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ORIGINAL ARTICLE



Tobacco Use among Adult Muslims in the United States

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ABSTRACT

Background: Compared with the general United States (US) population, Muslims in the US exhibit elevated rates of tobacco use. As a result, they might be at a higher risk for preventive disease and premature death as compared with the general US population. **Objective:** This study investigated the Social Cognitive Theory (SCT) factors that are associated with tobacco use among a sample of adult Muslims in the US. **Methods:** Data were collected (November 2016–March 2017) using a cross-sectional, on-line survey from a convenience sample of adult (≥ 18 years) US Muslims. Participants with a lung cancer history were excluded. Associations between SCT factors and tobacco use were investigated with bivariate analyses and multinomial logistic regression models. **Results:** Eligible participants ($n=271$) from 30 states completed the survey; 52.8% reported current tobacco use. A higher rate of current tobacco use was reported by men (62.8%) as compared to women (41.3%), $\chi^2(1, N=271) = 12.49, p < .001$. In terms of cognitive factors, individuals who (1) expected more personal consequences for tobacco use on health, and (2) had more confidence regarding ability to abstain from tobacco use, were less likely to report current tobacco use. In terms of environmental factors, individuals whose family members did not use tobacco were less likely to report current tobacco use. **Conclusion:** The study findings suggest that family-oriented interventions emphasizing self-efficacy and personal consequences to prevent tobacco use can potentially be effective in reducing tobacco use rates in the adult US Muslim population.

KEYWORDS

Muslims; tobacco use; Social Cognitive Theory; acculturation; religiosity; Social Norms

Introduction

Tobacco use is a major cause of premature death and preventable illness (Surgeon General's Report, 2014) in the United States (US). Additionally, tobacco use is strongly associated with several behavioral disorders such as substance misuse (Degenhardt & Hall, 2001). Although the cigarette smoking rate has declined since the 1960s, the overall rate of tobacco use has been constant (21.3%) over the past few years (Hu, 2016). The rates may even be higher among minorities such as US Muslims who may also experience higher rates of mortality and morbidity due to elevated rates of tobacco use (Newport & Himelfarb, 2013; Sayeed, 2011). Estimates of the number of Muslims in the US vary, ranging between 3 and 7 million (Kettani, 2010; Mohamed, 2016). Even though Islam has existed in the US since several hundred years ago (Simmons,

2008), research has shown that 63% of current US Muslims are foreign-born (Pew Research Center, 2011a). The number of foreign-born US Muslims may continue to grow because of increased immigration to the US, attributed to political instability in several countries with a predominantly Muslim population (Zong & Batalova, 2015).

US Muslims are more likely to use tobacco as compared to the US general population (Newport & Himelfarb, 2013; Sayeed, 2011), as tobacco use is culturally accepted in some Muslim majority countries (Unger et al., 2003). For example, 22.4% of US Muslims use waterpipes (Sayeed, 2011), whereas 1.3% of the US population use them (Lee, Hebert, Nonnemacher, & Kim, 2014). Historically, some Islamic scholars had deemed tobacco use acceptable from a religious point of view before its negative health impact was revealed

(Ghouri, Atcha, & Sheikh, 2006). Additionally, when Islamic scholars and jurisdictions, such as Al-Azhar University, clearly announced the theological ruling against tobacco use (World Health Organization, 2000), tobacco companies meticulously attempted to either belittle this religious ruling, for example by labeling it as an “extremism-view,” or through highlighting contrary voices among Muslim scholars (Boseley, 2015). These factors may explain continuously high tobacco use rate among Muslims. Further, US Muslims may favor cultural or spiritual healing methods, and can either delay seeking health care, or exhibit reluctance to receiving western medicine (Padela, Killawi, Forman, DeMonner, & Heisler, 2012). Thus, US Muslims may evidence health disparities and worse health outcomes (Padela & Curlin, 2013) due to negative health behaviors, such as tobacco use.

Previous studies investigating tobacco use in US Muslims were limited by investigating only a certain age group such as college students (Arfken, Abu-Ras, & Ahmed, 2015), a single ethnicity such as Arabs (Kassem et al., 2015b), one form of tobacco such as water-pipes (Arfken et al., 2015), or residents of one area such as New York city (Sayeed, 2011). Most importantly, they have not used a comprehensive behavioral model. Understanding the combined impact of cognitive and environmental factors on tobacco use behavior is particularly important for developing potential prevention and cessation modalities in the Muslim population. Thus, this study sought to understand factors that are associated with tobacco use in US Muslims using the Social Cognitive Theory (SCT) (Bandura, 1986).

The SCT presumes that (1) behavior interacts with (2) cognitive factors including knowledge of the consequences and outcome expectations associated with engaging in a specific behavior, and the perceived value, attitudes, and self-efficacy associated with changing this behavior, and (3) environmental factors including vicarious learning, perceived social norms surrounding the behavior, and barriers and facilitators of engaging in that behavior. This interaction is known as the “Triadic Reciprocity.” Because the majority of US Muslims are foreign-born (Pew Research Center, 2011a), they may have different health beliefs and attitudes, as well as different customs and social values. Thus, the SCT was appropriate to utilize for analyzing the factors associated with use of tobacco products among US Muslims due to its comprehensive inclusion of cognitive and environmental factors.

Cognitive factors in the SCT model can be applied to factors affecting tobacco use. *Knowledge* of the consequences refers to perceived understanding of the health consequences of tobacco use (Bandura, 2001b, 2004); individuals are more likely to use tobacco if they think it is not harmful (Bandura, 2004; Islam & Johnson, 2003). *Outcome expectations* refer to the perceived personal benefits or harms associated with tobacco use (Bandura, 2001b, 2004); greater likelihood of tobacco use is associated with believing negative consequences will not have a personal impact (Bandura, 2004; Islam & Johnson, 2003). *Perceived value* refers to the perceived importance of the consequences of behavior (Bandura, 2001a, 2004). For example, individuals are more likely to use tobacco products if they think that avoiding the negative consequences of tobacco use is not important to them (Islam & Johnson, 2003). *Attitudes* refer to the overall opinion with regard to a certain behavior (Bandura, 2001a); with more positive views about tobacco associated with greater likelihood of use (Bandura, 2004). It is also important to note that men and women may have different attitudes regarding tobacco use in the Muslim population, evidenced by their different rates of tobacco use (Pampel, 2001). For example, men’s views about tobacco use could be more influenced by prices of tobacco products whereas women’s views about tobacco use could be more influenced by body image such as body weight (Cawley, Markowitz, & Tauras, 2004). Finally, *self-efficacy* is individuals’ confidence in their ability to perform certain behaviors (Bandura, 2001b). Tobacco users with low self-efficacy may believe that they will have little success in quitting tobacco use (Schnoll et al., 2003).

