and cultures with numerous subcultures. Not only is

there vast heterogeneity between these two populations, there is also heterogeneity within each. Therefore, although the literature showed overlap, some culturally specific barriers may be unique to one population over the other, leading to under endorsement of those items from the whole sample. For example, concerns over haircare were particularly unique to Black women in the literature, whereas literature on Hispanic/Latinx women emphasized a cultural belief that taking time to exercise may be perceived as selfish. Similarly, some barriers might be specific to traditional gender roles or conditions, leading to further issues with item endorsement. For example, the barrier concerning inadequate childcare may disproportionately affect women, while work conflicts may more so affect men in families who follow more traditional gender roles. Future research should consider looking at more specific cultures or populations independently, as well as investigating the role that socioeconomic status plays. Finally, it is also possible that barriers to regular exercise among Black and Hispanic/Latinx adults are simply less impactful than originally believed.

Another important factor for consideration concerns the flawed measurement of the Barriers across SOC. The present study measured Barriers similarly to other TTM constructs, by plotting the mean Barriers T-Score by SOC. However, given that barriers to exercise represent inhibiting scenarios, it is possible that even one barrier item reported to be highly inhibiting is enough to prevent stage progression. For example, if an individual rated the barrier, “I have no spare time in my day” as extremely inhibiting and they rated all other barrier items as “Not at all” inhibiting, their mean barrier endorsement will still be quite low. However, they may remain in

Precontemplation or Preparation because they are unable to find the time in their day for the behavior. Therefore, given that the presence of even a single barrier can be impactful, perhaps future work should considering looking at barriers individually in an index, rather than as scales.

Limitations

Several study limitations should be noted. First, the cross-sectional methodology limits our understanding of how barriers and other TTM constructs shift longitudinally and how these changes are associated with actual changes in exercise behavior. Additionally, despite efforts to recruit participants with a wide range of exercise engagement, the resulting stage groupings were heavily skewed towards Preparation, with nearly 40% of the sample indicating readiness to engage in regular exercise in the next 30 days. The study could have benefitted from a larger representation of participants in the precontemplation and contemplation stages for exercise. Also, it is important to note that data for this study were collected using a private survey company study panel and was disseminated in February of 2021 when, due to the Covid-19 pandemic, the majority of the country was instructed to abide by safety restrictions that impacted the nature of work, childcare, social interaction, gym access, sporting events, and more. These changes in lifestyle might have influenced some participants perceptions of barriers, exercise access, or other relevant factors to their responses.

Strengths and Importance of the results

One major strength of this research is the racial, ethnic, and socioeconomic diversity of the sample. Black and Hispanic/Latinx populations have been

underrepresented in the TTM exercise literature and this research attempted to better understand factors impeding exercise behavior within these populations. Further, participants in this study mostly considered themselves to be in the working class, which represents another population that has been largely neglected in TTM and other health promotion research historically. Additionally, the final sample set was nearly complete and contained little missing data. This reflected a relative strength of the data collection site, Prolific. Additional strengths of Prolific have been established in previous literature and include a relatively naïve and honest respondent pool compared with other data collection sites, such as MTurk (Peer et al., 2017). Finally, the novelty of this research question reflects a significant strength and an important first step in diversifying the utility of the TTM for increasing exercise behavior among understudied populations in the United States.

These results are important as they represent, to our knowledge, the first attempt to address barriers to regular exercise in the traditional TTM framework with Black and Hispanic/Latinx populations. Findings suggest that barrier items can be added into the framework without disrupting the expected changes in constructs across SOC. Given these results and that this is the first step of measure development involving barriers to exercise, it is not yet possible to confidently assess where barrier content may best fit within the TTM. Regardless, these results provide evidence for the malleability of the TTM framework with specific populations moving forward. They suggest that population-specific barriers may be accounted for in future scales, which might expand the relevance and eventual success of future intervention research with a broader array of people.

