

Testing the Multi-Theory Model for initiation and sustenance of smoking cessation at Kathmandu Metropolitan City, Nepal: A cross-sectional study

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Abstract

Introduction: Smoking and use of other tobacco products are a global public health threat. The objective of the study was to predict the initiation and sustenance of smoking cessation (SC) by applying the multi-theory model (MTM) of health behavior change.

Methods: In a cross-sectional study, the face-to-face interview was conducted by visiting different public places and coffee shops in Kathmandu Metropolitan, Nepal. A 30-item valid and reliable MTM-based survey instrument was administered to the participants who smoked cigarettes. Stepwise multiple regressions were conducted to explain SC behavior. The entire value of the Cronbach alpha coefficient (α) of the subscales and the scale was 0.91 which is excellent internal consistency.

Results: A total of 132 participants completed the study (93.6%). The median age of participants was 35.53 years and 75% of them were males. The median number of cigarettes smoked per day was 7. Behavioral confidence ($\beta = 0.06$, $P = 0.02$) and changes in the physical environment ($\beta = 0.11$, $P = 0.01$) were significant predictors for the initiation of SC. Next, emotional transformation ($\beta = 0.25$, $P < 0.001$) was a significant predictor for sustenance for SC.

Conclusion: MTM has the usefulness to assess both the initiation and sustenance behavior of SC. Potential solutions using MTM constructs should be developed in future interventions to change behavior of SC.

KEY WORDS: Initiation; Multi-theory Model; smoking cessation; sustenance.

Riassunto

Introduzione: Il fumo di sigaretta ed il consumo di altri prodotti a base di tabacco rappresentano una minaccia per la sanità pubblica globale. L'obiettivo di questo studio è stato quello di prevedere l'inizio ed il mantenimento della cessazione dal fumo applicando il modello multi teorico (MTM) dei cambiamenti dei comportamenti salutari.

Metodi: Con uno studio trasversale, interviste faccia a faccia sono state condotte presso differenti spazi pubblici e coffe shop nella città metropolitana di Kathmandu, in Nepal. Uno strumento per la survey con 30 item basato sul modello MTM è stato somministrato ai partecipanti che fumavano sigarette. Regressioni multiple stepwise sono state condotte per spiegare il comportamento relativo alla cessazione del fumo. Il valore complessivo del coefficiente alpha di Cronbach (α) per le varie sottoscale ed il questionario è risultato pari a 0.91 con ciò indicando un'eccellente consistenza interna.

Risultati: Un totale di 132 partecipanti ha completato lo studio (93.6%). L'età mediana dei partecipanti era di 35,53 anni ed il 75% erano maschi. Il numero mediano delle sigarette fumate era pari a 7 al giorno. La fiducia nel comportamento ($\beta = 0.06, P = 0.02$) ed i cambiamenti nell'ambiente fisico ($\beta = 0.11, P = 0.01$) sono risultati predittori significativi per l'inizio della cessazione del fumo. Quindi, la trasformazione emotiva ($\beta = 0.25, P < 0.001$) è risultato essere un predittore significativo per il mantenimento della cessazione del fumo di sigaretta.

Conclusioni: Il modello MTM si è dimostrato utile per valutare sia l'iniziazione che il mantenimento del comportamento relative alla cessazione del fumo di sigaretta. Potenziali soluzioni usando i costrutti del MTM dovrebbero essere sviluppati in futuri interventi per modificare la cessazione del fumo.

TAKE-HOME MESSAGE

The policymakers and clinicians can apply the Multi-Theory Model to understand both long- and short- term behavior changes such as smoking cessation also in low-income countries.

Competing interests - none declared.

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INTRODUCTION

Smoking and use of other tobacco products are a global public health threat. It is responsible for premature mortality among 8 million people every year and is one of the leading risk factors for non-communicable diseases (NCDs) [1]. Studies reveal that only a few people understand the health risks of tobacco use. For example, only 38% of Chinese smokers knew smoking causes coronary heart disease [1]. Most of the tobacco users want to quit smoking and regret forever having started [2]. Only 26 high-income countries (HICs) have comprehensive smoking cessation (SC) programs to assist tobacco users. There are quitline services available in many low-income countries [1, 3]. Since NCDs account for 67% of deaths in low-and-middle-income countries (LMICs), there is an urgent need for effective smoking cessation programs [2, 4].