Environmental factors from the SCT are also key predictors of tobacco use. *Vicarious learning*, observation of others performing a behavior, has an important role in predicting behavior (Bandura, 2001a). Individuals are more likely to use tobacco if their friends and family members do so (Hu, Davies, & Kandel, 2006; Islam & Johnson, 2003; Mays et al., 2014; Schnoll et al., 2002). Additionally, *social norms*, which are cultural standards of behavior, highly influence behavior (Bandura, 2001a, 2001b). Believing that using tobacco is culturally acceptable is associated with greater likelihood of tobacco use (Islam & Johnson, 2003). In particular, religiosity is the individuals’ degree of adherence to the beliefs, doctrines, and practices of a particular religion (Dube & Wingfield, 2008). Thus, religiosity is a measure of the degree of conformity between individual religious attitudes and teachings and norms of the religion he/she believes in.

It has been reported that individuals who attend more religious activities are less likely to report current tobacco use (Brown et al., 2014).

Acculturation is another environmental factor that influences adoption of social norms. It measures the level of compliance with the host cultural environment (Hui, Lent, & Miller, 2013). Research on US Muslim population has shown that individuals with less acculturation (less compliance with US main culture) are more likely to use tobacco than those who are fully acculturated (Al-Omari & Scheibmeir, 2009; Jadalla & Lee, 2012). Finally, *barriers and facilitators*, which can be external environmental factors, are determinants of behavior related to using tobacco (Kassem et al., 2015a). Examples of these barriers and facilitators include discussing tobacco use with health care providers and whether using tobacco is allowed inside the home (Mills, Messer, Gilpin, & Pierce, 2009).

The current study aimed to investigate factors associated with tobacco use among a sample of adult US Muslims. The first objective was to investigate the associations between tobacco use and cognitive as well as environmental factors in a convenience sample of adult US Muslims. The first hypothesis was that participants would be more likely to report current tobacco use if they think that tobacco use is not harmful, if they think the negative consequences will not harm them, if they think the negative consequences of tobacco use are not important to them, if they have a positive attitude about tobacco use, if they have lower self-efficacy regarding ability to abstain from tobacco use, if their friends and family members use tobacco, or if they believe that tobacco use is culturally accepted. The second objective was to further address the influence of social norms by investigating the impact of religiosity and acculturation on tobacco use status in a convenience sample of adult US Muslims. The second hypothesis was that greater religiosity and greater acculturation would be associated with a lower likelihood of reporting current tobacco use. The third objective was to examine the interaction effect of sex and attitudes on tobacco use status in a convenience sample of adult US Muslims. The third hypothesis was that sex would moderate the association between attitudes and tobacco use status.

Methods

Participants

Eligibility criteria included adult (≥ 18 years old) Muslims who lived in the US and had no history of

lung cancer at the time of data collection. Lung cancer patients were excluded because they may have fundamentally different behaviors concerning tobacco use, perhaps due to greater interaction with health care providers. Currently, obtaining a representative sample of the US Muslim population is not practically achievable for several reasons (Gramlich, 2017). For instance, US Muslims feel discomfort identifying their religious affiliation to strangers (Gramlich, 2017). Therefore, collecting data utilizing random sampling design was not feasible. As a result, participants were recruited through convenience and snowball sampling procedures.

Procedures

Using web-based search engines, an Internet search was conducted to identify Islamic centers and organizations in the US. Once Institutional Review Board approval was obtained, an online advertisement, a cover letter, and a link to the survey were sent to 283 centers and organizations covering all 50 US states using the contact information that was available online for them. These centers and organizations were asked about their willingness to share the study information with members of their communities. Twenty-two centers and organizations from 14 different US states agreed to be part of the study and forwarded the survey information to their members and attendees. These 14 states were mainly central and eastern US states. Further, the online advertisement was posted on Facebook webpages as well as social media pages that are of interest to US Muslims (e.g., American Muslims Facebook page), if they allowed the public to post ads. This allowed recruiting participants who are not necessarily affiliated with Islamic centers and organizations. Following snowball sampling procedures, participants were encouraged to forward the survey link to friends, family members, and individuals they think are eligible to participate in the study.

A cross-sectional design with an on-line survey was utilized to collect data. The Qualtrics platform (Qualtrics Research Software, 2015) was utilized as a survey tool to collect data. The questionnaire was administered in English, Arabic, Farsi, and Urdu, which were chosen based on previous research on US Muslims (Pew Research Center, 2011a). After the questionnaire was translated from English to these three other languages, different translators back-translated the Arabic and Farsi versions to English in order to verify the accuracy of the translation. Any

differences between the original version and the back-translated versions were reconciled, when such differences existed. Back translation to Urdu was limited by not having a locally-available translator. The questionnaire took approximately 15 min to complete. Duplicate records were identified through examining Internet Protocol (IP) address and age, and subsequently were removed. To maximize participation, three participants were randomly selected to win a \$50 gift card each. Participants who desired to enter the gift card pool entered their e-mail addresses in a separate webpage after they completed the questionnaire. E-mail addresses were not linked to responses and were saved in a separate data file. Data were collected from November 2016 to March 2017.

Measures

The primary variable of interest was tobacco use. This variable consisted of three categories: (1) current user; (2) former user; and (3) nonuser. These categories were derived using four items; two items that measured cigarette smoking and two more items that measured use of other tobacco products. As defined in previous research (National Institutes of Health, 2014; Singh, 2016), current tobacco users were those who (1) smoked at least 100 cigarettes in lifetime and currently smoked "some days" or "every day", or (2) used any type of tobacco during the past 30 days. Former tobacco users were defined as those who (1) smoked at least 100 cigarettes in lifetime but reported that they currently did "not at all" smoke, or (2) used other types of tobacco in lifetime but did not use it during the past 30 days. Non-users were defined as those who (1) did not smoke at least 100 cigarettes in lifetime, and (2) never tried any other tobacco products.

