Original Article

Expectations and Satisfaction in the Use of the Smartphone Smoking Cessation Application "Thai Rai Kwan"

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Objective: To assess the expectations and satisfaction for using the "Thai Rai Kwan" smoking cessation smartphone application (TRK-App) and to evaluate its effectiveness in encouraging people to quit smoking.

Materials and Methods: The present was cross-sectional descriptive study. The participants included 112 smokers, 18 years or older who smoked at least five cigarettes a day and had installed the TRK-App in their mobile phone. Data were collected through self-reported questionnaires answered between March and June 2018.

Results: The participants had highest expectations for provision by the TRK-App of adequate smoking cessation information (mean 4.57; SD 0.56) and ease of first-time use (mean 4.51; SD 0.52). Afterwards, the participants' satisfaction was highest for ease of first-time use (mean 4.53; SD 0.51), but lowest for smooth running of the TRK-App. In terms of success in quitting smoking, the seven days point-prevalence abstinence rate at a one-month follow-up was 21.4%.

Conclusion: The TRK-App provided positive results and enabled smokers to quit smoking.

Keywords: Expectation, Satisfaction, Smart phone application, Smoking cessation

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Smoking is a critical risk factor for non-communicable diseases (NCDs) and poses a challenge for sustainable development goals. Based on a national survey in 2017, Thailand had 10.7 million smokers 15 years of age or older (19.1% of the entire Thai population)[1]. Although the smoking rate had declined since 2013, it was still far from meeting the World Health Organization (WHO)'s 9 Global NCD Targets (https://www.who.int/nmh/ncd-tools/definition-targets/en/), in which Thailand must reduce its number of smokers to under 9 million persons (15% of the population) by 2025[2]. Managing the risk factors for smoking behavior requires the participation of all stakeholders[3]. The Guidelines for Implementation of Article 14 of the WHO Framework Convention on Tobacco Control (FCTC) suggested that the parties to the convention should provide a health system to screen smokers and enable smoking cessation treatments in several different forms, ensuring that the service can be accessed by the entire population. The guidelines also emphasized the importance of mass communication programs to encourage and support cessation[4,5]. As a party to the WHO FCTC, Thailand has taken steps to encourage quitting through both supply- and demand-side initiatives that were considered progressive and exemplary. Thailand's initiatives have been replicated in many countries and include the development of treatment guidelines for tobacco dependence in 2009 (updated 2012)[6], the provision of telephone-based smoking cessation service, a toll-free national quitline, which increased the service channels for people who want to quit smoking[7]. The Thai Health Promotion Foundation together with the Health Professional Alliance against Tobacco developed a smartphone program, the "Thai

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Rai Kwan" application (TRK-App) or Smoke-free Thailand application (SFT-App) for people of all ages to connect with smoking cessation services. Since March 2016, the app has been free for download on both iOS and Android platforms.

Previous studies have shown promising results for smartphone apps in helping smokers to quit[8-10]. A review of eight studies by Regmi et al[11] indicated that app users attained a favorable smoking cessation rate of 13% to 24%. In regard to the quality of the smartphone apps, Hoeppner et al[12] conducted a content analysis of 225 Android smoking cessation apps and reported that most did not provide task-specific tools or feedback tailored to fit an individual user's needs. In Australia, Thornton et al[13] reviewed smartphone applications for smoking cessation and found that among 112 applications examined, only six were identified as high-quality. The review also emphasized the need for further research to investigate how to improve the efficacy of smartphone apps in supporting a smoker's desire to quit[13]. Chen et al[14] conducted a similar content analysis of 64 Chinese smoking cessation apps and reported that they had low levels of adherence to the China Clinical Smoking Cessation Guidelines. In summary, in spite of the relatively large number of smartphone smoking cessation applications available to the public, the scientific evidence on their effectiveness is limited.

