

## Impact of Cognitive and Social Factors on Smoking Cessation Attempts among US Adult Muslim Smokers

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### Abstract

**Background.** Muslims in the United States (US) exhibit high rates of cigarette smoking. Guided by the Social Cognitive Theory, the study aimed to investigate the associations between the number of serious cigarette smoking cessation attempts and cognitive as well as environmental factors in adult US Muslim smokers.

**Methods.** This cross-sectional study was based on a convenience sample of adult ( $\geq 18$  years) US Muslim smokers. After receiving IRB approval, data were collected using an on-line survey. Unadjusted Poisson regression followed by adjusted multivariable Poisson regression analyses were conducted to answer the research question.

**Results.** One hundred thirty-two smokers completed the questionnaire. Smokers reported more serious cigarette smoking cessation attempts if they 1) had more knowledge about the consequences of cigarette smoking cessation, 2) had more positive attitudes regarding quitting, and 3) reported greater religiosity. Additionally, smokers reported fewer serious cigarette smoking cessation attempts if they 1) were employed, 2) affiliated with Sunnah sect, 3) reported better self-assessed health, 4) reported higher perceived value for quitting, and 5) indicated that using tobacco was not allowed inside the home. Only three smokers reported using both prescription medications and counseling to aid with smoking cessation attempts.

**Conclusions.** Inadequate utilization of pharmaceutical smoking cessation products and provider professional assistance may exacerbate the problems associated with elevated rates of smoking among US Muslim smokers. Knowledge of the consequences, more positive attitudes, and greater religiosity can be influential constructs in future interventions aimed at encouraging smoking cessation attempts in this population.

**Keywords:** Muslims, Cognitive Factors, Environmental Factors, Quitting Smoking, Religiosity, Acculturation

### Introduction

Quitting cigarette smoking is associated with major health benefits, such as improved cardiovascular and respiratory functions.<sup>1</sup> A greater number of serious smoking cessation attempts (SSCA), defined as abstaining from cigarette-smoking for one day or longer while attempting to quit,<sup>2</sup> is associated with greater chances of successful cigarette-smoking cessation.<sup>3</sup> In 2015, 55% of cigarette smokers in the United States (US) had at least one SSCA over the past 12 months, but only 7% of them succeeded in quitting.<sup>2</sup> Thus, it is suggested that promoting smoking cessation could be achieved by encouraging more quit attempts.<sup>4</sup> In fact, it takes a cigarette smoker between 6 and 142 quit attempts to achieve successful cessation.<sup>3</sup> Therefore, investigating the number of SSCA is essential to identify factors that promote smoking cessation.

Previous research demonstrated that more frequent SSCA is associated with higher self-efficacy regarding the ability to quit smoking,<sup>5</sup> perceived social pressure due to interacting with nonsmokers,<sup>6</sup> lower acculturation,<sup>7</sup> living in a smoke-free home,<sup>8</sup> discussing smoking cessation with physicians,<sup>9</sup> more nicotine dependence,<sup>10</sup> being male,<sup>11</sup> and having a high school education or higher.<sup>11</sup> Additionally, previous research demonstrated that the number of SSCA could be influenced by several cognitive and environmental factors,<sup>2</sup> especially among minority groups.<sup>12</sup> As a minority group in the US, the Muslim population ranges between 3 and 7 million,<sup>13,14</sup> the majority (63%) of whom are foreign-born.<sup>15</sup> Although Islamic Jurisprudence entities consider cigarette-smoking to be forbidden in Islam,<sup>16</sup> Muslims exhibit elevated cigarette-smoking rates in the US<sup>17,18</sup> and around the world,<sup>19</sup> which places them at a higher risk of preventable disease and premature death compared to the remaining US population.

