Mediating Effects of Self-Efficacy in the Transtheoretical Model Among Adolescent Male Smokers in Korea

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Purpose This study examined the moderating and mediating effects of self-efficacy on the relationships between predictor variables (decisional balance and processes of change) and the outcome variable (stages of change) using the Transtheoretical Model.

Design Cross-sectional data were collected from 147 current and former smokers at three vocational technical high schools in Korean metropolitan areas.

Methods The survey instruments included decisional balance, self-efficacy, processes of change (behavioral and experiential), and stages of change. Regression analyses were used to identify the mediating effects of self-efficacy.

Results Self-efficacy mediated the relationships of decisional balance and behavioral processes with stages of change, but not that of experiential processes with stages of change.

Conclusions The study results will provide valuable information regarding how each predictor variable is connected and path through adoption of smoking cessation behavior. By understanding mechanisms of behavior change, health professionals could develop effective smoking cessation interventions with consideration of roles of self-efficacy in the smoking cessation behavior change. [Asian Nursing Research 2009;3(1):15–23]

Key Words male adolescents, self-efficacy, smoking cessation, transtheoretical model

INTRODUCTION

Smoking is the leading cause of preventable death in South Korea, with lung cancer being the number one cause of cancer deaths, constituting 23.9% of all cancer deaths among Korean men (National Cancer Center, 2006). Various types of interventions are offered to smokers and nonsmokers in communities, schools and occupational settings to prevent smoking and to help smokers quit. However, the smoking rate for Korean men is one of the highest in the world, with 40.4% of male adults and 18.1% of male adolescents identified as smokers in 2008 (Korean Association of Smoking & Health, 2008). Very few people first begin to use tobacco in adulthood, with most using tobacco for the first time before graduating from high school. The earlier young people begin using tobacco, the more likely it is that they will continue when they are adults, which in turn means that they are exposed to tobacco for a longer
period of time. Both the duration and amount of tobacco used are related to eventual chronic health problems (Centers for Disease Control & Prevention, 1994). Understanding the underlying factors that affect smoking cessation behavior may be useful to the development of effective interventions that will help Korean smokers to quit.

The Transtheoretical Model (TTM) has been used by many researchers to explain smoking cessation behavior (Jung, 2003; Prochaska, 1996). The main concept of TTM is that individuals go through changes as a process over time. In using the TTM model, previous studies have mainly delineated the relationships between stages of change and other TTM constructs, with associations between predictor variables (processes of change, self-efficacy, and decisional balance) generally not being investigated (De Vries, Mudde, Dijkstra, & Willemsen, 1998; Fahrenwald & Walker, 2003; Prochaska).

Bennett (2000) contended that determining the mechanisms of how, why, and when individuals adopt or abstain from certain behavior requires information regarding mediator variables to provide a clear picture of the process of behavior change. Mediator variables are a third variable that modifies the relationship between two types of variables, that is the independent and dependent variable (Baron & Kenny, 1986). A mediator variable requires the following three conditions to be met: (1) an independent variable should significantly predict a mediator variable; (2) the mediator variable should significantly predict a dependent variable; and (3) when associations identified in the prior two steps are controlled, a previously significant association between the independent and dependent variables becomes either less significant or not significant (Baron & Kenny; Bennett).

Bandura (1977) contended that self-efficacy determines whether certain behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles experienced by an individual. Researchers found that increased self-efficacy was associated with decreased smoking rate among middle school students (Lee, Kang, Lee, & Lee, 2001), while Borrelli & Mermalstein (1994) found that self-efficacy was the only predictor of abstinence at a 3-month follow-up. Therefore, exploring the roles of self-efficacy in smoking cessation behavior will provide valuable information in tailoring smoking cessation programs.

Previous researchers contended that self-efficacy has been a key mediator that predicts behavior change (Bandura, 1977; King, Marcus, Pinto, Emmons, & Abrams, 1996). Using TTM, other researchers found that exercise self-efficacy mediated the relationship between processes of change and stages of change of exercise behavior (Kim et al., 2000). However, the mediating effects of self-efficacy in TTM with smoking behavior change have not been previously explored.

The purpose of this study was to explore relationships between TTM variables and to examine the mediating effects of self-efficacy on the relationships between predictor variables (decisional balance and processes of change) and the outcome variable (stages of change). This would provide a more precise description of the relationships among TTM variables and also provide information in the development of effective intervention strategies for smoking cessation programs.

