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Knowledge about nicotine among HIV-positive smokers: Implications for tobacco regulatory science policy

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Abstract

The present paper describes the general knowledge of smoking and nicotine among a sample of current smokers living with HIV ($n=271$) who were recruited via Amazon Mechanical Turk. Descriptive statistics were used to report sociodemographic and smoking characteristics, as well as knowledge about smoking and nicotine. The sample was comprised of relatively light smokers, both in terms of cigarettes per day ($M=8.1$, $SD=9.7$) and dependence (67.5% had low dependence according to the Heaviness of Smoking Index). The majority of participants correctly identified smoking as being a potential cause of various smoking-related conditions and correctly identified constituents in cigarette smoke. However, a majority of participants also misattributed nicotine as being a potential cause of smoking-related illness. Accurate knowledge about nicotine was low. These misperceptions are of particular concern for vulnerable populations, such as persons living with HIV, who are disproportionately burdened by the prevalence of smoking and associated morbidities and mortality. These misperceptions could have unintended consequences in the wake of a potential nicotine reduction policy, such that reduced nicotine content products are perceived as safer than normal nicotine content products currently available for sale. Additionally, incorrect knowledge about nicotine has implications for the uptake and continued use of nicotine replacement therapy.

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Contributors

Author Pacek conceptualized the research question, conducted the statistical analyses, and wrote the first draft of the manuscript. Authors Rass and Johnson contributed to, have critically reviewed and revised, and have approved of the final manuscript.

Conflict of Interest

The authors have no conflicts of interest to declare.

Keywords

knowledge; nicotine; smoking; comorbidity; HIV

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1. Introduction

The Family Smoking Prevention Tobacco Control Act (FSPTCA) gives the Food and Drug Administration (FDA) the authority to reduce, but not eliminate, the levels of nicotine in cigarettes (Congress, 2009). The reduction of nicotine to nonaddictive levels could have a significant, positive impact on public health (Benowitz & Henningfield, 1994); the feasibility of this approach is supported by prior research using reduced nicotine content cigarettes (Benowitz et al., 2007; Donny et al., 2015; Hatsukami et al., 2010). Findings suggest that nicotine reduction has the potential to decrease dependence and subsequent tobacco use, which would likely translate into reduced smoking-related morbidity and mortality and thus reduce the economic burden of cigarette smoking.

One concern about implementing a nicotine reduction policy is that smokers may misunderstand the role of nicotine in smoking and smoking-related morbidity and mortality. Though nicotine is the primary addictive component in cigarettes, it is the tar and chemicals in cigarette smoke that are responsible for the majority of smoking-related adverse health outcomes, rather than nicotine itself (DHHS, 2010). However, in survey research, most smokers incorrectly identified nicotine as a cause of strokes, heart attacks/disease, asthma (Bobak, Shiffman, Gitchell, Bery, & Ferguson, 2010), and lung cancer (Bansal-Travers, Cummings, Hyland, Brown, & Celestino, 2010; Cummings et al., 2004; Mooney, Leventhal, & Hatsukami, 2006). Similar findings were observed among faculty at a major United States (U.S.) university: the majority correctly perceived cigarettes as a moderate or high risk for all health domains (i.e., general health, heart attack/stroke, all cancers, oral cancer), however, 78%-91% also perceived nicotine intake to be a moderate to high risk for the same domains (Patel, Peiper, & Rodu, 2012). Knowledge and beliefs about smoking and nicotine are related to socioeconomic status (SES). In an analysis of the International Tobacco Control Four Country Survey (ITC-4)—a cohort survey of 9,000 adult smokers from the United States, Canada, United Kingdom, and Australia—individuals of lower SES were more likely to have lower awareness of the harms of smoking and the harmful constituents of tobacco smoke. Additionally, lower SES was associated with the inaccurate belief that nicotine causes most of the cancer associated with smoking (Siahpush, McNeill, Hammond, & Fong, 2006).