There are many benefits of smoking cessation (SC). The mortality rates for smokers who stop smoking before 35 years of age are similar to those who never smoked [5]. SC helps for reducing pathogenic processes leading to chronic obstructive pulmonary diseases (COPDs) and cancers. SC also helps to reduce the risk of cardiovascular disease morbidity or mortality with or without coronary heart diseases [6]. In the United States, 68% of smokers want to quit smoking and 55% of smokers tried to quit smoking in the past year [7]. Nearly half of the smokers tried to quit smoking in the past year in Nepal [8]. Effective intervention programs play a significant role in the reduction of smoking in both HICs and LMICs. There are two major strategies for intervening with smokers either in the community or in clinical settings: i) counseling and ii) pharmacotherapy. There are three methods of counseling: Individual, group, and telephone. Pharmacotherapy includes: i) nicotine replacement such as patch, gum, lozenge, inhaler, and nasal spray; ii) non-nicotine are bupropion SR and varenicline. There is variation in the success rates of each approach with a clear need for improvement [9]. However, a review of pharmacothe-

rapies found that none of them were able to promote long-term SC [10]. A meta-analysis revealed that young adults can be motivated and benefited from the evidence-based SC treatment who seeks cessation treatment [11]. There are several theories to execute health behavior changes. The multi-theory model (MTM) is one of the innovative models that apply a fourth-generation framework to predict short- and long-term modifications of health behavior through the different education processes (Figure 1). The theory divides behavior change into two components: i) initiation and ii) sustenance [12, 13]. There are three constructs for initiation of behavior change: a) participatory dialogue is the two-way communication on advantages and disadvantages of the health behavior change; b) behavioral confidence is an assurance in one's ability to perform a behavior change despite various challenges such as without the symptoms of nicotine withdrawal; c) changes in the physical environment involves exposure, accessibility, and obtainability of resources that contribute tangibly to change in behavior. Next, the sustenance of behavior change has three constructs: a) emotional transformation is the ability to convert feelings into goals for behavior change; b) practice for change involves constantly thinking of behavior change and making rectifications to one's strategy, overcoming barriers, and remaining focused on health behavior change; c) changes in a social environment is forming social support that helps for behavior change [12, 13].

This study tested MTM in predicting the initiation and sustenance of smoking cessation among adults living in a low-income country where 27,137 people died due to smoking and constituted 14% of all deaths [18]. This investigation provides empirical evidence to inform the development of a future intervention for smoking cessation among those who smoke in Nepal.

Few studies have tested MTM for SC. Recently, two studies conducted in Iran revealed the use of MTM helps to reduce water pipe smoking among male adolescents by increasing perceived benefits of quitting, enhancing

