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Longitudinal examination of social and environmental influences on motivation for physical activity

Elizabeth Richards
Purdue University, earichar@purdue.edu

M McDonough

R Fu

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Abstract

Background: Physical activity behavior is influenced by numerous factors including motivation, social interactions, and the walkability of the environment. *Aim:* To examine how social contexts and environmental features affect physical activity motivational processes across time. *Methods*: Participants (N=104) completed 3 monthly online surveys assessing self-determination theory constructs, social partners in physical activity, neighborhood walkability, and weekly physical activity. Longitudinal path analysis examined the degree to which physical activity was predicted by individual goals, orientation, and autonomy support and whether these associations were meditated by motivation and moderated by the social and environmental contexts of physical activity. *Results:* The effect of controlled exercise orientations on physical activity was mediated by autonomous motivation. This association was stronger among those who perceived less crime in their neighborhoods. *Discussion:* To improve the ability to tailor physical activity counseling it is important to understand how each person views exercise situations and to understand his/her social and neighborhood environments.

Keywords: self-determination theory, mediation, moderation, physical activity, motivation

Chronic conditions such as cardiovascular disease and diabetes contribute to more than 75% of health care costs (Centers for Disease Control and Prevention, 2014). Participation in regular physical activity reduces the risk of chronic diseases and some cancers (Physical Activity Guidelines Advisory Committee, 2008). In addition, maintaining a physically active lifestyle is related to reduced symptoms of anxiety and depression and improved cognitive function (Physical Activity Guidelines Advisory Committee, 2008). For significant health benefits, adults need at least 150 minutes of moderate-intensity physical activity per week (Physical Activity Guidelines Advisory Committee, 2008). Despite known health benefits, as few as 20% of adults meet current physical activity guidelines (Centers for Disease Control and Prevention, 2013).

To address the low prevalence rates of physical activity, it is recommended that physical activity counseling be included in all primary care patient visits (Jacobson, Strohecker, Compton, & Katz, 2005). However, less than one-third of patients recall receiving physical activity advice from their healthcare provider (American College of Sports Medicine, 2011). Furthermore, up to 80% of patients do not adhere to disease prevention recommendations, including increasing physical activity (Christensen, 2004).

Meta-analyses indicate relatively low effect sizes in primary care counseling interventions to change physical activity behavior, and physical activity changes that do occur are short-lived (Conn, Hafdahl, & Mehr, 2011; Tulloch, Fortier, & Hogg, 2006). Furthermore, the number of contacts with patients in physical activity counseling does not appear to be related to behavior change, suggesting that more interaction with patients is not always better (Hobbs et al., 2013). Mode of intervention delivery also does not appear to be important for effectiveness in behavior change but tailoring the intervention to participants using personalized goals and/or

providing information about local opportunities to be active may be important (Hobbs et al., 2013; Richards & Cai, 2015).

One possible explanation for these low effect sizes and short-lived changes may be that physical activity counseling is often heavily focused on education regarding the benefits of an active lifestyle, even though focusing on education has been shown to be ineffective (Koelewijn-van Loon et al., 2008; Sanchez, Bully, Martinez, & Grandes, 2015). Furthermore, simply telling someone to increase their physical activity is insufficient and in fact, could undermine their motivation because it is often perceived as controlling, and motivation is more effectively fostered through supportive interventions (Conn et al., 2011). Studies consistently indicate lack of motivation as a major barrier to health behavior adherence and it has been suggested that motivation is one of the most under-addressed aspects to improve adherence (Hugtenburg, Timmers, Elders, Vervloet, & van Dijk, 2013; Jansink, Braspenning, van der Weijden, Elwyn, & Grol, 2010; Jones, Jolly, Raferty, Lip, & Greenfield, 2007).

Nurses have an ability to develop trusting, therapeutic relationships and are well positioned to help motivate patients to make health behavior changes (Levensky, Forcehimes, O'Donohue, & Beitz, 2007). Motivational interviewing is one counseling technique that has shown promise in health behavior change as this type of counseling focuses on enhancing a patient's internal motivation for change (Letourneau & Goodman, 2014). Motivational interviewing explores patients' values and goals to increase motivation and develop a plan that will work for each patient (Letourneau & Goodman, 2014). However, two systematic reviews found limited effectiveness of motivational interviewing on physical activity in patients (Lee, Choi, Yum, Yu, & Chair, 2016; O'Halloran et al., 2014). Lee and colleagues (2016) found that five lifestyle motivational interviewing interventions which included physical activity as an

outcome were not significantly better in facilitating behavior change than usual care. O'Halloran et al. (2014) performed a meta-analysis of motivational interviewing interventions which were solely focused on physical activity behavior change. This review found a small effect that motivational interviewing increased physical activity for patients with chronic health conditions immediately post-intervention (standardized mean difference=0.19, $p<0.01$). Maintenance of behavior change was not assessed. A possible limitation of motivational interviewing maybe that counseling is not tailored to the most important aspects of behavior change.

