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Smokers' perceptions of risks and harm from snus relative to cigarettes: a latent profile analysis study.

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Abstract

Introduction: Certain types of smokeless tobacco (SLT) products, particularly snus, carry fewer health risks than cigarette smoking and might be able to serve as harm-reduction products for smokers. However, studies frequently find that smokers misperceive SLT and snus to be as or more harmful than smoking. This perception is often measured with a single general harm question, and research on underlying risk perceptions is limited.

Methods: Using a sample of 256 current smokers, we utilized Latent Profile Analysis to examine response profiles to items that assessed perceived risk of specific health outcomes (lung cancer, heart disease, oral cancer) from snus relative to cigarettes, along with the typical single item measure of overall harm from snus compared to cigarettes.

Results: Three smoker response profiles emerged. Almost half (44.9%) of smokers perceived snus to be as or more risky than cigarettes for all three specific health outcomes (group 1), while over one third (38.3%) had an elevated perceived risk for oral cancer only (group 2). About 17% of smokers perceived snus to have lower risks for lung cancer only (group 3). Across each profile, perceived risk was highest for oral cancer, despite a lack of scientific evidence of this effect from snus use.

Conclusions: If smokers are to consider snus for harm-reduction, efforts may be needed to better inform smokers about their lower relative risks, including for particular health outcomes of interest. This study also suggests that smokers may vary in their level of need for information to correct their relative risk misperceptions.

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Contributors

OAW led conceptualization of this project, data collection, and writing of the introduction and discussion sections. AER led analysis of the data and writing of the methods and results sections. JLS contributed to the data analysis plan, writing of the methods and results sections, and drafts of the paper. All authors reviewed and edited the manuscript for critical intellectual content and approved the final version submitted.

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Conflict of interest

All authors declare that they have no conflicts of interest.

Keywords

snus; smokeless tobacco; harm perceptions; risk perceptions; measurement

I. Introduction

Tobacco products may confer different health risks, with risks generally higher from smoked products, such as cigarettes, versus non-combusted products like smokeless tobacco (SLT) (1). SLT contains nicotine, is addictive, and has been associated with cardiovascular and cancer risks, including oral cancer (2, 3), but as a non-combusted product, SLT has long been described as a less harmful alternative for smokers unable or unwilling to completely quit tobacco to switch to (1, 4). Snus, a Swedish style of SLT, has been at the forefront of SLT harm-reduction discussions, given its lower carcinogenic profile and association with reductions in smoking-related diseases among men in Sweden, where snus use is prevalent (5). Additionally, snus use has not been clearly linked as an independent risk factor for oral cancer (2). Snus is relatively new to the US, although the 2009 launch of Camel Snus, the best-selling snus brand (6), was associated with aggressive advertising to smokers (7) and news media coverage (8).

Whether smokers switch to snus may depend in part on their beliefs about its risk-reducing potential. However, several studies have found that many smokers and non-smokers incorrectly perceive SLT and snus to be as harmful or more harmful than smoking (9). For example, a 2015 national survey found that only 11% of participants agreed that some SLT products, including snus, are less harmful to health than cigarettes (10). These studies typically measure this relative harm perception with a single question (e.g., “how harmful do you think smokeless tobacco is compared to cigarette smoking?”) and there is little data on what drives responses to this question and whether participants consider different health risks (11). One US study found that participants, on average, perceived snus as less likely to cause lung cancer relative to cigarettes, equally likely to cause heart disease and more likely to cause oral cancer (12), but potential subgroups within these responses were not examined, nor were the relationships between these disease risk beliefs and the more frequently used global measure of harm from SLT/snus compared to smoking. Some qualitative research suggests that smokers may perceive SLT to be as harmful as smoking because they refer to a view that “all tobacco is harmful”, or perhaps think of an average effect (e.g., less risk for lung cancer but more risk for oral cancer)(13, 14). Additional research about smokers’ SLT and snus risk perceptions is important given calls for more accurate communication about tobacco product relative risks (12, 15–17) and SLT company applications to the Food and Drug Administration to make reduced risk claims in their advertising. Notably two companies have taken different approaches in their applications. While RJ Reynolds has requested to claim that smokers can reduce their risks of lung cancer, respiratory disease, heart disease and oral cancer by switching to Camel Snus, US Smokeless Tobacco Company’s application more simply requests a claim about reduced lung cancer risk for its Copenhagen brand (18, 19).