Demographic characteristics

Sex, age, race, ethnicity, marital status, education, employment status, income, and health insurance status were assessed using one item for each. General well-being was evaluated through measuring self-assessed health using a 5-point Likert scale item ranging from 1 = poor to 5 = excellent (Ware & Sherbourne, 1992), which was transformed into a continuous scale from zero (poor) to 100 (excellent) to present the linear relationship between item scores and the underlying health concept as guided by previous research (Stewart & Ware, 1992).

Cognitive factors

Cognitive factors were measured using one item for each. *Knowledge* of the consequences was measured with a 5-point response scale (1 = less than 20%—5 = more than 80%) that assessed perceived likelihood of disease or death as a result of tobacco use (Flay et al., 1994). *Outcome expectations* were measured with a 5-point scale (1 = not at all—5 = extremely) that assessed perceived effect of tobacco use on the respondent's personal health (Borland et al., 2010). *Perceived value* was measured with a 5-point scale (1 = not at all important—5 = extremely important) that assessed participants' perceived importance of abstaining from tobacco use (Shrier, Rhoads, Burke, Walls, & Blood, 2014). *Attitudes* were measured using a 5-point scale (1 = very negative—5 = very positive) that assessed participants' overall opinions on using tobacco (Hyland et al., 2006). However, it was dichotomized during analysis to examine the interaction with sex. Finally, *self-efficacy* was measured using a continuous scale (0%–100%) that assessed how certain individuals were that they could abstain from tobacco use (Perkins, Parzynski, Mercincavage, Conklin, & Fonte, 2012).

Environmental factors

Vicarious learning was measured using two items, which inquired about whether there was a tobacco user among (1) first-degree family members and (2) friends (Kandel, Kiros, Schaffran, & Hu, 2004). *Social norms* were also measured using two items, which addressed the perceived appropriateness of using tobacco products among (1) first-degree family members and (2) friends (Panday, Reddy, Ruiter, Bergstrom, & de Vries, 2005). Responses to social norms constructs were assessed using a 5-point scale, but collapsed into 3-point scales (1 = inappropriate, 2 = neither appropriate nor inappropriate, 3 = appropriate) during analyses due to lack of sufficient distribution. *Religiosity* was assessed using the Duke University Religion Index (Koenig & Büsing, 2010), a 5-item scale that demonstrated high internal consistency ($\alpha=0.87$ – 0.92) in the Muslim population (Saffari, Zeidi, Pakpour, & Koenig, 2013). Responses were normalized to construct an overall scale from 0 to 100. *Acculturation* was measured with the Brief Acculturation Scale, 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 ($\alpha=0.84$) (Meredith, Wenger, Liu, Harada, & Kahn, 2000). Again, acculturation overall score was normalized to range from 0 to 100. With regard to *barriers and*

facilitators, one item measured whether a health care professional has asked participants, any time during the past 12 months, about their tobacco use status (National Health Interview, 2015). Additionally, rules of using tobacco inside the home were assessed using one item with a 3-point response scale (1 = not allowed, 2 = allowed in some places, 3 = allowed anywhere) (Mills et al., 2009). During analysis, this item was collapsed into two categories due to lack of distribution (1 = not allowed, 2 = allowed at least sometimes or in some places).

Statistical analysis

The bivariate relationships between the primary variable of interest (i.e., tobacco use status) and variables of interest based on the SCT (i.e., cognitive and environmental factors) as well as demographic variables were tested with Chi-square tests, Fisher's exact test, Pearson's correlation coefficients, and Kendall's Tau correlation tests as appropriate. Due to lack of sufficient distribution, marital status, employment status, race, and sect variables were collapsed into binary variables. Education was collapsed into four categories. To accommodate multiple comparisons, a Bonferroni correction (Dunn, 1961) was utilized.

As tobacco use consisted of three categories, multinomial logistic regression was utilized to compare current use and former use with nonuse. Variables with modest association ($p \leq .1$) with tobacco use in the bivariate analyses were included in multinomial logistic regression models. The reason why variables with a p -value correlation of $>.1$ were excluded was to eliminate variables that are not likely to demonstrate significant association in the logistic regression. Subsequently, using fewer variables in the regression model is expected to result in more model stability. Unadjusted multinomial logistic regression was conducted followed by adjusted multinomial logistic regression. In both models, "non-use" was the reference group. Because sex interacted with attitudes and caused instability in the model, these two variables were replaced with an interaction variable (attitude by sex) in the final multinomial logistic regression analyses.

Results

Three hundred seventy participants have consented to participate and completed the questionnaire, of which 98 participants did not meet the eligibility criteria (4 participants younger than 18 years old, 61 participants from outside the US, 25 participants did not

affiliate with Islam, and 8 participants had a personal history of lung cancer). One duplicate record was identified. Eligible participants ($n = 271$) from 30 US states completed the questionnaire in English ($n = 180$), Arabic ($n = 88$), Farsi ($n = 2$), and Urdu ($n = 1$). Participants' age ranged from 19 to 70 with a median age of 32. One hundred thirty-eight participant (50.9%) identified as Sunnah, eight (3%) identified as Shaa, and the rest (46.1%) did not specify a sect to which they belonged. Though comparable, this proportion is a somehow different from Sunnah-Shaa proportion in the US (Pew Research Center, 2017) and worldwide (Pew Research Center, 2011b). The majority of participants (60.2%) were foreign-born. Only three participants reported being Hispanic or Latino/a. The majority of respondents (68.3%) reported discussing tobacco use with their physicians. More than half of the sample (52.8%) reported current tobacco use. Out of all current tobacco users ($n = 143$), the most commonly used tobacco products were cigarettes (92.3%) and water-pipes (55.9%), followed by electronic cigarettes (12.6%), as well as cigars (11.2%). Only 31.7% of those who completed the questionnaire in English reported nonuse of tobacco, whereas 44.0% were nonusers among participants who completed the questionnaire in other languages [$\chi^2(2, N = 271) = 5.6, p = .059$]. More than half of current tobacco users ($n = 74$) reported concurrent use of more than one tobacco product. Results of the bivariate analyses are shown in Table 1. Wald chi-square test values, unadjusted odds ratios, and confidence intervals are shown in Table 2. Sixteen variables were significantly associated with current use (as opposed to nonuse), whereas six variables were significantly associated with former use (as opposed to nonuse). As shown in Table 3, individuals with higher expectations, greater self-efficacy, and no tobacco users among their family members were less likely to report current tobacco use as opposed to nonuse. Individuals with higher self-assessed health, greater knowledge, lower religiosity, and friends who are tobacco users were less likely to report being a former tobacco user as opposed to nonuser. Finally, there was an interaction between sex and attitudes in association with tobacco use status. Among those with negative attitudes, women were less likely than men to report current tobacco use rather than nonuse.

