Factors Predicting Smoking Behavior Through Multilevel Interventions in the Royal Thai Army Conscripts

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Objective: *To determine factors predicting smoking behavior through multilevel interventions in the Royal Thai Army Conscripts.*
Material and Method: *The present study was a part of quasi-experimental research designed to evaluate the effectiveness of smoking cessation program based on ecological model for improving smoking behavior among the conscripts in the three levels of behavior change interventions; intrapersonal level, interpersonal level and organizational level. The 89 participants were purposively selected from the first infantry regiment of conscripts who were current smokers from the King's Royal Guards recruited into the Army in the first section of the year 2009 and put into a trial run-through of the three influential factors process throughout the first six months. The instruments used to collect data was a self-administered questionnaire used between May 2009 and November 2009. In addition, the individual interviews and checklists of observations were employed to collect data related to organizational intervention. Data mining classification was used to predict the influential factors improving smoking behavior after the end of smoking cessation program at six months.*
Results: *The conscripts were able to change their smoking behaviors. 62.9% of participants reduced smoking, and 4.5% could quit smoking. Data mining analysis showed self-efficacy in intrapersonal level was the crucial variable to predict smoking behavior which correctly classified in the model 77.78%, subsequently, behavioral factors, e.g., duration of smoking and the number of cigarettes smoked per day. Additionally, organizational intervention also had an influence on the change of smoking behavior by strengthening the policy related to tobacco control, setting smoke free workplace and supporting from the commander. For interpersonal intervention, family support alone did not improve their smoking behaviors.*
Conclusion: *Self-efficacy and organizational intervention can help the conscripts improve their smoking behaviors during service in the army.*

Keywords: *Predicting factors, Smoking behavior, Multilevel interventions, Conscripts*

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Cigarette smoking remains the number one preventable cause of morbidity and mortality among Thai people. According to a report from Global Adult Tobacco Survey in 2011 revealed that 13 million adults were current smokers (24.0%). The smoking rate among male was 46.6% and female 2.6%. Fifty-four percent of current smokers planned to or were thinking about quitting[1]. In the year 2012, the smoking rate decreased slowly (21.36%). However, smokers who were adolescents and young adult changed in smoking rates slowly and occasional smokers were increasing[2]. The study of Bundhamcharoen et al[3] indicated that people with aged 30 years and older died from smoking related diseases approximately 12% of total causes of death, for example, chronic obstructive pulmonary disease, lung cancer, cardiovascular disease and other cancers. Moreover, the report of international health policy program, Ministry of Public Health revealed that smoking is the leading cause of death of Thai people around 48,244 cases per year[4].

Cigarette smoking prevalence was relatively higher among military employees than in the general population[5,6]. The high frequency risk group were the military non-commissioned officers and privates[7]. The

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prevalence of smoking rate in the Royal Thai Army Personnel was 30.5-41.2%[8,9]. Conscripts are young adult or late adolescent who have higher smoking rates. By reviewing historical data, the prevalence of smoking among the conscripts in Thailand was higher than 50%[10,11].

Smoking cessation is described as a process. Smokers become motivated to change, decide to change, and finally they manage to change. There are many factors that predict smoking cessation and relapse; socio-demographic factors, physiological, behavioral, and psychosocial factors. Thus, there is a need for a thorough understanding of how these factors contributing to smoking cessation and relapse. For socio-demographic factors, older age found to be significant predictors of smoking cessation. In addition, a younger age of starting smoking before 20 years of age was associated with a reduced probability of cessation or lower quit rates and educational level is a strong predictor of smoking and quitting among the adult population[12]. For behavioral factors, cigarettes consumption, past quit attempts, method for quitting, alcohol consumption had influenced for quitting. The evidence showed that number of cigarettes smoked per day, duration of smoking and number of pack years were predictors of cessation and relapse[13]. Additionally, a greater number of previous quit attempts was negatively associated with successful cessation[14]. For physiological factors, nicotine dependence measures were significantly associated with quitting and intention to quit among current smokers and daily smokers. Withdrawal Symptoms and Craving were also a major role in precipitating relapse[15]. For psychological factors, the previous studies showed that motivation to quit, stress and depression, attitude toward smoking, self-efficacy, self-esteem and social support can influence the successful quitting[16,17]. Evidence showed that self-efficacy was a predictor of smoking and relapse[18]. For environmental factors, social context, peer and family influences, including smoking ban were also influence to cigarette smoking and quitting[19]. Although attempts to quit smoking are common among young smokers, only a few are successful[20]. A recent review concluded that the determinants of young adult cessation are not well understood. The study for determining factors of smoking behavior which were extracted after smoking cessation intervention have been found less. Data mining can use to predict hidden predictive information from large data base through database management and analyze data from different perspectives and summarizing it into useful information[21]. Data mining tools predict future trends and behaviors, knowledge-driven decisions. In data mining, a decision tree is a predictive model which can be used to represent both classifiers and regression models. Therefore, the objective of the present study was to determine factors that improve smoking behavior in each conscript after they had received multilevel interventions based on ecological model by analyzing with data mining. The benefit of the study is useful for planning effective smoking cessation intervention to support the conscripts to improve their smoking behaviors in the next time.