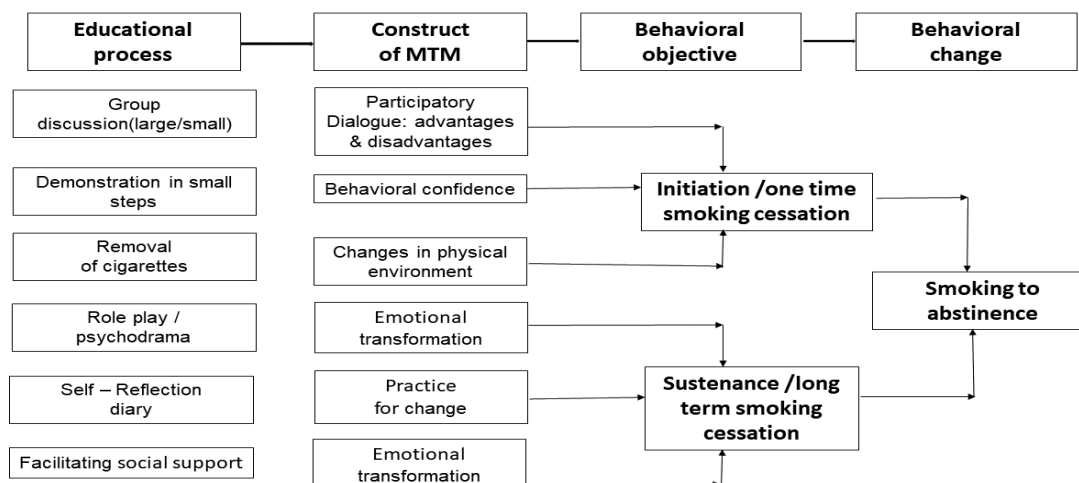


Figure 1. Diagrammatic presentation of Multi-Theory Model for smoking cessation in adults [12, 13].

behavior confidence, and managing positive emotional towards reducing smoking [14, 15]. A study conducted in the USA showed the MTM has effectiveness for predicting initiation and sustenance of SC behavior [16]. Another study from a mental health clinic in the USA also revealed participatory dialogue, behavioral confidence, practice for change, and social environment are predictors for intensification for substance cessation [17]. Such a study has not been yet conducted in low-income countries where the burden of tobacco and deaths is heaviest [1].

METHODS

Study design and participants

A cross-sectional study design was adopted for this study. The research was carried out in Kathmandu Metropolis of Kathmandu district of Nepal, where tobacco products are easily available. The study population was the current smokers above 16 years of age who had smoked cigarettes in the last seven days prior to the interview and willing to participate in the study. Since there is no availability of the sampling frame for smokers in the country, the purposive sampling technique was adopted. Using G*Power, a priori calculation, at an alpha of 0.05, power of 0.80, an estimated effect size of 0.08 (medium), 3 predictors in each model, and 2 covariates for regression modeling yielded 141 participants. After excluding

missing values and non-responses, the study analyzed 132 responses (93.6%) [16, 19].

Study instruments and measures

The anonymous, structured English version questionnaire was used for data collection. The face-to-face interview was conducted by visiting different public places and coffee shops in Kathmandu Metropolitan where it was easy to access the smokers. The data was collected by the two enumerators from February to May 2018. The smokers who met the inclusion criteria were included in the study. It took 25-30 minutes to complete a questionnaire.

The semi-structured questionnaire contained three major sections: a) Demographic information; b) smoking behavior; c) constructs of MTM (related to behavioral change and practice). A 41-items smoking cessation questionnaire was applied using relevant literature on tobacco smoking and health behavior research. The first 11 items were related to demographic characteristics and smoking behavior. The instrument is valid and reliable in an American sample [16]. The remaining 30 items of the questionnaire assessed constructs of MTM. The detail information on each item is given below:

Demographic Information

It contains information on age (years), sex (male/female), ethnicity (upper caste, relative

advantages, relatively disadvantaged and socioeconomically disadvantaged and others), education (10 years, 10+2 years, Bachelors, Masters, and Ph.D.), annual income and working status (yes/no).

Smoking behavior

It covers information on smoking cigarettes in the last seven days, the number of cigarettes smoked per day, and the use of smokeless products.

Initiation and Sustenance of smoking cessation

Initiation of smoking cessation entails starting with the decision to quit smoking and sustenance entails attaining abstinence [12, 13]. Both items were rated as: Not at all likely (0), somewhat likely (1), moderately likely (2), very likely (3), and completely likely (4) [12, 13].

Participatory dialogue

It contains information on the advantages and disadvantages of smoking cessation. Advantages have five questions related to benefits of smoking cessation (i.e. be healthy, able to save money, get sick less often, smell better, & enjoy life more) and disadvantages also have five questions related to difficulties on smoking cessation (i.e., not able to relax as well, not able to socialize as well, miss it, not be able to overcome the urge and loss friends). Both advantages and disadvantages were rated as: Never (0), almost never (1), sometimes (2), fairly often (3), very often (4). The possible total score ranged between 0 and 20. The higher score of advantages and the lower score for disadvantages was hypothesized to be associated with the likelihood of initiation of smoking cessation or behavior change. The participatory dialogue was the score that was obtained by subtracting the score of disadvantages from advantages. Its value ranged from 20 to 20 [12, 13].