Discussion

This study aimed to investigate the association between tobacco use and cognitive as well as

Table 1. Variables of interest by tobacco use categories. Muslim adults (≥ 18 years) in the United States (numbers, row percentages, and bivariate tests statistics).

Variable		Non-user <i>N</i> = 97, 35.8% (row percentage)	Former user <i>N</i> = 31, 11.4% (row percentage)	Current user <i>N</i> = 143, 52.8% (row percentage)	Test statistics
<i>Demographic characteristics</i>					
Sex	Male	41 (28.3%)*	13 (9.0%)	91 (62.8%)*	$\chi^2(2, N = 271) = 12.49, p = .002$
	Female	56 (44.4%)	18 (14.3%)	52 (41.3%)	
Age	<i>M</i> = 35.35 (<i>SD</i> = 11.70)	<i>M</i> = 34.22 (<i>SD</i> = 10.28)	<i>M</i> = 35.16 (<i>SD</i> = 13.48)	<i>M</i> = 36.17 (<i>SD</i> = 12.21)	<i>r</i> = 0.077, <i>n</i> = 271, <i>p</i> = .204
Education (scale from 1–4)	<i>M</i> = 2.87 (<i>SD</i> = 1.03)	<i>M</i> = 3.04 (<i>SD</i> = 0.98)	<i>M</i> = 2.87 (<i>SD</i> = 0.99)	<i>M</i> = 2.75 (<i>SD</i> = 1.06)	$\tau_b(271) = -0.115, p = .034$
Ever changed religion	No	92 (36.2%)	25 (9.8%)*	137 (53.9%)	$\chi^2(2, N = 271) = 10.28, p = .006$
	Yes	5 (29.4%)	6 (35.3%)*	6 (35.3%)	
Sect followed	Sunnah	56 (40.6%)	24 (17.4%)*	58 (42.0%)*	$\chi^2(2, N = 271) = 16.65, p < .001$
	Something else	41 (30.8%)	7 (5.3%)	85 (63.9%)	
Self-assessed health (scale from 0–100)	<i>M</i> = 82.62 (<i>SD</i> = 19.54)	<i>M</i> = 87.94* (<i>SD</i> = 15.90)	<i>M</i> = 73.10* (<i>SD</i> = 24.21)	<i>M</i> = 81.08 (<i>SD</i> = 19.74)	<i>r</i> = -0.150, <i>n</i> = 271, <i>p</i> = .013
Income (scale from 1–9)	<i>M</i> = 5.31 (<i>SD</i> = 1.98)	<i>M</i> = 5.39 (<i>SD</i> = 2.04)	<i>M</i> = 5.32 (<i>SD</i> = 2.33)	<i>M</i> = 5.26 (<i>SD</i> = 1.86)	$\tau_b(271) = -0.033, p = .520$
Health insurance	No	5 (23.8%)	2 (9.5%)	14 (66.7%)	<i>FET</i> (<i>N</i> = 271) = 1.66, <i>p</i> = .389
	Yes	92 (36.8%)	29 (11.6%)	129 (51.6%)	
Marital status	Married or living as married	76 (35.8%)	23 (10.8%)	113 (53.3%)	$\chi^2(2, N = 271) = 0.35, p = .839$
	Not married	21 (35.6%)	8 (13.6%)	30 (50.8%)	
Race	White	70 (35.7%)	23 (11.7%)	103 (52.6%)	$\chi^2(2, N = 271) = 0.06, p = .970$
	Non-white	27 (36.0%)	8 (10.7%)	40 (53.3%)	
Employment status	Employed	63 (34.8%)	18 (9.9%)	100 (55.2%)	$\chi^2(2, N = 271) = 1.85, p = .397$
	Not employed	34 (37.8%)	13 (14.4%)	43 (47.8%)	
<i>Cognitive factors</i>					
Knowledge (scale from 1–5)	<i>M</i> = 3.13 (<i>SD</i> = 1.36)	<i>M</i> = 3.98* (<i>SD</i> = 1.03)	<i>M</i> = 3.90* (<i>SD</i> = 1.22)	<i>M</i> = 2.38* (<i>SD</i> = 1.14)	$\tau_b(271) = -0.488, p < .001$
Expectations (scale from 1–5)	<i>M</i> = 3.34 (<i>SD</i> = 1.28)	<i>M</i> = 4.20* (<i>SD</i> = 0.81)	<i>M</i> = 4.42* (<i>SD</i> = 0.81)	<i>M</i> = 2.52* (<i>SD</i> = 1.05)	$\tau_b(271) = -0.551, p < .001$
Attitudes	Negative	94 (58.8%)*	29 (18.1%)*	37 (23.1%)*	<i>FET</i> (<i>N</i> = 271) = 158.10, <i>p</i> < .001
	Positive	3 (2.7%)	2 (1.8%)	106 (95.5%)	
Perceived value (scale from 1–5)	<i>M</i> = 3.42 (<i>SD</i> = 1.51)	<i>M</i> = 4.58* (<i>SD</i> = 0.72)	<i>M</i> = 4.52* (<i>SD</i> = 0.85)	<i>M</i> = 2.40* (<i>SD</i> = 1.27)	$\tau_b(271) = -0.601, p < .001$
Self-efficacy (scale from 0–100)	<i>M</i> = 62.73 (<i>SD</i> = 30.93)	<i>M</i> = 85.11* (<i>SD</i> = 20.00)	<i>M</i> = 90.35* (<i>SD</i> = 15.00)	<i>M</i> = 41.55* (<i>SD</i> = 23.25)	<i>r</i> = -0.671, <i>n</i> = 271, <i>p</i> < .001
<i>Environmental factors</i>					
A tobacco user family member	No	69 (63.9%)*	14 (13.0%)	25 (23.1%)*	$\chi^2(2, N = 271) = 69.82, p < .001$
	Yes	28 (17.2%)	17 (10.4%)	118 (72.4%)	
A tobacco user friend	No	31 (57.4%)*	18 (33.3%)*	5 (9.3%)*	$\chi^2(2, N = 271) = 61.25, p < .001$
	Yes	66 (30.4%)	13 (6.0%)	138 (63.6%)	
Family-related social norms (scale from 1–3)	<i>M</i> = 1.57 (<i>SD</i> = 0.59)	<i>M</i> = 1.28* (<i>SD</i> = 0.47)	<i>M</i> = 1.48 (<i>SD</i> = 0.72)	<i>M</i> = 1.78* (<i>SD</i> = .53)	$\tau_b(271) = 0.395, p < .001$
Friends-related social norms (scale from 1–3)	<i>M</i> = 1.95 (<i>SD</i> = 0.75)	<i>M</i> = 1.54* (<i>SD</i> = 0.58)	<i>M</i> = 1.48* (<i>SD</i> = 0.72)	<i>M</i> = 2.33* (<i>SD</i> = 0.65)	$\tau_b(271) = 0.460, p < .001$
Acculturation (scale from 0 to 100)	<i>M</i> = 53.15 (<i>SD</i> = 31.52)	<i>M</i> = 47.72 (<i>SD</i> = 31.16)	<i>M</i> = 53.47 (<i>SD</i> = 34.79)	<i>M</i> = 56.52 (<i>SD</i> = 30.90)	<i>r</i> = 0.129, <i>n</i> = 241, <i>p</i> = .046
Religiosity (scale from 0–100)	<i>M</i> = 59.09 (<i>SD</i> = 32.56)	<i>M</i> = 75.49* (<i>SD</i> = 16.39)	<i>M</i> = 83.87* (<i>SD</i> = 13.27)	<i>M</i> = 42.59* (<i>SD</i> = 34.72)	<i>r</i> = -0.484, <i>n</i> = 271, <i>p</i> < .001
Tobacco use inside home	Not allowed	80 (57.6%)*	27 (19.4%)*	32 (23.0%)*	<i>FET</i> (<i>N</i> = 271) = 107.92, <i>p</i> < .001
	Allowed	17 (12.9%)	4 (3.0%)	111 (84.1%)	
Physician asked about tobacco status	No	30 (34.9%)	11 (12.8%)	45 (52.3%)	$\chi^2(2, N = 271) = 0.24, p = .889$
	Yes	67 (36.2%)	20 (10.8%)	98 (53.0%)	

