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A research agenda to examine the efficacy and relevance of the Transtheoretical Model for physical activity behavior

Claudio R. Nigg [a,*], Karly S. Geller [b], Rob W. Motl [c], Caroline C. Horwath [d], Kristin K. Wertin [a], Rodney K. Dishman [e]

[a] Department of Public Health Sciences, John A. Burns School of Medicine, University of Hawaii at Manoa, 1960 East-West Road, Honolulu, HI 96822, USA
[b] Cancer Research Center of Hawaii, University of Hawaii at Manoa, 1960 East-West Road, Honolulu, HI 96822, USA
[c] Department of Kinesiology, University of Illinois at Urbana-Champaign, 332 Louis Freer Hall, 906 South Goodwin Avenue, Urbana, IL 61801, USA
[d] Department of Human Nutrition, University of Otago, P.O. Box 56, Dunedin, New Zealand
[e] Department of Kinesiology, College of Education, University of Georgia, 1151 Ramsey Center, 300 River Road, Athens, GA 30602-6554, USA

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ABSTRACT

Regular physical activity (PA) decreases the risk of several chronic diseases including some cancers, type II diabetes, obesity, and cardiovascular disease; however, the majority of US adults are not meeting the recommended levels to experience these benefits. To address this public health concern, the underlying mechanisms for behavior change need to be understood, translated and disseminated into appropriately tailored interventions. The Transtheoretical Model (TTM) provides a framework for both the conceptualization and the measurement of behavior change, as well as facilitating promotion strategies that are individualized and easily adapted. The purpose of this manuscript is to present the constructs of the TTM as they relate to PA behavior change. We begin with a brief synopsis of recent examinations of the TTM constructs and their application. Subsequent to its introduction, we specifically present the TTM within the PA context and discuss its application and usefulness to researchers and practitioners. Criticisms of the TTM are also noted and presented as opportunities for future research to enhance the valid application of the TTM. We offer general study design recommendations to appropriately test the hypothesized relationships within the model. With further examinations using appropriate study design and statistical analyses, we believe the TTM has the potential to advance the public health impact of future PA promotion interventions.

Increasing physical activity (PA) has been designated high priority in Healthy People 2010 Objectives (U.S. Department of Health and Human Services (USDHHS), 2000). PA has the potential to reduce the risk of coronary heart disease (CHD) (Lee, Sparrow, Vokonas, Landsberg, & Weiss, 1995; Manson et al., 1999; Morris, Clayton, Everitt, Semmence, & Burgess, 1990; Paffenbarger & Hyde, 1984; Paffenbarger, Hyde, Hsieh, & Wing, 1986; Powell, Thompson, Caspersen, & Kendrick, 1987), hypertension, type 2 diabetes mellitus, obesity (Albright et al., 2000; Grundy et al., 1999; Hu et al., 1999; Paffenbarger, Wing, Hyde, & Jung, 1983), various cancers (Lee, 2003), and overall mortality (Lee & Skerrett, 2001). Furthermore, physical inactivity accounts for an estimated 200,000 deaths annually (Powell & Blair, 1994) and is a key contributor to the 50% increase in obesity prevalence among US adults during the past decade (Mokdad et al., 1999).

Considering this evidence, the USDHHS developed the 2008 Physical Activity Guidelines for Americans, recommending adults aged 18 years or older engage in at least 150 min a week of moderate-intensity, or 75 min a week of vigorous-intensity PA (2008). Unfortunately, despite widespread attempts to increase PA in the general population, 39% of adults are considered inactive and 61% never engage in any periods of vigorous-intensity PA (Pleis & Lucas, 2009). In reflection of the numerous health benefits associated with PA, this low occurrence among US adults is a clear public health concern.

In order to address this concern, the underlying mechanisms for behavior change (i.e., increased PA) need to be clarified and translated into interventions that can then be disseminated. In addition to providing a framework for both the conceptualization and the measurement of behavior change, the Transtheoretical Model of Behavior Change (TTM) (Prochaska & DiClemente, 1983; Prochaska, Redding, & Evers, 1996) facilitates intervention strategies that are both individually tailored and easily modified to fit diverse populations.

* Corresponding author. Tel.: +1 808 956 2862; fax: +1 808 956 5818.
E-mail address: cnigg@hawaii.edu (C.R. Nigg).

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Several approaches to health behavior have examined whether individuals were at a criterion or not (e.g., Courneya, 1995); however, behavior change is dynamic and experts recommend a more complex framework (Dishman, 1988; Sallis & Hovell, 1990; Sonstroem, 1988). A model used to explain and to motivate individuals to engage in health behaviors should include a range of mechanisms appropriate for those not ready for change, those habitually involved, and those regressing or relapsing. Further, there are many aspects of motivation. For example, incentives to engage in a health behavior may be self-centered, socially focused, intrinsic (i.e., enjoyment) and/or achievement oriented. The TTM is appealing because it categorizes individuals according to their readiness to change and then provides practitioners with concrete strategies on how to intervene for a specific individual (e.g., Riebe & Nigg, 1998).