Future Directions

This research represents a small but meaningful step forward in broadening the inclusion of and applicability to diverse populations in TTM literature and more research must be done to replicate and expand on these findings. Future studies could address the structural invariance of the new scales across key demographic factors including gender, race, and ethnicity. Future research should consider limiting recruitment by stage to ensure a more equal stage distribution. Also, it will be important to investigate Black, Hispanic/Latinx, and other populations independently to account for each group's unique challenges or circumstances regarding exercise barriers. More population-specific barrier items might increase the variability of responses and give researchers a better idea of which items best reflect the key TTM constructs. Future research should also consider studying barriers in the TTM framework longitudinally to assess trends over time in tandem with other TTM constructs. Finally, it will be crucial to assess how these barriers might be incorporated into TTM-tailored intervention research effectively to increase successful behavior change.

APPENDICES

APPENDIX A: Cognitive Interview Questions

1. Can you tell me in your own words what the instructions are asking you to do?
2. Do you think the answer choices are clear?
3. Were there any questions that didn't apply to you? How did/would you answer those questions?
4. Were there any questions that you didn't agree with? How did you answer them?
5. Were there any questions that seemed confusing because you did not understand what was being asked?
6. Were there any questions that were emotionally difficult to answer?
7. Did any other questions stand out to you? How?
8. PROBE on specific items the project team or earlier interviewees identified as potentially problematic.

APPENDIX B: Demographics Questionnaire

1. What is your age?

2. Do you identify as Black and/or Hispanic/Latinx?

- Yes (1)
- No (2)

Skip To: End of Survey If Do you identify as Black and/or Hispanic/Latinx? = No

3. Which of the following races/ethnicities best apply to you? More than one may be chosen.

1. White
2. Black or African American
3. American Indian or Alaska Native
4. Asian
5. Native Hawaiian or Pacific Islander
6. Hispanic/Latinx
7. Not listed
8. Prefer not to say

4. What is your gender?

- Man
- Woman
- Transgender man
- Transgender woman
- Gender non-conforming
- Not listed

- Prefer not to say

5. What is your current employment status?

- Employed full-time
- Employed part-time
- Seeking employment
- Not seeking employment
- Receiving disability benefits
- Retired

6. What is the highest degree or level of education you have completed?

- Pre-school/Nursery school to 8th grade
- Some high school, no diploma
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade/technical/vocational training
- Associate degree
- Bachelor’s degree
- Master's degree
- Professional degree
- Doctorate degree

7. How would you describe your social class?

- Poor
- Working class
- Middle class

- Affluent

8.What is your height?

9. What is your weight in pounds?

APPENDIX C: IPAQ-SF

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

1. Think about all the ***vigorous*** activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time. During the last **7 days**, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling.
2. In minutes, how much time did you usually spend doing vigorous physical activities on one of those days?
3. Think about all the ***moderate*** activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time. During the last **7 days**, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

4. In minutes, how much time did you usually spend doing moderate physical activities on one of those days?
5. Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure. During the last **7 days**, on how many days did you walk for at least 10 minutes at a time?
6. In minutes, how much time did you usually spend walking on one of those days?
7. The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television. During the last 7 days, how much time (in hours) did you spend sitting on ONE average week day?

APPENDIX D: STAGE OF CHANGE

Regular exercise is any planned physical activity (for example, brisk walking, jogging, bicycling, swimming, basketball, aerobics classes, etc.) performed to increase physical fitness. Such activity should be performed at least 150 minutes (2.5 hours) each week at a level that increases your breathing rate and heart rate. Using this definition…

1. Do you currently engage in regular exercise (at least 150 minutes each week)?

- Yes
- No

Skip To: 4 Do you currently engage in regular exercise (at least 150 minutes each week)? = Yes

Skip To: 2 Do you currently engage in regular exercise (at least 150 minutes each week)? = No

2. Do you intend to engage in regular exercise in the next 6 months?

- Yes
- No

Skip To: End of Block If Do you intend to engage in regular exercise in the next 6 months? = No

3.Do you intend to engage in regular exercise in the next 30 days?

- Yes
- No

Skip To: End of Block If Do you intend to engage in regular exercise in the next 30 days? = Yes

Skip To: End of Block If Do you intend to engage in regular exercise in the next 30 days? = No

4. Have you been exercising regularly for the past six months or more?

    - Yes, for 6 months or more.
    - No, for less than 6 months.