The present study literature review indicated that the Guidelines for the Implementation of Article 14 of the WHO FCTC recommended that parties pursue innovative approaches to promote tobacco abstinence and continue monitoring and evaluating all tobacco cessation and treatment programs[4,5]. Thus, as a Party to the WHO FCTC, Thailand has an obligation to implement the recommendations of Article 14 and its guidelines, including testing and evaluating new quitting strategies. To date, the effectiveness of the TRK-App, the first mobile phone application for smoking cessation in Thai, is unknown. Therefore, the present study aimed to gather data from a cross-section of the Thai population using the TRK-App and assess their expectations, satisfaction after use, and quitting success rate.

Materials and Methods

Study design and sampling

The present research was performed as a cross-sectional study. The participants were smokers age at least 18 years old, who smoked at least five cigarettes a day regularly, could read and understand the Thai language, and had downloaded the TRK-App between December 2017 and June 2018.

Ethical considerations

For the protection of participants' human rights, the study proposal was approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Sciences Group, Chulalongkorn University (COA No.180.1/60). All participants were provided with information explaining the study's purpose, procedure, and benefits. Those agreed to take part in the study provided electronic informed consent before participation.

Instruments

In the present study, four types of questionnaire were used:

1. A data record form that was used to collect information from the system, including nickname, gender, age, type of tobacco product used (manufactured cigarettes, hand-rolled cigarettes, electronic cigarettes, etc.) and regular places for smoking.

2. A demographic and smoking characteristics questionnaire developed by the researchers and based on review of the literature. This questionnaire assessed the number of cigarettes smoked daily, time of first cigarette after waking up, occupation, and the presence of any known health conditions (yes/no).

3. The expectations and satisfaction questionnaire was also developed by the researchers after careful review of the literature. The questionnaire consisted of thirteen questions, ranked on a Likert rating scale of 1 (least expected/least satisfied) to 5 (most expected/most satisfied), to determine the users' expectations and satisfaction with the convenience, information provided, quality of care, aesthetics and overall ease of use of the TRK-App. The content of the questionnaire was validated by three experts and the expectation and satisfaction parts had Cronbach's alpha values of 0.87 and 0.93, respectively.

4. The quit-smoking questionnaire was modified from a previous study[15] and consisted of three questions. The participants were asked whether: (i) during the past seven days they had continuously abstained from smoking, (ii) they had made any attempt to quit smoking (abstinence for at least 24 hours) after using the TRK-App, or (iii) if they used other smoking cessation method(s) other than the TRK-App.

Data collection

The study was advertised in the general education

Table 1. Participants' characteristics

	n (%)
Sex	
Male	101 (90.2)
Female	11 (9.8)
Age (years) (mean 28.34, SD 10.69)	
16 to 24	54 (48.2)
25 to 44	46 (41.1)
45 to 59	12 (10.7)
Occupation	
Student	35 (31.3)
Currently employed	65 (58.0)
Others (agriculturist, monk, etc.)	12 (10.7)
Number of cigarettes smoked per day	
1 to 10	47 (42.0)
11 to 20	55 (49.1)
>20	10 (8.9)
Time to first cigarette in the morning	
Within 5 minutes	54 (48.2)
6 to 30 minutes	58 (51.8)
31 to 60 minutes	54 (48.2)
>60 minutes	58 (51.8)
Level of nicotine dependence	
Mild	54 (48.2)
Moderate	58 (51.8)

SD=standard deviation

courses and via Facebook. Smokers were encouraged to download the TRK-App and register with the program. If the smokers matched the inclusion criteria, the mobile phone screen would show the participation information sheet and ask for their consent to participate in the study. The TRK-App has seven main features. The first are instructions to help quit smoking. The second feature is the sending of reminder texts at times when smokers frequently light up, such as after a meal, in the rest room, or in areas where smoking commonly occurs. The messages sent by the TRK-App strongly reminded the participants that they were in the process of quitting. The third app function records whether users have smoked or not, while the fourth and fifth share anti-smoking information, images, and videos from social media platforms and provide age-related expense calculations to show the losses that result from smoking. The sixth is the Quitline 1,600 for smoking cessation, which users can call for free expert advice, while the final feature provides directions and access information to the nearest "Fah Sai" (Clear Sky) clinic to get smoking cessation service. After one month, the participants received a message from the TRK-App that invited them to fill out both the satisfaction survey regarding their TRK-App usage and the quit-smoking questionnaire. After responding to the quit-smoking questionnaire, a gift was sent to those participants who agreed to provide a mailing address.