Behavioral confidence

It contains five questions related to the surety

of confidence regarding smoking cessation, i.e. ability to quit smoking this week, ability to quit smoking this week and complete all work-related tasks, ability to quit smoking this week and feel relaxed, ability to this week without getting anxious, and ability to quit smoking this week without getting withdrawal symptoms. The responses of each item were rated as: Not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4). The possible total score range was 0 to 20. Higher the score more likelihood of initiation of smoking cessation [12, 13].

Changes in the physical environment

It contains three questions related to surrounding environments that help to quit smoking, i.e. ability to get rid of all cigarettes from one's environment this week, the ability not to buy cigarettes this week, and the ability to substitute smoking time with something else this week. Each item response was rated as: Not at all sure (0) to completely sure (4). The possible total score range was 0 to 12. Higher the score more the likelihood of initiation of smoking cessation [12, 13].

Emotional transformation

It contains three questions related to emotions that help to quit smoking, i.e. ability to direct one's emotions/feelings to the goal of being smoke-free every week, ability to motivate oneself to be smoke-free every week, and ability to overcome self-doubt in accomplishing the goal of being smoke-free. Each item response was rated as: Not at all sure (0) to completely sure (4). The possible total score range was 0 to 12. Higher the score more chances of initiation of smoking cessation [12, 13].

Practice for changes

It has three questions related to practice for change that helps quit smoking, i.e. ability to keep a self-diary to monitor smoking urge every week, be smoke-free every week when encountered with barriers and change plan for being smoke-free every week if difficulties were faced. Each item response was rated

as: Not at all sure (0) to completely sure (4). The possible total score range is 0 to 12. Higher the score more chances of sustenance of smoking cessation [12, 13].

Changes in the social environment

It has three questions related to the probability of getting social support from family members, friends and health professionals, i.e. ability to get the help of a family member to be smoke-free every week, ability to get the help of a friend to be smoke-free every week and the ability to get the help of a health professional to be a smoke-free every week. Each item response was rated as: Not at all sure (0) to completely sure (4). The possible total score range is 0 to 12. The higher score associated with the sustenance of smoking cessation [12, 13].

Ethical aspects

The ethical clearance was obtained from the institutional review committee of Kathmandu Medical College, Nepal. The objectives were initially explained to the selected participants and confidentiality was maintained. The participation was completely voluntary and no personal identifiers were collected. The written informed consent was taken and requested to provide correct information.

Statistical analysis

Collected data were coded and entered into CS Pro 7.0 software and analyzed using STATA SE Version 12. Categorical data are presented as numbers and percentages and interval data as the range (Min-Max), median and interquartile range (IQR). The stepwise regression analysis was performed to identify the best possible predictors of smoking cessation behavior change, i.e. initiation and sustenance while controlling the demographic characteristics. The significance level was set at $P < 0.05$. Cronbach's alpha (α) was computed to determine the internal consistency of the questionnaire. The coefficient of the scale as a whole and the subscale are presented in the result section. The minimum value of α coefficient 0.7 or higher is recommended

as acceptable and below 0.5 as unacceptable [20-21].

RESULTS

Table 1 describes the demographic characteristics of the participants. Nearly 8 in 10 smokers were male and the majority of them belong to the age group 25-35 years, i.e. 6 in 10. The median age of respondents was 30 years (IQR: 18-38). Nearly 7 in 10 belong to upper caste and 8 of 10 had either a Bachelor or Master's degree. More than 50% of the smoker annual income was more NRS 200 thousand or more. The median number of cigarettes smoked per day was 5 (IQR: 1-12) and median years of smoking was 7 (IQR: 1-18) (data not shown in table).