Inaccurate beliefs that nicotine is the harmful constituent in cigarettes and that low nicotine products are safer are potentially dangerous for smokers. Should the FDA mandate a reduction in nicotine content in cigarettes nationwide, lack of knowledge and misunderstanding regarding the role of nicotine in smoking-related morbidity and mortality could result in: 1) decreased urgency to reduce or quit smoking; and 2) the perceived opportunity to resume smoking among former smokers. Moreover, inaccurate beliefs about nicotine in the presence of a nicotine reduction policy have the potential to be especially detrimental among vulnerable populations, like persons living with HIV, among whom

smoking is highly prevalent (40-75%) (Helleberg et al., 2013; Mdodo et al., 2015; Pacek, Harrell, & Martins, 2014; Pacek, Latkin, Crum, Stuart, & Knowlton, 2014). This group exhibits greater risk of cardiovascular disease, non-AIDS-malignancies, and all-cause mortality compared to non-smokers with HIV (Helleberg et al., 2015). Helleberg and colleagues (Helleberg et al., 2014) found that smokers living with HIV currently lose a greater number (15 versus 3) of life-years to smoking than to HIV itself.

Little is known about knowledge of smoking and nicotine among smokers living with HIV, a group with a higher prevalence of smoking as well as associated morbidity and mortality than the general population. Data regarding beliefs and misinformation regarding smoking and nicotine are critical for developing appropriate educational and labeling information for nicotine and tobacco products. The present study addresses this gap in the literature by assessing general knowledge regarding smoking and nicotine, as well as characteristics associated with knowledge, among a sample of current smokers living with HIV.

2. Methods

2.1 Data Source

Data were from an online survey targeting current cigarette smokers living with HIV. Participants were recruited from Amazon Mechanical Turk (MTurk). MTurk provides a cost-effective and rapid method for conducting studies that span multiple disciplines, including public health (Carter, DiFeo, Bogie, Zhang, & Sun, 2014; Rass, Pacek, Johnson, & Johnson, 2015). In order to view and participate in the survey, individuals registered on MTurk were required to: 1) have a 95% or higher approval rating from previously submitted surveys; 2) be 18 years of age; and 3) reside in the U.S. (confirmed during initial MTurk registration).

The survey was advertised as a "Survey about HIV and health behaviors." Interested individuals read a description of the survey (e.g., purpose, confidentiality/anonymity, compensation) and completed a brief screening questionnaire to determine study eligibility. Inclusion criteria consisted of: 1) lifetime diagnosis of HIV; 2) having smoked at least 100 cigarettes in their lifetime; and 3) having smoked at least one cigarette within the past month. Participants were also asked about lifetime use of alcohol and cannabis in an attempt to mask the true nature of the survey. If a participant met inclusion criteria, he/she was given a code to access the password-protected survey, hosted by Qualtrics. A total of 5,257 participants completed the screener questionnaire, and 304 (5.8%) met eligibility criteria. Participants were instructed to complete the survey in one sitting and were paid \$1. The survey was active from March 16-May 14, 2015. The average time to complete the survey was 19 minutes, 39 seconds ($SD=12$ minutes, 37 seconds). Participation was voluntary and anonymous (no name or IP address was recorded). The Institutional Review Board at Johns Hopkins University approved this study.

2.2 Measures

2.2.1 Sociodemographic characteristics—Sociodemographic variables included: sex, age (continuous), race (Caucasian, African American, other), income (<\$25,000; \$25,000-\$34,999; \$35,000-\$49,999; \$50,000-\$74,999; \$75,000+), marital status (married, not

married), and education (less than high school, high school graduate/GED, more than high school).

2.2.2 HIV-related characteristics—Participants reported the age at which they received their first diagnosis. Subtracting age-at-diagnosis from their current age resulted in a “length of time since initial diagnosis” variable. Participants reported currently taking any medications for the treatment of HIV (yes/no).