APPENDIX E: SELF-EFFICACY

Listed below are situations in which some people might choose not to exercise when something gets in the way. Please rate how confident you are that you would participate in regular exercise, using the following 5-point scale: 1 = Not at all confident, 2 = Somewhat confident, 3 = Moderately confident, 4 = Very confident, 5 = Completely confident. **How confident are you that you could exercise if:**

1. I am under a lot of stress.
2. I do not have a safe place to exercise.
3. I am depressed.
4. I have other work responsibilities.
5. I am anxious.
6. I am physically exhausted from work.
7. I feel I don't have the time.
8. It could ruin my hair.
9. I don’t feel like it.
10. I feel stiff or sore.
11. I am busy.
12. I have other demands.
13. I am alone.
14. My exercise partner decides not to exercise that day.
15. I don’t have access to exercise equipment.
16. I am traveling.
17. My friends don’t want me to exercise.

18. It’s raining or snowing.
19. My significant other does not want me to exercise.
20. I am spending time with friends or family who do not exercise.
21. It’s cold outside.
22. I do not have childcare.
23. I am a little tired.
24. I am in a bad mood.
25. It becomes boring.
26. It is important that you pay attention in this study. Please select "Completely confident"
27. My gym is closed.
28. I have not noticed any improvements.
29. I have other family responsibilities.
30. I cannot afford a gym membership or equipment.
31. Other people might feel I am being selfish if I take time to exercise.
32. I have other social or community responsibilities.
33. I am trying to get ahead in my job.
34. It is hot outside.
35. If there are not enough people like me at the gym.

APPENDIX F: DECISIONAL BALANCE

The following statements represent different opinions about exercising regularly. Please rate HOW IMPORTANT each statement is to your decision to exercise regularly according to the following five point scale. If you disagree with an item, that usually means it is not important to your decision to exercise. 1 = Not important 2 = Slightly important 3 = Moderately important 4 = Very important 5 = Extremely important **How important is this in your decision to exercise regularly?:**

1. I would have more energy for my family and friends if I exercised regularly.
2. Getting exercise would put my safety at risk.
3. Exercise would make me feel physically tired.
4. Exercising puts me in a better mood for the rest of the day.
5. I would feel more comfortable with my body if exercised regularly.
6. I would feel embarrassed if people saw me exercising.
7. Sweat and exercise would ruin my hair.
8. Exercising would be painful.
9. I would feel less stressed if I exercised regularly.
10. Exercising prevents me from spending time with my friends.
11. I feel uncomfortable or embarrassed in exercise clothes.
12. Regular exercise would help me have a more positive outlook on life.
13. Taking time to exercise would cause my children or siblings to go without caregiving.

14. It is important that you pay attention in this study. Please select "Not important"
15. It would take time away from completing my family responsibilities.
16. Exercise could cause me to lose weight I do not want to lose.
17. There is too much I would have to learn to exercise.
18. Exercise puts an extra burden on my significant other.
19. I would feel more confident about my health by exercising.
20. I would sleep better.
21. I feel uncomfortable at gyms if not enough people are like me.
22. Exercise would help me control my weight.
23. It would take time away from completing my work responsibilities.
24. Exercising is a good way to meet people.
25. Exercise on top of my other daily responsibilities would make me too tired.
26. Exercise will get me out of the house more.
27. Regular exercise would take too much of my time.
28. I'd worry about looking awkward if others saw me exercising.
29. My own exercise could encourage my loved ones to exercise, too.
30. Getting exercise would cost too much money.
31. Exercise would put my health at risk.
32. Taking time to exercise would take time away from completing my social and community responsibilities.
33. I could be part of an exercise community.

APPENDIX G: BARRIERS

The following statements represent different barriers to regular exercise people may encounter. Please rate to what extent each of the following situations keep you from regularly exercising according to the following five-point scale. 1 = Not at all 2 = A little bit 3 = Moderately 4 = Very much 5 = Extremely. **How much is this a barrier to you regularly exercising?:**

1. I have no spare time in my day.
2. I have too many caregiving duties.
3. I do not have a safe place in my neighborhood or community to exercise.
4. I have a physical disability that prevents me from exercising.
5. I have a health condition that could put my health at risk if I exercised.
6. I do not have access to facilities or equipment to exercise.
7. I have competing family responsibilities.
8. I cannot afford to exercise.
9. It is important that you pay attention in this study. Please select "A little bit"
10. My weight prevents me from safely exercising.
11. Taking time to exercise is selfish.
12. I have too many other things to do at work and at home.
13. My work/school schedule is too busy (i.e. long work days, long commuting, multiple jobs).

