# Korean American Smokers' Perspectives on Mobile Smoking Cessation Applications

Joonwoo Moon[iD], Julaine S Rigg and Janice E Smith

Morgan State University, Baltimore, MD, USA.

**ABSTRACT**

**INTRODUCTION:** The primary purpose of this research is to investigate the adoption process of mobile smoking cessation apps for Korean American smokers with the eventual purpose of proposing a new combined model of smartphone smoking cessation adoption.

**METHODS:** From September 2018 to March 2019, a total of 227 Korean American smokers responded to surveys regarding the effectiveness of mobile applications for smoking cessation. A path analysis was used to analyze the predictors of adopting and using smoking cessation applications available via smartphones.

**RESULTS:** Perceived benefits and self-efficacy were important factors for influencing the perceived usefulness of a smoking cessation mobile app. Moreover, the perceived usefulness of a smoking cessation mobile app was also positively related to intention to use a smoking cessation mobile app.

**CONCLUSION:** Although mobile smoking cessation apps can help many individuals quit smoking, most Korean American smokers are not current users of smoking cessation mobile apps. Therefore, there is a strong need to use strategic evidence-based communication interventions for promoting the widespread adoption of smoking cessation applications.

**KEYWORDS:** Smoking cessation, mobile smoking cessation apps, Korean Americans, health belief model, technology acceptance model

## Introduction

Tobacco-related health disparities are a pressing challenge for tobacco control in the United States.[1] Korean Americans comprise the fifth largest Asian American subgroup with more than 1.4 million living in the United States in 2010, a 33% increase during the past 10 years.[2] The current smoking rate among Korean Americans has been reported to be between 27% and 39%, which is greater than the 23.1% smoking rate in the general U.S. population.[3] There may be a variety of aspects that are responsible for the high prevalence of smoking among Korean Americans. First, smoking is so prevalent and so ingrained within the culture, many smokers may not perceive themselves as being capable of quitting.[4] Therefore, there is a need to identify how key psychosocial variables may relate to smoking among Korean Americans. Second, age was significantly associated with Korean American men's smoking status with men younger than 40 years being more likely to be current smokers than older.[5] Last, religion has also been identified as being significantly related to Korean American men's smoking status. Korean American male smokers who were non-Christians or had no religion were 16.6 times more prone to be current smokers.[3] Smoking cessation is an active process that begins with a smoker's decision to quit smoking and ends with abstinence from smoking that is maintained for a long time.[6] Although the harmful effects of cigarette smoking are widely known, cessation of smoking is difficult, even for those who have a strong desire to stop smoking. Recently, the mobile phone has been shown to be an important communication tool for promoting smoking cessation.[7] These smoking cessation programs delivered with text messages including quit-lines, counseling services, and check nicotine test opportunities.[8] Evidence has shown that these mobile phone-based smoking cessation programs that use smartphones are especially effective because they can deliver information and support to help smokers quit using tobacco whenever and wherever they need help.[7,9] However, there has been very little research conducted concerning the acceptance of mobile smoking cessation for underrepresented populations. Therefore, this study attempts to explain smokers' acceptance of smartphone-based smoking cessation programs with an integrated model that includes both the health belief model (HBM) and the technology acceptance model (TAM).

### Mobile health (mHealth)

Mobile health, also known as mHealth, is defined as medical and public health practice supported by mobile devices, such as mobile phones, personal digital assistants (PDAs), and other wireless devices.[10] New technologies, like smartphones, continue to have advancements such as additional data gathering and manipulation capacity. The widespread diffusion of these technologies and the continual improvements in this technology continue to change how health care information is accessed and delivered. It is well known that these mHealth

communication systems can provide benefits for users' health, but there has not yet been sufficient study about the using of smartphone-based smoking cessation apps. However, only a few interventions have also been designed to deliver customized motivational messages that lead to smoking cessation through behavior change.[11-13] These interventions vary from sending customized motivational messages to multimedia messages. The advantages of mobile phones for the interventions were found to be low cost, better reach, increased interaction between researcher and participants and easier as well as faster ways to send tailored and personalized messages.[14]