Data analysis

The demographic data and smoking characteristics were analyzed and described as the frequency, mean and standard deviation using the IBM SPSS Statistics software, version 22.0 (IBM Corp., Armonk, NY, USA). The Z-test was also applied to calculate the 7-day point prevalence abstinence rate using the number of participants who downloaded the TRK-App during the data collection period as the denominator.

Results

Data were collected between January and June 2018 from 112 smokers who agreed to participate in the present study. Most participants (90.2%) were male and did not have any known health condition. Almost half (48.2%) were less than 24 years old, while about 40% were 25 to 44 years old. Almost half of the participants smoked 11 to 20 cigarettes a day and 34.8% had their first cigarette 31 to 60 minutes after waking, while 36.6% smoked their first cigarette at least 60 minutes after waking. Data on the number of cigarettes smoked daily and time of first cigarette upon waking were used to calculate the heaviness of smoking index (HSI) score. The HSI score is an extensively used behavioral measure of nicotine dependence[16] and a score greater than four indicates high dependence. In the present study, about half of the participants had HSI scores between 2 and 4, indicating medium nicotine dependence. See Table 1 for descriptive statistics of the study sample.

Expectations before using the TRK-App

Features perceived as having the highest expectation were receiving useful information on how to quit smoking (59.8%), an update for the TRK-App to fix bugs (57.1%), download convenience for initial use (52.1%), user-friendly design (50.9%), coherence between the graphic and the textual contents (50.0%), and a high processing speed and responsiveness (50.0%) (Table 2). Overall, the participants had very high expectations for the TRK-App (mean 4.6; SD 0.5) (Table 3).

Table 2. Users' assessment of the features and use of the TRK-App

Features	Expectation (n=112); n (%)				Satisfaction (n=38); n (%)			
	Very expect	Expect	Quite expect	Little expect	Very satisfied	Satisfied	Quite satisfied	Little satisfied
Efficient information on how to stop smoking	67 (59.8)	43 (38.4)	1 (0.9)	1 (0.9)	19 (50.0)	16 (42.1)	1 (2.6)	2 (5.3)
Update for the TRK-App to fix bugs	64 (57.1)	30 (26.8)	14(12.5)	4 (3.6)	11 (28.9)	6 (15.8)	12 (31.6)	9 (23.7)
Download convenience for initial use	59 (52.7)	52 (46.4)	1 (0.9)	-	20 (52.6)	18 (47.4)	-	-
Friendly use of application design	57 (50.9)	29 (25.9)	26 (23.2)	-	18 (47.4)	10 (26.3)	10 (26.3)	-
Coherence between graphic and text contents	56 (50.0)	54 (48.2)	2 (1.8)	-	22 (57.9)	14 (36.8)	2 (5.3)	-
Processing speed and responsiveness	56 (50.0)	40 (35.7)	15 (13.4)	1 (0.9)	6 (15.8)	8 (21.1)	13 (34.2)	11 (28.9)
Automated message about hazards of smoking	49 (43.7)	61 (54.5)	2 (1.8)	-	16 (42.1)	11 (28.9)	9 (21.1)	3 (7.9)
Usefulness of quit smoking instruction	47 (41.9)	62 (55.4)	3 (2.7)	-	8 (21.0)	15 (39.5)	12 (31.6)	3 (7.9)
Easy-to-understand language use in the app	37 (33.0)	73 (65.2)	2 (1.8)	-	16 (42.1)	20 (52.6)	2 (5.3)	-
Clarity of explanations in the App's instruction	36 (32.1)	62 (55.4)	14 (12.5)	-	14 (36.8)	17 (44.8)	7 (18.4)	-
Smooth running of the App	35 (31.2)	76 (67.9)	1 (0.9)	-	4 (10.6)	7 (18.4)	13 (34.2)	14 (36.8)
Aesthetics of the App	33 (39.5)	53 (47.3)	25 (22.3)	1 (0.9)	16 (42.1)	12 (31.5)	8 (21.1)	2 (5.3)
Overall expectation/ overall satisfaction	70 (62.5)	40 (35.7)	2 (1.8)	-	12 (31.6)	19 (50.0)	5 (13.1)	2 (5.3)