The Social Cognitive Theory (SCT) was used to investigate the factors associated with the number of SSCA.<sup>20</sup> The SCT suggests that behavior depends on the interaction among several cognitive and environmental factors. Cognitive factors include 5 constructs: 1) **knowledge** of the general consequences of

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cigarette-smoking cessation, 2) personal **expectations** of the impact of cigarette-smoking cessation on health, 3) **perceived value** of this health impact, 4) **attitudes** (i.e., overall opinion) regarding cigarette-smoking cessation, and 5) **self-efficacy** regarding one's ability to quit smoking. In contrast, environmental factors include 3 constructs: 1) **vicarious learning**, 2) **social norms** surrounding quitting smoking, and 3) **barriers and facilitators** related to quitting smoking.<sup>21-23</sup> In addition, **acculturation** and **religiosity** are key concepts within **social norms**. Acculturation assesses how assimilated immigrants are with the main culture of their new environment,<sup>24</sup> whereas religiosity measures the level of compliance of individuals with their own religious beliefs and practices.

Despite the importance of human agency in health behavior,<sup>25</sup> social norms can be key determinants of smoking behavior in Muslims. For example, tobacco use is socially accepted and may promote social interaction in some predominantly Muslim countries.<sup>26</sup> Additionally, religiosity was noted as an important factor in smoking cessation attempts,<sup>27</sup> especially among Muslims.<sup>28</sup> However, gender-specific analysis has shown that weekly attendance of religious services was associated with more likelihood of quitting cigarette-smoking only in women.<sup>27</sup> In sum, due to its inclusion of pertinent psychosocial factors, utilizing the SCT was appropriate for analyzing factors associated with SSCA among US Muslim smokers.

Because the majority of US Muslims are foreign-born,<sup>15</sup> they may have different cognitive and social characteristics affecting their cigarette-smoking cessation than other US citizens. Prior to this research, there was a gap in the literature regarding associations between the number of SSCA and Social Cognitive Theory (SCT) factors in US Muslim smokers. Thus, the current study investigated the SCT factors that are associated with the number of SSCA in a sample of adult US Muslim smokers. The overarching hypothesis was that adult Muslim smokers would have more SSCA if they exhibit favorable cognitive and social factors according to the SCT. Additionally, the study examined the interaction effect of sex and religiosity on the number of SSCA. The hypothesis was that sex would moderate the association between religiosity and the number of serious attempts to quit cigarette smoking.

## Methods

### Design

The dataset used to test the hypotheses was part of a larger cross-sectional design study.<sup>18</sup> This dataset was based on a quantitative online survey that was deployed January to March of 2017, and collected data from 370 participants to assess the factors that are associated with the use of tobacco products, including cigarettes, cigars, and water-pipes (i.g., hookah). However, this project was restricted to participants who reported current cigarette smoking. The study included a convenience sample of adult ( $\geq 18$  years old) US Muslim smokers. Due to potentially different cigarette-smoking

cessation behaviors, 2 smokers with a personal history of lung cancer were excluded from the analyses. Lung cancer patients were excluded because they may have fundamentally different behaviors concerning tobacco use, perhaps due to greater interaction with health care providers. The Office of Research Integrity and Compliance has reviewed and determined the research to be exempt.

### Measures

The primary variable of interest was assessed using one item that inquired about the number of SSCA during the past 12 months. SSCA was defined as abstaining from smoking for one day or longer as an attempt to quit smoking.<sup>2</sup> Because only participants who reported current cigarette smoking were included in the study, eligible participants were those who 1) smoked a total of at least 100 cigarettes in their entire life, and 2) reported current smoking 'some days' or 'every day', consistent with the definition of *current smoking* in previous research.<sup>29</sup> Pertinent constructs from the SCT were measured following previous research,<sup>30-36</sup> and are presented in Table 1. Acculturation was measured using the Brief Acculturation Scale,<sup>37</sup> which is a 4-item scale that measures language preference, self-identity, country where participants spent childhood, and place of birth. This scale has demonstrated good internal consistency ( $\alpha=0.84$ ) in previous research.<sup>37</sup> Religiosity was measured using the Duke University Religion Index,<sup>38</sup> which is a 5-item scale that demonstrated high internal consistency in previous research ( $\alpha=0.87$ ).<sup>39</sup> Responses to acculturation and religiosity were normalized to range from zero to 100 as explained in the original study.<sup>18</sup> In terms of barriers and facilitators, nicotine dependence was measured using the Heavy Smoking Index, a 2-item scale with high concordance with Fagerström Nicotine Dependence Scale.<sup>40</sup> Discussing cigarette-smoking cessation with a physician anytime over the past 12 months (No/Yes) and rules of using tobacco inside the home (Not allowed/Allowed) were assessed using one item for each as described previously.<sup>18</sup> Finally, use of cigarette-smoking cessation techniques was measured using a multiple-answer item. Responses included 1) nicotine replacement, 2) prescription medications, 3) behavioral support, and 4) no pharmaceutical/behavioral assistance. Lastly, demographic characteristics, including sex, age, race, ethnicity, marital status, education, employment status, income, health insurance status, and general well-being were measured using one item for each as explained previously.<sup>18</sup>