Table 2 depicts both descriptive statistics and Cronbach alpha for the initiation and sustenance of smoking cessation. The median score for different constructs was ranged from 1 to 16. The highest median value was 14 (IQR: 11-16) and the lowest median values were in the changes in physical environment 3(0-7), practice for change 3(6-9), and changes in the social environment 3(5-7). For participatory dialogue, the median score was 4 (2-7). The entire value of the Cronbach alpha coefficient (α) of the subscales and the scale was 0.91, which is excellent internal consistency. The value of α for participatory dialogue for advantages and disadvantages were 0.74 and 0.73 respectively, i.e. acceptable internal consistency. There is an excellent internal consistency for behavioral confidence ($\alpha = 0.96$), changes in the physical environment ($\alpha = 0.96$), and emotional transformation ($\alpha = 0.95$). The value of α for the practice of change and changes in social-environmental was 0.88 and 0.74 respectively, which shows good internal consistency.

Table 3 depicts the results of stepwise logistic regression for the initiation and sustenance of smoking cessation. It shows 48% of the variance in the initiation of smoking cessation is explained by behavioral confidence and changes in the physical environment ($F(2,129) = 60.51, P < 0.001$). Likewise, 54% of the variance in the sustenance of smoking cessation

Table 1. Demographic characteristics of respondents ($n = 132$).

Demographic Characteristics	Frequency (%)
Sex	
Male	104 (78.8)
Female	28 (21.2)
Age (years) *	
17-20	13 (9.8)
20-25	20 (15.2)
25-30	39 (29.5)
30-35	45 (34.1)
35-40	15 (11.4)
Ethnicity **	
Upper caste	88 (66.7)
Relatively advantaged	28 (21.2)
Relatively disadvantaged	10 (7.58)
Socioeconomically disadvantaged and others	6 (4.5)
Education	
10 years	4 (3.0)
10+ 2 years	13 (9.9)
Bachelor	56 (42.4)
Master	55 (41.6)
PhD	4 (3.0)
Currently Working	
Yes	100 (75.8)
No	32 (24.2)
Annual Income (NRs)	
<50,000	3 (2.3)
50,000-100,000	3 (2.3)
100,001-150,000	3 (2.3)
150,001-200,000	14 (10.6)
>200,000	77 (58.3)

* Median age = 30 years (IQR: 18-38)

**Upper caste (Brahmin, Chhetri); Relatively advantaged (Newar); Indigenous disadvantaged groups (Magar, Tamang, and Rai); and Socioeconomically Disadvantaged (Dalit).

is explained by emotional transformation $F(1,130) = 157.14, P < 0.001$.

DISCUSSION

The purpose of this study was to apply the multi-theory model of health behavior change to predict the initiation and sustenance of smoking cessation among smokers of Nepal. Our study suggests the MTM model works well not only in high-income countries but also in low-income countries. This theory has

been applied in different areas to change health behavior such as to predict: SC, water drinking instead of sugar-sweetened beverages, adequate sleep, physical activities, and dietary patterns. The findings of these studies revealed MTM theory significantly predict for both initiation and sustenance of behavior changes [12, 14, 16, 17, 22-26]. The reliability coefficient of each construct in this study is ≥ 0.7 indicates constructs are acceptable which

Table 2. Descriptive statistics of study variables related to the initiation and sustenance of smoking cessation ($n = 132$).

Constructs	Possible Range	Median (IQR)	Cronbach's alpha
Initiation	0-4	1 (0-3)	
Participatory dialogue: advantages	0-20	14 (11-16)	0.74
Participatory dialogue: disadvantages	0-20	9 (6-12)	0.73
Participatory dialogue: advantages - disadvantages score	-40	4 (2-7)	-
Behavioral confidence	0-20	5 (2-14)	0.96
Changes in physical environment	0-12	3 (0-7)	0.96
All constructs of initiation model			0.9
Sustenance	0-4	1 (0-2)	
Emotional transformation	0-12	5 (3-8)	0.95
Practice for change	0-12	3 (6-9)	0.88
Changes in social environment	0-8	3 (5-7)	0.74
All constructs of sustenance model	-	-	0.76
Entire	-	-	0.91

Table 3. Parameter estimates based on stepwise regression analysis to predict the initiation and sustenance of smoking cessation ($n = 132$).

