

การวิเคราะห์เส้นทางปัจจัยที่ส่งผลต่อพฤติกรรมการสูบบุหรี่และระดับการติดยาโคติน ในคนขับรถจักรยานยนต์สาธารณะ จังหวัดสงขลา Path Analysis of Factors Influencing Smoking Behavior and Nicotine Dependence Level among Motorcycle Taxi Drivers in Songkhla Province

นิพนธ์ต้นฉบับ

Original Article

รดาพร สบงกฏ*, จุฑารัตน์ สถิรปัญญา, ณัฏฐวรรต บัวทอง และ วิศรุต ศรีสินทร

Radaporn Subongkot*, Chutarat Sathirapanya, Napakkawat Buathong and Wisarut Srisintorn

คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์ อ.หาดใหญ่ จ.สงขลา 90110

Faculty of Medicine, Prince of Songkhla University, Hatyai, Songkhla, 90110

* Corresponding author: radapornst@gmail.com

* Corresponding author: radapornst@gmail.com

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บทคัดย่อ

Abstract

วัตถุประสงค์: เพื่อศึกษาพฤติกรรมการสูบบุหรี่ และวิเคราะห์เส้นทางปัจจัยที่ส่งผลต่อพฤติกรรมการสูบบุหรี่และระดับการติดยาโคติน ในคนขับรถจักรยานยนต์สาธารณะ จังหวัดสงขลา **วิธีการศึกษา:** เป็นการศึกษาเชิงพรรณนาภาคตัดขวาง กลุ่มตัวอย่างคือคนขับรถจักรยานยนต์สาธารณะในอำเภอเมืองสงขลาและอำเภอหาดใหญ่ที่สูบบุหรี่ ทั้งหมด 90 คน เก็บข้อมูลด้วยแบบสอบถามการสำรวจพฤติกรรมการสูบบุหรี่ แบบทดสอบวัดระดับการติดยาโคติน และแบบประเมินบันไดของความพร้อมในการเลิกสูบบุหรี่ เครื่องมือมีความเชื่อมั่นสูง (ค่าสัมประสิทธิ์แอลฟาของครอนบาค เท่ากับ 0.859, 0.903 และ 0.969 ตามลำดับ) และวิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนาและวิเคราะห์เส้นทางปัจจัย **ผลการศึกษา:** กลุ่มตัวอย่างเป็นเพศชายทั้งหมด ส่วนใหญ่อายุ 51-60 ปี สูบบุหรี่ไม่เกิน 10 มวนต่อวัน (52.2%) และสูบบุหรี่ทุกวัน (91.1%) มักสูบบุหรี่ขณะนั่งพักที่คิวรถจักรยานยนต์ (42.2%) พบว่าโมเดลเส้นทางปัจจัยที่ส่งผลต่อพฤติกรรมการสูบบุหรี่และระดับการติดยาโคตินสอดคล้องกับข้อมูลเชิงประจักษ์ ($\chi^2 = 19.558$, $df = 21$, $\chi^2/df = 0.931$, P -value = 0.549, CFI = 1.000, TLI = 1.000, RMSEA < 0.001, SRMR = 0.057, $R^2 = 0.686$) โดยพฤติกรรมการสูบบุหรี่ในด้านระยะเวลาที่สูบบุหรี่ได้รับอิทธิพลจากอายุ การรับรู้ผลกระทบต่อสุขภาพ การรับรู้กฎหมายห้ามสูบบุหรี่ในที่สาธารณะ ส่วนพฤติกรรมการสูบบุหรี่ในด้านความพยายามเลิกบุหรี่ได้รับอิทธิพลจากการรับรู้กฎหมายห้ามสูบบุหรี่ในที่สาธารณะ และระดับการติดยาโคตินได้รับอิทธิพลจากพฤติกรรมการสูบบุหรี่ในด้านปริมาณการสูบบุหรี่ ความพยายามเลิกบุหรี่ ปัญหาทางด้านสุขภาพหรือโรคที่เกิดจากการสูบบุหรี่ ทศนคติต่อการสูบบุหรี่ และการรับรู้กฎหมายห้ามสูบบุหรี่ในที่สาธารณะ **สรุป:** สามารถนำผลการศึกษานี้เป็นแนวทางจัดโปรแกรมเลิกบุหรี่ให้คนขับรถจักรยานยนต์สาธารณะโดยเน้นการสร้างตระหนักรู้เกี่ยวกับผลกระทบต่อสุขภาพ กฎหมายห้ามสูบบุหรี่ในที่สาธารณะ และส่งเสริมทัศนคติเชิงลบต่อการสูบบุหรี่

Objective: To determine levels of and factors influencing smoking behavior and nicotine dependence level of motorcycle taxi riders in Songkhla province.

Method: This cross-sectional descriptive survey recruited 90 motorcycle taxi drivers in Mueang Songkhla district and Hatyai district. Data were collected by the questionnaire on smoking behavior, the Fagerstrom Test for Nicotine Dependence, and the readiness to quit ladder. These questionnaires had high internal consistency reliability (Cronbach's alpha coefficients of 0.859, 0.903 and 0.969, respectively). The data were analyzed by descriptive statistics and path analysis. **Results:** All participants were male. The majority were 51 - 60 years old, smoked no more than 10 cigarettes per day (52.2%), smoked daily (91.1%), and smoked at the motorcycle taxi queue (42.2%). Factors influencing smoking behavior and nicotine dependence level fit well with empirical data ($\chi^2 = 19.558$, $df = 21$, $\chi^2/df = 0.931$, P -value = 0.549, CFI = 1.000, TLI = 1.000, RMSEA < 0.001, SRMR = 0.057, $R^2 = 0.686$). The smoking duration was influenced by age, health impact perception, and perception of the law prohibiting smoking. The quit attempt was influenced by perception of the law prohibiting smoking. The nicotine dependence level was influenced by smoking amount, the quit attempt, health problem or smoking related diseases, attitude towards smoking, and perception of the law prohibiting smoking. **Conclusion:** The results could be used as a guideline to develop a proper smoking cessation program for motorcycle taxi riders that focuses on awareness of the health issues, the law prohibiting smoking, and the negative attitude towards smoking.

