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Can current physical activity act as a reasonable proxy measure of future physical activity? Evaluating cross-sectional and passive prospective designs with the use of social cognition models

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Abstract

Background. The standard methodological approach for evaluating social cognitive theories when predicting physical activity behavior is the passive prospective/longitudinal survey design. Although this design is logical, a cross-sectional design may be a cost-effective alternative if the relationships between social cognitive constructs and physical activity are relatively stable. The purpose of this study was to evaluate the utility of a concurrent measure of physical activity used in a cross-sectional design in comparison to the standard prospective measure.

Methods. This study included two 6-month prediction time-periods, between 1997 and 1998, for the purpose of analysis replication, and the theory of planned behavior, the transtheoretical model, protection motivation theory, and social cognitive theory as the models of interest in a population sample (N = 703).

Results. Results showed trivial (69% of tests; $q < 0.10$) to small (31% of tests; q = 0.11–0.18) differences in the correlations between social cognitive constructs and vigorous physical activity occur when using a cross-sectional or prospective design. The cross-sectional design estimated slightly larger coefficients than the prospective design.

Conclusions. It appears that a measure of concurrent physical activity included in a cross-sectional design can act as a reasonable proxy measure of future behavior measured in a passive prospective/longitudinal design. These findings support the use of cross-sectional designs when researchers seek a standard correlational investigation of physical activity and social cognitive constructs with the possibility that coefficients may be slightly biased upwards.

Keywords: Theory of planned behavior; Social cognitive theory; Protection motivation theory; Transtheoretical model

Introduction

Engaging in regular physical activity has well-documented benefits, but less than optimal participation rates [1]. It is widely accepted that regular physical activity is associated with a significant decline in all-cause mortality [2] and the prevention of numerous other disease states, such as cancer [3], type 2 diabetes mellitus [4], and cardiovascular disease [5]. Nevertheless, recent statistics indicate that most individuals in many developed countries are insufficiently active to obtain these health benefits [1,6]. Therefore, the need to understand exercise behavior and implement effective intervention strategies is paramount.

Social cognitive theories are popular frameworks for understanding physical activity and exercise behavior. Examples of these theories include the theory of planned behavior (TPB) [7], the transtheoretical model of behavior change (TTM) [8], social cognitive theory (SCT) [9], and protection motivation theory (PMT) [10]. These theories

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often include similar constructs, the same constructs, or constructs that overlap in their measurement domains [9,11]. Thus, unsurprisingly, these social cognitive frameworks all explain approximately the same amount of variability in physical activity, which is approximately 30% explained variance [12–14].

Briefly, the TPB [7] suggests the proximal determinant of volitional behavior is one's intention to engage in that behavior. Intention is the summary motivation to engage or not engage in a behavior. Attitudes and subjective norms are theorized to exert their effects upon behavior through intention. Attitudes are the overall evaluations of performing the behavior by the individual. Subjective norms assess the social pressures on the individual to perform or not to perform a behavior. Further, the TPB tries to also predict behaviors that are not completely volitional by incorporating perceptions of control over performance of the behavior as an additional predictor of intention and behavior. Perceived behavioral control (PBC) is the individual's perception of ability to perform a behavior while holding motivation constant.

The TTM [8] posits that people progress through stages of readiness when making a lifestyle physical activity change. Five main constructs influence physical activity readiness: pros, cons, behavioral processes of change, cognitive processes of change, and self-efficacy. Self-efficacy [9] is the perception of capability to execute and enact physical activity behavior. Pros and cons are the positive and negative aspects of the outcomes derived from engaging in physical activity. Finally, the processes of change are the covert and overt activities that people use to progress through the stages of readiness and are considered either cognitive/experiential or behavioral. The five experiential processes are consciousness raising (gathering information), self-reevaluation (reconsidering the consequences of the behavior on oneself), dramatic relief (experiencing affect), environmental reevaluation (reconsidering the consequences of the behavior on others), and social liberation (attending to social norms). The five behavioral processes are counter conditioning (substituting new behaviors for old ones), stimulus control (controlling environmental cues), reinforcement management (rewards), helping relationships (social support), and self-liberation (committing to change).

PMT [10] explains the cognitive mediation process of behavioral change in terms of threat and coping appraisal. The threat appraisal consists of (1) the individual's estimate of the severity of the health issue/disease (perceived severity); and (2) his or her estimate of the chance of contracting ill health/disease (perceived vulnerability). The model's coping appraisal consists of (1) the individual's expectancy that carrying out recommendations can remove the threat (response efficacy); and (2) belief in one's capability to execute the recommended course of action successfully (self-efficacy). The strength of protection motivation is estimated through measuring intentions to adopt the recommended behavior, with behavior as the expected outcome of strong intentions.

SCT [9] comprises a broad range of constructs which in part include self-efficacy, outcome expectations (conceptually similar to pros and cons), and environmental factors. The social environment may include one's family, friends, and community; the physical environment typically includes characteristics of the natural environment (e.g., weather) and constructed environment (e.g., facilities). These SCT constructs have been widely applied in the physical activity domain [15].

The most common methodological approach for evaluating social cognitive theories when predicting physical activity behavior is the passive (i.e., non-interventional) prospective/longitudinal survey design (PD). Specifically, social cognitive constructs are measured at baseline, and behavior is predicted at a second measurement period. This temporal spacing is a standard assumption in prediction, and a necessary feature for causality [16]. Furthermore, the methodological artifact of consistency effects between behavior and social cognitive constructs may occur during a cross-sectional design (CD; i.e., one-shot survey). That is, because the participant is answering both behavior and social cognitive measures at the same sitting, the ease of maintaining consistency between measures may bias correlations upwards.

Finally, the use of time frame compatibility between social cognitive measures and the future behavior measure is considered an essential methodological tenet of attitude-behavior models like the TPB [7]and its predecessor, the theory of Reasoned Action [17] . For example, Ajzen and Fishbein [17,18] stipulate the best methodology to examine a relationship between an attitude and a behavior is to ensure the prospective context, action, target, and time frame are matched between measurement of attitude and behavior. These assumptions are considered essential for use of the TRA and TPB, but have not been regularly adopted for SCT, TTM, and PMT [19].

Although the use of PDs and time frame compatibility between social cognitive measures and physical activity behavior make logical sense, tests of these methodologies are scarce. Indeed, the only studies that have focused on support of time frame compatibility of social cognitive constructs were for oral contraceptive behavior [20] and blood donation [21]. No examinations of the PD in comparison to the cross-sectional survey design (CD) have been reported in the physical activity domain. Thus, exploration of whether a concurrent measure of physical activity behavior included in a CD may act as a reasonable proxy measure of a future physical activity measure included in a PD is needed.

The main rationale for examining the utility of concurrent physical activity as a proxy measure for future physical activity is the cost-benefit of CDs in comparison to PDs. If the findings from PDs are no different from CDs, then physical activity surveys need not be as costly. First, the additional supplies (e.g., paper,