Material and Method

The analyzed data was part of an application of ecological model for improving smoking behavior among the conscripts in the Royal Thai Army and was approved by the Ethics Committee for Human Research, Mahidol University (MUPH2009-098). The study was performed from May 2009 to November 2009 in 89 Army conscripts of the first infantry regiment of the King's Royal Guard who received three levels intervention: intrapersonal, interpersonal and organizational level. The conscripts were recruited following the inclusion criteria which consisted of those who have smoked before entering the military and still smoked when entered basic military training. The exclusion criteria did not recruit the smokers who had a higher addiction to nicotine. At baseline, 105 conscripts who were current smokers attended in smoking cessation program. After six months, 15.3% of them retired from the unit, therefore only 89 conscripts remained in this study. The conscripts were in three stages of change; pre-contemplation stage, contemplation stage and preparation stage. The intervention in intrapersonal level consisted of seven sessions of package intervention based on processes of change in Transtheoretical model (TTM). For interpersonal level, social support from the family was used to give support to the conscripts either by training the family via face to face or telephone along with booklets from the researcher. The organizational level intervention was designed to support activities following policy, rule or regulation for quitting smoking by the company commander of the military unit.

The research instruments consisted of the questionnaires for data collection, and the instrument for smoking cessation intervention. The questionnaires used in this study were socio-demographic data, stages of change algorithm of Di Clemente et al (1991)

decisional balance; evaluation of the perception of pros and cons of smoking which was translated from the decisional balance of Velicer et al (1985) and adapted to be suited for the conscripts, self-efficacy to control smoking behavior was translated and adapted from the self-efficacy/temptations scale from Velicer, Di Clemente & Rossi et al (1990), social support to control smoking behavior; evaluation about the conscripts' perceived support from the parent and significant others which was translated and adapted from Partner Interaction Questionnaire (PIQ) of Mermelstein et al (1986). Content Validity were approved by six specialists and three experts checked content validity of smoking cessation guidelines. The questionnaires were tested reliability in the conscripts of the 3rd infantry battalion. Cronbach's Alpha Coefficient of pros and cons of smoking, self-efficacy to control smoking behavior, social support to control smoking behavior and attempt to quit behaviors had coefficient of 0.8261, 0.9123, 0.8870 and 0.8171 respectively.

Data were collected by questionnaire at onset and six months after intervention.

The data consisted of smoking behavior, stages of change, decisional balance (pros and cons of smoking), perceived self-efficacy to control smoking behavior, perceived social support to control smoking behavior and attempts to quit smoking. Checklist observation was used to evaluate activities at the organizational level.

Statistical analysis

Waikato Environment for Knowledge Analysis or WEKA Data mining analysis (version 3.4.3) was used to analyze which factors contributed to improve smoking behavior among the conscripts after program implementation. Data were analyzed by using data mining classification. The Weka's module, J48 classifier algorithm was employed for the construction of the C4.5 decision tree. Before analyzing the data, initial data-mining which attributed to code by studying histograms of values. Histograms of each attribute were examined to determine natural groupings of values into categories. Data set in this study which were described by attributes (variables) consisted of 20 nominal attributes run in the program. The outcome variable was taken as the dependent attribute. The main outcome analyzed was smoking behavior of the conscripts which consisted of two variables; one was quit and reduce smoking, another was smoking the same as at baseline or increase smoking. The attributes to explain or predict smoking behavior were selected from literature review which included socio-demographic status, history of smoking such as duration of smoking, a number of cigarettes smoked per day and past quit attempts, types of military company, types of intervention in organizational level and interpersonal level. The organizational level intervention could separate into two types; good organization and fairly good organization. The interpersonal level consisted of two types of social support which the researcher trained the conscripts' families via face to face with booklet and telephone with booklet. All conscripts received intrapersonal level intervention similarly. The variables from the outputs of intrapersonal level and interpersonal level were put into the program. The outputs of intrapersonal level consisted of the change of categorized scores of pros of smoking, cons of smoking, perceived self-efficacy to control smoking behavior, and attempt to quit behavior when compared between baseline and six months, stages of change at baseline and six months were also run in the program. The output of interpersonal level intervention was the change of categorized scores of perceived social support to control smoking behavior between baseline and six months.

