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Application of the transtheoretical model to identify predictors of physical activity transition in university students

SooJin Kang* and YoungHo Kim*

APLICACIÓN DEL MODELO TRANSTEÓRICO PARA IDENTIFICAR LOS PREDICTORES DE TRANSICIÓN DE LA ACTIVIDAD FÍSICA EN LOS ESTUDIANTES UNIVERSITARIOS

KEYWORDS: Physical activity, transitional shifts, university students, transtheoretical model.

ABSTRACT: Within the physical activity domain the majority of transtheoretical model research has employed a cross-sectional research design. While useful for characterizing participants within the various stages of change, it fails to capture the dynamic nature of change. The purpose of the current study was to identify predictors of naturally occurring transitional shift patterns in physical activity behavior observed over six months among 202 university students. The full set of variables from the transtheoretical model as well as exercise METS was examined. Results indicated that stable active participants reported more exercise METs at baseline than both activity adopters and perpetual preparers in multinomial logistic regression analysis (p<.01). Stable active participants were also significantly different in their cognitive process of change scores compared to activity adopters (p<.05). Activity adopters differed from stable active participants in their initial decisional balance scores (p<.05). These findings should help inform theory development and physical activity interventions and programs.

Despite the dissemination of health information promoting the benefits of regular participation in physical activity, a large volume of studies indicated that the majority of youth around the world either engage in physical activity on an irregular basis or are completely sedentary (Korea Ministry of Health and Welfare, 2015; U.S. Center for Disease Control and Prevention, 2012; World Health Organization, 2017). There is an estimated 62.5% reduction in physical activity behavior between high school and college (Wengreen and Moncur, 2009). The prevalence of sufficient physical activity to obtain health benefits among college students is estimated to be less than 50% (Irwin, 2004). To improve the limited understanding of physical activity behavior change and promotion, recent studies have been directed towards behavioral interventions based on psychological theories, such as the transtheoretical model (TTM) (Kim and Cardinal, 2009; Woods, Mutrie and Scott, 2002).

The TTM consists of five main stages of change, referred to as the temporal and motivational aspects of change (*i.e.*, precontemplation, contemplation, preparation, action, and maintenance). In addition, several psychological and behavioral variables such as processes of change, self-efficacy, and decisional balance (*i.e.*, pros and cons) have been shown to have predictable relationships with the stage of change construct, and are included as other constructs in the model (Prochaska and DiClemente, 1983). The basic and specific descriptions for the TTM constructs have been well documented in a number of previous studies (Cardinal, Kosma, and McCubbin, 2004; Kim, 2007). TTM suggests that behavior change occurs over time in a series of stages, and that the mechanisms of change include the cognitive and behavioral processes that individuals engage in at different stages of change. Additionally, individuals will weigh the pros and cons of engaging in physical activity, and will generally experience increased self-efficacy as they advance

Correspondence: YoungHo Kim. Department of Sport Science. Seoul National University of Science and Technology. 172 Gongneung-dong, Nowon-gu, Seoul, 139-743, Korea. E-mail: yk01@seoultech.ac.
*Seoul National University of Science and Technology
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through the stages of physical activity behavior change (Levy and Cardinal, 2006; Spencer, Adams, Malone, Roy and Yost, 2006).

While characterizing participants by their stage of change is convenient, it may fail to fully capture the dynamic nature of change (Cardinal, 1998). To accomplish this, researchers have increasingly encouraged that transitional shift patterns be examined (Cardinal, Engels and Smouter, 2001; Levy and Cardinal, 2006).

The purpose of this study was to identify predictors of naturally occurring transitional shifts in physical activity behavior observed over six months among university students.

Method

Participants

A total of 202 university students were recruited into this study using a press release issued through university, recruitment flyers posted on university websites, and announcement made through classes. Through these procedures, 250 students gave their consent form to participate in the study. Of those, 202 students (male: 111, female: 91) completed questionnaires at baseline and then again six months later. All participants in the age cohort were 19-26 years old (M_{age} = 21.23years, *SD* = 1.31). This study was approved by the Research Committee of Seoul National University of Science and Technology.

Measures

The measures applied in the current study were originally developed in English (Benisovich., Rossi, Norman and Nigg, 1998; Godin and Shepard, 1985; Plotnikoff, Blanchard, Hotz and Rhodes, 2001; Reed, Velicer, Prochaska, Rossi and Marcus, 1997), and translated into Korean using the methodology outlined by Banville, Desrosiers and Genet-Volet (2000). The full translation and validation processes have been described elsewhere (Hwang and Kim, 2013; Kim, 2004; Kim, Cardinal, and Lee, 2006).

At each time period the Korean version of stage of exercise behavior change questionnaire was used to measure the participants' physical activity stages in this study (Cronbach α = .85). On the basis of their responses, participants were classified into one of five possible "transitional shift" groups using the classification procedures proposed by Cardinal et al. (2001). The patterns were stable sedentary (*n* = 6), stable active (*n* = 120), activity adopter (*n* = 38), activity relapser (*n* = 0), and perpetual preparer (*n* = 38). Due to sample size limitations, the stable sedentary and activity relapser groups were dropped from further consideration.