TRK-App="Thai Rai Kwan" application

Table 3. Expectation and Satisfaction Scores for the TRK-App

Features	Expectation			Satisfaction		
	Mean	SD	Order	Mean	SD	Order
Efficient information about how to stop smoking	4.57	0.56	1	4.37	0.79	3
Download convenience for initial use	4.51	0.52	2	4.53	0.51	1
Coherence between graphic and text contents	4.48	0.54	3	4.52	0.60	2
Automated message about hazards of smoking	4.42	0.53	4	4.05	0.98	8
Usefulness of the quit smoking instruction	4.39	0.54	5	3.74	0.89	9
Update for the TRK-App to fix bugs	4.37	0.84	6	3.50	1.16	10
Processing speed and responsiveness	4.34	0.78	7	3.18	1.14	11
Easy-to-understand language use in the App	4.31	0.50	8	4.37	0.59	3
Smooth running of the App	4.30	0.48	9	3.03	1.00	12
Friendly use of application design	4.28	0.81	10	4.21	0.84	5
Clarity of explanations in the App's instruction	4.20	0.64	11	4.18	0.73	6
Aesthetics of the App	4.05	0.74	12	4.11	0.92	7
Overall	4.61	0.53		4.08	0.82	

TRK-App="Thai Rai Kwan" application; SD=standard deviation

Satisfaction after using the TRK-App

Only 38 out of the initial 112 registered smokers responded to the satisfaction questionnaire. Fifty-eight percent of the participants (22/38) were most satisfied with the information and the coherence between the graphic and textual contents, 52.6% (20/38) were most satisfied with the convenience in downloading the app for initial use, and half of the participants were most satisfied with receiving useful information about how to quit smoking (Table 2). The participants' satisfaction was highest for convenience of first-time use (mean 4.53; SD 0.5), but lowest for smooth running of the TRK-App (mean 3.0; SD 1.0) (Table 3).

Smoking quit-rate of those using the TRK-App

Smoking cessation outcome in the present research was evaluated by determining the 7-day point

prevalence abstinence rate at four weeks using both the period protocol and the intention to treat (ITT) analyses. The smoking cessation rate in the period protocol was calculated by dividing the number of participants who said that they did not smoke during the 7-day period by the total number of participants to the abstinence questionnaire after a one month period, following downloading of the TRK-App. Only 38 out of the initial 112 smokers responded to the quit-smoking questionnaire. Out of these 38 participants, 24 reported that they had stopped smoking for seven consecutive days (63.2%). Using the ITT analysis, non-responders were considered as current smokers and the 7-day point prevalence abstinence rate was 29.0%.

Discussion

The study indicated that before using the TRK-App more than half of the participants expressed high expectations of receiving good information about how to quit smoking, updates to fix bugs, a convenient download for initial use and a user-friendly design. In contrast, users had the lowest expectations about the aesthetic features of the TRK-App. After using the TRK-App, most of the participants said they were satisfied with the coherence between the graphic and textual contents, the ease of downloading for initial use and the quality of the information received about how to quit smoking. However, they were less than satisfied with the processing speed, responsiveness, and the smoothness of running of the TRK-App. The present study results were similar to those from a study by Oliver et al[17] that examined the perceptions of the utility of smartphone application features for smoking cessation of 224 daily cigarette smokers. The study found that the feature perceived as the most useful was the gain-frame messages (e.g., "Tells me how much my health is improving each day that I don't smoke").

Comparison of the participants' expectations and satisfaction revealed some disparities in many features, especially the updates to fix bugs, processing speed, responsiveness, and smoothness of operation. Overall, it can be said that the satisfaction of the participants with the TRK-App was lower than their expectations. The results suggest that the service providers or relevant parties need to improve the TRK-App to better fit the users' needs. It may be that the low satisfaction with the processing speed and operation may have caused the number of users completing the smoking cessation questionnaire to be less than the number initially enrolling in the study. The comments from some users of iOS smartphones posted as reviews on the TRK-App store website were revealing: "[I] logged in but immediately the App restarted automatically. It seems that it is not stable." (User Review, 1 June 2017), "[I] logged in with Facebook but the App restarted when I selected the types of cigarette." (User Review, 11 August 2017). These problems could be a result of the iOS operating system being Version 1.0 (not updated), whereas the Android operating system was updated to Version 1.0.4 on 28 March 2018.