### Health belief model (HBM)

Since 1950, the health belief model (HBM) has emerged as one of the critical models in health behavior theory. The HBM was designed to account for health behaviors that seek a chance to decrease disease occurrence using individual perceptions and beliefs.[15] In other words, people have choices and are capable, when presented with information, of making good decisions about their health. The HBM emphasized that smoking is determined by an individual's perceptions regarding personal vulnerability to illness caused by smoking, the seriousness of smoking as health problems, treatment costs and effectiveness, barriers to quitting, and cues to change smoking behaviors. Over the last few years, the popularity of this model has led to its use not only in health or medical contexts but also in studying various health behaviors, including the study of preventive healthcare using smartphone applications.[16] Perceived susceptibility is one of the critical constructs in accepting one's health behavior.[15] If a perceived risk is high, it will reduce that risk. Perceived severity is the construct about individuals' judgments about the seriousness of health threats for them.[15] Perceived severity is basically based on health or medical information and knowledge, but it could also be influenced by the beliefs of a person struggling with a disease. Perceived benefits are a construct about one's perceptions or beliefs that a new health behavior could decrease the occurrence and worsen of diseases.[15] Behavioral changes are often difficult to achieve easily perceived barriers are a construct that helps to explain perceived impediments to behavior change and is the final major last exogenous variable in the HBM.[15] It refers to the individual's evaluation of any obstacles to starting a new behavior. Demographic factors can also influence an individual's perceptions and beliefs, often serving as modifying variables to health beliefs and behavior change.[15] These demographic factors can include culture, education, past experience, skill, and motivation. In 1988, the self-efficacy construct was added to the HBM.[17] Self-efficacy is the situation-specific confidence levels that people possess to engage in healthy behavior across different challenging or high-risk situations.[18]

### Technology acceptance model (TAM)

One of the well-known models related to technology acceptance and use is the technology acceptance model (TAM),

originally proposed by Fred Davis in 1985. The model suggests that when users are presented with new technology, a number of factors influence their decision about how and when they will use it.[19] TAM has been widely used to identify the predictors of technology acceptance in many contexts, especially for predicting people's acceptance of new technology. According to the theory, 2 important factors can influence users' decisions about how and when they will use a new technology: one factor is perceived usefulness (PU), and the other factor is perceived ease of use (PEOU). TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use.[20] However, TAM has 2 limitations. First, the theory pays little attention to the identification of antecedent variables that could influence PU and PEOU. For example, some people are predisposed to embrace new technologies regardless of perceived usefulness and perceived ease of use, while others may be generally less accepting of new technologies. Second, although the theory is useful in identifying factors that influence people's technology acceptance and use, the theory cannot fully explain why people accept and use a particular technology. In an attempt to overcome these limitations of TAM, this study was guided by integrating the health belief model (HBM) and technology acceptance model (TAM). Based on these backgrounds, the following hypotheses are proposed (Figure 1):

H1-1: Perceived susceptibility to smoking-associated diseases is positively related to the perceived usefulness of a smoking cessation mobile app. H1-2: Perceived susceptibility to smoking-associated diseases is positively related to perceived ease of using a smoking cessation mobile app. H1-3: Perceived susceptibility to smoking-associated diseases is positively related to the intention to use a smoking cessation mobile app.

H2-1: Perceived severity of smoking is positively related to the perceived usefulness of a smoking cessation mobile app. H2-2: Perceived severity of smoking is positively related to perceived ease of using a smoking cessation mobile app. H2-3: Perceived severity of smoking is positively related to the intention to use a smoking cessation mobile app.

H3-1: Perceived benefits of using a smoking cessation mobile app are positively related to the perceived usefulness of a smoking cessation mobile app. H3-2: Perceived benefits of using smoking cessation mobile app is positively related to perceived ease of using a smoking cessation mobile app. H3-3: Perceived benefits of using smoking cessation mobile app is positively related to the intention to use a smoking cessation mobile app.