### Statistical Analysis

Descriptive analyses were conducted to identify the distribution of categorical variables with regard to SSCA. Due to lack of sufficient distribution, some variables were collapsed into binary variables, as explained in the original study.<sup>18</sup> In order to examine associations with the primary variable of interest (i.e., number of SSCA), cognitive and environmental variables as well as demographic variables were investigated using 2 Poisson regression models, individually in an unadjusted model and collectively in an adjusted model. We used this type

of regression due to the distinct binomial distribution of the primary variable of interest (i.e., SSCA). Because it is used to model count data, and because of rare large counts found in the distribution of SSCA variable, Poisson regression was determined to be the most applicable to answer the research question. Secondary independent samples *t*-test was conducted to identify whether men and women varied in religiosity. Finally, a Poisson regression analysis was conducted to examine the potential interaction between the sex of respondents and religiosity on number of SSCA.

## Results

Because this research study was part of a larger study,<sup>18</sup> there was a total of 370 responses. However, only 132 participants met the eligibility criteria for this study (4 participants younger than 18 years old, 61 participants from outside the US, 25 participants did not affiliate with Islam, 8 participants had a personal history of lung cancer, one duplicate record, and 139 did not report current cigarette-smoking). Eligible participants completed the questionnaire in English (*n*=91), Arabic (*n*=40), and Farsi (*n*=1). Participants' age ranged from 19 to 68, with a mean age of 37. Only one participant was Hispanic or Latino/a. The majority (59%) of participants were foreign-born. Only 47% of the sample of smokers attempted to quit smoking seriously at least once over the past 12 months. This rate was slightly lower, but not statistically significant ( $t(131) = -1.933, p = .055$ ) from the most recently reported rate of annual quit attempts among US smokers (55%).<sup>2</sup>

The number of quit attempts ranged from zero to 30, with a mean value of 1.56. Out of 62 smokers in the sample with at least one SSCA, only 3 smokers reported using both prescription medications and counseling to aid with SSCA. Additionally, 24 smokers reported using nicotine replacement, 31 smokers reported not using any form of assistance, and the rest reported using either prescription medications or counseling. Variables that were significantly associated with the number of SSCA in the unadjusted Poisson regression model are presented in Table 2.

In adjusted Poisson regression analyses, significant associations were observed between some SCT factors and the number of SSCA (Table 3). With regard to cognitive factors, knowledge was positively associated with SSCA; those who perceived a higher reduction in chances of diseases or death as a result of quitting smoking had 41% higher number of SSCA (adjusted incident rate ratio (AIIR) = 1.405; 95% confidence interval (CI) = 1.098 – 1.798). Similarly, smokers who had more positive views on cigarette-smoking cessation had 51% higher number of SSCA compared to those with negative views on cigarette-smoking cessation (AIIR = 1.513; 95% CI = 1.122; 2.041). However, those with a higher perceived value of cigarette-smoking cessation had 26% lower number of SSCA (AIIR = 0.744; 95% CI: 0.562-0.985).