**METHODS**

**Design and sample**

A cross-sectional survey using self-reported data was conducted with male vocational technical high school students. Participating high schools were recruited via telephone. School nurses were asked whether data collection could be performed in the schools and whether smoking cessation programs had previously been provided within the school; in the latter case the school was excluded as potential participants. Several vocational technical high schools located in adjacent cities of D metropolitan city were contacted but only three schools permitted data collection. The sampling was performed using a stratified random sampling method by randomly selecting one class from each of the 10th, 11th and 12th grades from each school, and school nurses were asked to randomly select one class from each of the grades.
Questionnaires were distributed to 360 students from nine classes of the three schools, of which 300 questionnaires were returned (response rate of 83.3%). Among them, 147 (49.0%) students were identified as current or former smokers. The inclusion of 147 participants for multiple regression analysis with two independent variables to detect a medium effect size of 0.15 yielded a power of 99% (\(a = .05\); Cohen, 1988). Data were collected during 2004.

**Instruments**

The instruments used in the study included questions relating to the general characteristics of the students and their parents, stages of change, processes of change, decisional balance, and self-efficacy. A preliminary questionnaire was developed through a literature review and was pilot tested with 40 male students prior to data collection targeting students attending schools other than the three participating vocational technical schools. In the pilot test, the students were asked whether the questions were understandable and whether any of the questions were offensive. The pilot test results indicated that no parts of the instruments needed revision. Content validity was assessed by consultation with an expert in the field of health promotion related to smoking and confirmed that the items were relevant and adequately measured each dimension.

**Stages of change**

The stages of change questions were developed based on the University of Rhode Island Change Assessment (URICA) scale (Diclemente, Schlundt, & Gemmell, 2004). Each question was measured with five ordinal questions that were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Each question asked whether students were in the precontemplation, contemplation, preparation, action or maintenance stage. In determining the stage of the participants, the highest-score method was used, in which students were assigned to a specific stage based on the highest score on the dimension scale (Heuts et al., 2005). If a student showed equally high scores in two or more stages, the student was considered to belong to the most advanced stage. The URICA scale has been widely used to assess the readiness to change with regard to various health behaviors with the intention of becoming more sensitive in measuring the individual’s motivation for change (Diclemente et al.; Dozois, Westra, Collins, Fung, & Garry, 2004). An example question included whether the student intended to quit smoking within the next 6 months.

**Processes of change**

Questions regarding the 10 processes of change were developed through a literature review (Prochaska & DiClemente, 1983; Prochaska, Velicer, DiClemente, & Fava, 1988; Rakowski et al., 1997). Thirty items were initially developed for the 10 processes of change, and those items that exhibited reliability coefficients of less than .60 were deleted from the data collection and analysis process, leaving 26 items to be used in the analysis. A confirmatory factor analysis was conducted with a principal components factor and extracted Eigenvalues greater than 1 to establish construct validity. The results yielded a 10-factor solution, which was identical to the 10 processes of change. Example statements included “experiencing fear after recognizing the harmful effects of smoking on health” (for dramatic relief) and “removing things from around myself that remind me of smoking” (for stimulus control). The 10 processes of change were scored on a 5-point Likert scale ranging from 1 (never) to 5 (always).

The 10 processes of change were divided into two higher order structures: experiential and behavioral. The experiential processes comprised consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, and social liberation, while the behavioral processes consisted of helping relationships, counter-conditioning, reinforcement management, stimulus control, and self-liberation (Prochaska & DiClemente, 1983). The reliability coefficients for the higher order structure (experiential and behavioral) were .78 and .87, respectively.

**Decisional balance**

Eighteen questions regarding the pros and cons of smoking were developed through a review of
the literature (De Vries et al., 1998; Jung, 2003; Prochaska, 1996; Rakowski et al., 1997; Rohsenow et al., 2003), and included questions such as “smoking helps to reduce stress” (a pro of smoking) and “smoking annoys others” (a con of smoking). Items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The summation of decisional balance variables was calculated by subtracting total scores of the cons of smoking from total scores of the pros of smoking. The reliability coefficients were .88 and .92 for the pros and cons questions, respectively.

Self-efficacy
Five items were developed to measure self-efficacy through a review of previous studies (De Vries et al., 1998; Kim, 2001; Lee et al., 2001), and included questions such as “I am confident that I won’t smoke when feeling tense.” Items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), for which the reliability coefficient was .92.

Procedure
Approval for the study was obtained from the research board of the school of medicine within the university, before the questionnaires were sent out. The principals of the participating high schools permitted a survey targeting students in their schools. Questionnaires were sent out to school nurses via regular mail service after obtaining approval for the study from the university and high schools. School nurses explained the purpose of the survey to potential participants. Verbal consent was obtained prior to data collection from the students who agreed to participate in the study. The school nurses administered the questionnaires with guidance for the students and collected the completed questionnaires. The survey was conducted anonymously, and took approximately 20 minutes to complete.