H4-1: Perceived barriers of using smoking cessation mobile apps are negatively related to the perceived usefulness of a smoking cessation mobile app. H4-2: Perceived barriers of
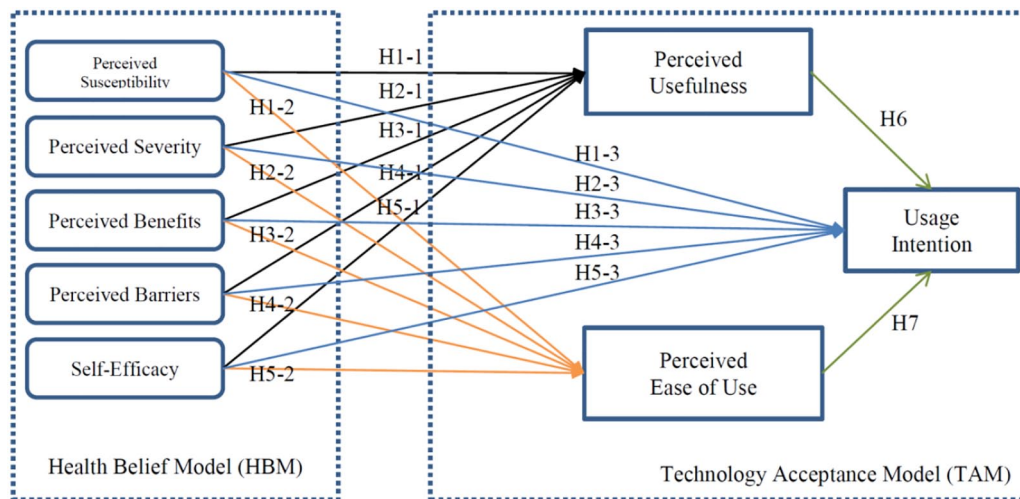
**Figure 1.** Research model.

using smoking cessation mobile apps are negatively related to perceived ease of using a smoking cessation mobile app. H4-3: Perceived barriers of using smoking cessation mobile apps are negatively related to intention to use a smoking cessation mobile app.

H5-1: Self-efficacy is positively related to the perceived usefulness of a smoking cessation mobile app. H5-2: Self-efficacy is positively related to perceived ease of using a smoking cessation mobile app. H5-3: Self-efficacy is positively related to the intention to use a smoking cessation mobile app.

H6: Perceived usefulness is positively related to the intention to use a smoking cessation mobile app.

H7: Perceived ease of use is positively related to the intention to use a smoking cessation mobile app.

## Methods

The present study was empirical in nature and utilized a cross-sectional design with the aim of making a generalization from a sample of Korean Americans. Based on the literature reviewed and theoretical framework, this study used a non-experimental survey research design utilizing both a self-reported web-based survey and a paper-based self-reported survey to evaluate the proposed model and research hypotheses.

*Assessments and measures*

The self-reported questionnaire contains both short open-ended questions and close-ended questions using 5-point Likert scale responses. First, to assess differences in smokers' smoking behavior across 3 countries, 2 open-end questions were asked to determine (1) the reasons for smoking, and (2) what strategies or methods they have tried to quit. Second, to evaluate differences in smokers' perception of smoking across 3 countries, 2 open-end questions were asked to determine (1) the reasons to quit smoking, and (2) the most effective ways to quit smoking. The survey

instrument also included HBM items, TAM items, intention to using a quit smoking mobile app, and demographic items. Responses to the various variables related to the perceptions of the individual subjects were measured with 5-point Likert-type scales, ranging from 1 (strongly disagree) to 5 (strongly agree). Since the constructs found in the HBM and TAM parallel constructs found in other research models, the survey items were adapted from other research on healthcare.[21-24] The scales created in previous healthcare research have been tested for validity and reliability. Furthermore, Cronbach's alpha was used to measure the internal consistency of the items in the factor. The lower limit for an acceptable Cronbach's alpha is 0.7, though 0.6 may be acceptable for newly defined scales.[25]