2.2.3 Smoking characteristics—Participants reported how many cigarettes per day (CPD) and on how many days in the past month they smoked as continuous measures. A dichotomous “daily smoking” variable was created (i.e., smoking on 30/31 days in the past month (yes/no)). Participants also reported the age at which they began smoking; subtracting that age from their current age resulted in a “years smoking” variable.

Time to first cigarette (TTFC) upon waking (<5 minutes, 5-30 minutes, 31-60 minutes, >60 minutes) was assessed. Summing TTFC and CPD (categorized as: 10 or less, 11-20, 21-30, 31 or more) produced the Heaviness of Smoking Index (HSI), a measure of nicotine dependence (Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989). Scores on the HSI range from 0-6, with higher scores indicating greater dependence; the HSI was used as a continuous variable.

Participants reported the characteristics of their usual cigarette brand: preference for menthol cigarettes (menthol, non-menthol), type of cigarette typically smoked (machine-manufactured, roll-your-own), whether their cigarette was filtered (filtered, non-filtered), and length of their typical cigarette was (“regular”, “King size (80-85 mm)”, “100 mm”, “other”, “don’t know”).

2.2.4 Knowledge about smoking and nicotine—Drawing upon items from previous evaluations of smoking knowledge (Bansal-Travers et al., 2010; Bobak et al., 2010; Cummings et al., 2004; Mooney et al., 2006; Patel et al., 2012; Siahpush et al., 2006), participants were presented with a series of statements intended to assess their general knowledge regarding smoking and nicotine, and asked to indicate whether they believed each of the statements to be true or false. For instance, “Smoking may be a cause of: 1) Heart disease; 2) Heart attack; 3) Stroke; 4) Impotence; 5) Asthma; 6) Lung cancer.” Additionally, participants responded to the statement “Tobacco smoke contains: 1) Cyanide; 2) Mercury; 3) Arsenic; 4) Formaldehyde; 5) Carbon monoxide”, and were asked to evaluate each statement (true/false). Similar statements pertaining to general knowledge of nicotine were also presented. For instance, “Nicotine may be a cause of: 1) Heart disease; 2) Heart attack; 3) Stroke; 4) Impotence; 5) Asthma; 6) Lung cancer.” Participants answered two additional true/false questions about nicotine: “Nicotine is the addictive component of tobacco products” and “Nicotine causes most of the cancer that people get from smoking.”

2.3 Quality check(s)

Several questions served as quality checks throughout the survey, and were used to exclude questionable data. For instance, within the main survey, participants were again asked about their HIV diagnosis and current cigarette smoking status; participants not reporting a

diagnosis of HIV or current cigarette smoking were removed from the analyses. Additionally, at the conclusion of the survey, participants were asked, “Do you feel that you took your time with this survey and that we should use your responses?” Response options included: a) “Yes, I took my time. Please include my data in your analyses”; b) “No, I was rushed or distracted, so you would be better off not including my data.” Participants indicating that their data should not be used were paid, but their data were excluded from analyses.

2.4 Statistical Analysis

A total of 302 individuals took the survey. Of these, 20 participants were excluded for: failing to meet inclusion criteria related to current smoking status despite having qualified via the screening questionnaire ($n=10$); indicating that their data should not be used ($n=10$); reporting at the end of the survey that they did not actually have HIV ($n=1$); and endorsing implausible HIV medication regimens (e.g., reporting that they currently take all antiretroviral medications listed or reporting that they take a medication 20 times per day; $n=3$). Note that these numbers do not sum to 20 given that there was some overlap between the aforementioned categories. Of the remaining 282 individuals, 271 answered questions regarding knowledge about smoking and nicotine, and were included in the present analyses. Descriptive statistics were used to evaluate sociodemographic, cigarette smoking, and knowledge of smoking/nicotine characteristics. Adjusted linear regression analyses were conducted to examine associations between participant characteristics and overall knowledge of 1) health risks associated with smoking; 2) chemicals present in tobacco smoke; 3) health risks associated with nicotine. Variables in the adjusted models were selected based on a combination of *a priori* theory and the literature (i.e., (Siahpush et al., 2006), and included sex, age, education, income, CPD, and HSI score. All analyses were conducted using STATA SE statistical software version 12.0 (StataCorp, 2011).