In terms of environmental factors, religiosity and tobacco use inside the home were significantly associated with SSCA. Higher scores on religiosity scale were associated with 1% higher number of SSCA (AIIR = 1.011; 95% CI = 1.002, 1.020). However, those who lived in homes where tobacco use was not allowed had 53% lower number of SSCA compared to smokers who lived in homes where tobacco use was allowed (AIIR = 0.473; 95% CI = 0.299 – 0.750).

Among the demographic factors, employment status, sect affiliation, and general well-being were associated with SSCA. Employed individuals had 53% lower SSCA compared to those who were not employed (AIIR = 0.467; 95% CI = 0.299 – 0.727). Smokers who reported affiliation with Sunnah sect had 51% lower number of SSCA compared to smokers who did not affiliate with Sunnah sect (AIIR = 0.485; 95% CI = 0.318 – 0.740). Finally, smokers who reported better perceived well-being had 1% lower number of SSCA (AIIR = 0.986; 95% CI = 0.977 – 0.966).

Secondary analyses demonstrated that men scored higher on religiosity (Mean (M) = 54.9, Standard deviation (SD) = 33.9) compared to women (M = 19.2, SD=23.8),  $t(130) = -6.489, p < .001$ . However, the interaction between sex of respondent and religiosity in association with SSCA was not statistically significant ( $p = .932$ ).

## Discussion

The associations between SSCA and knowledge of the consequences as well as attitudes were consistent with previous research.<sup>33,41</sup> If based on the SCT, future interventions targeting this population may address techniques to stop smoking and to seek professional assistance. Because 59% of the participants were foreign-born, their past education before immigrating to the US may not have equipped them with sufficient knowledge about the consequences of smoking. This highlights the importance of effective patient-provider communication in this regard. Additionally, few participants reported nicotine replacement use, which again, might be related to little knowledge about smoking cessation. Contrary to the hypothesis, smokers who reported a higher perceived value of smoking cessation had fewer SSCA. One explanation might be that quit attempts last longer in smokers with a higher perceived value of smoking cessation, and therefore, a fewer number of quit episodes are attempted during a 12-month period.

The role of religiosity in promoting cigarette-smoking cessation was documented in previous research on Muslim smokers outside the US,<sup>28</sup> as well as in this study. Higher religiosity may have been observed as higher compliance with religious rulings related to abstaining from harmful substances.<sup>42</sup> Therefore, religion-based messages might hold promise for encouraging SSCA in US Muslim smokers. However, because men scored higher on the religiosity scale compared to women, this finding should be interpreted with caution. Future research may examine the potential moderating effect of sex on religiosity.

Contrary to previous research linking no smoking in the home to more smoking cessation attempts,<sup>8,43</sup> the findings of this study demonstrated that smokers who reported living in smoke-free homes had fewer SSCA. Due to not exposing their family members to secondary smoking, smokers who live in smoke-free homes may have less motivation to quit. Another interpretation might be that smokers who live in smoking-friendly homes perceive greater health risk, possibly combined with the smoking of others, and therefore, they exert more effort to quit smoking.

It has been reported that discussing cigarette-smoking cessation with health care providers facilitates cigarette-smoking cessation attempts.<sup>44</sup> However, 27 smokers (21%) reported that no health care providers had asked them about quitting smoking over the past 12 months, either because they did not see a health care provider during the 12 months period before data collection, or because they failed to discuss cigarette-smoking cessation during health care encounters. In addition, although combination therapy (prescription plus counseling) has shown the highest effectiveness rates for successful cigarette-smoking cessation,<sup>44</sup> only 3 smokers reported using both techniques to help with quit attempts. In sum, limited assistance from health care providers might be a barrier to curbing smoking rates among this population.

Some demographic factors were also associated with the number of SSCA. Employed individuals had lower SSCA compared to those who were not employed. This could be interpreted as employed individuals choosing not to endure withdrawal symptoms due to work-related stress or because employed smokers do not have the time to invest in seeking medical or behavioral assistance to quit smoking. More research is needed to address this relationship in the future. Finally, smokers with worse self-assessed health reported more SSCA. Although causation cannot be implied, it is possible that those with lower self-assessed health may be acting to improve their health status by attempting to quit smoking.