*Data collection and analysis*

According to the U.S. Census 2000, 96% of Korean Americans live in metropolitan areas in the United States. The Washington, D.C. Metropolitan Area ranks third with the highest Korean American population after the Los Angeles and New York Metropolitan Areas.[26] This study was conducted through a paper-based survey from September 2, 2018 to March 24, 2019. Survey flyers were posted in locations frequented by smokers, such as supermarkets and restaurants in the Washington D.C. Metropolitan Area, and also were distributed in 23 Korean American protestant churches in the same area. Intercept surveys were also administered in Washington D.C., Maryland, and Northern Virginia. The questionnaire was written in English and then translated to Korean by professional translators. A participant was able to choose their preferred language at the beginning of the questionnaire, but all participants chose the Korean survey. Of the 244 questionnaires collected, 17 were not usable. Therefore, a total of 227 questionnaires were coded for data analysis. Each author independently read open-ended survey responses multiple times and generated initial codes of notable concepts. Patterns in the initial codes were identified as themes. The 2 authors then

**Table 1.** Demographic characteristics of respondents (N = 227).

| VARIABLE | FREQUENCY | PERCENT |
|---|---|---|
| Average number of cigarettes smoked per day | M = 7.33 | |
| Reasons for smoking | | |
| Habit | 67 | 29.5 |
| Addiction | 55 | 24.2 |
| Release stress | 42 | 18.5 |
| No specific reason | 20 | 8.8 |
| Relaxation | 17 | 7.5 |
| Pleasure | 11 | 4.9 |
| Social activity | 15 | 6.6 |
| Smoking cessation experiences | | |
| Yes | 204 | 89.9 |
| No | 23 | 10.1 |
| Strategies tried to quit smoking | | |
| Cold turkey | 71 | 31.3 |
| Used alternative nicotine products | 54 | 23.8 |
| Used electronic cigarette | 48 | 21.2 |
| Willpower | 34 | 14.9 |
| Used chewing gum/seeds/candy | 17 | 7.5 |
| Never tried to quit smoking | 3 | 1.3 |
| Reasons to quit smoking | | |
| Health reasons | 106 | 46.7 |
| For family/friend | 64 | 28.2 |
| Live longer | 22 | 9.7 |
| Finance reasons | 18 | 7.9 |
| Breath better | 14 | 6.2 |
| Do not want to stop smoking | 3 | 1.3 |
| Gender | | |
| Male | 198 | 87.2 |
| Female | 29 | 12.8 |
| Age group | | M = 44.67 |
| Below 20 | 0 | .0 |
| 20s | 41 | 18.1 |
| 30s | 77 | 33.9 |
| 40s | 51 | 22.5 |
| 50s | 30 | 13.2 |

*(Continued)*

**Table 1.** (Continued)

| VARIABLE | FREQUENCY | PERCENT |
|---|---|---|
| Over 60s | 28 | 12.3 |
| Marital status | | |
| Now married | 131 | 57.7 |
| Never married | 48 | 21.1 |
| Divorced | 24 | 10.6 |
| Separated | 14 | 6.2 |
| Widowed | 8 | 3.5 |
| Other | 2 | 0.9 |
| Use of smoking cessation apps | | |
| No | 219 | 96.5 |
| Yes | 8 | 3.5 |
| Education level | | |
| College graduate | 161 | 70.9 |
| Graduate college and over | 38 | 16.7 |
| High school graduate | 24 | 10.6 |
| High school or lower | 4 | 1.8 |
| Annual household income | | |
| $10 000-$39 999 | 24 | 10.6 |
| $40 000-$69 999 | 91 | 40.1 |
| $70 000-$99 999 | 81 | 35.7 |
| $100 000 or more | 22 | 9.7 |
| Less than $10 000 | 9 | 3.9 |
| Total | 227 | 100 |

reviewed the themes together, refined them, and created a thematic coding scheme. Discrepancies in final coding were resolved through discussion.