Keywords: path analysis, smoking behavior, nicotine dependence, motorcycle taxi driver

คำสำคัญ : การวิเคราะห์เส้นทาง, พฤติกรรมการสูบบุหรี่, การติดยาโคติน, คนขับรถจักรยานยนต์สาธารณะ

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Introduction

Smoking is one of the preventable causes of disease and death. Smoking affects the health of both smokers and those who are exposed to the secondhand smoke which consequently leads to various diseases such as cardiovascular diseases, cancer, chronic obstructive

pulmonary disease.¹ In addition, it also negatively affects the economy, career, and money wasted on cigarettes and healthcare cost. Each year, the government spends a lot of health care budgets on smokers' medical expenses. According to the World Health Organization, more than 8 million people

die from cigarettes annually, with more than 7 million deaths from direct smoking, while another 1.2 million were those who exposed to secondhand smoke.² According to the 2017 National Statistics Office's Smoking Behavior Survey of Thailand, it was found that there were around 10.7 million smokers (19.1%) in the population aged 15 and over.³ The age range with the highest smoking rate was 25 - 44 years (21.9%), with males 22 times more than females. The population in the south has the highest smoking rate (24.5%). In Songkhla, a province in the south of Thailand, the population ranked the sixth highest smoking rate among the whole country (25.3%). When classified regular smokers into category by occupation, it was found that occupations in transportation and storage categories were the fifth most frequent smokers of all occupations with the motorcycle taxi driver was one of the occupations that falls into this category.³ Motorcycle taxi drivers are a group with a large number of smokers.⁴ Smoking in this group of people not only affect the health of the smoker, but also affects the health of passengers, people commuting on the road, including groups of people who work or live near motorcycle taxi queues. These individuals are likely to be exposed to secondhand smoke and have the same health effects as smokers. There is currently the Vehicle Act, B.E. 2547 (2004) which stipulates that smoking is not allowed while there are passengers on board⁵ and the notification of the Ministry of Public Health, B.E. 2561 (2018) stating that motorcycle taxi and motorcycle waiting points are non-smoking zones.⁶ However, there are still a large number of motorcycle taxi drivers who violate or fail to comply with the law. With a concern that smoking among motorcycle taxi drivers is one of the most important public health problems, there is a need to study the smoking behavior of motorcycle taxi drivers, including factors influencing smoking behavior and nicotine dependence level among motorcycle taxi drivers.

Smoking behavior is considered a risk-taking behavior that can have a wide range of effects, especially effects on health. The mechanism that leads to cigarette addiction is caused by 3 main factors namely an addiction of nicotine contained in cigarette smoke, emotional and psychological addiction and behavioral, social and habitual addiction.⁷ Based on the Health Belief Model, the decision of individuals on the health behavior is a result of the health belief, and factors that are constituents of the health belief pattern including perceived susceptibility, perceived severity, perceived benefits, perceived barriers,

perceived barriers, cues to action which consists of internal triggers such as having a disease or having a health problem and external triggers such as being warned or advised by people in the close circle, modifying factors which are personal factors, psychosocial factors and structural factors such as having knowledge about disease and perceived self-efficacy.⁸

According to relevant literatures, it was found that factors related to smoking behavior were gender, age, domicile, marital status, education level, occupation, monthly income, health status, alcohol consumption, attitude to smoking, awareness of the health effects of smoking, influence from a family member or group of friends, and laws and policies concerning cigarettes.⁹⁻¹⁴ Factors associated with nicotine dependence levels were gender, age at which smoking began, education level, monthly income, marital status, having health problems, inactivity, family influences, smoking behavior and the absence of plans to quit smoking.¹⁵⁻¹⁹

However, from various literature review, no studies have been found focusing on studying the factors influencing smoking behavior and nicotine dependence levels among motorcycle taxi drivers. Therefore, the results obtained from this study will provide a useful basis for the development of a suitable smoking cessation program for motorcycle taxi drivers. The target study population was motorcycle taxi drivers in Songkhla Province. This study aimed to determine levels of and factors influencing smoking behavior and nicotine dependence among motorcycle taxi drivers in Songkhla Province. It was hypothesized that personal factors, attitude toward smoking, perceived smoking's health impacts, perceived laws prohibiting smoking in public places and smoking of close people influenced smoking behavior. It was also hypothesized that attitude toward smoking, perceived smoking's health impacts, perceived laws prohibiting smoking in public places and smoking behavior influenced nicotine dependence levels.

In this study, motorcycle taxi drivers referred to individuals aged 20 years and over who has a motorcycle taxi driver's license with a motorcycle registered as a public service vehicle. Cigarettes meant products containing tobacco leaves or nicotiana plants, and nicotine-containing products, but not including medicines taken by smoking, sucking, sniffing, chewing, eating, applying, blowing, or spraying into the mouth or nose.²⁰ Personal factors included age, underlying disease, and health problems or diseases caused by smoking and alcohol drinking alcohol. Attitude towards smoking meant

the feelings, thoughts, beliefs and values of the participant towards smoking. Perceived smoking prohibition law was defined as the process by which the participants was exposed to stimuli and interpreted them using their existing knowledge, memory and experience resulting in knowledge and understanding about the laws prohibiting smoking in the non-smoking area, smoking area and provisions.

Perceived health impact of smoking was defined as the process by which the participants were exposed to stimuli and interpreted them using their existing knowledge, memory and experiences and resulted in knowledge and understanding on the health impact of smoking on themselves and others. The smoking of people in the close circle referred to the smoking behavior of a person who was close to the participant including parents, close friends and people living in the same household.

For smoking behavior, it was defined as the actions a person performed when exposed to various stimuli or situations related to smoking. Smoking behavior consisted of smoking duration, smoking amount and efforts to quit smoking. Smoking duration was the number of years the participant began to smoke from the beginning to the present, the amount of smoking was the number of cigarettes that the participant smoked on average per day. Attempts to quit smoking was a history of trying to quit smoking for at least 24 hours. Nicotine dependence level was defined as a score measuring an addiction to nicotine using a nicotine dependence level questionnaire. Finally, readiness to quit smoking meant how participants were interested in, or willing and eager to change their behavior to quit smoking.

Methods

In this cross-sectional analytic study, 90 motorcycle taxi drivers who smoked and lived in Mueang Songkhla district and Hat Yai district, Songkhla province, were selected by purposive sampling. They were 20 years old or older, agreed to participate in the study and had a history of having smoked at least 100 cigarettes or more, and still smoked daily or on certain days while participating in this study.