3. Results

3.1 Sociodemographic characteristics

The sample was predominantly male, Caucasian, and 29.4 ($SD = 7.3$) years old (Table 1). Approximately half of the sample had an annual income of \$34,999 or less. Most were unmarried and had more than a high school education/GED. Participants reported an average of 5.9 ($SD = 4.7$) years since diagnosis with HIV, and nearly three-quarters reported currently taking HIV medications.

3.2 Cigarette smoking characteristics

Participants smoked an average of 8.1 ($SD = 9.7$) cigarettes per day (Table 2). Most were non-daily smokers and smoked an average of 21.3 ($SD = 10.5$) days in the past month. Participants initiated smoking at 15.1 ($SD = 3.8$) years, and had been smokers for 14.3 ($SD = 7.8$) years. Approximately half of the sample smoked within the first 30 minutes of waking. Participants exhibited low levels of nicotine dependence, on average ($M = 1.7$, $SD = 1.5$). Half of the sample smoked menthol cigarettes, and most reported that their usual brand cigarettes were machine-manufactured, filtered, and “regular” length.

3.3 General knowledge about smoking

Most participants correctly identified smoking as a potential cause of: lung cancer (92.2%), asthma (89.3%), heart disease (88.9%), stroke (86.7%), heart attack (85.6%), and impotence (75.6%; Table 3). Most correctly identified the following chemicals as constituents of cigarette smoke: carbon monoxide (84.1%), formaldehyde (78.2%), arsenic (76.7%), cyanide (76.0%), and mercury (63.8%). Participants correctly answered 86.4% ($SD = 25.0$) of questions about smoking-related morbidity and 75.8% ($SD = 32.4$) of questions about chemicals in tobacco smoke (not shown).

3.4 General knowledge about nicotine

Few participants accurately indicated that nicotine is not the primary cause of: impotence (34.3%), asthma (28.0%), stroke (24.7%), heart attack (22.9%), heart disease (21.4%), and lung cancer (21.4%; Table 3). Approximately half (48.3%) of the sample incorrectly indicated that nicotine is the cause of most cancer that occurs as a result of smoking. Conversely, the majority (93.0%) of the sample correctly identified nicotine as being the primary addictive component in tobacco. On average, participants answered 36.8% ($SD = 29.5$) of these questions correctly (not shown).

3.5 Linear regression analyses

In adjusted analyses, older individuals ($\beta = -0.77$, $t(254) = -3.10$, $p = 0.002$) and those with higher income levels had less knowledge of the health risks of nicotine (Table 4). Participants who smoked a greater number of cigarettes per day had greater knowledge of the health risks of nicotine ($\beta = 0.64$, $t(254) = 2.73$, $p = 0.007$). Conversely, participants who smoked a greater number of cigarettes had less knowledge of the health risks of smoking ($\beta = -0.42$, $t(254) = -2.05$, $p = 0.042$). Individuals with an income of \$35,000-\$49,000 had greater knowledge of the chemicals in cigarette smoke, as compared to individuals with an income of less than \$25,000 ($\beta = 17.19$, $t(254) = 2.67$, $p = 0.008$).

4. Discussion

The present study described a sample of U.S. current smokers living with HIV, recruited via a crowdsourcing Internet marketplace. Participants were light smokers—smoking relatively few CPD on average, and the majority being non-daily smokers. Nicotine dependence was correspondingly low for the majority of the participants. Most of the sample accurately identified cigarette smoking as a potential cause of a variety of health conditions, all of which are related to smoking. Most participants accurately identified various chemicals as being constituents of tobacco smoke, and identified nicotine as the primary addictive component of tobacco. This is encouraging, and indicates that public health efforts to communicate the health risks of smoking have been and continue to be effective. However, most participants also misattributed nicotine as being a potential cause of smoking-related morbidity and most smoking-related cancers. These findings are consistent with other studies of current smokers in the general population (Bansal-Travers et al., 2010; Bobak et al., 2010; Cummings et al., 2004; Mooney et al., 2006; Oncken, McKee, Krishnan-Sarin, O'Malley, & Mazure, 2005; Siahpush et al., 2006) and faculty at a major U.S. university (Patel et al., 2012).