14. I have too many social and family responsibilities.
15. I am too busy in my community activities (i.e. church, volunteering).
16. Work/school is a higher priority than exercising.
17. My family roles are higher priorities than exercising.
18. After fulfilling my key family and social roles, I am too stressed and exhausted to exercise.
19. My job is physically exhausting.
20. I do not want to lose any weight by exercising.
21. There are not enough people like me at the gym.

APPENDIX H: DESCRIPTIVE STATISTICS FOR SE, DB, AND BARRIER INVENTORIES

Self-Efficacy Item	N	Mean	Std. Deviation	Skewness	Kurtosis
I am under a lot of stress	450	2.09	1.24	0.957	-0.123
I do not have a safe place to exercise	450	1.53	1.006	2.025	3.349
I am depressed	450	1.63	1.052	1.766	2.382
I have other work responsibilities	450	1.98	1.061	1.066	0.636
I am anxious	450	2.15	1.175	0.865	-0.067
I am physically exhausted from work	449	1.52	0.926	2.12	4.32
I feel I don't have the time	450	1.77	1.019	1.418	1.554
It could ruin my hair	449	3.14	1.575	-0.154	-1.498
I don’t feel like it	450	2.2	1.169	0.837	-0.043
I feel stiff or sore	450	2.13	1.059	0.793	0.107
I am busy	449	1.84	1.073	1.364	1.302
I have other demands	450	1.86	1.011	1.236	1.196
I am alone	447	3.52	1.419	-0.557	-0.994
My exercise partner decides not to exercise that day	449	3.19	1.506	-0.156	-1.42
I don’t have access to exercise equipment	448	2.66	1.361	0.391	-1.01
I am traveling	449	1.74	1.073	1.563	1.836
My friends don’t want me to exercise	450	3.25	1.551	-0.24	-1.44
It’s raining or snowing	448	2.42	1.396	0.58	-0.946
My significant other does not want me to exercise	450	2.98	1.549	0.059	-1.479
I am spending time with friends or family who do not exercise	448	2.58	1.42	0.449	-1.111
It’s cold outside	449	2.68	1.376	0.358	-1.046
I do not have childcare	448	2.74	1.676	0.269	-1.598
I am a little tired	450	2.49	1.058	0.539	-0.113
I am in a bad mood	449	2.28	1.271	0.748	-0.51
It becomes boring	449	2.39	1.27	0.608	-0.631
It is important that you pay attention in this study	450	4.95	0.414	-8.854	78.955
My gym is closed	449	2.81	1.516	0.227	-1.392

I have not noticed any improvements	449	2.63	1.259	0.389	-0.828
I have other family responsibilities	449	2.04	1.126	0.98	0.237
I cannot afford a gym membership or equipment	449	2.83	1.45	0.2	-1.296
Other people might feel I am being selfish if I take time to exercise	450	3.26	1.508	-0.229	-1.365
I have other social or community responsibilities	449	2.3	1.191	0.725	-0.281
I am trying to get ahead in my job	450	2.31	1.255	0.71	-0.506
It is hot outside	450	2.55	1.371	0.439	-1.009
If there are not enough people like me at the gym	450	3.1	1.477	-0.053	-1.394

Decisional Balance Item	**N**	**Mean**	**Std. Deviation**	**Skewness**	**Kurtosis**
I would have more energy for my family and friends if I exercised regularly	449	3.24	1.288	-0.219	-1.005
Getting exercise would put my safety at risk	449	2.49	1.462	0.487	-1.17
Exercise would make me feel physically tired	448	2.17	1.168	0.864	-0.011
Exercising puts me in a better mood for the rest of the day	448	3.7	1.178	-0.728	-0.218
I would feel more comfortable with my body if exercised regularly	449	4.07	1.131	-1.123	0.455
I would feel embarrassed if people saw me exercising	449	2.06	1.304	1.024	-0.159
Sweat and exercise would ruin my hair	449	1.45	0.891	2.176	4.37
Exercising would be painful	448	2.24	1.18	0.78	-0.195
I would feel less stressed if I exercised regularly	448	3.55	1.266	-0.518	-0.76
Exercising prevents me from spending time with my friends	449	1.78	1.02	1.28	1.024
I feel uncomfortable or embarrassed in exercise clothes	448	1.78	1.166	1.403	0.895
Regular exercise would help me have a more positive outlook on life	447	3.76	1.235	-0.731	-0.478