Overall, translation of the TTM research into practice has facilitated efforts to prevent disease, prolong of life, and promote good health. The remaining sections of this paper present the TTM constructs as mechanisms for behavior change applied specifically to PA. We begin by offering a description of research evaluating the interplay between TTM constructs and overview its major advantages and criticisms. Next, we present recent citations for the operationalization of the TTM constructs within the PA context, suggesting optimal approaches to critically evaluate the hypothesized relationships within the model. In general, the purpose of this paper is to describe the mechanisms of the TTM and suggest a research agenda to future research in hopes of advancing the appropriate and effective application of the TTM in future PA interventions.

Constructs of the TTM

The TTM was developed as a comprehensive model of behavior change, incorporating cognitive, behavioral, and temporal aspects into a unified approach for behavior change. The constructs outlined in the TTM consist of the stages of change, the processes of change, decisional balance, self-efficacy and temptation. Stage of change classifies individuals regarding their progression toward habitual PA and is hypothesized to relate with the other TTM constructs. Thus, individuals' processes of change, decisional balance, self-efficacy, and temptation are expected to change as they move through the stages of change.

The stage of change construct characterizes the time or readiness dimension into five progressive stages along which behavior change occurs. The first stage is precontemplation and includes those individuals with no intention to engage in regular PA. The second stage is contemplation or the intent to engage in regular PA within the next 6 months, which is followed by individuals in the preparation stage who have immediate intentions and commitment to engage in regular PA (i.e., within the next 30 days). Individuals who have actually initiated regular PA behavior have advanced to the action stage. Finally, once an individual has persisted in habitual PA behavior for more than 6 months, he or she has entered the maintenance stage. It should be noted that habitual PA (maintenance) rarely occurs the first time and relapse to earlier stages is expected. Individuals respond to their environment and learn from their failures, eventually trying behavior change again.

The processes of change are the strategies used to progress along the stages of change and are labeled as either experiential or behavioral. Experiential processes are gathered through personal experiences while behavioral processes accumulate from the environment and through action. Research has demonstrated a relationship between a person's stage of change and the specific processes used in that stage (Marshall & Biddle, 2001; Prochaska & DiClemente, 1983; Rhodes, Plotnikoff, & Courneya, 2008), such that experiential processes benefit progression through the earlier stages of change while behavioral processes emerge during later stages. This interplay between the stages and the processes of change is considerably constructive to PA promotion, providing information to more efficiently tailor unique, individualized interventions.

Decisional balance is an individual's evaluation regarding the costs (cons) and benefits (pros) of engaging in a behavior, and stage progression is suggested to occur as pros increase and cons decrease (Marshall & Biddle, 2001; Prochaska et al., 1996). Self-efficacy (personal confidence) is reported to increase with stage progression (Marshall & Biddle, 2001), which was demonstrated for PA among diverse adult populations (Huang, Hung, Chang, & Chang, 2009; Mori et al., 2009). Temptation (negative urges) has been validated in the PA context (Hausenblas et al., 2001) and between gender and among ethnicities (Paxton et al., 2008).

Fig. 1 provides a pictorial display of how the TTM constructs are theoretically related. The processes of change theorized as most appropriate at each stage are listed, demonstrating more behavioral processes in advanced stages. Also, notice that decisional balance is expected to have the strongest relationship with the earlier stages of change, which has received strong support from a recent meta-analysis (Hall & Rossi, 2008). Thus, as individuals progress toward preparation, they evolve from perceiving greater cons related to PA (precontemplation) to rating the pros and cons more equally (contemplation, preparation). Also depicted in Fig. 1 is the increase in self-efficacy and decrease in temptations that is expected to occur as individuals progress through the stages. In a recent examination of the intention–planning–action relationship related to PA behavior, Lippke, Wiedemann, Ziegelmann, Reuter, and Schwarzer (2009) reported that self-efficacy moderated this relationship. In other words, the movement of an individual into action depends on higher levels of self-efficacy.

Research examining the TTM constructs has been numerous, ranging from measurement development and validation studies to more recent applications of intervention evaluations. In a recent meta-analytic examination, Hall and Rossi (2008) analyzed 120 separate studies between 1984 and 2003 that examined the consistency of the TTM within and across 48 different health behaviors (approximately 50,000 participants from 10 different countries). The theoretical mechanisms for behavior change outlined in the TTM were reported as remarkably consistent despite the range of behaviors and populations (Hall & Rossi, 2008). Results implied a common pathway to behavior change (i.e., stages of change), which supports application of the TTM to multiple health behaviors, including PA, among diverse populations.

In addition to construct validation, recent research reports successful application of TTM-based interventions to promote a wide range of health behaviors among various populations. For instance, the stages concept was validated with moderate and strenuous PA among children (Haas & Nigg, 2009), college-age athletes during injury rehabilitation (Clement, 2008), adult high-risk employees (Faghri, Blozie, Gustavesen, & Kotejoshyer, 2008), and among older adults during cardiac rehabilitation (Rivett et al., 2009) and PA program enrollment (Hildebrand & Neufeld, 2009).

Another benefit of the TTM is its applicability to interventions targeting multiple-behaviors within a single program, suggesting potential for an increased public health impact. For example, Johnson et al. (2008) reported significant improvements in healthy eating, exercise, emotional distress management, and weight among overweight/obese adults randomly assigned to a fully tailored, TTM-based multiple behavior intervention. Moreover, significant treatment effects were reported for untreated fruit and vegetable intake, suggesting the potential of a TTM-based intervention to create a unique synergy among multiple health behaviors.