Confusion regarding the role of nicotine in smoking-related morbidity is not surprising in light of public health campaigns that broadly discourage the use of tobacco products without distinguishing between the effects of combustion and nicotine itself. Prior to the passage of the FSPTCA, this lack of distinction was perhaps not necessary. However, the misattribution of nicotine as a carcinogen and as the constituent in tobacco products that is responsible for morbidity may be counterproductive to the goals of potential regulatory decisions. With the possibility for a nationwide nicotine reduction policy in the U.S., the inaccurate belief that nicotine is the harmful constituent in cigarettes could result in a current smoker's decreased urgency to quit. Additionally, former smokers may interpret the availability of reduced nicotine content products as an opportunity to resume smoking if they are perceived as safer. In fact, research shows that smokers who have developed inaccurate beliefs about the benefits of reduced nicotine exposure in tobacco products (i.e., "light" and "ultralight" cigarettes) take these beliefs into account when selecting which cigarettes to smoke (Cohen, 1996; Etter, Kozlowski, & Perneger, 2003; Kozlowski et al., 1998; Kozlowski & Pillitteri, 2001; Shiffman, Pillitteri, Burton, Rohay, & Gitchell, 2001a, 2001b). Beyond regulatory science implications, inaccurate beliefs about nicotine have the potential to decrease interest in and uptake of nicotine replacement therapy (NRT) products for smoking cessation (Mooney et al., 2006).

When assessing correlates of knowledge, associations with socioeconomic status were inconsistent. For instance, higher income was associated with less knowledge about health risks of nicotine, though having an income of \$35,000-\$49,999—as compared to an income of <\$25,000—was associated with greater knowledge of the chemicals in cigarette smoke. Siahpush and colleagues (Siahpush et al., 2006) also showed that higher income was associated with greater knowledge of the chemical constituents of tobacco smoke. Notably, education was not correlated with knowledge, potentially because the sample was well educated (e.g., only 8 participants had less than a high school diploma/GED). Additionally, greater CPD was associated with both less knowledge of the risks of smoking and greater knowledge regarding health risks of nicotine. In post hoc analyses, we found that a small to moderate proportion (5.2% - 21.8%) of the sample reported that neither smoking nor nicotine were potential causes of each of the health conditions assessed. Moreover, individuals who incorrectly reported that smoking is not a potential cause of the health condition in question were significantly more likely to also correctly report that nicotine is not potential a cause of the same condition (p 's<0.001). These findings could potentially help to explain the divergent associations between income and CPD with knowledge of the potential harms of smoking and nicotine. Ultimately, additional research is needed to more fully examine the associations between income and CPD with knowledge of smoking and nicotine, and elucidate reasons for inconsistent associations.

The present study has several limitations that should be noted. First, data were cross-sectional and collected via self-report. As a result, we are unable to verify participants' HIV and smoking statuses, as well as other comorbidities. It is possible that the anonymous nature of data collection—as well as the mTurk monetized data collection system—may negatively impact reliability and validity of results. Generalizability may be limited due to the unique nature of the sample: the present sample is comprised of notably more young and White individuals as compared to other samples of smokers living with HIV (Mdodo et al.,

2015; Pacek, Harrell, et al., 2014). Additionally, though the predominantly male sample is representative of the HIV-positive population at large, oversampling of female HIV-positive cigarette smokers may be an important next step. It is possible that the wording of the true/false statements regarding smoking and nicotine (e.g., “Nicotine *may* be a cause of...”) is open to interpretation, as opposed to wording such as “Nicotine *is* a cause of...” Additionally, distractor items were not included in the sets of questions regarding knowledge about smoking or nicotine (i.e., “Smoking may be a cause of: chicken pox.”), which could have led to response bias with participants responding identically across all questions. Additionally, participants may have endorsed all medical conditions as being a potential consequence of smoking/nicotine based on beliefs about general plausibility of such associations, rather than specific knowledge for each health condition. Knowledge of smoking and nicotine should be evaluated further, particularly among vulnerable smokers, using language that clearly implies causality, as well as the inclusion of distractors items.