The study aimed to use Latent Profile Analysis (LPA) in a nationally representative sample of smokers to explore the presence of subgroups, or types, of smokers who have similar response patterns to questions about the perceived risks of snus relative to cigarettes. Although previous studies have provided valued insights by demonstrating the prevalence of isolated risk perceptions averaged across samples, little is known about how perceptions related to various health risks combine within individuals to influence their views of the risks of snus relative to cigarettes. LPA can provide novel insights into how smokers view multiple aspects of snus risks and potentially inform targeted communication messages based on such patterns.

2. Methods

2.1. Sample.

Our analysis was conducted on a sub-sample of 256 current smokers recruited from a commercially available national research panel (GFK's Knowledge Panel) as part of a larger experiment on the effects of snus news coverage (20). GFK's panel is assembled through probability-based sampling of addresses from the US Postal Service's Delivery Sequence File. Participants were from the control group of the broader study (additional sampling details provided elsewhere) (15), were not exposed to any stimuli, and only completed an online survey (collected in 2016). Participants were adult (at least 18 years old) current smokers (i.e., have smoked 100 cigarettes in their lifetime and now smoke "everyday" or "some days") who were not current SLT users (i.e., no use in the past 30 days) and had used SLT fewer than 20 times in their lifetime. The average age was 48 (range 19–65) and most (69.1%) were white (14.8% black, 10.2% Hispanic, 5.8% other), 49.6% were male, 47.3% had at least some college education, and 56.4% were employed. Most (75.8%) participants were daily smokers and 19.5% had ever tried SLT. About 47.7% had ever heard of snus specifically before the study and 7.8% had ever tried snus. Sample characteristics were generally comparable to those of smokers from the 2016 National Health Interview Survey.

2.2. Measures.

Relative perceived overall harm was measured on a 5-point scale (1 = a lot less harmful – 5 = a lot more harmful) with a single question ("compared with daily cigarette smoking, how harmful to health do you think daily use of snus is?") (21). Responses were collapsed into three categories: 1 = less harmful; 2 = as harmful; 3 = more harmful. Respondents were also asked two parallel questions about snus and smoking: "how likely or unlikely do you think regularly [using snus/smoking cigarettes] would cause a [snus user/smoker] to develop each of the following diseases in their lifetime?"; 1) heart disease, 2) lung cancer, and 3) oral cancer (from 1 = Not at all likely—5 = Extremely likely) (11). For each health outcome, we compared responses to the two parallel snus and cigarette measures, coding a lower rating for snus as "less harmful/risky" (=1); the same rating for both as an "as harmful/risky" perception (=2), and a higher rating for snus than cigarettes as "more harmful/risky" (=3) (22, 23).

2.3. Analysis.

LPA was used to identify subgroups of participants, or latent profiles, with similar patterns of responses to the four indicator variables of perceived risk of harm from snus versus cigarette smoking. LPA is used to determine the optimal number of profiles in the data, the mean item responses for indicator variables within each profile, and the percentage of participants who fit each profile (24).

The best-fitting model was determined using an iterative approach (25) in Mplus Version 7.4. We first constrained the data to a one-profile solution. Subsequent models were run in which an additional profile was specified in each step, and fit indices were compared to the previous model. This approach continued until model fit indices failed to improve over the previous model and/or the model failed to converge. Common fit indices for LPA include the Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), and sample-size adjusted BIC, in which lower values indicate better model fit (26). The Lo-Mendell-Rubin (LMR) test was also employed, where significant p-values are indicative of a better fitting model. Practical interpretability of the models was also considered. Once the best fitting model was identified, gender was included as a covariate to determine whether the distribution of profiles was different for males and females (27).