Results

Majority of the conscripts came from the North-Eastern region of Thailand. 47.2% were 21 years with the average age 20.94 years. They finished secondary education (39.3%), followed by primary education (30.3%). Most of them were single (80.9%). They started smoking between 13 to 15 years old (46.6%), more than half of them have been smoking for four to six years (51.6%). They were daily smokers (85.1%). They smoked 6-10 cigarettes with an average 12.51 cigarettes per day. 61.8% of the sample reported having experiences of quitting and 75.5% of them tried to quit attempts one to three times.

From Fig. 1 consisted of 20 attributes (variables) were three shortage leaf node applied to model I that would be concluded in Rule 1 to Rule 3. The overall prediction was correctly classified 59.09%.

Rule 1: If the conscripts smoked cigarettes $\leq$5 years and smoked $\leq$10 cigarettes per day, they would have a higher chance to reduce and quit smoking.

Rule 2: If the conscripts smoked cigarettes $\leq$ 5 years and smoked $\leq$10 cigarettes per day and they have changed of pros of smoking from baseline, they would have a higher chance to reduce and quit smoking.

Rule 3: If the conscripts smoked cigarettes > 5

years and smoked 21-40 cigarettes per day, they would have a higher chance to reduce and quit smoking.

The result from Model 1 revealed that duration of smoking and the number of cigarettes smoked per day could predict smoking behavior in reducing and quitting. Therefore, the conscripts who smoked for a few years and were mild smokers that smoked cigarettes less than and equal to 10 cigarettes/day would improve their smoking behaviors.

Fig. 2 showed the result of Model 2 which 11 variables were run to predict smoking behavior; socio-demographic, experiences of smoking and stages of change at baseline and six months. The short armed of leaf node presented the result of Rule 4 which was similar to Model 1. The overall prediction in this model was correctly classified 64.15%.

Rule 4: If the conscripts smoked less than and equal to five years, they would have a change to reduce and quit smoking. This rule showed the important of duration of smoking to improve smoking behavior. The shorter they smoke, the more they reduce and quit smoking.

Fig. 3 showed Model 3 consisted of 7 variables which focused on the three levels intervention and the outputs of cognitive and behavior change. The variables were types of organizational intervention, social support, output of intrapersonal level; pros of smoking and cons of smoking, perceived self-efficacy to control smoking behavior, attempt to quit behavior and output of interpersonal level; perceived social support to control smoking behavior. There were three rules in this model and the shortest leaf node when compared with other models. The overall prediction was correctly classified 77.78%. The sensitivity and specificity of this model were 90.0% and 51.7%, respectively. This model was the best model which could explain the variables to predict smoking behavior much more other models that shown in the percentage of prediction correctly was higher than Model 1 and Model 2. The model emphasized in intervention and outputs which did not include socio-demographic and behavioral variables.

Rule 5: If the conscripts have changed of perceived self-efficacy to control smoking behavior increasing from baseline, they would have a higher chance to reduce and quit smoking.

Rule 6: If the conscripts have not changed of perceived self-efficacy to control smoking behavior and received social support by training via face to face with booklet, they would have a higher chance to reduce and quit smoking.

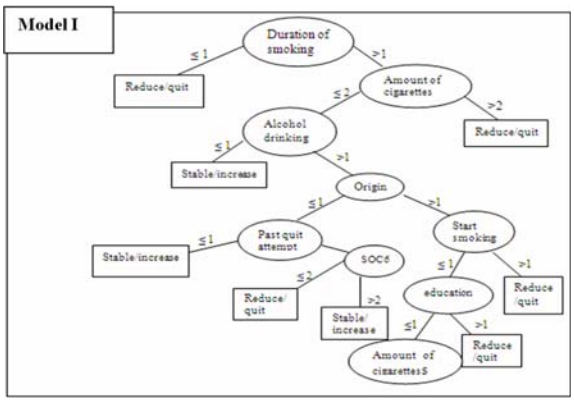

Fig. 1 Decision tree rules of Model 1.