Taking time to exercise would cause my children or siblings to go without caregiving	446	2.19	1.494	0.829	-0.861
It is important that you pay attention in this study	449	1.01	0.133	14.933	221.982
It would take time away from completing my family responsibilities	449	2.49	1.289	0.468	-0.861
Exercise could cause me to lose weight I do not want to lose	449	1.72	1.167	1.487	1.073
There is too much I would have to learn to exercise	449	1.68	1.073	1.631	1.913
Exercise puts an extra burden on my significant other	446	1.72	1.128	1.478	1.128
I would feel more confident about my health by exercising	449	4.09	1.122	-1.135	0.39
I would sleep better	449	4.05	1.112	-1.031	0.236
I feel uncomfortable at gyms if not enough people are like me	449	2.06	1.217	0.952	-0.101
Exercise would help me control my weight	449	3.8	1.325	-0.821	-0.563
It would take time away from completing my work responsibilities	449	2.39	1.209	0.517	-0.711
Exercising is a good way to meet people	449	1.91	1.184	1.112	0.189
Exercise on top of my other daily responsibilities would make me too tired	447	2.46	1.176	0.574	-0.438
Exercise will get me out of the house more	449	2.94	1.375	0.055	-1.211
Regular exercise would take too much of my time	449	2.19	1.147	0.734	-0.275
I'd worry about looking awkward if others saw me exercising	448	2.15	1.379	0.947	-0.412
My own exercise could encourage my loved ones to exercise, too	448	2.97	1.33	-0.002	-1.12
Getting exercise would cost too much money	449	2.1	1.239	0.896	-0.276
Exercise would put my health at risk	449	2.2	1.424	0.846	-0.68
Taking time to exercise would take time away from completing	449	1.92	1.053	1.057	0.477

my social and community responsibilities					
I could be part of an exercise community	449	1.82	1.17	1.321	0.749

Barrier Item	N	Mean	Std. Deviation	Skewness	Kurtosis
I have no spare time in my day	445	2.4	1.301	0.481	-0.913
I have too many caregiving duties	444	1.76	1.165	1.46	1.071
I do not have a safe place in my neighborhood or community to exercise	445	1.93	1.251	1.209	0.316
I have a physical disability that prevents me from exercising	444	1.53	1.101	2.119	3.375
I have a health condition that could put my health at risk if I exercised	444	1.47	1.052	2.395	4.776
I do not have access to facilities or equipment to exercise	445	2.18	1.259	0.78	-0.487
I have competing family responsibilities	443	1.85	1.115	1.24	0.68
I cannot afford to exercise	444	1.68	1.116	1.683	1.94
It is important that you pay attention in this study	445	2	0.126	5.771	172.012
My weight prevents me from safely exercising	445	1.42	0.86	2.242	4.611
Taking time to exercise is selfish	444	1.17	0.603	4.317	20.537
I have too many other things to do at work and at home	445	2.38	1.254	0.565	-0.73
My work/school schedule is too busy	444	2.27	1.329	0.656	-0.8
I have too many social and family responsibilities	445	1.83	1.054	1.182	0.619
I am too busy in my community activities	444	1.35	0.771	2.601	7.028
Work/school is a higher priority than exercising	444	2.68	1.364	0.225	-1.175
My family roles are higher priorities than exercising	445	2.23	1.356	0.765	-0.672
After fulfilling my key family and social roles, I am too stressed and exhausted	445	2.2	1.23	0.819	-0.31
My job is physically exhausting	443	1.9	1.202	1.186	0.343
I do not want to lose any weight by exercising	443	1.48	0.998	2.164	3.857

There are not enough people like me at the gym	444	1.7	1.101	1.582	1.606

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