3. Results

Descriptive statistics on perceptions of harm/risk items are provided in Table 1 and LPA results, including model fit indices and mean responses for each item within profile, are shown in Table 2. The two-profile solution fit better than the one-profile solution as evidenced by lower AIC, BIC, and SSABIC values and the LMR test ($p < .05$). The three-profile solution yielded lower AIC, BIC, and SSABIC values suggestive of better fit compared to the two-profile solution. However, the LMR test for the 3-profile vs. 2-profile model was non-significant ($p = .13$). The four-profile solution did not converge, indicative of model overfitting, and thus no fit indices are presented. Despite the non-significant LMR, the 3-profile solution was retained based on superior fit indices to the 2-profile model, the high entropy value indicative of clear separation of profiles (0.98), and the interpretation of the results.

The first profile described nearly half the sample (45%), and was labeled “non-discerners”. This profile was characterized by means slightly above 2 for each indicator (i.e., perceived risk of individual outcomes and overall perceived harm), with a value of 2 meaning that participants perceived snus to be as harmful/risky as cigarette use.

The second profile described 38% of the sample and was labeled “mixed accuracy–high”. In this profile, means for perceived risk of lung cancer and heart disease were 1, (i.e., lower from snus compared to smoking). However mean perceived risk for oral cancer was 2 (i.e., perceived as equally likely from snus use and smoking). The mean for the perceived harm of daily snus use relative to daily cigarette smoking was between less than and as harmful, but closer to as harmful (1.7).

The third profile described 17% of the sample and was labeled “mixed accuracy–low”. Individuals described by this profile accurately perceive that cigarettes are more likely than snus to cause lung cancer, but tend to perceive risk of heart disease as the same between the two products. The highest mean score for perceived likelihood of oral cancer (2.5) was observed in this profile, suggesting that individuals were somewhere between thinking snus is as likely or more likely to cause oral cancer as cigarettes. For the direct comparison of overall perceived harm, the mean was just under 2 (1.8), suggesting these individuals again were closest to rating the substances to be of similar harm.

The inclusion of gender as a covariate in the 3-profile model was non-significant, suggesting the distribution of profiles among males and females was similar.

4. Discussion

This study provides additional information about smokers’ perceived risks and harm from snus compared to cigarettes. Consistent with previous research, we found that across the profiles, most smokers rated the overall harm of snus use to be about the same as that of smoking (means ranged from 1.68 to 2.20). However, when examining perceptions about specific risks, we found some nuance in beliefs, with three distinct smoker subgroups.

Almost half the sample rated snus and cigarettes as being equally harmful overall and across all risks, even lung cancer, and were labeled as “non-discerners.” While this may reflect some degree of survey satisficing whereby participants choose responses that require the least cognitive effort to complete the task, this could also be related to “all tobacco is harmful” perceptions found in previous qualitative studies (13, 14), and to exposure to warnings that SLT is “not a safe alternative to smoking,” which may be misinterpreted as meaning the products are equally harmful (28). This may also underscore concerns that the public does not understand the role of combustion in making tobacco use especially harmful (12). While the FDA recently created educational videos about this, widespread diffusion of and exposure to this information may not yet have been reached.

Over one-third of smokers were labeled “mixed accuracy – high,” as this group was the most accurate of the three in terms of their perceived risk of harm from snus relative to cigarettes, but perceived risk from oral cancer to be the same, and trend towards perceiving snus to be as harmful overall. Notably, this subgroup of smokers might be receptive to educational efforts about the risks of oral cancer from smoking compared to snus given they already hold several accurate beliefs about the relative risk of snus.

The third group, which fit less than 20% of the sample, was labeled “mixed accuracy – low”, given their inaccurate perceptions of all risks except lung cancer. Notably, perceived risk for oral cancer from snus (relative to cigarette smoking) was highest across all groups and contributed to the overall perception that snus is as or more harmful than smoking. These perceptions may be influenced by memorable graphic images of oral cancer effects used in SLT prevention campaigns (13) and requirements that snus products carry mouth cancer warning labels. This is significant given that research suggests risks of oral cancer from American smokeless tobacco use are lower than that from smoking cigarettes (2, 29, 30)

(which do not carry an oral cancer warning) and that Scandinavian snus use has not been clearly associated as a risk factor for oral cancer (2).