Notwithstanding these limitations, these results represent one of the first investigations into the general knowledge of smoking and nicotine among a vulnerable population of smokers (Chisolm et al., 2010). Importantly, it is the first study of knowledge and beliefs about nicotine and smoking among smokers living with HIV, a group that is disproportionately impacted by cigarette smoking and associated morbidity and mortality. The use of mTurk to conduct research has a number of benefits: reliability, low cost, speed of data collection, and heterogeneity of participants (Goodman, Cryder, & Cheema, 2013). Additionally, these findings are relevant to upcoming tobacco regulatory science decisions, and are informative for shaping the ways in which the scientific and regulatory communities will communicate these decisions to the public. Moreover, the findings are relevant to promotion and uptake of products like NRT and e-cigarettes.

Addressing misperceptions regarding the role of nicotine in smoking is a complex issue, but is one that should be attended to, particularly with the possibility of a nationwide nicotine reduction policy being enacted in the United States. Information about these perceptions and misperceptions should be assessed further among vulnerable smokers and the general population. Findings indicate poor knowledge of the role that nicotine plays in smoking-related morbidity among HIV-positive smokers. The fact that many individuals living with HIV are engaged in regular medical care for the treatment of HIV represents a natural point for intervention. Along with routine screening regarding smoking and interest in cessation, the provision of information during these medical visits—by HIV care providers or other healthcare professionals—regarding the relative harms of nicotine in the context of smoking, as well as nicotine itself, has the potential to mitigate concerns misinformation about nicotine in this vulnerable group of smokers. Additionally, findings from our study inform the need for carefully crafted warning labels on nicotine and tobacco products and/or educational or mass media campaigns that clarify the relative harm of NRT and reduced nicotine content products.

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Highlights

- Most participants identified smoking as a cause of smoking-related morbidity
- Most participants misattributed nicotine as causing smoking-related morbidity
- Misperceptions about nicotine have implications for potential tobacco regulations

Table 1

Sociodemographic characteristics of current smokers living with HIV (n=271)

Characteristic	n (%)
Sex	
Male	180 (66.4)
Female	91 (33.6)
Age - mean, SD	29.4 (7.3)
Race	
Caucasian	203 (74.9)
African American	30 (11.1)
Other	38 (14.0)
Income	
<\$25,000	68 (25.7)
\$25,000-\$34,999	62 (23.4)
\$35,000-\$49,999	44 (16.6)
\$50,000-\$74,999	42 (15.8)
\$75,000	49 (18.5)
Marital status	
Married	59 (21.8)
Not married	212 (78.2)
Education	
<High school/GED	8 (3.0)
High school/GED	41 (15.1)
Some college or greater	222 (81.9)
Time since initial HIV diagnosis - mean, SD	5.9 (4.7)
Currently on HIV medications	
No	74 (27.3)
Yes	197 (72.7)

Table 2

Cigarette smoking characteristics of current smokers living with HIV (n=271)

Characteristic	n (%) or mean (SD)
Cigarettes per day – mean, SD	8.1 (9.7)
Daily smoking	
No	166 (61.2)
Yes	105 (38.7)
Days smoked in past month – mean, SD	21.3 (10.5)
Age at first cigarette – mean, SD	15.1 (3.8)
Years smoking – mean, SD	14.3 (7.8)
<i>Nicotine dependence</i>	
Time to first cigarette	
<5 minutes	50 (18.4)
5-30 minutes	78 (28.8)
31-60 minutes	46 (17.0)
60+ minutes	97 (35.8)
Cigarettes per day	
10 or less	189 (69.7)
11-20	65 (24.0)
21-30	11 (4.1)
31+	6 (2.2)
Dependence (Heaviness of Smoking Index)	
Low	183 (67.5)
Moderate	81 (29.9)
High	7 (2.6)
HSI – mean (SD)	1.7 (1.5)
<i>Characteristics of usual brand cigarettes</i>	
Menthol	
No	142 (52.4)
Yes	129 (47.6)
Type	
Machine-manufactured	248 (91.5)
Roll-your-own	23 (8.5)
Filtered	
No	245 (90.4)
Yes	26 (9.6)
Cigarette length	