Sample size was estimated based on a proportion of smokers among motorcycle taxi drivers, tricycle drivers and hawkers in Bangkok and Samut Prakarn of 0.448285 (279 out of 622 persons surveyed)⁴ and a population of 1,568 public service motorcycles registered in Songkhla province provided

by the Department of Land Transportation.²¹ Based on the equation of Krejcie and Morgan²², $n = \frac{\chi^2 \cdot N \cdot p \cdot (1-p)}{[e^2 \cdot (N - 1) + \chi^2 \cdot p \cdot (1-p)]}$, acceptable margin of error ϵ of 0.1, and χ^2 of 3.941 corresponding to 95% confidence and a degree of freedom, a sample size of 90 was required.

For path analysis, a sample size should be approximately 5 - 20 times of the number of observed variables.²³ In this study, there were 12 observed variables; hence the required sample size was 60 – 240 participants. Our estimated size of 90 participants sufficed such requirement.

Research instruments

Research instrument was a questionnaire consisting of 3 sections as follows.

First section: smoking behavior and related psychosocial factors.

The participants were asked to provide their **demographic characteristics** with 9 questions, both open-ended and closed-ended questions. Thirteen questions, both open-ended and closed-ended, measuring **smoking behavior** were developed by the researcher. Three questions, both open-ended and closed-ended, measured **smoking of people in a close circle** were taken from a questionnaire of the Tobacco Control Research and Knowledge Management Center²⁴ which was developed from the Global Youth Tobacco Survey.²⁵

Twelve questions to measure **attitude towards smoking** were taken from a questionnaire of the Tobacco Control Research and Knowledge Management Center²⁴ which was developed from the Global Youth Tobacco Survey.²⁵ With a weight of 1 point for each question, the total score was 12 points. Negative and positive attitude was categorized using the method of Best and Kahn criteria²⁶ of which the cut-off value could be obtained by determining the width of the class interval, i.e., highest score - lowest score, divided by the number of intervals. In this study, with the lowest score of 3.24 and the highest score of 12, and 2 intervals of attitude categories (i.e., negative and positive attitudes), score ranges of 3.24 - 7.61 and 7.62 – 12 points indicated negative and positive attitudes towards smoking, respectively.

Eleven questions measuring **perception of law prohibiting smoking** were taken from a questionnaire of the Tobacco Control Research and Knowledge Management Center²⁴ which was developed from the Global Youth Tobacco

Survey.²⁵ With 1 and 0 point given for a yes and no answer, respectively, a total score of 11 points could be obtained. Based on the Bloom criteria²⁷, 3 levels were classified as high, moderate and low perception of law prohibiting smoking, corresponding to a total score of 80% or higher (9 – 11 points), 60 - 79% (7 - 8 points), and less than 60% (0 - 6 points), respectively.

Twenty questions assessing **perception of smoking-related health impact** were taken from the questionnaire of Romket.²⁸ With 1 and 0 point given for a yes and no answer, respectively, a total score of 20 points could be obtained. Based on the Bloom criteria²⁷, 3 levels were classified as high, moderate and low perception of smoking-related health impact, corresponding to a total score of 80% or higher (16 – 20 points), 60 - 79% (12 - 15 points), and less than 60% (0 - 11 points), respectively.

Second section: nicotine dependence

Nicotine dependence was assessed using the 10-item **Fagerstrom Test for Nicotine Dependence (FTND)** which was developed by Fagerström et al²⁹ and translated into Thai by the Thai Health Professional Alliance Against Tobacco.³⁰ With a 1 and 0 point for yes and no answer, respectively, a total score of 10 points could be obtained. Three levels of nicotine dependence were categorized as high, moderate and low level (7 - 10, 4 – 6, and 0 - 3 points, respectively).

Third section: readiness to quit smoking

Readiness for smoking cessation was assessed using the 10-item **readiness to quit ladder** developed by Biener and Abrams³¹ and translated into Thai by Saengchanchai.³² With a 1 and 0 point for yes and no answer, respectively, a total score of 10 points could be obtained. Two levels of nicotine dependence were categorized ready and not ready to quit smoking (7 – 10 and 0 – 6 points, respectively).

Research instrument quality assurance

Psychometric properties of psychosocial scales were tested. Acceptable internal consistency reliability of these scales was found in our study. For each of individual aspects of smoking (smoking behavior, smoking of intimates, attitude towards smoking, perception of the law prohibits smoking, and perception of smoking's health impact), their Cronbach's alpha coefficients were in the range of 0.848 to 0.969, with a coefficient of 0.859 for all individual aspects combined. The

Fagerstrom test for nicotine dependence and the readiness to quit ladder were found to have a high internal consistency reliability with Cronbach's alpha coefficients of 0.903 and 0.969, respectively.

Research ethics

This research project was approved by the Human Research Ethics Committee, Faculty of Medicine, Prince of Songkla University (approval number: REC 63-009-9-4).

Data collection procedure

Data were collected by in-person interview of a total of 90 individuals with a smoking behavior using the questionnaire mentioned above. All participants completed the questionnaire (100%).

Data analysis

Descriptive statistics including frequency with percentage, mean with standard deviation (SD), range, and median with interquartile range were used to summarize demographic characteristics, and all study behavioral and psychosocial variables. The associations between factors influencing smoking behavior and nicotine dependence were tested using path analysis. The model based on hypothesis and evidence was tested for consistency. The criteria for determining the Goodness of Fit Index are as follows: $\chi^2/df < 2$, P -value > 0.05 , Comparative Fit Index (CFI) > 0.9 , Tucker-Lewis Index (TLI) > 0.9 , Root Mean Square Error of Approximation (RMSE) < 0.05 , and Standardized Root Mean Squared Residual (SRMR) < 0.08 . Statistical significance was set at a type I error of 5%. All statistical analyses were performed using the SPSS software version 27 and Stata software version 14.1.