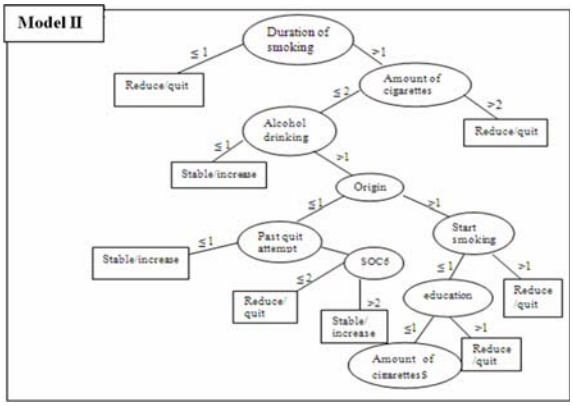

Fig. 2 Decision tree rules of Model 2.

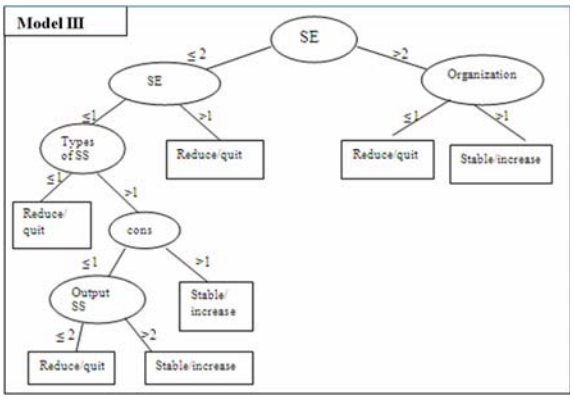

Fig. 3 Decision tree rules of Model 3.

Rule 7: If the conscripts have changed of perceived self-efficacy decreasing from baseline and received fairly good organization, they would have a

higher chance to reduce and quit smoking.

Model 3 suggested that perceived self-efficacy was the main predictor to improve smoking behavior. The conscripts who had perceived self-efficacy scores higher after intervention would have a higher chance to reduce and quit smoking. Additionally, in case of self-efficacy have not changed, social support by face to face training could contribute changing smoking behavior. For those, who have self-efficacy decreased at six months could change their smoking behavior if they received organizational intervention, even though it was a fairly good organization. Therefore, organizational intervention could affect to improve smoking behavior with self-efficacy.

Discussion

The present study indicated that the main predictive variables to improve smoking behavior were perceived self-efficacy and duration of smoking. Model 3 was likely to be the best model because it was correctly classified 77.78% which was higher than other models. The conscripts who have perceived self-efficacy scores increase from baseline would have a higher chance to reduce and quit smoking. The result of self-efficacy was supported with the previous studies[22,23]. Self-efficacy in the present study was measured by temptation to smoke in three categories of situations characterized by being either positive/social, negative /affective, or habit/addictive. The conscripts have increased perceived self-efficacy to avoid smoking in some situations that encouraged them to have temptation to smoke such as "staying with smokers", "when they have a party or stress situation", "when they are having a drink". They could control themselves not to smoke in those situations. Therefore, self-efficacy is a cognitive determinant which should be considered to mediate improvement in the smoking cessation program.

In addition to Model 3, if the scores of perceived self-efficacy have not increased, the conscripts would have a higher chance to reduce and quit smoking when they received good and fairly good organizational intervention and received social support from the family. Good organizational level intervention referred to the organization in which the commander created smoke free environments, including the policy regarding tobacco control and the activities to support the conscripts to quit smoking. This finding is consistent with Borland et al[24] that smoking bans in the workplace showed a reduction of cigarette consumption. Additionally, the effect of smoke free workplaces policies on cigarettes consumption was associated with a reduction in absolute prevalence of 3.8% and a decrease in consumption of 3.1 cigarettes/day per continuing smoker[25].

The result of behavioral factors, duration of smoking was the significant variable to predict smoking behavior, followed by the number of cigarettes smoked per day. The conscripts who smoked less than and equal to 5 years would have a higher chance to reduce and quit smoking. It was consistent with Agudo et al[13] that the number of cigarettes smoked per day, duration of smoking and number of pack years were predictors of cessation and relapse. For cigarette consumption, the number of cigarettes smoked per day was the additional variable in the model which was consistent to the previous studies[26,27].

Data mining classification can show users to understand and interpret the results from the model. A decision tree is a predictive model which can be used to represent both classifiers and regression models and referred to a hierarchical model of decisions and their consequences. A classification itself, performed by using methods like logistic regression, neural networks and others. The results from the models can create the methods both scientific and clinical implication, decision support systems and mass customization of health behavior interventions[28]. It is suitable for a large data set which users can put many independent variables run in the program to extract the predictive variable. In the present study, it showed each variable that influenced each conscript to change smoking behavior, so the researcher would know the factors and interventions that affect the conscripts to improve their smoking behavior.