The effectiveness of counseling for behavior change for physical activity behavior change may be enhanced with more specific tailoring which includes attention to the social and physical environment. There is solid evidence that external factors of social support and walkability are strongly related to physical activity (Bauman et al., 2012; Bauman, Sallis, Dzewaltowski, & Owen, 2002). What is not as clear is how these factors may influence motivation and antecedents of motivation or how changes in these support and environment factors and motivation over time influence physical activity behavior change.

In order to effectively provide tailored and supportive physical activity counseling, it may be necessary to more fully understand how motivation may be affected by the combination of individual, social and environmental contexts specific to the behavior. Current practice often treats motivation for behavior change with a one-size-fits-all approach; however, patients have varying social and environmental resources to support their physical activity as compared to other health behaviors, and it is currently not known how these resources act in combination to affect the efficacy of physical activity motivation. By understanding how motivational processes vary based on social and environmental contexts, nurses can be better positioned to develop and implement effective interventions to influence regular physical activity.

Purpose

The purpose of this research is to examine how social contexts (solo vs. with friends, family, pet) and environmental features (walkability) affect physical activity motivational processes across time. The preponderance of the research on self-determination theory and physical activity is cross-sectional, and examining longitudinal relationships between these constructs will allow an examination of how the hypothesized antecedents of physical activity behavior predict changes in behavior across time, and allow for an examination of mediators and moderators of this process. Furthermore, assessing the degree to which motivational processes involved with physical activity behavior are moderated by features of the social and environmental context will allow a greater understanding of individual differences in physical activity behavior because it can illuminate the conditions under which certain motivational antecedents operate, or have stronger or weaker effects. Understanding how this process may vary based on availability of social and environmental resources is an important asset in developing effective, individually tailored strategies to influence physical activity behavior change.

It was hypothesized that having more self-determined goals, more autonomous orientations, and greater autonomy support for being physically active would predict increased autonomous motivation which, in turn, would predict greater physical activity behavior. It was also hypothesized that these effects on physical activity behavior would be stronger when participants reported having more social and environmental resources in which to engage in physical activity. That is, being active with friends, family, or pets and having access to a more walkable environment (i.e. well-maintained, connected sidewalks; aesthetically pleasing areas to

be active; access to places to walk) would enhance the effects of this motivational process on physical activity. See Figure 1 for the complete hypothesized model.

Theoretical Framework

Physical activity is a complex health behavior with no single determinant able to predict physical activity adoption or maintenance. Therefore, a combination of health behavior theories is often used to explain physical activity behavior. Self-determination theory, a theory of motivated behavior, is frequently used to examine physical activity behavior (Fortier, Duda, Guerin, & Teixeira, 2012; McDonough & Crocker, 2007; Teixeira, Carraca, Markland, Silva, & Ryan, 2012). Self-determination theory proposes multiple types of motivation that range on a continuum from high (i.e. autonomous) to low (i.e. controlled) self-determination (Deci & Ryan, 1985). More autonomous forms of motivation are hypothesized to lead to better persistence and adherence to behavior change. It is important to note that motivation is influenced by the social and physical environment (McNeill, Wyrwich, Brownson, Clark, & Kreuter, 2006; Ryan & Deci, 2000) which is in line with both the social ecological model (Stokols, 1996) and social cognitive theory (Bandura, 1986). The social environment includes perceptions of autonomy support received from those deemed important, including healthcare providers. Autonomy support involves encouraging participation in decision-making and acknowledging personal feelings and perspectives (Ryan & Deci, 2000). The social environment also includes access to being physically active with others such as family members, friends, or even a pet. The physical environment, specifically walkability, refers to pedestrian (i.e. sidewalks, crosswalks) and personal safety features (i.e. lighting, traffic, crime) (Cerin, Saelens, Sallis, & Frank, 2006). Studies have shown that autonomous motivation is influenced by perceptions of walkability (McNeill et al., 2006). Motivation is also influenced by individual goals and exercise causality

orientations (Deci & Ryan, 1985). Individuals' goals related to health, seeking affiliation, and personal growth are more likely to promote autonomous motivation than goals more external in nature, such as seeking a reward (Teixeira et al., 2012). Exercise causality orientations are based on personality traits and predispose individuals to seek out informational, controlling or impersonal characteristics in order to motivate their behavior (Rose, Markland, & Parfitt, 2001). It is theorized that informational orientations will foster autonomous motivation while a controlling orientation will undermine autonomous motivation by imposing pressure to act in a certain manner (Rose et al., 2001). The impersonal orientation is related to feelings of independence between behavior and outcomes which leads to a lack of motivation for behavior change (Rose, Parfitt, & Williams, 2005).