Results

Of the 90 motorcycle taxi drivers in Songkhla province recruited, all of them were male with an average age of 54.81 years (Table 1). Most of them were in their 51 - 60 years of age (42.2%), were married (74.4%), had primary education (57.8%), had a monthly income in the range of 5,001 - 10,000 Baht (65.6%), and had no underlying disease (66.7%). In those 30 participants with underlying disease, most of them had hypertension (21.1%), followed by diabetes (14.4%). The majority had no medications taken regularly (70.0%). For

alcohol drinking behavior, participants with the occasional alcohol consumption were mostly found (44.4%). There were 25.6% of participants with smoking-related health problems or illnesses with cough as the most frequently found symptom (7.8%), followed by fatigue (5.6%) (Table 1).

Table 1 Demographic characteristic of participants (N = 90).

Characteristics	N	%
Gender: male	90	100
Age (year), mean = 54.81 ± 9.22, range = 28 - 77		
21 - 30	1	1.1
31 - 40	4	4.4
41 - 50	23	25.6
51 - 60	38	42.2
≥ 61	24	26.7
Marital status		
Single	10	11.1
Married	67	74.4
Widowed	4	4.4
Divorced	9	10.0
Education level		
Primary school	52	57.8
Secondary school	22	24.4
High school / Vocational certificate	13	14.4
Associate degree/ Higher vocational certificate	3	3.33
Average monthly income (Baht)		
0 - 5,000	5	5.6
5,001 - 10,000	59	65.6
10,001 - 15,000	23	25.6
15,001 - 20,000	3	3.3
Having underlying disease		
No	60	66.7
Yes	30	33.3
Medicines taken regularly		
No	63	70.0
Yes	27	30.0
Alcohol consumption		
Daily	8	8.9
Occasionally	40	44.4
Ex-drinker	12	13.3
No drinking	30	33.3
Health problems or diseases caused by smoking		
No	63	70.0
Yes	27	30.0
Not sure	4	4.4

Smoking behavior

The participants had a mean smoking duration of 28.73 years, and 31.1% had the duration of 31 - 40 years (Table 2). The majority smoked 0 - 10 cigarettes per day (52.2%), smoked daily (91.1%), smoked during the waiting for passengers at the taxi queue (42.2%), smoked factory-made cigarettes (72.2%), had curiosity as the reason of the first trial (58.9%), bought cigarettes from grocery stores (55.6%), smoked at workplace (61.1%), had at least one attempt to quit smoking (63.3%), used the "Cold Turkey" method (46.7%), and faced temptations from the people who smoked as the barrier for smoking cessation (21.1%). The participants

Table 2 Smoking behaviour (N = 90).

Smoking behavior	N	%
Duration (year), mean = 28.73 ± 13.46, range = 1 - 55		
0 - 10	12	13.3
11 - 20	12	13.3
21 - 30	27	30.0
31 - 40	28	31.1
≥ 41	11	12.2
Number of cigarettes currently smoked per day, mean = 15.40 ± 9.49, range = 3 - 50		
0 - 10	47	52.2
11 - 20	33	36.7
≥ 21	10	11.1
Smoking frequency		
Daily	82	91.1
Occasionally	8	8.9
Smoking time		
Morning	13	14.4
During toilet break	6	6.7
After meals	29	32.2
During the waiting for passengers	38	42.2
After work	4	4.4
Type of tobacco products		
Factory made cigarette	65	72.2
Manually prepared cigarette	25	27.8
Reason for trying smoking		
Curiosity	53	58.9
Effort for cool-looking image	2	2.2
Stress relief	14	15.6
Peer pressure	14	15.6
Socialization	7	7.8
Source of tobacco		
Convenient stores	29	32.2
Grocery stores	50	55.6
Others	11	12.2
Location for smoking		
Home	25	27.8
Workplaces	55	61.1
Restaurants	3	3.3
Public places	7	7.8
Quit attempt		
Never	33	36.7
Yes	57	63.3
Number of quit attempt (days)		
median (interquartile range)		2 (1-3)
(lowest - highest)		(0 - 10)
Lo ngest period of quit attempt (days)		
median (interquartile range)		12.5 (7 - 37.5)
Smoking cessation methods		
Cold turkey	42	46.7
Gradually	15	16.7
Never quit	33	36.7
Problem and barrier from previous quit attempt		
Poor mood	13	14.4
Temptation from environment	19	21.1
Stress	13	14.4
Craving	11	12.2
Boredom	1	1.1
Willingness to quit		
No plan	19	21.1
Contemplating with no concrete plan	65	72.2
Plan to quit within 1 month	6	6.7
Motivation for smoking cessation (more than 1 answer was applicable)		
Risk awareness and concern for health	43	47.8
Medical condition, advice from medical professional	17	18.9
Insufficient income	17	18.9
Family's wish	28	31.1
Concern for risk on family members	22	24.4
Law prohibiting smoking in public places	5	5.6
Pictorial warning on package	1	1.1
Others	2	2.2

thought about smoking cessation but lack of a plan (72.2%). The reasons for smoking cessation attempts were the increased awareness of the dangers of smoking and concern for health, followed by family request, and concern for the risk on family members (47.8%, 31.1%, and 24.4%, respectively) (Table 2).

Smoking of people in the close circle

Most participants reported that they had people in the close circle who smoked (76.7%), followed by their fathers who smoked (44.4%), and people living in the same house who smoked (25.6%). Most of their family members were concerned about the dangers of smoking (74.4%).

Attitudes towards smoking

The participants had an average overall attitude score of 7.04 points, with 76.7% and 23.3% of negative and positive attitude towards smoking, respectively.

Perception of laws prohibiting smoking in public places

The participants had an average score of 8.86 points on the perception of laws prohibiting smoking in public places, with 67.8%, 16.7%, and 15.6% of high, moderate and low level, respectively.

Perception of smoking-related health impact

The participants had an average score of 15.47 points for the perceived health impacts with 47.8%, 43.3%, and 8.9% of highly, moderately and poorly perceived health impacts, respectively.

Nicotine dependence level

The participants had a mean overall nicotine addiction score of 4.51 points, and most of them had a moderate, low and high levels (61.1%, 24.4%, and 14.4%, respectively).

The readiness to quit ladder

The participants had an overall readiness to quit ladder score of 4.84 points with 80% and 20% not ready and ready to quit smoking, respectively.

Path analysis of factors influencing smoking behavior and nicotine dependence levels

Based on the initial path analysis model (over identified model) (Figure 1), most of the 12 variables had a positive

correlation coefficient to each other (Table 3). These correlations between all variables were not higher than the specified norm of 0.7³³, so the variables had no problem of multicollinearity.