The behavioral and cognitive processes of change were assessed using the Korean version of processes of change questionnaire (Cronbach α = .79 for behavioral processes and .89 for cognitive processes). The Korean version of decisional balance scale was adopted to assess perceived benefits and barriers of physical activity (Cronbach α = .91 for pros and .89 for cons). Self-efficacy was assessed using the Korean version of self-efficacy scale (Cronbach α = .86), and the Korean version of weekly leisure time exercise questionnaire was used to assess the participants' physical activity behavior (Cronbach α = .86).

Data analysis

Descriptive statistics (i.e., means and *SD*s) were used to summarize participant characteristics. Univariate *F* analysis was conducted to identify the differences BMI, self-efficacy, decisional balance, behavioral processes, cognitive processes, and physical activity behavior of the university students across the stages of physical activity. In addition, multinomial logistic regression analysis was carried out to investigate predictors of transitional shifts in physical activity behavior. All statistical methods applied in this study were conducted using the SPSS 22.0 version.

Results

In univariate analyses, those classified as stable active, activity adopters, and perpetual preparers differed significantly (p<.01) from one another on each variable. These results are summarized in Table 1.

As for predictive differences, multinomial logistic regression analyses revealed that participants in the stable active group reported significantly more exercise METs at baseline than did activity adopters and perpetual preparers (figure 1). Scores one standard deviation above the mean were 5.17 times more likely to be reported by stable active participants rather than activity adopters (p < .01) and 7.62 times more likely than perpetual preparers. (p < .01). Reports of scores one standard deviation above the mean for the cognitive processes of change were 2.96 times more likely to be from stable active participants compared to activity adopters (p < .05; figure 2). Decisional balance scores one standard deviation above the mean were 2.96

times more likely to be reported by activity adopters compared to stable active participants ($p < .05$; figure 3).

Discussion

The univariate results partially support the findings of Levy and Cardinal (2006) who followed participants for 10-weeks. In their study the behavioral processes of change and increasing pros were found to be especially important concomitants of physical activity adoption. Extending those findings, the present study applied multinomial logistic regression analyses to determine which constructs had the most impact on whether a person progressed to a higher stage of change. In comparison to activity adopters and those in perpetual preparation, those classified as stable active reported the highest exercise METs at baseline. Activity adopters would have reported less exercise MET's at baseline because their activity levels were minimal or inconsistent at that time. It was over the six months that they were able to consistently add physical activity to their weekly routines. Perpetual preparers were less likely to be physically active at either time period.

The stable active participants responded more favorably than activity adopters to the cognitive process of change questions at baseline. These individuals had already "committed to physical activity," "found new methods of being active," and "believed that they could do physical activity regularly." These are things the activity adopters learned how to do in the six months between the two data collections and this enhanced their ability to engage in physical activity on a regular basis.

At baseline the activity adopters were more likely to report higher decisional balance scores than the stable active group. That is they reported higher pros than cons prior to undertaking a behavior change. Elevating the pros above the cons (the so called "cross-over" point) may be an important mediator of physical activity behavior change (Marshall and Biddle, 2001). Because this finding may be counterintuitive, an alternative hypothesis is that the stable active group simply had a more realistic perspective relative to their assessment of cons in comparison to the activity adopters. Regardless, this finding suggests the importance of creating a positive decisional balance in the early stages of physical activity adoption.

Despite the significant findings of the current study, there are a number of limitations to this study that should be addressed in consideration of future research. Although physical activity and psychological variables were measured with standardized measures with proven reliability and validity, there were all self-reported measures and therefore item interpretation, recall, and social desirability were not controlled. Moreover, this study is limited in that all data are based on self-report and issues such as item interpretation, recall, and social desirability cannot be controlled for. In future studies it would be useful to have all the posited transitional shift patterns represented.

In spite of these limitations the findings add to our understanding of the dynamic nature of physical activity behavior change. Previous, studies (primarily cross-sectional designs) have suggested that physical activity behavior change efforts be directed toward the behavioral processes of change, increasing self-efficacy, and to a lesser extent, creating a positive decisional balance. The current prospective study suggests that the cognitive processes of change and creating a positive decisional balance are especially important factors in the first six months of physical activity adoption.

Variable	Transitional Shift Classification: Stable Active (n = 120)	Activity Adopter (n = 38)	Perpetual Preparation (n = 38)	F (df=2,198)	p
Age (yr.)	20.8 ± 1.9	21.9 ± 1.8	22.4 ± 2.1	1.7	=.96
Body Mass Index (kg/m^2)	21.7 ± 3.8	22.2 ± 4.0	23.6 ± 3.7	1.5	=.95
Behavioral Processes	57.0 ± 7.3	48.9 ± 8.4	46.7 ± 8.1	16.0	<.01
Cognitive Processes	54.9 ± 7.6	52.3 ± 9.2	49.4 ± 8.1	10.2	<.01
Decisional Balance	10.8 ± 4.0	7.1 ± 4.9	5.9 ± 5.0	13.6	<.01
Self-Efficacy	64.3 ± 10.2	56.1 ± 9.9	54.6 ± 10.2	11.1	<.01
Physical activity behavior (METS)	66.7 ± 26.3	43.3 ± 11.1	35.1 ± 21.5	13.3	<.01

Table 1. Descriptive statistics (M ± SD) and univariate summary by transitional shift group classification.