Data analysis
Descriptive statistics were used to delineate general and smoking-related characteristics of the study participants. Correlation analysis was performed to illustrate relationships between variables. Three regression analyses were performed to test the mediating effects of self-efficacy in TTM: (a) regressing the mediator (self-efficacy) on predictor variables (behavioral processes and decisional balance), (b) regressing the outcome variable (stages of change) on predictor variables (behavioral processes and decisional balance), and (c) regressing the outcome variable (stages of change) on the mediator (self-efficacy) and predictor variables (behavioral processes and decisional balance). A mediator effect was present if the first two regression analyses yielded significant results and a mediator was a significant predictor of the dependent variables, and the relationship between the predictor and outcome variables was less significant in the third equation when the mediator variable was controlled (Bennett, 2000). Data were screened for data-entry accuracy and to assure that the assumptions of the statistical tests had been met. Differences with a probability of less than .05 were considered to be statistically significant. SPSS (v. 12.0) was used for the analyses.

RESULTS

General characteristics
Among the students who participated in the study, 34.0%, 44.2% and 21.8% were in the 10th, 11th and 12th grades, respectively, and 53.7% (n=79) were current smokers and 46.3% (n=68) were former smokers. Regarding the stages of change, 17.0%, 21.1%, 15.7%, 19.7% and 26.5% were in the pre-contemplation, contemplation, preparation, action, and maintenance stages, respectively (Table 1).

Correlation matrix of processes of change, decisional balance and self-efficacy
Correlation analysis results indicated that stages of change were significantly correlated with behavioral processes, pros of smoking, cons of smoking and self-efficacy (p < .01). Behavioral processes was significantly associated with experiential processes, pros of smoking, cons of smoking and self-efficacy, while self-efficacy was significantly correlated with pros of smoking (p < .01; Table 2).
Multiple regression analyses of the mediating effects of self-efficacy
The multiple regression analyses conducted to determine the mediating effects of self-efficacy on the relationship between behavioral processes and stages of change demonstrated that behavioral processes were a significant predictor of self-efficacy in the first equation ($\beta = .350, p < .001$), and behavioral processes were a significant predictor of stages of change in the second equation ($\beta = .293, p < .001$). In the third equation, both the mediator (self-efficacy) and the predictor (behavioral processes) were significantly associated with stages of change, and these variables explained 21% of the variance ($F = 19.78, p < .001$).
The decreased standardized beta coefficients of behavioral processes between equations 2 ($\beta = .293$) and 3 ($\beta = .159$) verified the action of the mediating effects of self-efficacy on the relationship between behavioral processes and stages of change. Therefore, when influence of self-efficacy was eliminated, an association between behavioral processes and stages of change became less significant in the third equation compared to that of the second equation (Figure 1).

The mediating effects of self-efficacy on the relationship between decisional balance and stages of change were also confirmed (Figure 2). The former two equations revealed that decisional balance was a significant predictor of both self-efficacy ($\beta = -.307$, $p < .001$) and stages of change ($\beta = -.439$, $p < .001$). In the third equation, self-efficacy and decisional balance were significantly associated with stages of change and together explained 29% of the variance ($F = 30.17$, $p < .001$). The decrease in the standardized beta coefficients of decisional balance from $-.439$ in the second equation to $-.336$ in the third, verified the mediating effects of self-efficacy (Table 3). As experien- tial processes were not significantly associated with the mediator (self-efficacy) or the outcome variable (stages of change), regression analyses were not performed to define the mediating effects of self-efficacy.

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**Table 3**

*Multiple Regression Analyses of the Mediating Effects of Self-efficacy on the Relationships between Processes of Change and Stages of Change (n = 147)*

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<thead>
<tr>
<th>Predictors</th>
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<th>Additional $R^2$</th>
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<td>Behavioral processes</td>
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<td>1. BP $\to$ SE</td>
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<td>2. BP $\to$ SOC</td>
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<td>3. SE $\to$ SOC</td>
<td>.384**</td>
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<td>Decisional balance</td>
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<td>1. DB $\to$ SE</td>
<td>-.307**</td>
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*Note.* BP = behavioral processes, SE = self-efficacy, SOC = stages of change, DB = decisional balance. *$p < .05$, **$p < .01$.}
DISCUSSION

This study was conducted to define the mediating effects of self-efficacy in TTM. The study results revealed the mediating effects of self-efficacy on the relationship between behavioral processes and stages of change, and between decisional balance and stages of change. The current study found partial mediation of self-efficacy in those behavioral processes and decisional balance remained significant when influences of self-efficacy were eliminated in the third equations. The partial mediating effects of self-efficacy indicated the operation of multiple mediating factors (Baron & Kenny, 1986). Wagner, Burg, & Sirois (2004) found that within the framework of TTM, increasing social support was associated with advancing stages among adult smokers. Therefore, it is assumed that social support may have played a mediating role within the framework of TTM.