Variables	B	95% CI	P-value
Initiation *			
Behavioral confidence	0.06	0.01-0.19	0.020
Changes in physical environment	0.11	0.03-0.28	0.010
Sustenance **			
Emotional transformation	0.25	0.21-0.28	<0.001

*Initiation: $R^2 = 0.48$, $F(2,129) = 60.51$, $p < 0.001$. Removed variable from the model: advantages outweighing disadvantages (participatory dialogue) ($p=0.49$), and work status (yes/no) ($P=0.19$)

** Sustenance: $R^2 = 0.54$, $F(1,130) = 157.14$, $p < 0.001$. Removed variable from model: changes in the social environment ($p=0.28$), practice for change ($p=0.09$)

is consistent with previous studies [12, 16]. For the initiation of SC, the constructs of behavioral confidence and changes in the physical environment were significant predictors of smoking cessation. Smoking behavior and the MTM constructs for behavioral change and change in the physical environment explained 48% of the variance in the initiation of SC. Both MTM constructs demonstrate a positive relationship with initiation for smoking cessation which is consistent with a previous study [12]. The findings from the rural area of Kentucky revealed that behavioral confidence is significantly associated with smoking cessation [12]. Other MTM studies related to physical activities, sugar-sweetened beverages, and sleep also revealed that behavioral confidence has consistently emerged as a significant predictor of initiation of smoking

cessation [23–25]. Behavioral confidence of MTM was derived from Bandura's self-efficacy and Ajzen's perceived behavior control [13, 27, 28]. The previous studies showed that perceived behavioral control and self-efficacy increase smoking cessation behavior [16, 28]. Our study reveals that changes in the physical environment played a significant role in SC. This means the ability to get rid of all cigarettes from the environment, the ability to refrain from buying cigarettes, and the ability to substitute smoking time with something else which is derived from Bandura's social cognitive theory [12–28]. Previous studies on SC shows a change in the physical environment is not statistically significant but found significant in physical activities and drinking water instead of sugar-sweetened beverage [12, 22, 24]. The environmental factors in a

combination of individual, family, and community factors play an important role in generating differences in health behavior across the countries [29].

Two-way communication between person facilitating smoking cessation and a person who wants to quit in which the facilitator tries to underscore the advantages of quitting over the disadvantage item, i.e. participatory dialogue. It helps to predict for SC as well as evaluation of intervention in individuals and groups. This is the first step of initiation of SC which is derived from Freire's model of adult education [13]. The uniqueness of this model is two-way communication which is not found in the trans-theoretical and health belief model. However, our study shows participatory dialogue is not statistically significant for the initiation of SC. Though knowledge is essential for health behavior change, there are a lot of questions about how knowledge should be learned, represented, and justified [30].

In the present study, only emotional transformation is a significant predictor of sustenance of SC and accountable for 54% of the variance which is high for behavioral studies. This is consistent with the previous study and can be contributed to long-term SC [16]. Contrary to this study, other studies related to MTM have shown practice for a change and changes in the social environment are associated with other health behaviors such as small portion size, physical activities, and plain water con-

sumption [24–26]. It may be due to unwillingness to i) monitor their smoking habit by maintaining dairy and ii) social stigma related to smoking habits [31]. It is also further supported by a median score (Md = 3) which is very low.

The study has some limitations. First, the cross-sectional design of our study does not allow us to establish a causative relationship between smoking behavior and constructs of MTM. Second, the study adopted non-probability sampling which lacks generalization and representation of the population. Third, the respondents' mood during the interview might affect the outcome of the study. Finally, this study does not include confounding variables such as environmental factors and nicotine dependence which might influence the findings.

CONCLUSION

This study provides a framework for implementing MTM to decrease the prevalence of population who smokes in the community, colleges, and hospitals. The findings from this study recommend that the MTM can be utilized for both initiation and sustenance of SC. The future interventions based on MTM should develop modalities to incorporate behavioral confidence, changes in the physical environment, and emotional attachment for behavior change for both initiation and sustenance of SC.

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