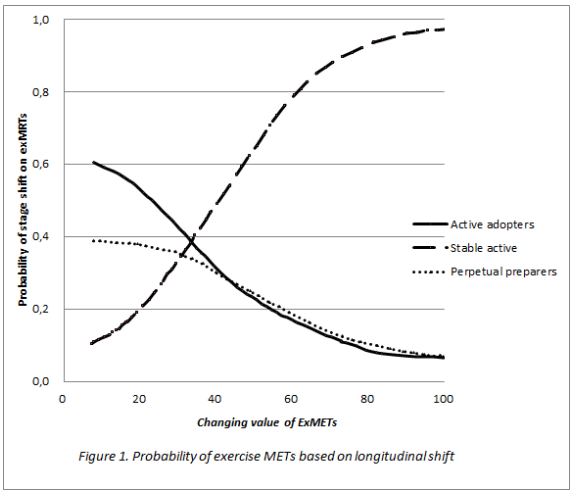

Figure 1. Probability of exercice METs based on longitudinal shift patter

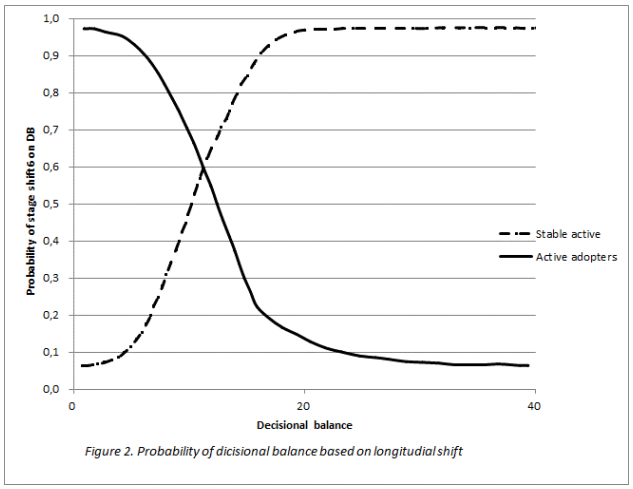

Figure 2. Probability of desicional balance based on longitudinal shift patter

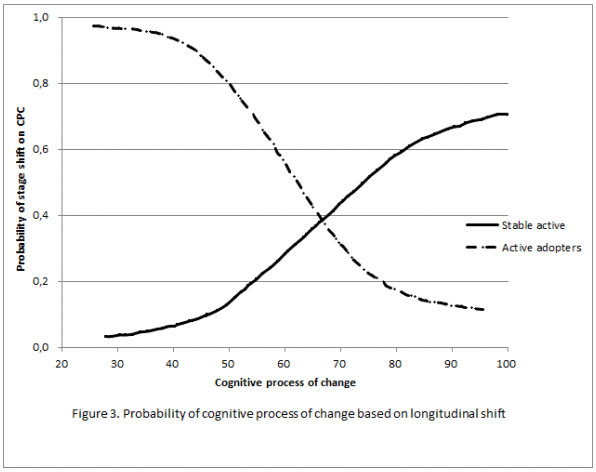

Figure 3. Probability of cognitive process of change based on longitudinal shift patter

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PALABRAS CLAVE: Actividad física; cambios de transición; estudiantes universitarios; modelo transteórico.

RESUMEN: Dentro del dominio de la actividad física, la mayoría de la investigación de modelos transteóricos ha empleado un diseño de investigación transversal. Si bien es útil para caracterizar a los participantes en las diversas etapas del cambio, no capta la naturaleza dinámica del cambio. El propósito del presente estudio fue identificar predictores de patrones de cambio de transición que ocurren naturalmente en el comportamiento de la actividad física observados durante seis meses entre 202 estudiantes universitarios. Se examinó el conjunto completo de variables del modelo transteórico, así como el ejercicio METS. Los resultados indicaron que los participantes activos estables reportaron más MET de ejercicio al inicio que los adoptantes de actividad y los preparadores perpetuos en el análisis de regresión logística multinomial (p <0.01). Los participantes activos estables también fueron significativamente diferentes en su proceso cognitivo de puntuaciones de cambio en comparación con los adoptantes de actividad (p <0.05). Los adoptantes de actividades difirieron de los participantes activos estables en sus puntuaciones iniciales de equilibrio decisional (p <0.05). El presente estudio sugiere que los procesos cognitivos de cambio y la creación de un equilibrio decisorio positivo son factores especialmente importantes en los primeros seis meses de adopción de actividad física.

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