Abbreviations: χ^2 , Chi-square; FET, Fisher's exact test; τ_b , Kendall's Tau-b correlation; *r*, Pearson correlation coefficient; *N*, number of subjects included in the analysis, *p*, significance level or *p*-value; *M*, mean; *SD*, standard deviation.

*A category that is significantly different from the other two categories combined (horizontal comparison).

environmental factors in a sample of adult US Muslims. Due to the key associations between tobacco use status and religiosity as well as acculturation (Al-Omari & Scheibmeir, 2009; Brown et al., 2014; Jadalla & Lee, 2012), these relationships were also investigated in the sample. Elevated rates of current tobacco use in the study sample (52.8%) aligns with rates reported in previous research on US Muslims

(Newport & Himelfarb, 2013; Sayeed, 2011). This may indicate little receptiveness for tobacco cessation interventions by US Muslims or a lack of exposure to such interventions. Additionally, the finding that men were more likely to report current tobacco use compared to women may be explained by potential cultural constraints on tobacco use among women in certain countries (Shechter, 2006), which can be source

Table 2. Unadjusted odds ratios, 95% confidence interval, and Wald Chi-Square from multinomial logistic regression on tobacco use categories. Adult (≥ 18 years) Muslims in the United States (reference category for tobacco use = non-users).

	Current user			Former user		
	UOR (95% CI)	Wald	p-value	UOR (95% CI)	Wald	p-value
<i>Demographic characteristics</i>						
Sex						
Male	2.390 (1.410–4.051)	10.478	.001**	0.986 (0.435–2.238)	0.001	.974
Female	[Reference]			[Reference]		
Education	0.752 (0.580–0.974)	4.651	.031*	0.843 (0.565–1.259)	0.694	.405
Ever changed religion						
No	1.241 (0.368–4.186)	0.121	.728	0.226 (0.064–0.804)	5.283	.022*
Yes	[Reference]			[Reference]		
Sect followed						
Sunnah	0.500 (0.296–0.843)	6.759	.009**	2.510 (0.987–6.383)	3.735	.053
Something else	[Reference]			[Reference]		
General Well-being						
Self-assessed health	0.978 (0.963–0.994)	7.599	.006**	0.962 (0.942–0.982)	13.602	<.001***
<i>Cognitive factors</i>						
Knowledge	0.318 (0.240–0.423)	62.143	<.001***	0.935 (0.642–1.363)	0.121	.728
Expectations	0.192 (0.129–0.285)	66.740	<.001***	1.461 (0.840–2.542)	1.800	.180
Attitudes						
Negative	0.011 (0.003–0.037)	53.163	<.001***	0.463 (0.074–2.905)	0.676	.411
Positive	[Reference]			[Reference]		
Perceived value	0.193 (0.131–0.285)	68.677	<.001***	0.896 (0.526–1.526)	0.163	.686
Self-efficacy	0.929 (0.914–0.945)	72.985	<.001***	1.020 (0.993–1.049)	2.067	.150
<i>Environmental factors</i>						
Vicarious learning—Family						
No	0.086 (0.046–0.159)	61.011	<.001***	0.334 (0.145–0.768)	6.657	.010*
Yes	[Reference]			[Reference]		
Vicarious learning—Friends						
No	0.077 (0.029–0.207)	25.778	<.001***	2.948 (1.284–6.769)	6.497	.011*
Yes	[Reference]			[Reference]		
Social norms—Family	5.679 (3.291–9.798)	38.940	<.001***	2.227 (1.021–4.856)	4.050	.044*
Social norms—Friends	5.996 (3.694–9.733)	52.515	<.001***	0.866 (0.440–1.705)	0.174	.677
Acculturation	1.009 (1.000–1.018)	3.977	.046*	1.006 (0.991–1.020)	0.608	.436
Religiosity	0.958 (0.946–0.970)	43.598	<.001***	1.025 (1.001–1.050)	4.019	.045*
Tobacco use inside home						
Not allowed	0.061 (0.032–0.118)	69.891	<.001***	1.434 (0.444–4.637)	0.363	.547
Allowed	[Reference]			[Reference]		

Abbreviations: UOR, unadjusted odds ratio; CI, confidence interval, Wald, Wald Chi-square.