The current study had some limitations. First, using convenience sampling techniques limits the generalizability of these results to all adult US Muslim smokers. Second, because participation was voluntary and data were collected online, the response rate could not be enumerated, and consequently, rates of non-response remain unknown. Third, the cross-sectional design hinders the ability to investigate causal relations for any of the observed associations. Fourth, the rules of tobacco use at the workplace were not measured. This may have limited the capability to fully understand the association observed between employment status and the number of SSCA. Finally, we utilized single-item measures, which may result in limited validity for the results. Nevertheless, data was collected from smokers in 23 states in the US, so the findings are not confined to a particular region of the country. Additionally, this was the first study to investigate the associations between SSCA and cognitive as well as

environmental factors among adult US Muslim smokers using the SCT.

### Conclusion

The current study investigated the SCT factors related to the number of SSCA in a sample of adult Muslim smokers in the US. The majority of participants (63%) were men, which is typical, considering the higher likelihood of cigarette-smoking in Muslim men compared to Muslim women.<sup>45</sup> In the study sample, 47% of smokers attempted to quit at least once during the 12 months period prior to data collection. This is slightly lower than the national rate of quit attempts, which was 55% in 2015.<sup>2</sup> Researchers who address smoking cessation in adult US Muslim smokers should bear in mind two important implications for this study. First, more SSCA is associated with more knowledge of the consequences, more positive attitudes, and greater religiosity, all of which can be used to build future cigarette-smoking cessation interventions. Second, inadequate utilization of pharmaceutical smoking cessation products and provider professional assistance among US Muslim smokers may exacerbate the problems associated with elevated rates of smoking in this population.

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**Table 1:** Social Cognitive Theory Factors as Utilized in the Study and Measured in the Survey.

Domains and Factors	How Items were Measured in the survey	How the Scale was Assesed
Cognitive factors		
Knowledge	Perceived likelihood of reduction in chances of diseases or death as a result of quitting smoking.	5-point ordinal scale
Outcome Expectations	Perceived effect of cigarette-smoking cessation on personal health.	5-point ordinal scale
Perceived Value	Perceived importance of gaining the benefits of cigarette-smoking cessation.	5-point ordinal scale
Attitudes	Smokers' overall opinions on cigarette-smoking cessation.	5-point ordinal scale
Self-efficacy	Pecrieved self-confidence regarding ability to quit smoking.	Continuous scale ranging from 0% to 100%.
Environmental factors		
Vicarious Learning	Measured through assessing whether smokers knew of any former smoker among their first-degree family members and friends	Yes/No
Social Norms	Measured through assessing perceived acceptability of quitting smoking among first-degree family members and friends	5-point ordinal scale

**Table 2:** Descriptive Statistics, Unadjusted Incident Rate Ratio, 95% Confidence Interval, Standard Error, and Significance Level from Poisson Regression on Number of Serious Cigarette-smoking Cessation Attempts. Muslim Adult ( $\geq 18$  years) Smokers in the United States.