## Results

The demographic profile of the respondents is presented in Table 1. Among the sample, 87.2% were male (N = 198) and 12.8% were female (N = 29). These results are in line with existing research,[3-5] which found that Korean American male adults were more likely to be current cigarette smokers than female adults. Although all participants are currently using a smartphone, more than 95% of participants answered that they are not currently using mobile smoking cessation apps. All participants mentioned that smoking is either a bad habit or an addiction. Nearly 90% of participants (N = 204) have experience in smoking cessation, and they want to quit their cigarette smoking behaviors. Additionally, health concerns are the biggest reason for quitting smoking by Korean America smokers. In terms

**Table 2.** Path analysis.

| KOREAN AMERICAN SMOKERS (N = 227) | | | | |
|---|---|---|---|---|
| PATHS | ESTIMATE | S.E. | C.R | *P* VALUES |
| H1-1. PSUS → PU | .05 | .07 | .57 | .78 |
| **H1-2. PSUS → PEOU** | **.31** | **.09** | **4.22** | ** |
| H1-3. PSUS → INT | .15 | .09 | 2.04 | .09 |
| H2-1. PSEV → PU | −.02 | .09 | −.72 | .66 |
| H2-2. PSEV → PEOU | .02 | .08 | .09 | .92 |
| H2-3. PSEV → INT | −.09 | .07 | −2.21 | .34 |
| **H3-1. PBEN → PU** | **.88** | **.02** | **18.19** | *** |
| **H3-2. PBEN → PEOU** | **.56** | **.02** | **17.83** | *** |
| **H3-3. PBEN → INT** | **.44** | **.06** | **5.91** | *** |
| H4-1. PBAR → PU | −.07 | .04 | −.88 | .51 |
| **H4-2. PBAR → PEOU** | **−.18** | **.04** | **−3.88** | *** |
| H4-3. PBAR → INT | −.04 | .04 | −1.13 | .48 |
| **H5-1. SELF → PU** | **.19** | **.05** | **2.93** | ** |
| H5-2. SELF → PEOU | .08 | .07 | .48 | .73 |
| H5-3. SELF → INT | −.14 | .07 | −2.17 | .06 |
| **H6. PU → INT** | **.19** | **.06** | **2.15** | * |
| **H7. PEOU → INT** | **.51** | **.06** | **8.01** | *** |

*$P$ < .05, **$P$ < .01, ***$P$ < .001.

of effective strategies to quit smoking, 31.3% of participants (N = 71) answered that "cold turkey" is the best way to quit smoking. Furthermore, socioeconomic factors are another indicator of smoking among Korean Americans. Generally, people with lower incomes were more likely to be smokers than people with average incomes.[1,3-5] However, nearly 50% of participants (N = 112) earned more than $70 000, only 10.6% of participants (N = 24) earned less than $40 000.

To test the hypotheses, a path analysis was conducted using SPSS AMOS 22. Based on the results of the path analysis, the following 8 hypotheses were supported. The supported hypotheses were: H1-2: Perceived susceptibility to smoking-associated diseases (PSUS) is positively related to perceived ease of using a smoking cessation mobile app (PEOU). H3-1: Perceived benefits of using a smoking cessation mobile app (PBEN) are positively related to the perceived usefulness of a smoking cessation mobile app (PU). H3-2: Perceived benefits of using smoking cessation mobile app (PBEN) is positively related to perceived ease of using a smoking cessation mobile app (PEOU). H3-3: Perceived benefits of using smoking cessation mobile app (PBEN) is positively related to the intention to use a smoking cessation mobile app (INT). H4-2: Perceived barriers of using smoking cessation mobile apps (PBAR) are

negatively related to perceived ease of using a smoking cessation mobile app (PEOU). H5-1: Self-efficacy (SELF) is positively related to the perceived usefulness of a smoking cessation mobile app (PU). H6: Perceived usefulness (PU) is positively related to the intention to use a smoking cessation mobile app (INT). H7: Perceived ease of use (PEOU) is positively related to the intention to use a smoking cessation mobile app (INT).

**Discussion**

The primary purpose of this research is to investigate the adoption process of mobile smoking cessation apps for Korean American smokers. Previous studies on mobile smoking cessation apps demonstrate that these apps are highly effective for managing the cravings for smoking.[7] Although the research shows that mobile smoking cessation apps are effective for helping smokers quit, the research does not answer questions about how and why smokers adopt these apps. There are very few studies reported in the research literature concerning the adoption and use of mobile smoking cessation apps. In response to this gap in the research literature, this study was conducted to examine the predictors of adopting and using smoking cessation applications available via smartphones. The research model for this study includes constructs from the HBM and TAM, that are highly cited models in the new technology literature. The research model tested in this study provides empirical evidence that the constructs contained in the HBM can be used to examine this understudied area of smoking cessation.