Although the participants' satisfaction with the TRK-App did not correspond very well to expectations, it can be concluded that overall, the participants were highly satisfied with the TRK-App. These results were consistent with a randomized, double-blind pilot study, comparing two other smoking cessation Apps (SmartQuit and QuitGuide) and involving 196 smokers, age 18 and older, who smoked more than five cigarettes a day. The study participants stated that they were very satisfied with both apps and that the applications helped them to quit smoking[8].

The seven-day point prevalence abstinence rate at four weeks in the present study was 63.2% (24/38 persons) but applying the ITT method gave a seven-day point-prevalence rate at one month of 21.4% (24/112). Although, only 38 participants returned the smoking cessation questionnaire, which was less than the researchers' expectations, the results suggested that the TRK-App can help smokers to quit successfully. One reason for the good abstinence rate in the present study was likely that the participants were not heavy smokers. Around half of the participants (51.8%) had only moderate nicotine dependence and strong intentions to quit smoking, and they were not using smoking cessation medication or nicotine supplements. At the same time, by using the TRK-App the participants received encouraging messages to quit, in the form of texts warning them of the health hazards of smoking.

The abstinence rate in the present study was consistent with previous research findings. The pilot study mentioned previously, which evaluated the SmartQuit and QuitGuide apps, reported quit rates of 8% to 13%[8]. Likewise, the preliminary evaluation of the SmokeFree 28: SF28 app in a U.K. study found that the abstinence rate for 28 or more continuous smoke-free days after using the 'SF28' App was 18.9%[9]. In the U.S., a single-arm clinical trial evaluated the effectiveness of the Clickotine app among a population of 18- to 65-year-old who smoked

at least five cigarettes a day. Using principle ITT analysis, the seven-day point prevalence abstinence rate measured at the eighth week was 45.2% (n=188), while the 30-day self-reported abstinence rate from smoking at the eighth week was 26.2% (n=109)[10]. Finally, the abstinence rate in the present study fell within the same range as reported in a review of eight studies on smoking cessation apps, in which the smoking cessation rate among users of these apps ranged from 13% to 24%[11].

Conclusion

To the best of the authors' knowledge, the present study is the first to evaluate and compare the expectations and subsequent satisfaction with the TRK smoking cessation smartphone app. However, the study's results were limited by the poor retention of participants over the complete period of the study, which reduced the number of app users available for assessment. The study also suffered from time and budget constraints, which prevented an analysis of the most used operating system among the users who downloaded the TRK-App. In spite of these drawbacks, the findings demonstrate that the TRK-App provided positive results and enabled smokers to quit smoking. Smoking cessation applications clearly have a great potential for reaching the largest number of smokers[17]. Healthcare providers such as nurses and physicians who have significant roles in promoting progressive smoking cessation methods and helping people to quit smoking, should be among the first to adopt effective smoking cessation applications like TRK-App as a useful new tool for smokers. The authors recommend the TRK-App be updated to fix the user satisfaction problems and be more widely publicized to ensure its availability to the greatest number of Thai people. In addition, comparison of participants' expectation and satisfaction with regard to their demographic and smoking characteristics should be explored in order to design and develop the smoking cessation application that meet target users. Suggestions for the next phase of research include assessing the level of smoking cessation after using the TRK-App for six months in conjunction with measurement of biological markers such as cotinine levels and exhaled carbon monoxide.

What is already known on this topic?

The Guidelines for the Implementation of Article 14 of the WHO FCTC recommended that parties pursue innovative approaches to promote tobacco abstinence and continue monitoring and evaluating all tobacco cessation and treatment programs.

What this study adds?

The "Thai Rai Kwan" smoking cessation smartphone application (TRK-App) provided positive results and enabled smokers to quit smoking.

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Conflicts of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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