The current study results were consistent with previous studies that used TTM in explaining exercise behavior targeting the Korean elderly (Carson, Taenzer, Koopmans, & Casebeer, 2003; Kim et al., 2000; King et al., 1996). Kim et al. found that self-efficacy mediated the relationship between processes of change and stages of change of exercise behavior, while Carson et al. found that decisional balance was predictive of smoking cessation at 3-month follow-up and King et al. found that the impact of decisional balance on stages of change was mediated through self-efficacy. They indicated decisional balance as a predictor mediated through self-efficacy and claimed that decisional balance parallels with positive and negative attitudes. Other than mediator effects of behavioral intention on the relationship between attitudes and behavior (Ajzen & Fishbein, 1980), mediators that reduce the discrepancy between attitudes and behavior have not been explored extensively (Beech, Rice, Myers, Johnson, & Nicklas, 1999; Chan, Sarna, Wong, & Lam, 2007). Investigation of the mediating roles of self-efficacy between attitude and behavior may provide valuable information to increase our understanding of the mechanisms of behavior change. Future studies should attempt to identify variables that mediate attitude–behavior relationships for various types of behaviors in order to provide clues for effective intervention strategies.

The current study found that only behavioral processes were significantly associated with stages of change. Lazarus & Folkman (1984) classified two types of coping strategies: problem-focused coping (PFC) and emotion-focused coping (EFC). They defined PFC as thoughts and actions aimed at managing, changing, or solving a problem, which is comparable to behavioral processes in TTM. They defined EFC as processes aimed to decrease emotional distress, which is similar to experiential processes. Consistent with the current study results, Lindberg (2000) found that PFC was significantly associated with condom use and mediated by self-efficacy, while EFC did not significantly affect behavior of condom use.

Experiential processes were not significantly associated with stages of change, or this was not mediated by self-efficacy, in the current study. It appeared that self-efficacy was more closely related to behavioral coping than to emotional coping. Wagner, Myers, & McIninch (1999) suggested that PFC is more effective in situations where one’s volitional control is high, while EFC is more beneficial when situations are beyond one’s control. Willis & Hirky (1996) found that those who utilized PFC routinely were more likely to overcome problems with substance abuse. Regarding smoking cessation, where behavior is often executed under one’s volitional control, self-efficacy effectively mediates behavioral coping and helps to adopt and maintain smoking cessation, while for those dominantly using experiential processes (emotion-focused relief-oriented coping), self-efficacy appears to be irrelevant to achieving smoking cessation.

The results of the current study suggest that self-efficacy should be included in smoking cessation programs so as to stimulate benefits (pros) of and to diminish costs (cons) of smoking cessation and to emphasize use of behavioral coping strategies in various tempting situations. The use of decisional balance and behavioral processes through enhanced self-efficacy will improve the adoption and maintenance of smoking cessation. This study tried to explore
the relationships among TTM variables in the smoking cessation situations. The study results will provide valuable information regarding how each predictor variable is connected and path through adoption of smoking cessation behavior. By understanding mechanisms of behavior change, health professionals could develop effective smoking cessation interventions with consideration of roles of self-efficacy in the smoking cessation.

Most of the previous studies that used TTM to investigate smoking cessation behavior have explored the relationships between stages of change and other variables (Chang, Kim, Kil, Seomun, & Lee, 2005; Son, 2005). However, efforts to illuminate the mediating roles of self-efficacy with smoking stages of change have not been examined. Chang et al. found that self-efficacy, processes of change, and decisional balance were significant predictors of smoking cessation and that none of the experiential processes, other than self-reevaluation, was significantly associated with smoking stages of change among Korean adolescents. Their study results were congruent with the current study result that behavioral processes, decisional balance, and self-efficacy were significant predictors of stages of change among adolescent smokers in Korea, while experiential processes were not significant.

The current study measured five stages of smoking cessation using the URICA scale. Measurement of the stages of change has presented significant challenges across various health behaviors, and multiple measures have been used to classify individuals into stages including URICA. The URICA scale was able to divide the individuals into subgroups that are consistent with the description of the five stages (DiClemente et al., 2004).

The current study recruited participants from three schools in two Korean cities. Therefore, the generalizability of the results may be limited to male current and ex-smokers in Korean high schools, and it may be inappropriate to make inferences to the wider population. Another limitation is the cross-sectional nature of the study method, with relationships between the concepts identified in the current study being associational rather than truly predictive.

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REFERENCES