*.01 ≤ p-value < .05.

**.001 ≤ p-value < .01.

***p-value < .001.

countries for immigration to the US. Such constraints may lead to reduced tobacco use rates or under-reporting of tobacco use by women. Nevertheless, this statistic was consistent with previous research on adults in the US (Garrett et al., 2013; Hu, 2016).

The lower-rated self-assessed health in former users as compared to nonusers has several potential interpretations. Former users may believe that the detrimental impact of tobacco use on health is irreversible, and therefore, quitting tobacco is insufficient to restore pre-tobacco health status. Another explanation might be that another health condition arose that made former users discontinue tobacco use. This finding suggests that more effort may be needed to educate the US Muslim population about the positive, but gradual, health consequences of quitting tobacco.

Several cognitive factors played a role in tobacco use. Consistent with previous research (Bandura, 2004; Islam & Johnson, 2003; Schnoll et al., 2003), study participants were less likely to report current

tobacco use if they had higher self-efficacy regarding their ability to abstain from tobacco and if they believed that tobacco use causes negative personal health consequences (i.e., higher expectations). Because these two factors may be protective against initiating tobacco, the findings affirm the importance of enhancing self-efficacy and educating the US Muslim population about the personal impact of tobacco use on health. In addition, participants with higher knowledge about the general consequences of tobacco use were less likely to report being a former user rather than nonuser. The importance of education in curbing tobacco use demonstrated in our results was consistent with a findings of another recent study addressing Muslims outside the US (Widyaningrum & Yu, 2018).

These findings, however, should be understood in light of the fact that the majority of participants (60.2%) were foreign-born. Due to spending part of their lifespan outside the US, they may not have had

Table 3. Adjusted odds ratios, 95% confidence interval, and Wald Chi-Square from multinomial logistic regression on tobacco use categories. Adult (≥ 18 years) Muslims in the United States (reference category for tobacco use = non-users).

	Current user			Former user		
	AOR (95% CI)	Wald	p-value	AOR (95% CI)	Wald	p-value
<i>Demographic characteristics</i>						
Education	0.885 (0.370–2.116)	0.075	.784	1.154 (0.616–2.162)	0.200	.655
Ever changed religion						
No	0.003 (0.000–1.330)	3.493	.062	0.094 (0.003–3.091)	1.758	.185
Yes	[Reference]			[Reference]		
Sect followed						
Sunnah	0.286 (0.036–2.284)	1.393	.238	0.964 (0.176–5.287)	0.002	.967
Something else	[Reference]			[Reference]		
General well-being						
Self-assessed health	0.974 (0.935–1.014)	1.638	.201	0.945 (0.909–0.981)	8.506	.004**
<i>Cognitive factors</i>						
Knowledge	1.085 (0.532–2.214)	0.050	.823	0.452 (0.213–0.959)	4.284	.038*
Expectations	0.317 (0.114–0.880)	4.863	.027*	1.511 (0.606–3.764)	0.785	.376
Perceived value	0.588 (0.270–1.277)	1.800	.180	0.696 (0.284–1.707)	0.626	.429
Self-efficacy	0.938 (0.901–0.977)	9.605	.002**	0.987 (0.943–1.032)	0.340	.560
<i>Environmental factors</i>						
Vicarious learning—Family						
No	0.048 (0.007–0.333)	9.439	.002**	0.477 (0.091–2.483)	0.775	.379
Yes	[Reference]			[Reference]		
Vicarious learning—Friends						
No	0.104 (0.002–4.498)	1.386	.239	6.544 (1.133–37.795)	4.408	.036*
Yes	[Reference]			[Reference]		
Social norms—Family	0.603 (0.129–2.818)	0.414	.520	3.369 (0.831–13.655)	2.893	.089
Social norms—Friends	1.925 (0.389–9.521)	0.644	.422	3.444 (0.954–12.441)	3.562	.059
Acculturation	1.004 (0.970–1.038)	0.043	.835	1.015 (0.989–1.041)	1.206	.272
Religiosity	1.007 (0.956–1.062)	0.076	.783	1.070 (1.005–1.138)	4.534	.033*
Tobacco use inside home						
No	0.604 (0.093–3.905)	0.280	.597	1.887 (0.315–11.312)	0.483	.487
Yes	[Reference]			[Reference]		
<i>Interaction between sex and attitudes</i>						
Women with positive attitudes	0.298 (0.007–11.947)	0.413	.520	1.062 (0.026–43.073)	0.001	.975
Women with negative attitudes	0.012 (0.000–0.394)	6.169	.013*	3.506 (0.598–20.546)	1.933	.164
Men with positive attitudes	0.529 (0.021–13.344)	0.150	.699	0.407 (0.007–24.839)	0.184	.668
Men with negative attitudes	[Reference]			[Reference]		

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; Wald, Wald Chi-square.

*.01 \leq p-value < .05.

**.001 \leq p-value < .01.

***p-value < .001.

sufficient education about how tobacco use can negatively affect health, which is evident in high rates of current tobacco use rates in the sample. Therefore, when providing care to Muslim immigrants, health care providers may need to assess patients' awareness and knowledge of the consequences of tobacco use. However, compared with 55.3% of the US population who reported being asked by their health care providers about tobacco use (National Health Interview Survey, 2017), a higher percentage of adult US Muslims (68.3%) reported the same, which may indicate better patient-provider communication about tobacco use among adult US Muslims. Finally, the interaction noted between attitudes and sex in association with tobacco use suggests that sex plays a moderating effect in the relation between attitudes and tobacco use. This indicates the importance of considering sex-related differences in tobacco use behavior. If attitudes are addressed in future interventions, different messages regarding tobacco cessation for men and women might be needed.