This is the first study to both describe smokers' snus risk perceptions for the sample overall and use LPA to describe patterns of risk responses among subgroups of smokers. Although our sample size was somewhat small, it resulted in a model with high fit indices and three distinct profiles, and was drawn using probability sampling techniques, which increases confidence in the generalizability of our findings. Nonetheless, future work with a larger sample could be used to replicate the work and examine demographic covariates beyond gender. It should also be noted that about half of our sample (52%) had never heard of snus before, and this lack of familiarity may have impacted their responses, although participants were provided with a one paragraph description of snus before the perception measures (describing it as a type of pouched, spit-free moist snuff tobacco). Also, the risk measures used asked about risk to "users" more generally, rather than about perceived risk to respondents personally, which could have resulted in different estimates. More research is needed on best practices for tobacco risk perception measures (31).

Whether smokers completely switch to smokeless tobacco and reduce their risk of harm is likely dependent on multiple factors, including product satisfaction and acceptability. However, it has been argued that if smokers are to consider snus for harm-reduction, than more accurate relative-risk information and product labeling strategies may be needed (15, 16, 32, 33), and a limited set of studies provide some evidence that such information can influence smokers' SLT risk perceptions and product interest (20, 34–37). This study suggests that smokers' misperceptions that snus use is as harmful as smoking is related to their perceptions about risk for different health outcomes, and therefore that the effectiveness of efforts to "correct" this information may depend in part on communications about specific health risks. Direct messages about the risks of oral cancer in particular may be relevant to a subgroup of smokers who may otherwise perceive snus to have lower risks for other major smoking-related diseases.

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Highlights:

- Three distinct subgroups related to perceptions of harm and risk from snus use relative to cigarette smoking were identified.
- Almost half of participants (44.9%) perceived snus to be as harmful/risky as cigarettes across both specific and general indicators and were labeled “non-discerners.”
- Over one-third of participants (38.3%), labeled “mixed accuracy – high”, accurately perceived snus to pose less risk for lung cancer and heart disease than cigarettes, but perceived snus to have the same risk as cigarettes for oral cancer.
- Less than 20% of the sample (16.8%), labeled “mixed accuracy – low”, were accurate in their perceptions related to lung cancer, but inaccurate with regards to heart disease, and oral cancer.
- Across all profiles, perceived risk was highest for oral cancer.

Table 1.

Descriptive Statistics for Perceptions of Harm of Snus Relative to Cigarettes

Item	Less harmful %	As harmful %	More harmful %
Overall perception of relative harm	25.4	55.1	19.5
Perceived risk of lung cancer	54.6	37.8	7.6
Perceived risk of heart disease	37.9	51.8	10.3
Perceived risk of oral cancer	13.7	47.5	38.8

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Table 2.

Latent Profile Analysis Model Results

Model Fit Indices			
Model	AIC	BIC	SSABIC
1-profile solution	2035.05	2063.41	2038.04
2-profile solution	1760.35	1806.44	1765.22
3-profile solution	1678.58	1742.40	1685.33

Note. AIC = Akaike information criteria; BIC = Bayesian information criteria; ABIC = Sample-size adjusted Bayesian information criteria; 4-profile solution did not converge.

Conditional Means and Variances on the Indicator Variables (Perceptions of harm of SNUS use compared to cigarette use) by Profile

Variable	Profile 1 Non-discerners n = 115 44.92%	Profile 2 Mixed accuracy – high n = 98 38.28%	Profile 3 Mixed accuracy – low n = 43 16.80%	σ^2
Perceived risk of lung cancer [*]	2.17	1.02	1.00	0.07
Perceived risk of heart disease [*]	2.18	1.00	2.12	0.08
Perceived risk of oral cancer [*]	2.38	1.98	2.54	0.41
Overall perception of relative harm ^{**}	2.20	1.68	1.84	0.39

Note. In LPA, variances are constrained to be equal for each indicator across profile.

^{*} = response options for these survey items were recoded to represent 1 = snus is less risky than cigarettes, 2 = as risky and 3 = more risky than cigarettes

^{**} recoded response categories were 1 = snus is less harmful, 2 = as harmful and 3 = more harmful