Methods

Design and participants

Participants from across the United States were recruited via e-mail through e-Rewards Market Research®. This research firm has over 6 million participants enrolled in survey panels and uses a 'by invitation-only' methodology to invite everyday consumers into the survey panel. This recruitment approach yields representative panel members and guards against duplication, fraudulent respondents, and professional survey takers. Panel members earn points for the time he/she spends answering the survey and can redeem points for a variety of rewards. Procedures were approved by the XXX University Committee on the Use of Human Research Subjects.

An initial sample of 500 men and women between the ages of 18-75 who reported taking part in some physical activity over the past month were recruited. There were no other inclusion or exclusion criteria. Participants who completed the first survey were invited to take a second and third survey, at one-month intervals. Little (Little, 2013) recommends a final analytic sample

size of 100 to achieve adequate power to detect small-to-moderate effect sizes (0.20) of change in the dependent variable in longitudinal panel models, and that there are diminishing returns in terms of power for larger samples. Therefore, taking into account typical attrition rates through e-Rewards Market Research® we purposefully recruited 500 participants at baseline (T1), 337 participants at the 1 month survey (T2) and the final sample in this study includes 104 participants who also completed the survey at 2 months (T3). It is important to note that the reduction in sample size each month was purposeful and does not reflect attrition. Rather the gradual reduction in sample size was deliberate to end with a final sample size of at least 100 to allow for adequate power while not exhausting the budget allocated for data collection. The market research firm used purposeful sampling to maintain a diverse (e.g., demographics) sample of participants throughout all three data collection time points.

Measures

Standardized online questionnaires were administered at each time point with demographics assessed only at T1.

Demographic characteristics. Age, gender, race, ethnicity, marital status, height, weight, household income, education level, and employment status were assessed at baseline. Body mass index (BMI) was calculated based on height and weight using the following formula: weight (lb) / [height (in)]^2 x 703 (Centers for Disease Control and Prevention, 2015). Participants were classified as normal weight if BMI was $\leq$ 25.0, overweight if BMI was 25.0-29.9 and obese if BMI was $\geq$30.0 (Centers for Disease Control and Prevention, 2015).

Goals. Individual goals were assessed with the Goal Content for Exercise Questionnaire (GCEQ), a 20-item measure of intrinsic (health management, skill development, social affiliation) and extrinsic (social recognition, image) exercise goals (Sebire, Standage, &

Vansteenkiste, 2008). Items are scored using a 7-point Likert-type scale ranging from 1 (not at all important) through 7 (extremely important). Internal consistency, factorial validity and invariance has been supported (Sebire et al., 2008). Five manifest variables were created by taking the mean of the four items that measure each dimension of individual goals (health management, skill development, social affiliation, social recognition, and image; internal consistencies: α=0.70 to α=0.97).

Individual orientation was assessed with the Exercise Causality Orientations Scale (ECOS), a 7-item measure of tendency to seek out opportunities to be autonomous, controlled, or impersonal in physical activity contexts (Rose et al., 2001). Factorial validity and invariance has been supported across stages of behavior change (Rose et al., 2001) Three manifest variables were created by taking the mean of the seven items that measure each dimension of individual orientation (autonomous, controlled, and impersonal orientation; internal consistencies: α=0.76 to α=0.86).

Autonomy support was assessed with two measures: 1) the Perceived Autonomy Support (PAS) scale, a 6-item scale assessing the degree to which people who are close to the respondent are perceived as supportive in regard to physical activity behaviors (Peddle, Plotnikoff, Wild, Au, & Courneya, 2008), and 2) the Health Care Climate Questionnaire (HCCQ), a 6-item scale that measures perceptions of autonomy support received by their health care provider. Internal consistency has been good in prior studies (Peddle et al., 2008). Two manifest variables were created for each dimension of autonomy support by taking the mean of each scale (internal consistencies: α=0.94 to α=0.95).