In conclusion, self-efficacy is the crucial variable to improve smoking behavior in the present study; therefore the intervention to increase self-efficacy is essential to help the smokers to change their smoking behaviors, such as techniques instruction from mastery experience, verbal persuasion and emotional arousal, including practice refusal skill. The policy ban on smoking during basic military training (BMT) and creating smoke free environments in the military unit should be continued for tobacco control to support the conscripts to reduce or quit smoking, and eventually it can reduce the smoking rate of a number of soldiers who smoke in the Army.

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Potential conflicts of interest

None.

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ปัจจัยทำนายพฤติกรรมการสูบบุหรี่ผ่านการปฏิบัติการหลายระดับในทหารกองประจำการกองทัพบก

พรรณี ปานเทวัญ, มณฑา เก่งการพานิช

วัตถุประสงค์: เพื่อค้นหาปัจจัยทำนายพฤติกรรมการสูบบุหรี่ในทหารกองประจำการกองทัพบก

วัสดุและวิธีการ: การศึกษานี้เป็นส่วนหนึ่งของการวิจัยกึ่งทดลองเพื่อประเมินประสิทธิผลของโปรแกรมการเลิกสูบบุหรี่ โดยประยุกต์แบบจำลองเชิงนิเวศ 3 ระดับ; ระดับบุคคลระหว่างบุคคลและระดับองค์กร ตัวอย่างเป็นทหารกองประจำการผลัดที่ 1/2552 กรมทหารราบที่ 1 มหาดเล็กรักษาพระองค์ ที่สูบบุหรี่จำนวน 89 นาย ได้รับโปรแกรมการเลิกสูบบุหรี่ในเวลา 6 เดือน เก็บรวบรวมข้อมูลโดยใช้แบบสอบถามก่อนการได้รับโปรแกรมใน เดือนพฤษภาคม พ.ศ. 2552 และหลังสิ้นสุดโปรแกรมในเดือนพฤศจิกายน พ.ศ. 2552 และใช้การสัมภาษณ์และสังเกตตามแบบบันทึกรายการเพื่อประเมินผลลัพธ์ในระดับองค์กร วิเคราะห์ข้อมูลหาปัจจัยทำนายพฤติกรรมการสูบบุหรี่ด้วยการทำเหมือง ข้อมูลแบบการจำแนกภายหลังสิ้นสุดโปรแกรมเลิกสูบบุหรี่เมื่อเวลา 6 เดือน

ผลการศึกษา: *ทหารกองประจำการที่เป็นกลุ่มตัวอย่างสามารถปรับเปลี่ยนพฤติกรรมการสูบบุหรี่โดย 62.9% สามารถลดปริมาณการสูบบุหรี่และ 4.5% สามารถเลิกสูบบุหรี่ได้ การวิเคราะห์เหมืองข้อมูลพบว่าโมเดลที่สามารถทำนายการปรับเปลี่ยนพฤติกรรมการสูบบุหรี่ ในการเลิกและลดการสูบบุหรี่ได้ดีที่สุด คือ ตัวทำนายด้านการรับรู้ ความสามารถในตนเองโดยพยากรณ์ได้ 77.78% รองลงมาคือ ระยะเวลาการสูบบุหรี่และปริมาณการสูบบุหรี่ต่อวัน การจัดกิจกรรมในระดับองค์กรโดยการสร้างความเข้มแข็งด้านนโยบายการควบคุมยาสูบ การจัดสภาพแวดล้อมที่ปลอดบุหรี่และการสนับสนุนจากผู้บังคับบัญชา สามารถช่วยให้ทหารกองประจำการเลิกหรือลดการสูบบุหรี่ได้ การให้แรงสนับสนุนทางสังคมจากครอบครัวหรือญาติพี่น้องเพียงอย่างเดียวในกิจกรรมระหว่างบุคคลไม่ช่วยในการปรับเปลี่ยนพฤติกรรมการสูบบุหรี่*

สรุป: *การรับรู้ความสามารถในตนเองและการจัดกิจกรรมในโปรแกรมระดับองค์กร สามารถช่วยให้ทหารกองประจำการกองทัพบกปรับเปลี่ยนพฤติกรรมการสูบบุหรี่ในทางที่ดีขึ้น*