The results from this study show that the perceived benefits of using a smoking cessation mobile app and self-efficacy were important factors for influencing the perceived usefulness of a smoking cessation mobile app among Korean American smokers. This is in line with findings from a study by Carpenter[27] who did a meta-analysis of several studies use of HBM model to predict health behavior. From the studies, perceived benefits and perceived barriers were the strongest predictors of behavior. Moreover, perceived susceptibility to smoking-associated diseases and perceived benefits of using a smoking cessation mobile app was positively related to perceived ease of using a smoking cessation mobile app. However, perceived barriers to using a smoking cessation mobile app were negatively related to perceived ease of using a smoking cessation mobile app. Perceived usefulness and perceived ease of use were also positively related to the intention to use a smoking cessation mobile app. This finding concurred with Deng et al's[28] findings that perceived usefulness and perceived ease of were strong predictors for the adoption intention toward Mobile Health Services. The results of this study suggest that the HBM is not a well-suited model for predicting users' acceptance of smartphone-based smoking cessation apps because its main theoretical constructs, such as perceived severity of smoking was not associated with TAM's endogenous variables. These findings can be explained by the limitations of the HBM. The HBM assumes that everyone has access to equal amounts of information on smoking problems and does not suggest any strategy for changing health-related

actions.[15] This is relevant to this study as research[27] has found that the constructs of HBM can be incorporated when examining the predictors of cigarette smoking and developing smoking prevention programs.

## Conclusion

This study is the first to investigate Korean American smokers' perceptions of using mobile applications for smoking cessation. Findings from this study provide meaningful insights for future intervention work targeting this underserved population. Since most Korean American smokers are not current users of smoking cessation mobile apps, there is a strong need to use strategic evidence-based communication interventions for promoting the widespread adoption of smoking cessation applications. The potential benefits of mobile smoking cessation applications can be customized to target smokers. Therefore, it is strongly recommended that the apps should include several customized services, such as the ability for smokers to chat with medical professionals. These interactive functions can help reduce smokers' barriers to using smoking cessation apps and increase their perceived benefits of using the app. Moreover, in-app rewards can be used to bolster users' self-efficacy, especially when goals are being met; this may help users to be more inclined to accept the usefulness of the apps. Similarly, apps should not only be seen as useful but should be designed to be user-friendly, as this has a positive impact on the intention to use the app.

The major limitation of this study involves the study sample of respondents. It is difficult to make broad generalizations from this limited study because of the demographic and cultural constructs of the study's targeted population. Yet, this leaves room to expand research into the use of technology across a spectrum of health issues for other racial and ethnic groups in the United States. Another limitation of the study is that many of the smokers sampled were not currently using or had never used mobile smoking cessation apps, limiting their knowledge and insights into using this smoking cessation intervention strategy. Although the researcher explained smoking cessation mobile apps, the study did not determine the probability of respondents' intentions to use mobile smoking cessation apps.

For improvement of the study, it is recommended that future research use representative and targeted sampling strategies for recruiting respondents for a survey about the adoption and use of mobile smoking cessation applications to increase the generalizability of findings and to validate the results obtained with this study. This research did not discriminate smokers with an intention to quit and smokers without an intention to quit. Generally, smokers with an intention to quit are more likely to quit smoking, but this research did not control the effects of intention to quit smoking and there were many hypotheses that were not supported during the analysis of the data collected in this study.

Replication of this study is encouraged to examine the value of these hypotheses to the research model proposed in this study. Also, many smokers do not know much about the use of smoking cessation apps, it is hoped that future research will target smokers who are utilizing these smoking cessation interventions to provide detailed information about their experiences with these programs. Last, it will be important to extend the findings from this and related studies to go beyond just providing background data about smartphone mobile apps usage in tobacco control but to also provide valuable insights for developing smoking cessation programs and the use of other mHealth intervention services.

## ORCID iD

Joonwoo Moon  https://orcid.org/0000-0003-0201-5030

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