Physical activity motivation was assessed with the Behavioral Regulation in Exercise Questionnaire (BREQ), a 15-item scale that measures the continuum of physical activity

motivation (external regulation, introjected regulation, identified regulation, and intrinsic regulation). It has been previously shown to have strong reliability and factorial validity (Markland & Tobin, 2004). Two manifest variables were created for each dimension of motivation. The variable for autonomous motivation was created by taking the mean of intrinsic motivation and identified regulation subscales and controlled motivation was created by taking the mean of introjected regulation and external regulation subscales (internal consistencies: α=0.70 to α=0.91).

(Hagger, Chatzisarantis, & Harris, 2006)

Social and Environmental Context. Potential moderators included both social and environmental contexts. Environmental context was assessed using the Abbreviated Neighborhood Environment Walkability Scale (A-NEWS), a 44-item scale which uses a 4-point rating, to assess perceptions of neighborhood design features related to physical activity, including residential density, street connectivity, infrastructure for walking, neighborhood aesthetics, safety and neighborhood satisfaction (Cerin et al., 2006). The A-NEWS has been extensively tested for reliability and validity (internal consistencies: α=0.71 to α=0.90) (Cerin et al., 2006). Social context was assessed by asking participants to select if they are typically physically active alone or with others (pet, family, friends). Participants could select all that apply. For the moderation analysis three groups were created: alone=0; with others (including a pet) =1; or sometimes alone and sometimes with others =3.

Physical activity. Self-reported physical activity during the past seven days was assessed with six items from the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003). Questions assessed the number of days and minutes per day of moderate and vigorous physical activity and walking performed for at least 10 minutes at a time. Prior studies demonstrated

strong reliability and criterion validity of the IPAQ (Craig et al., 2003). Participants were classified as being sufficiently active (yes/no) if they accumulated at least 150 minutes of physical activity per week, which is the benchmark for meeting national physical activity guidelines (Physical Activity Guidelines Advisory Committee, 2008).

Statistical Analysis

Descriptive statistics were calculated with Stata (version 14.1). Hypotheses about relationships between self-determination theory constructs and meeting physical activity guidelines as well as the mediation and moderation were tested using longitudinal path analysis in Mplus (version 7.4) Because the model had a combination of continuous and dichotomous dependent variables, we used a probit model with a robust weighted least squares estimator (Muthén, du Toit, & Spisic, 1997). A full measurement model specifying factor invariance of all measures across time was tested first. Then a longitudinal structural model was tested for the direct effect of the self-determination theory constructs (T1) on the outcome measure of meeting physical activity guidelines (T3). This direct-effect model controlled for demographic variables that have been shown to be related to physical activity (age, gender, income, and BMI). Next, a longitudinal structural model was tested for the mediating effect of motivation (T2) on the direct association established previously. Given the complexity of the model and the sample size of this study, the model had to be simplified to achieve convergence, so all hypothesized pathways were explored and paths which were not significant were eliminated.

Mediation was examined using bootstrapping to test the significance of indirect effects (Efron, 1987; MacKinnon, 2008; Preacher, Rucker, & Hayes, 2007). Specifically, 95%, bias-corrected (BC) confidence intervals (CIs) were calculated to determine if the proposed meditating variables explained the relationship between independent variables and physical

activity. Standard bootstrap percentile estimates are sometime inaccurate, especially with smaller samples. Efron (1987) proposed BC methods using second-order correction to improve standard bootstrap CIs. The 95% BC CIs of the indirect effects were obtained with 1,000 bootstrap resamples. A significant indirect effect via mediators between dependent and independent variables was determined if the 95% BC CIs did not contain zero (Preacher & Hayes, 2008).

To test for moderation, we computed interaction terms between each social and environmental context variable and individual goals and exercise orientations to examine whether these different resources moderate the relationship between goals and orientations and physical activity motivation. Since we explored a large number of potential moderators (T2 environmental and social context) we examined each potential moderator individually and report only on those that significantly moderated the final model. To interpret the moderation effect, we followed a standard approach by comparing groups that are high or low in each of these dimensions by fixing scores based on high (1 SD above the mean) and low (1 SD below the mean) of the moderator and mediator variables (Wu & Zumbo, 2008). An excel macro was also used to graph the two-way interaction (Dawson & Richter, 2006).