	N	Mean	S.D.	UIRR (95% CI)	SE	p-value
<b>Demographic Characteristics</b>						
Sex						
Male	83	2.12	3.76	3.463 (1.756 - 6.832)	1.200	<.001
Female	49	0.61	1.24	[Reference]		
Employment Status						
Employed	93	1.43	3.48	0.764 (0.414 - 1.411)	0.239	.390
Not Employed	39	1.87	2.19	[Reference]		
Sect						
Sunnah	51	2.31	4.46	2.130 (1.125 - 4.031)	0.693	.020
Something Else	81	1.09	1.81	[Reference]		
Health Insurance						
No	14	2.21	2.01	1.493 (0.814 - 2.739)	0.462	.195
Yes	118	1.48	3.26	[Reference]		
Income						
Age				0.866 (0.766 - 0.979)	0.054	.021
Self-assessed Health				0.970 (0.951 - 0.990)	0.010	.004
				0.988 (0.973 - 1.003)	0.008	.116
<b>Cognitive Factors</b>						
Knowledge				1.987 (1.681 - 2.348)	0.169	<.001
Outcome Expectations				1.876 (1.554 - 2.265)	0.180	<.001
Attitudes				2.243 (1.865 - 2.697)	0.211	<.001
Perceived Value				1.708 (1.112 - 2.622)	0.374	.014
Self-efficacy				1.025 (1.013 - 1.037)	0.006	<.001
<b>Environmental Factors</b>						
Vicarious Learning – Family						
No	91	1.33	3.48	0.641 (0.343 - 1.201)	0.205	.165
Yes	41	2.07	2.21	[Reference]		
Vicarious Learning – Friends						
No	95	1.05	1.72	0.367 (0.191 - 0.708)	0.123	.003
Yes	37	2.86	5.11	[Reference]		
Social Norms - Family						
Social Norms - Friends						
Acculturation						
Religiosity						
Nicotine Dependence						
Tobacco Use Inside Home						
Not allowed	26	1.73	1.51	1.140 (0.662 - 1.962)	0.316	.637
Allowed	106	1.52	3.44	[Reference]		
Discuss Cigarette-smoking Cessation with Doctor						
No	27	3.15	5.68	2.732 (1.302 - 5.733)	1.033	.008
Yes	105	1.15	1.91	[Reference]		

Abbreviations: N, Number of participants included in the analysis, Mean, Mean of the Number of SSCA across Categorical Variables, S.D., Standard Deviation of the Number of SSCA, UIRR, Unadjusted Incident Rate Ratio, CI, Confidence Interval, SE, Standard Error

**Table 3:** Adjusted Incident Rate Ratio, 95% Confidence Interval, Standard Error, and Significance Level from Poisson Regression on Number of Serious Cigarette-smoking Cessation Attempts. Muslim Adult ( $\geq 18$  years) Smokers in the United States.

	AIRR (95% CI)	SE	p-value
<b>Demographic Characteristics</b>			
Sex			
Male	1.682 (0.951 - 2.976)	0.490	.074
Female	[Reference]		
Employment Status			
Employed	0.467 (0.299 – 0.727)	0.106	.001
Not Employed	[Reference]		
Sect			
Sunnah	0.485 (0.318 – 0.740)	0.105	.001
Something Else	[Reference]		
Health Insurance			
No	1.014 (0.605 – 1.699)	0.267	.958
Yes	[Reference]		
Income	1.040 (0.909 – 1.190)	0.072	.568
Age	0.997 (0.976 – 1.019)	0.108	.800
Self-assessed Health	0.986 (0.977 – 0.996)	0.005	.005
<b>Cognitive Factors</b>			
Knowledge	1.405 (1.098 – 1.798)	0.177	.007
Outcome Expectations	1.257 (0.901 – 1.754)	0.214	.178
Attitudes	1.513 (1.122 – 2.041)	0.231	.007
Perceived Value	0.744 (0.562 – 0.985)	0.107	.039
Self-efficacy	1.011 (0.998 – 1.023)	0.006	.091
<b>Environmental Factors</b>			
Vicarious Learning – Family			
No	1.009 (0.654 - 1.558)	0.223	.967
Yes	[Reference]		
Vicarious Learning – Friends			
No	1.389 (0.965 - 2.000)	0.258	.077
Yes	[Reference]		
Social Norms - Family	1.311 (0.721 – 2.384)	0.400	.374
Social Norms - Friends	1.024 (0.778 – 1.349)	0.144	.863
Acculturation	1.002 (0.995 – 1.009)	0.004	.616
Religiosity	1.011 (1.002 – 1.020)	0.005	.016
Nicotine Dependence	0.867 (0.673 – 1.118)	0.112	.271
Tobacco Use Inside Home			
Not allowed	0.473 (0.299 – 0.750)	0.111	.001
Allowed	[Reference]		
Discuss Cigarette-smoking Cessation with Doctor			
No	0.957 (0.641 – 1.428)	0.196	.828
Yes	[Reference]		

Abbreviations: AIRR, Adjusted Incident Rate Ratio, CI, Confidence Interval, SE, Standard Error