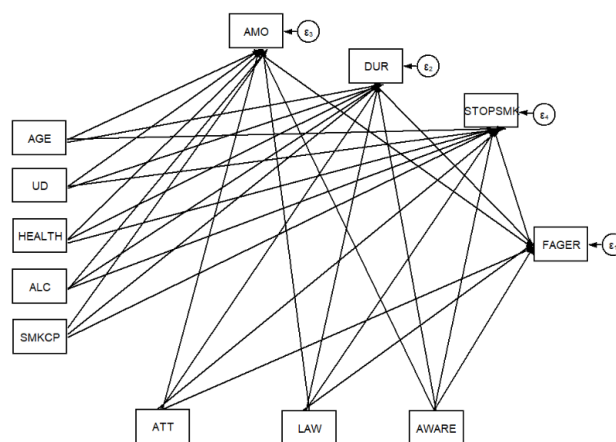


Figure 1 Initial path model of the hypothesized relationships (over identified model).

Note: AGE = Age UD = Underlying disease, HEALTH = Health problems, ALC = Alcohol drinking, SMKCP = Smoking of people in the close circle, ATT = Attitude towards smoking, LAW = Perception of law prohibiting smoking in public places, AWARE = Perception of smoking-related health impacts, AMO = Amount of smoking, DUR = Duration of smoking, STOPSMK = Attempt to stop smoking, FAGER = Nicotine dependence level.

Table 3 Relationships among study variables as indicated by correlation coefficients (N = 90).

	AGE	UD	HEALTH	ALC	SMKCP	ATT	LAW	AWARE	AMO	DUR	STOPSMK	FAGER
AGE	1.000											
UD	0.277 [†]	1.000										
HEALTH	-0.121	0.180	1.000									
ALC	-0.018	0.015	0.190	1.000								
SMKCP	-0.150	0.156	0.241 [*]	0.100	1.000							
ATT	0.000	0.093	-0.042	0.120	0.163	1.000						
LAW	-0.044	0.012	-0.016	0.037	0.025	-0.066	1.000					
AWARE	-0.152	-0.146	0.231 [*]	-0.198	0.214 [*]	-0.080	0.397 [†]	1.000				
AMO	-0.033	0.008	0.079	0.080	0.090	0.055	0.092	0.028	1.000			
DUR	0.411 [†]	-0.059	-0.117	-0.037	-0.058	-0.025	-0.155	0.126	0.081	1.000		
STOPSMK	-0.011	0.071	0.068	-0.018	0.030	0.143	0.181	0.173	0.329 [†]	0.196	1.000	
FAGER	-0.026	-0.029	0.096	0.137	0.192	0.211 [*]	0.042	0.089	0.608 [†]	0.120	0.026	1.000

[†] P-value < 0.01, * P-value < 0.05.
Note: AGE = Age UD = Underlying disease, HEALTH = Health problems, ALC = Alcohol drinking, SMKCP = Smoking of people in the close circle, ATT = Attitude towards smoking, LAW = Perception of law prohibiting smoking in public places, AWARE = Perception of smoking-related health impacts, AMO = Amount of smoking, DUR = Duration of smoking, STOPSMK = Attempt to stop smoking, FAGER = Nicotine dependence level.

Parameter estimation of the model

Path analysis showed that the significant pairs of correlations (i.e., P-value < 0.05) were duration of smoking and age (DUR <--- AGE), duration of smoking and perception of the law prohibiting smoking in public places (DUR <--- LAW), duration of smoking and perception of smoking-related health impact (DUR <--- AWARE), nicotine dependence level and smoking amount (FAGER <--- AMO), nicotine dependence level and attempt to quit smoking (FAGER <--- STOPSMK), and the level of nicotine dependence and attitudes towards smoking (FAGER <--- ATT) (Figure 2 and Table 4).

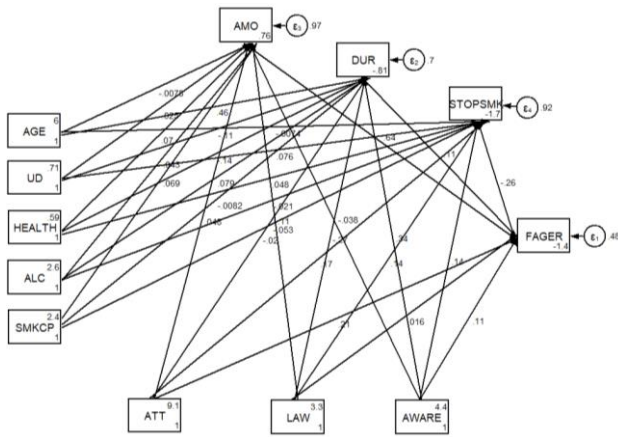


Figure 2 The results of the model parameter estimation and coefficient estimation.

Note: AGE = Age UD, = Underlying disease, HEALTH = Health problems, ALC = Alcohol drinking, SMKCP = Smoking of people in the close circle, ATT = Attitude towards smoking, LAW = Perception of law prohibiting smoking in public places, AWARE = Perception of smoking-related health impacts, AMO = Amount of smoking, DUR = Duration of smoking, STOPSMK = Attempt to stop smoking, FAGER = Nicotine dependence level.

Table 4 Standardized regression weights of the initial hypothesized model.