Comparative fit index (CFI) and root mean square error of approximation (RMSEA) were used as the primary criteria to evaluate model fit with a CFI $\geq$ 0.90 and RMSEA $\leq$ 0.08 interpreted as adequate fit (Kline, 2010). Akaike Information Criterion (AIC) was used as a comparative measure of fit between the mediation and moderation model. Lower AIC values indicate a better fit (Kline, 2010). Squared multiple correlations were used to examine the effectiveness of the model in explaining the variance in physical activity.

Results

One-hundred and four participants completed the survey at all three time points. Participant characteristics are displayed in Table 1. Participants were primarily White (91.3%) with a fairly even split between males (52.9%) and females (47.1%). Approximately 13% of participants were ages 18-30, 22% were 31-45, 32% were 46-60 and 33% were 61 years of age or older. Half of participants were classified as normal weight, 29.8% as overweight, and 19.2% as obese. Correlations, means, and standard deviations of each variable are reported in Table 2.

In the direct effects model, health management goals positively predicted meeting physical activity guidelines ($\beta = 0.54$, $p = 0.002$) and controlled exercise orientations negatively predicted meeting physical activity guidelines ($\beta = -0.34$, $p = 0.009$). This model explained 39.3% of the variance in meeting physical activity guidelines.

A mediation model including predictor variables that had significant direct effects with physical activity and autonomous motivation in the previous model, and indirect effects from each T1 predictor to meeting physical activity guidelines (T3) via autonomous motivation (T2) was tested. Skill related goals ($\beta = 0.38$, $p = 0.001$) and controlled exercise orientations ($\beta = -0.41$, $p = 0.001$) predicted autonomous motivation. The positive direct effect of health management goals on meeting physical activity guidelines held ($\beta = 0.47$, $p = 0.004$), and autonomous motivation also positively predicted physical activity ($\beta = 0.29$, $p = 0.02$). In this model the direct effect of controlled exercise orientations on meeting physical activity guidelines was no longer significant ($\beta = -0.22$, $p = 0.14$), but was mediated by autonomous motivation, as evidenced by a significant indirect effect ($\beta = -0.18$; 95% BC CI = [-0.25, -0.02]). This mediation model demonstrated good model fit (CFI = 0.99; RMSEA = 0.03).

In building the final moderated mediation model, we first tested a direct effects model with all variables directly predicting the dependent variable of meeting physical activity

guidelines, then tested a mediation model including autonomous and controlled motivation as potential mediators of those direct effects, followed by testing the full moderated (by environment) mediation model. In the final model including potential moderators (see Figure 2), social context did not moderate these associations. Perceived crime, a component of neighborhood walkability, was a significant moderator of the association between controlled orientations and autonomous motivation, which also suggests that the indirect effect of controlled orientations on meeting physical activity guidelines via autonomous motivation is moderated. Both perceived neighborhood crime and controlled exercise orientations negatively predicted autonomous motivation, but the significant interaction term demonstrates that those main effects are conditional ($\beta = 0.07$, $p = 0.03$). Those with a greater orientation towards controlled forms of motivation tended to have lower levels of autonomous motivation, and in turn a lower probability of meeting recommendations for physical activity. This association was somewhat stronger for those who perceived less crime in their neighborhoods (see Figure 3), suggesting that motivational orientation matters somewhat less in terms of predicting motivation and physical activity behavior for those who live in high crime areas. The final model had an AIC of 265.38, which was slightly lower than that in the mediation model (AIC = 266.22) indicating that the moderation model had better fit than the mediation model (Kline, 2010).

Discussion and Recommendations

The purpose of this research was to examine how social contexts (solo vs. with friends, family, pet) and environmental features (walkability) affect physical activity motivational processes across time. Our first hypothesis, that having more self-determined goals, autonomous orientations, and autonomy support for being physically active would predict increased self-determined motivation which would then predict greater increases in physical activity behavior,