Environmental factors are also critical in understanding tobacco use in the US Muslim population. Consistent with the hypotheses, participants were less likely to report current use of tobacco if none of their first-degree family members were current users. Considering the importance of family-connectedness and its influence on health behavior among US Muslims (Daneshpour, 1998), the study results affirm the importance of devising family-based prevention strategies that aim to control tobacco use in this population. For example, by abstaining from smoking, parents would not only protect their children from second hand smoking, but also act as role models for them. In sum, future approaches to curb tobacco use in US Muslims might include measures to encourage families to stop modeling smoking.

Having friends who were tobacco users was more likely among nonusers as opposed to former users. Those who never used tobacco might have vicariously learned the negative consequences of using tobacco from friends, not the behavior of using tobacco itself;

the behavior itself may have been learned from observing parents—a stronger and longer source of vicarious learning. Thus, being in contact with friends who were tobacco users may have equipped the participants with knowledge that shielded them from initiating tobacco use. Another interpretation might be that former users have restrained from socializing with friends who use tobacco in order to reduce temptation for tobacco use.

In terms of religiosity, individuals with higher religiosity were more likely to report former tobacco use rather than nonuse. Even though previous research showed a significant association between religiosity and smoking status as well as smoking intensity (Widyaningrum & Yu, 2018), nonusers and current users did not significantly differ in religiosity in this study. Therefore, we think that having higher religiosity was a cue to quitting tobacco use among former users, but not protective against initiating tobacco use among nonusers.

Although acculturation was not significantly associated with tobacco use status in the multinomial logistic regression model, acculturation might still be an important factor because of two observations. First, descriptive analyses demonstrated a trend between language of completing the questionnaire and nonuse of tobacco. Second, acculturation showed modest association with tobacco use status in the bivariate analysis and the unadjusted multinomial regression analysis. Therefore, examining the influence of acculturation on tobacco use status might be warranted in future research.

The findings of this study should be interpreted in light of certain limitations. First, due to the difficulty in accessing the US Muslim population (Gramlich, 2017), the convenience and snowball sampling techniques may limit the study generalizability to adult Muslims in the US. This limitation, however, is mitigated by the fact that recruitment of participants was not restricted to one state or one geographical area, but included participants who resided in a vast geographical area across the US (30 states). Second, because recruiting was conducted online (using websites and social media sites) and because it was voluntary, estimating the response rate was not possible. Therefore, non-response bias might be a concern. Third, causality cannot be inferred for any of the observed associations due to the cross-sectional design. Additionally, interpretation of above-mentioned associations can be understood in different ways. For example, lower self-efficacy reported among current tobacco users could be the outcome—and not

the predictor—of current tobacco use. However, having theory-based *a priori* hypotheses to guide data analyses may mitigate the limitation associated with using a cross-sectional design. Fourth, unlike items that were used to measure other cognitive factors, the self-efficacy item examined *abstaining* from tobacco use, not tobacco use itself. This might have created confusion among participants when completing the survey. Fifth, we utilized single-item measures, which may result in limited validity of data. Additionally, the survey was not piloted; this may threaten the reliability and validity of the findings due to lack of information on the psychometric properties of certain measures (e.g., acculturation measure). Finally, we acknowledge that the study is underpowered due to small sample size. Thus, odds ratios for some associations in the multinomial logistic model had wide confidence intervals, and therefore, limited reliability. However, despite not meeting the recommended sample size as suggested by previous research (Hosmer Jr, Lemeshow, & Sturdivant, 2013), this exploratory study has identified some significant associations that provided a rich seminal work for future research on this population.

The SCT provided a sound theoretical framework to study tobacco use in this population. This is the first study to investigate the associations between tobacco use and cognitive as well as environmental factors in adult US Muslims using the SCT. This study is expected to be a seminal work for future research that addresses means of manipulating certain factors to curb tobacco use in this population. The findings presented several social and health care-related implications. For example, the study findings demonstrated the importance of family members' tobacco use status, outcome expectations, and abstinence self-efficacy in tobacco use behavior in US Muslims. Therefore, Muslim parents and family members may act as role models to equip their family members with the needed awareness and confidence against initiating tobacco use.

In terms of health care, the findings of this study may demonstrate the need for increasing awareness of the negative health impacts of tobacco on health among US Muslims. For example, future interventions based on the SCT that aim to reduce tobacco use may educate adult US Muslims about the healthcare-based assistance they can receive, such as prescription medications or nicotine replacement. Such interventions can also demonstrate techniques that aid in quitting tobacco use. As opposed to only unrelated individuals, getting entire families or groups of friends involved in

tobacco cessation interventions could potentially be more effective as individuals vicariously learn from their family members and friends the skills of quitting tobacco use.

Considering the findings related to the potential influence of religiosity on tobacco use in our research, future research may investigate the association between religiosity and quitting tobacco in longitudinal studies among adult US Muslim tobacco users in order to understand how this construct can be used to improve quitting tobacco use in this population. Additionally, measuring length of stay in the US can potentially be a confounding factor in some observed associations. So, it is strongly encouraged to measure this factor in future studies addressing tobacco use in US Muslims.

Disclosure of interest

The authors declare no conflicts of interest.

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Appendix

Tobacco use among a sample of adult Muslims in the United States

The purpose of this survey is to learn about your viewpoint with regard to tobacco use. Please answer based on your own beliefs or behaviors. There are no right or wrong answers.