Variable correlation	Regression Coefficient (Estimate)	S.E.	C.R. (t value)	P-value
DUR				
DUR <--- AGE	0.463	0.082	5.62	< 0.001
DUR <--- UD	-0.108	0.099	-1.09	0.274
DUR <--- HEALTH	-0.137	0.099	-1.38	0.167
DUR <--- ALC	0.079	0.096	0.83	0.408
DUR <--- ATT	-0.02	0.091	-0.22	0.824
DUR <--- LAW	-0.274	0.096	-2.86	0.004
DUR <--- AWARE	0.337	0.105	3.2	0.001
DUR <--- SMKCP	-0.008	0.097	-0.08	0.933
constant	-0.806	1.139	-0.71	0.480
AMO				
AMO <--- AGE	-0.008	0.112	-0.07	0.944
AMO <--- UD	-0.025	0.117	-0.22	0.828
AMO <--- HEALTH	0.07	0.118	0.6	0.551
AMO <--- ALC	0.043	0.113	0.38	0.706
AMO <--- ATT	0.048	0.107	0.45	0.652
AMO <--- LAW	0.108	0.117	0.93	0.354
AMO <--- AWARE	-0.038	0.13	-0.29	0.769
AMO <--- SMKCP	0.069	0.114	0.61	0.544
constant	0.759	1.365	0.56	0.578
STOPSMK				
STOPSMK <--- AGE	-0.007	0.109	-0.07	0.945
STOPSMK <--- UD	0.076	0.113	0.67	0.504
STOPSMK <--- HEALTH	0.048	0.114	0.42	0.676
STOPSMK <--- ALC	-0.021	0.11	-0.19	0.848
STOPSMK <--- ATT	0.169	0.102	1.66	0.098
STOPSMK <--- LAW	0.139	0.113	1.23	0.217
STOPSMK <--- AWARE	0.137	0.125	1.1	0.273
STOPSMK <--- SMKCP	-0.053	0.111	-0.48	0.633
constant	-1.719	1.293	-1.33	0.184
FAGER				
FAGER <--- DUR	0.108	0.077	1.4	0.163
FAGER <--- AMO	0.638	0.059	10.78	< 0.001
FAGER <--- STOPSMK	-0.258	0.077	-3.37	0.001
FAGER <--- ATT	0.214	0.072	2.97	0.003
FAGER <--- LAW	0.016	0.083	0.2	0.845
FAGER <--- AWARE	0.108	0.081	1.33	0.182
Constant	-1.367	0.795	-1.72	0.086

With certain insignificant relationships based on the initial hypothesized model (Figure 1? Figure 2? and Table 4), such insignificant paths were omitted and retested. This resulting parsimonious model showed that significant correlations

included the duration of smoking and the perception of smoking-related health impact (DUR <--- AWARE), duration of smoking and age (DUR <--- AGE), duration of smoking and the perception of the law prohibiting smoking in public places (DUR <--- LAW), attempt to quit smoking and the perception of the law prohibiting smoking in public place (STOPSMK <--- LAW), attitudes towards smoking and health problems (ATT <--- HEALTH), perception of smoking-related health impact and perception of the law on prohibiting smoking in public places (AWARE <--- LAW), nicotine dependence level and attempt to quit smoking (FAGER <--- STOPSMK), nicotine dependence level and attitudes towards smoking (FAGER <--- ATT) and nicotine dependence level and smoking amount (FAGER <--- AMO) (Figure 3 and Table 5).

Model fit

This modified model was found to adequately fit the empirical data with the model fit indices of $\chi^2 = 19.558$, $df = 21$, $\chi^2/df = 0.931$, P -value = 0.549, CFI = 1.000, TLI = 1.000, RMSEA < 0.001, and SRMR = 0.057. Specifically, χ^2/df of less than 2, CFI and TLI approaching 1 (> 0.95), RMSEA index lower than 0.05, and SRMR approaching 0.05 all indicated an acceptable modified model (Figure 3). Therefore, the model was consistent with the evidence.

This modified model suggested that age, perception of laws prohibiting smoking in public places and perception of

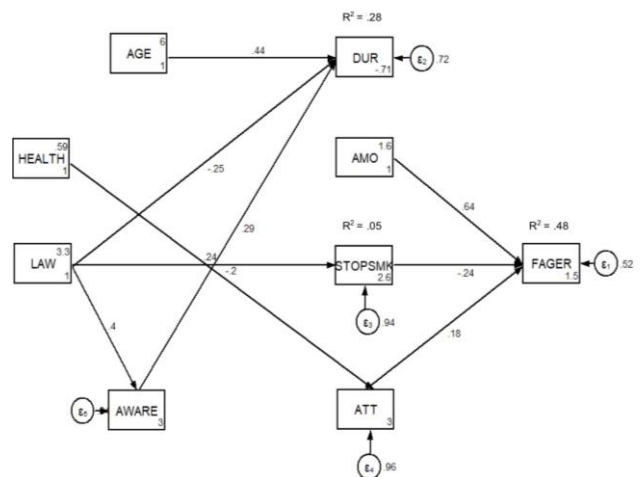


Figure 3 The final path model of factors influencing smoking behavior and nicotine dependence level.

$\chi^2 = 19.558$, $df = 21$, $\chi^2/df = 0.931$, P -value = 0.549, CFI = 1.000, TLI = 1.000, RMSEA < 0.001, SRMR = 0.057, $R^2 = 0.686$.

Note: AGE = Age UD, = Underlying disease, HEALTH = Health problems, ALC = Alcohol drinking, SMKCP = Smoking of people in the close circle, ATT = Attitude towards smoking, LAW = Perception of law prohibiting smoking in public places, AWARE = Perception of smoking-related health impacts, AMO = Amount of smoking, DUR = Duration of smoking, STOPSMK = Attempt to stop smoking, FAGER = Nicotine dependence level.

smoking-related health impacts could explain 28.37% of the variations of duration of smoking (Figure 3). The perception of law prohibition of smoking in public place could explain 5.88% of the variations of attempt to quit smoking. Finally, factors for smoking-related health problems or diseases, smoking amount, attempt to quit smoking, attitudes towards smoking and the perception of law prohibition smoking in the public places could explain 48.33% of the variability in nicotine dependence levels among motorcycle taxi drivers (Figure 3).

Table 5 Standardized regression weights of the modified model.