Characteristic	n (%) or mean (SD)
Regular	187 (69.0)
King size	27 (10.0)
100	53 (19.6)
72	1 (0.4)
Don't know	3 (1.1)

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Table 3

General knowledge of cigarette smoking and nicotine among current cigarette smokers living with HIV (n=271)

Variable	Correct Response	Correct n (%)
Smoking may be a cause of:		
Lung cancer	True	250 (92.2)
Asthma	True	242 (89.3)
Heart disease	True	241 (88.9)
Stroke	True	235 (86.7)
Heart attack	True	232 (85.6)
Impotence	True	205 (75.6)
Cigarette smoke contains:		
Carbon monoxide	True	228 (84.1)
Formaldehyde	True	212 (78.2)
Arsenic	True	208 (76.7)
Cyanide	True	206 (76.0)
Mercury	True	173 (63.8)
Nicotine may be a cause of:		
Impotence	False	93 (34.3)
Asthma	False	76 (28.0)
Stroke	False	67 (24.7)
Heart attack	False	62 (22.9)
Heart disease	False	58 (21.4)
Lung cancer	False	58 (21.4)
Nicotine is:		
The addictive component in cigarettes	True	252 (93.0)
The cause of most of the cancer that people get from smoking	False	131 (48.3)

Table 4

Linear regression analyses describing the association between overall knowledge of smoking and nicotine and participant characteristics (n=271)

	Health Risks of Nicotine	Health Risks of Smoking	Chemicals in Cigarette Smoke
	B^a (95% CI ^b)	B^a (95% CI ^b)	B^a (95% CI ^b)
Sex			
Male	Ref ^c	Ref	Ref
Female	-5.04 (-12.49, 2.39)	5.93 (-0.55, 12.42)	7.13 (-1.45, 15.71)
Age	-0.77 (-1.24, -0.29)	0.39 (-0.02, 0.80)	-0.08 (-0.63, 0.46)
Education			
<High school/GED	Ref	Ref	Ref
High school/GED	0.53 (-21.35, 22.41)	6.88 (-12.20, 25.96)	5.15 (-20.10, 30.40)
Some college or greater	5.21 (-15.52, 25.94)	4.21 (-13.87, 22.29)	6.83 (-17.10, 30.76)
Income			
<\$25,000	Ref	Ref	Ref
\$25,000-\$34,999	-10.23 (-20.09, -0.37)	3.83 (-4.77, 12.43)	10.26 (-1.12, 21.64)
\$35,000-\$49,999	-15.91 (-26.90, -4.92)	6.60 (-2.99, 16.18)	17.19 (4.50, 29.87)
\$50,000-\$74,999	-19.07 (-30.20, -7.95)	6.05 (-3.65, 15.76)	7.52 (-5.32, 20.36)
\$75,000	-11.92 (-22.92, -0.92)	4.57 (-5.02, 14.17)	7.33 (-5.37, 20.02)
CPD^d	0.64 (0.18, 1.11)	-0.42 (-0.83, -0.01)	-0.19 (-0.73, 0.34)
HSI^e	-1.72 (-4.84, 1.38)	-1.02 (-3.73, 1.69)	1.35 (-2.24, 4.94)

Note: Bolded text indicates statistically significant findings

^a Adjusted for sex, age, education, income and CPD

^b CI = confidence interval

^c Ref = reference group

^d CPD = cigarettes per day

^e HSI = Heaviness of Smoking Index