- Have you smoked at least 100 cigarettes in your entire life?
 - No
 - Yes

- How often do you now smoke cigarettes?
 - Not at all
 - Some days
 - Every day

- Which of the following products have you tried, even just one time? (Please check all that apply. If you did not use any of the following products, please check "I did not use any of these products")
 - Cigarettes
 - Shisha or Hookah (waterpipe, narghile, goza, or bubble bubble pipes)
 - Snus
 - Electronic cigarettes (e-cigarettes or vaporizers)
 - Khat (Catha edulis)
 - Bidis
 - Kretek
 - Chewing tobacco (pan/gutka or ghutka)
 - Cigar
 - Smokeless tobacco
 - Cigarillos
 - Biri
 - Betel nut (Areca nut)
 - Pipe
 - Other products (Please specify)

 ○ I did not use any of these products

- During the past 30 days, did you use any form of tobacco mentioned above?
 - No
 - Yes

- How likely is it that tobacco users, in general, will contract diseases or die due to tobacco use?
 - More than 80% likely
 - 60%–80% likely
 - 40%–60% likely
 - 20%–40% likely
 - Less than 20% likely

- How much do you think it would affect your health if you were to use tobacco?
 - Not at all
 - A little
 - Somewhat
 - A lot
 - Extremely

- What is your overall opinion of using tobacco?
 - Very negative
 - Negative
 - Neither negative nor positive
 - Positive
 - Very positive

- How important is it to you that you abstain from tobacco?
 - Not at all important
 - Slightly important
 - Moderately important
 - Very important
 - Extremely Important

- On a scale from 0% to 100%, how certain are you that you could abstain from using tobacco, such as when you spend time with friends who use tobacco?
 - 0 10 20 30 40 50 60 70 80 90 100
 - Degree of Certainty  █

- Among your best friends, is at least one of them a tobacco user?
 - No
 - Yes

- Among your first-degree family members (spouse, parents, brothers, sisters, sons, daughters), is at least one of them a tobacco user?
 - No
 - Yes

- My friends think that using tobacco products is:
 - Absolutely inappropriate
 - Slightly inappropriate
 - Neither inappropriate nor appropriate
 - Slightly appropriate
 - Absolutely appropriate

- My family members think that using tobacco products is:
 - Absolutely inappropriate
 - Slightly inappropriate
 - Neither inappropriate nor appropriate
 - Slightly appropriate
 - Absolutely appropriate

- Which statement best describes the rules about using tobacco inside your home?
 - Using tobacco is not allowed anywhere inside my home
 - Using tobacco is allowed some places or at some times
 - Using tobacco is allowed anywhere inside my home

- During the past 12 months, has a doctor or other health professional asked you about your tobacco use status?
 - No
 - Yes

- Which language do you prefer to speak?
 - English
 - A different language (The language of my family's ethnic background)

- Do you identify yourself as:
 - American
 - A different identity (My family's ethnic background)

- Where were you raised?
 - In a foreign country
 - Mostly in a foreign country
 - Mostly in the U.S.
 - In the U.S. only

- Which generation of immigrants are you?
 - First-generation {born outside the US}
 - Second-generation {born in the US to at least one immigrant parent}
 - Third- or higher-generation {born in the US to US-born parents}

- How often do you attend places of worship or other religious meetings?
 - Never
 - Once a year or less
 - A few times a year
 - A few times a month
 - Once a week
 - More than once every week

- How often do you spend time in private religious events? (For example: prayer, meditation or religious education)
 - Rarely or never
 - A few times a month
 - Once a week
 - Two or more times/week
 - Daily
 - More than once a day

- In my life, I experience the presence of the Divine (God).
 - Definitely not true
 - Tends not to be true
 - Unsure
 - Tends to be true
 - Definitely true of me

- My religious beliefs are what really lie behind my whole approach to life.
 - Definitely not true
 - Tends not to be true

- Unsure
- Tends to be true
- Definitely true of me

- I try hard to carry my religion over into all other dealings in life.
 -
 - Definitely not true
 - Tends not to be true
 - Unsure
 - Tends to be true
 - Definitely true of me

- Are you male or female?
 - Male
 - Female

- What is your age?
- What is your race?
 - American Indian/Alaskan Native
 - Asian
 - Black or African American
 - Native Hawaiian/Other Pacific Islander
 - White
 - Multiple Races
 - Other (Please specify): _____

- Are you of Hispanic, Latino/a, or Spanish origin?
 - No
 - Yes

- In what country do you live?
 - In the United States
 - Elsewhere. Please specify: _____

- In what State do you live?
- What is your current religion, if any?
 - Islam (Muslim)
 - Protestant
 - Roman Catholic
 - Mormon
 - Orthodox
 - Hinduism (Hindu)
 - Judaism (Jewish)
 - Buddhism (Buddhist)
 - Confucianism
 - Taoism
 - Atheism
 - Agnosticism
 - Nothing in particular
 - Prefer not to answer
 - Something else (Please specify): _____

- What sect do you follow, if any?
 - Sunnah (Sunni)
 - Shi'ah (Shiites)
 - Nothing in particular
 - Other (Please specify): _____

- Have you ever changed your religion?
 - No

- Yes

- What is your marital status?
 - Married
 - Living as married
 - Divorced
 - Widowed
 - Separated
 - Single, never been married

- What is the highest grade or level of schooling you completed?
 - None
 - 1st Grade
 - 2nd Grade
 - 3rd Grade
 - 4th Grade
 - 5th Grade
 - 6th Grade
 - 7th Grade
 - 8th Grade
 - 9th Grade
 - 10th Grade
 - 11th Grade
 - 12th Grade
 - GED
 - Some College/technical/trade school, but less than 1 year
 - 1 or more years of College/technical/trade school, No Degree
 - Technical or Trade Degree or Certification
 - Associate Degree (for example: AA, AS)
 - Bachelor's Degree (for example: BA, AB, BS, BSN)
 - Master's Degree (for example: MA, MS, MPH, MSW, MBA)
 - Professional Degree (for example: MD, DDS, DVM, LLB, JD)
 - Doctorate Degree (for example: PHD, EDD)
 - Other (Please Specify) _____

- What is your current employment status?
 - Employed
 - Unemployed
 - Homemaker
 - Student
 - Retired
 - An individual with a disability
 - Other (Please specify): _____

- For the past year, what was your total household income before tax?
 - \$0 to \$9,999
 - \$10,000 to \$14,999
 - \$15,000 to \$19,999
 - \$20,000 to \$34,999
 - \$35,000 to \$49,999
 - \$50,000 to \$74,999
 - \$75,000 to \$99,999
 - \$100,000 to \$199,999
 - \$200,000 or more

- Do you have any kind of health insurance?
 - No
 - Yes
- Have you ever been diagnosed as having lung cancer?
 - No
 - Yes
- How would you rate your health today?
 - Poor
 - Fair
 - Good
 - Very good
 - Excellent