Variable	Correlation	Regression coefficient (Estimate)	S.E.	C.R. (t value)	P-value
DUR					
DUR <--- AWARE		0.289	0.094	3.07	0.002
DUR <--- AGE		0.436	0.076	5.72	< 0.001
DUR <--- LAW		-0.248	0.093	-2.66	0.008
Constant		-0.714	0.707	-1.01	0.313
STOPSMK					
STOPSMK <--- LAW		0.242	0.098	2.48	0.013
Constant		2.590	0.452	5.73	< 0.001
ATT					
ATT <--- HEALTH		-0.203	0.100	-2.03	0.043
Constant		3.035	0.240	12.63	< 0.001
AWARE					
AWARE <--- LAW		0.397	0.085	4.66	< 0.001
Constant		3.043	0.486	6.27	< 0.001
FAGER					
FAGER <--- STOPSMK		-0.238	0.075	-3.19	0.001
FAGER <--- ATT		0.184	0.075	2.45	0.014
FAGER <--- AMO		0.636	0.052	12.17	< 0.001
Constant		1.531	0.404	3.79	< 0.001

Effects of influencing factors on smoking behavior and nicotine dependence

The smoking behavior of the motorcycle taxi drivers in terms of duration of smoking received highest total positive, direct effect from age (beta = 0.436), followed by a positive, direct effect from the perceptions of smoking-related health impact (beta = 0.289). Duration of smoking also had a total negative effect from the perception of law prohibition smoking in the public places (beta = -0.133) which consisted of a negative, direct effect (beta = -0.248) and a positive, indirect effect (beta = 0.155). Attempts to quit smoking received a positive, direct effect from the perception of law prohibiting smoking in the public places (beta = 0.242).

The nicotine dependence level of the motorcycle taxi drivers received the highest positive effect from the smoking amount (beta = 0.636) which was only a direct effect, followed by a negative total effect from the quit attempts (beta = -0.238) which was from only a direct effect, a total positive effect from the attitude toward smoking (beta = 0.184) which was from only a direct effect, a total negative effect from smoking law

perception (beta = -0.058) which was only an indirect effect, and a total negative effect from the health problems or smoking-related diseases (beta = -0.037) which was only from an indirect effect.

When comparing the study results with the first hypothesis, it was found that only the personal factor of age, a perception of smoking-related health impacts and the perceptions of law prohibiting smoking in public places that influenced smoking behavior. And when compared with the second hypothesis, it was found that only attitude towards smoking, perception of laws prohibiting smoking in public places and smoking behavior that influenced nicotine dependence levels.

Table 6 Path analysis effects (beta) of smoking behavior and nicotine dependence level (N = 90).

Variable	Smoking behavior						Nicotine dependence level		
	Duration of smoking (DUR)			Quit attempt (STOPSMK)			dependence level (FAGER)		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
AGE	0.436	-	0.436	-	-	-	-	-	-
Underlying disease*	-	-	-	-	-	-	-0.037	-0.037	-
Tobacco consumption	-	-	-	-	-	-	0.636	-	0.636
Duration of smoking	-	-	-	-	-	-	-	-	-
Quit attempt	-	-	-	-	-	-	-0.238	-	-0.238
Attitude towards smoking	-	-	-	-	-	-	0.184	-	0.184
Perception of smoking law	-0.248	0.115	-0.133	0.242	-	0.242	-	0.058	0.058
Perception of health impact	0.289	-	0.289	-	-	-	-	-	-

Note: TE= Total effect, DE = Direct effect, IE = Indirect effect.

* Underlying disease or disease related to smoking.

Discussions and Conclusion

From the study result, it was found that the recruited motorcycle taxi drivers in Songkhla were all male. Most of them were 51 - 60 years old, married, with primary education, with an average monthly income of 5,001 - 10,000 Baht, and with a history of occasional drinking. This is in line with the results of the smoking behavior survey of Thai people by the National Statistical Office in the year 2017 which found that most of the smokers were male, had primary school education, and had a history of drinking alcohol.³ It is also consistent with the studies in other countries, finding that the present smokers are male having low education and low monthly income.^{11,13,17}

It was found that factors influencing smoking duration included age, perception of smoking-related health impacts and perception of the law prohibiting smoking. Age had a positive, direct effect on smoking duration which indicates that the older the motorcycle taxi drivers, the longer the duration of smoking. This is consistent with the previous studies which founded that smoking behavior was related to age. Most of

the smokers in their middle age began to smoke since their adolescence age and had a duration of smoking for more than 20 years.¹⁰⁻¹² Perception of smoking-related health impact had a positive influence on smoking duration which indicated that motorcycle taxi drivers with higher perception of smoking-related health impacts would have a longer smoking duration. Despite being well perceived, smoking could remain. This could be because they were not aware of the danger of smoking, were healthy, had no health problems, were unable to successfully quit smoking. As a result, they continued to smoke for a long time. This finding is consistent with a study by Al-Haqwi et al which revealed that even medical students who know well about the dangers of smoking still continued to smoke.³⁴ The perception of law prohibiting smoking in public places had a total negative effect on smoking duration which indicated that in motorcycle taxi drivers who had low awareness of the law prohibiting smoking would have a long smoking duration. This finding is consistent with Laksamon et al which found that the perception of non-smoking laws was significantly related to the smoking behavior of youths.¹⁴

The perception of law prohibiting smoking in public places had a positive, direct effect on quit attempts. This indicated that motorcycle taxi drivers with high perception of law prohibiting smoking would have more attempts to quit smoking than those with low perception of the law. This may result from a difficulty feeling in places where smoking is prohibited which triggers the idea of trying to quit smoking. It could be the result from the perceived law that leads to raised awareness of smoking-related health impacts to those people around them. These could lead to the intention to make attempts to quit smoking. The finding is in line with a study by Goto et al which found that in people with low nicotine dependence level who face a fine from smoking in non-smoking places had more attempts to quit smoking than those with moderate and high nicotine dependence level.¹⁵

Factors influencing nicotine dependence levels were smoking quantity, attitude towards smoking, an attempt to quit smoking, having health problems or disease from smoking and the perception of the law prohibiting smoking in public places. The amount of smoking that had a positive, direct effect on nicotine dependence levels indicated that motorcycle taxi drivers who smoke in a large quantity would have a high level of nicotine dependence level. This finding is in line with the study conducted by Meamar et al. which found that nicotine dependence levels were associated with smoking amount.