was partially supported. In this study, goals considered more self-determined such as health management goals directly and positively predicted meeting physical activity guidelines, and skill building goals positively predicted autonomous motivation. These findings are somewhat consistent with past research on goals and exercise behaviors. A systematic review found consistent evidence that self-determined goals were positively associated with both motivation and exercise behavior (Teixeira et al., 2012). In our study, controlled exercise orientations negatively predicted both autonomous motivation and physical activity. Fewer theory-based studies have examined the role of exercise causality orientations but our findings are consistent with two studies which have investigated these associations (Kwan, Caldwell Hooper, Magnan, & Bryan, 2011; Rose et al., 2005). In the current study perceived autonomy support received from others including healthcare providers did not emerge as a significant predictor of motivation or physical activity. Previous cross-sectional research has found a positive relationship between autonomy support perceived from friends (Wilson & Rodgers, 2004) or perceived from exercise class instructors (Edmunds, Ntoumanis, & Duda, 2006) with autonomous motivation. However, previous longitudinal research examining perceived autonomy support from physical activity counselors (Edmunds, Ntoumanis, & Duda, 2007) or exercise class instructors (Edmunds, Ntoumanis, & Duda, 2008) did not demonstrate significant relationships with physical activity motivation or behavior. Given that our sample reported to be more active than the general population, it is possible that participants may not have had recent discussions about physical activity with their healthcare providers, which may have contributed to us not finding significant relationships. Furthermore, the effect of controlled exercise orientation on physical activity was mediated by autonomous motivation. This finding is

consistent with self-determination theory and previous studies examining these relationships (Teixeira et al., 2012).

Our second hypothesis, that these positive effects on physical activity behavior would be stronger when participants reported more social and environmental resources in which to engage in physical activity, was also partially supported. While a moderating effect was not found for the social context of physical activity, a moderating effect was found for one component of neighborhood walkability, perceived crime. The negative effect of a controlled orientation on motivation was stronger for those in low crime areas. The examination of moderated mediation leads to enhanced understanding of the processes involved in physical activity behavior and can provide a refined framework for physical activity interventions to increase their efficacy by determining which constructs to foster at which time and in which way (Bauman et al., 2002; Fortier et al., 2011). In the current study, perceptions of neighborhood crime significantly moderated the negative relationship between controlled exercise orientations and autonomous motivation. Participants who perceived lower crime in his/her neighborhood demonstrated a stronger association between controlled orientation and autonomous motivation. This suggests that these motivational predictors have a stronger influence on physical activity behaviors under conditions where participants perceive less crime. Perhaps when there is more crime, there are other concerns, primary to motivational process such as safety and access that make motivation matter less to overall physical activity levels.

There are study limitations and strengths worth noting. As the case with many survey-based studies, participants chose whether or not to participate, which may lead to selection bias. In addition, while attrition was as expected it may have led to a biased sample. However, age was the only variable with a significant difference between the full sample and the final analytic

sample and hence age was controlled for in the final model. Furthermore, while this study used reliable and valid measures, the use of self-report measures for physical activity has the possibility of recall and social desirability bias. These biases may be seen in the high proportion of participants who met physical activity guidelines. However, the IPAQ has been shown to have acceptable criterion validity when compared to objective physical activity assessment using accelerometers (r=0.47) (Craig et al., 2003). Objective assessments of physical activity such as the use of accelerometers, pedometers, or smart phone based fitness apps should be considered in future studies (Strath et al., 2013; van den Berg, Schoones, & Vliet Vlieland, 2007). In addition, the non-experimental design of this study precludes making causal inferences about self-determination theory constructs and physical activity. However, the longitudinal design allowed us to examine whether the theory-based determinants of physical activity predicted greater physical activity behavior prospectively. The longitudinal design of this study is a significant contribution beyond existing correlational research and provides compelling preliminary data for a self-determination theory-based physical activity intervention. This study did have a relatively small sample which was a limiting factor in analytic technique. In addition, the majority of the participants were educated, non-Hispanic white females, potentially limiting generalizability. Study replication is warranted in a larger trial with more diverse populations.

There are several practical and theoretical implications of the results of this study. When providing physical activity counseling, it is important to foster autonomous motivation (Fortier et al., 2012). In order to achieve this it is important to understand how each person views exercise situations and to consider social and neighborhood environments before tailoring physical activity counseling. Theoretically, this study provides a unique contribution to the literature on understanding self-determination theory-based predictors of physical activity. To our

knowledge, no other study has tested the moderated-mediation effects of social and environmental contexts with physical activity motivation longitudinally. To build on the results of this study, future research should further examine physical activity motivational processes for populations who may have more pressing safety concerns in their neighborhood. Addressing some of those safety concerns may need to occur in concert with motivational interventions to promote physical activity among those who may live in less walkable environments.

In conclusion, understanding the effects of social and environmental resources on motivational process could facilitate the development of more effective, individualized, physical activity interventions. Results suggest motivational orientations (i.e. the way individuals experience/interpret events which initiate/regulate behavior) are important in physical activity. To improve our ability to tailor physical activity counseling and ultimately improve effectiveness of physical activity counseling it is important to understand how each person views exercise situations and to understand social and neighborhood environments of our clients.

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