Those who smoke in a large quantity would have a high nicotine dependence level.¹⁶ Attitude towards smoking had a positive, direct effect on nicotine dependence levels. This indicated that motorcycle taxi drivers who have a positive attitude towards smoking would have higher nicotine dependence level. This finding is consistent with the study by Thanchanok Ji-Nga which found that attitude toward smoking were significantly correlated with nicotine dependence levels.⁹

Attempts to quit smoking had a negative, direct effect on nicotine dependence level. This indicated that motorcycle taxi drivers who have never tried to quit smoking tend to have higher nicotine dependence levels than those who have. This is in line with a study by Ayo-Yusuf and Omole which found that South African smokers with high nicotine dependence levels would have fewer attempts to quit smoking.¹⁸ However, it is different from the study by Pöld et al which found that nicotine dependence level was not correlated with the number of previous attempts to quit smoking.¹⁹

Having health problems or smoking-related diseases had a negative, indirect effect on nicotine dependence levels. This indicated that motorcycle taxi drivers with health problems or smoking-related diseases would have lower nicotine dependence levels. This may be because health problems or smoking-related diseases make them be more aware of the dangers of smoking. As a result, they try to reduce smoking, leading to low nicotine dependence level. On the contrary, the study by Meamar et al found that nicotine dependence levels were correlated with health problems. Meamar et al showed that heavy smokers who suffer from lung disease or sleep disorder had high nicotine dependence level.¹⁶

The perception of the law prohibiting smoking in public place had a total negative effect which consisted only of an indirect effect on nicotine dependence levels. This indicated that in motorcycle taxi drivers with a low perception of the law prohibiting smoking in public places would have higher nicotine dependence levels. This is in line with a study by Goto et al which found that smoking laws are effective for smokers with low levels of nicotine dependence, but not on smokers with moderate and high nicotine dependence level.¹⁵

Personal factor in terms of age was not correlated with smoking behavior in terms of smoking amount. This is in line with the results from the survey of the smoking behavior in Thai people conducted by the National Statistical Office in the year 2017 which found that smokers of different age groups, whether a group of working-age, elderly or adolescence, all

had a similar smoking amount with an average number of cigarettes smoked per day of 10.4, 9.8 and 8.1, respectively.³ This was in line with the study conducted by Raksuk which found that age was not associated with smoking behavior in terms of the smoking amount.¹² Age was not associated with attempts to quit smoking. In other words, despite older age, they were not aware of the dangers from smoking or they probably did not have any health problems. Therefore, they never attempted to quit smoking. This is in line with some previous studies which found that age was not associated with quitting attempts.^{35,36}

Having underlying diseases, health problems or smoking-related diseases was found not associated with smoking behavior in terms of the smoking duration, smoking amount and attempts to quit smoking. Due to a relatively small number of participants in this study, most of motorcycle taxi drivers did not have underlying diseases or diseases caused by smoking. Hence, no correlation was found. In addition, it could be that their health conditions were not severe enough to require treatment or hospitalization; they did not realize the harms from smoking and continued their smoking behavior without trying to quit or cut down. This is consistent with the study of Charoenchairatana and Phaileakli which found that as high as 43.3% of patients with chronic diseases in Nong Bua Lam Phu province continued to smoke and most of them had no plans to quit smoking.³⁷ Some previous studies which found that having underlying diseases or diseases caused by smoking has a correlation with smoking behavior.^{38,39} Smokers with underlying disease or smoking-related health problems would reduce smoking amount and have more attempts to quit smoking than those with no such problems.

For personal factors regarding alcohol consumption, there was no relationship with smoking behavior in terms of neither smoking duration nor smoking amount and attempts to quit smoking. This could be because most motorcycle taxi drivers drank alcohol occasionally, followed by not drinking alcohol. In addition, only a small portion of them drank regularly. Therefore, no relationship with smoking behavior was found. This is in contrast to some previous studies that alcohol drinking was associated with smoking behavior.^{40,41}

As for the smoking of people in the close circle, no correlation was found with smoking behavior regarding smoking duration, smoking quantity or attempts to quit smoking. This may be due to a relatively small number of participants in our study. Some previous studies found that

smoking of people in the close circle, such as parents, family members and friends was correlated with smoking behavior. People who have smokers in their close circle are at greater risk to smoking and face more difficulty quitting smoking than those without such smokers.⁴²⁻⁴⁴

Awareness of smoking-related health's impact was not associated with smoking behavior regarding smoking amount, quit attempts, or nicotine dependence levels. It could be that motorcycle taxi drivers perceived but did not realize enough about the harmful effects of smoking or nicotine dependence, they did not plan to reduce tobacco use or attempt to quit. In contrast to some previous studies, people who were aware of danger and harmful effects from diseases caused by smoking have less tendency to pick up smoking and have more quit attempts. Nicotine dependence had a direct effect on perception of smoking related health impacts caused by smoking; those with nicotine dependence perceived more about the risk.⁴⁵⁻⁴⁷

Attitude towards smoking was not associated with smoking behavior regarding smoking duration, smoking amount or quit attempt. Despite having negative attitude towards smoking, the majority of motorcycle taxi drivers were still in contemplation stage, had no concrete plan to quit and did not try to reduce amount of smoking, stop smoking or put any attempt to quit smoking. This is in line with some previous studies showing that attitude towards smoking cannot predict smoking behavior.^{48,49}

Perception of law prohibiting smoking in public places was not associated with smoking behavior regarding smoking amount. It could probably be that even though they had high perception of law prohibiting smoking, most of the motorcycle taxi drivers did not comply and still continued to smoke in high amount in a non-smoking area, especially at motorcycle taxi queue or smoking in high amount in a smoking zone. This finding is consistent with the study of Pieroni et al reporting that smoking laws in Italy has no influence on tobacco use among Italians.⁵⁰

Duration of smoking was not associated with nicotine dependence level. Despite smoking for a long time, most of the motorcycle taxi drivers did not smoke more than 10 cigarettes per day. Therefore, no association with nicotine dependence levels was found. This finding is similar to the study of Jhanjee et al which found that nicotine dependence score had no correlation with the duration of smoking.⁵¹

Based on our findings, related parties such as Songkhla Provincial Public Health Office, Muang Songkhla District Health Office, Hatyai District Health Office and other relevant authorities should launch anti-smoking campaign to raise awareness on danger of smoking among motorcycle taxi drivers. In addition, health education about smoking cessation should be organized. Songkhla Provincial Public Health Office, Mueang Songkhla Public Health Office, Hatyai Public Health Office, and other relevant authorities should implement a monitoring measure to refrain people from smoking in non-smoking areas, along with serious punishments. The education institutions and families should strengthen the awareness of the danger of smoking, and build a proper attitude and value for youth, because most of the motorcycle taxi riders started smoking when they were adolescent. In terms of further research, the sample size of the study should be increased and the area should be expanded to cover all districts in Songkhla province or other provinces which may have different demographic profiles.

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