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Comparative risk assessment and cessation information seeking among smokeless tobacco users

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HIGHLIGHTS

- Smokeless tobacco users showed comparative optimism about their health risks
- Tobacco users and non-users rated addiction risks of smokeless tobacco lower than cigarettes.
- The optimism was negatively correlated with cessation information seeking
- The optimism predicted decreased intent to use cessation support
- Optimism may influence cessation directly and indirectly moderated by information-seeking

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ABSTRACT

Introduction: This research examined (1) smokeless tobacco users' comparative optimism in assessing the health and addiction risks of their own product in comparison with cigarettes, and (2) the effects of comparative optimism on cessation information-seeking.

Methods: A nationally-representative sample from the 2015 Health Information National Trends Survey (HINTS)-FDA was employed.

Results: The analyses revealed the presence of comparative optimism in assessing both health and addiction risks among smokeless tobacco users. Comparative optimism was negatively correlated with most cessation information-seeking variables. Health bias (the health risk rating gap between the subject's own tobacco product and cigarettes) was associated with decreased intent to use cessation support. However, the health bias and addiction bias (the addiction risk rating gap between the subject's own tobacco product and cigarettes) were not consistent predictors of all cessation information-seeking variables, when covariates of socio-demographics and tobacco use status were included. In addition, positive correlations between health bias and past/recent cessation-information searches were observed.

Conclusions: Optimisic biases may negatively influence cessation behaviors not only directly but also indirectly by influencing an important moderator, cessation information-seeking. Future interventions should prioritize dispelling the comparative optimism in perceiving risks of smokeless tobacco use, as well as provide more reliable cessation information specific to smokeless tobacco users.

1. Introduction

The popularity and use of smokeless tobacco products is on the rise, especially among youth and young adults in the U.S. (Dave & Saffer, 2013). The prevalence of smokeless tobacco, which reached an all-time low in 2003, has since rebounded (Chang, Levy, & Meza, 2016), and 6% of youths and 3.4% of adults currently use smokeless tobacco (CDC, 2016). Tobacco companies have long been interested in smokeless tobacco to address growing health concerns about conventional cigarette smoking (Carpenter, Connolly, Ayo-Yusuf, & Wayne, 2009) and to fill the decrease of cigarette sales and retain profits, and since 2006, they have heavily promoted smokeless tobacco products (Popova & Ling, 2013). Tobacco companies spent $684.9 million on advertising and promotion of smokeless tobacco products in 2015 (Federal Trade Commission, 2017), and the advertising/promotional expenditure comprised nearly 20% of smokeless tobacco sales, compared to an all-industry average of 4–5% (Dave & Saffer, 2013).

One of the tobacco industry's strategies to promote smokeless tobacco products is to discount the health risks by comparing them with cigarettes. Tobacco companies and smokeless tobacco proponents cite

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the experience in Sweden that a high prevalence of snus use is associated with a decline of male smoking and lung cancer rates in the country (Foulds, Ramstrom, Burke, & Fagerström, 2003). However, this pattern has not been observed in other countries (Tomar, 2007). Promoting smokeless tobacco as a harm reduction measure or a cigarette cessation aid not only lacks sufficient evidence but also is problematic as it may introduce societal harms by hindering cigarette users from quitting completely, encouraging dual use of smokeless tobacco with other products, and facilitating new users, especially youth (Tomar, Fox, & Severson, 2008). Although exclusive use of smokeless tobacco has lower cardiovascular and respiratory risks relative to exclusive use of cigarettes (Zeller, 2013), smokeless tobacco is addictive (Ebbert, Severson, Danaher, Schroeder, & Glover, 2012) and has been linked to important health risks, such as oral, lung, and pancreatic cancer, as well as with fatal strokes and coronary heart disease (Boffetta, Hecht, Gray, Gupta, & Straif, 2008; Boffetta & Straif, 2009; Henley et al., 2007). It was also demonstrated that smokeless tobacco as a cessation aid has no long-term efficacy (Tønnesen, Mikkelsen, & Bremann, 2008). People who started using snus before the age of 16 years were three times more likely to be lifetime smokers than those who initiated snus later (Lund & Scheffels, 2014).

Nonetheless, tobacco companies have continued claiming smokeless tobacco as 'naturally flavored', 'cleanest', or 'least harmful' methods of nicotine delivery, and therefore are healthier or safer alternatives to cigarettes (Carpenter et al., 2009; Gartner, Hall, Chapman, & Freeman, 2007; Richtel & Jolly, 2014). Swedish Match, the leading manufacturer of Swedish snus continues promoting snus as an effective cigarette smoking cessation aid while discounting its addiction risk (Richtel & Jolly, 2014; Swedish Match, 2017). These claims are largely aligned with many smokeless tobacco users' perceptions that their form of tobacco use is less harmful as compared to smoking cigarettes (McClave-Regan & Berkowitz, 2011; O'Connor et al., 2007). A half of participants of a qualitative study viewed snus as a smoking cessation aid (Kaufman, Grenen, Grady, Leyva, & Ferrer, 2016).

One way of explaining smokeless tobacco users' misperception of the risk involved in their behavior is optimistic bias, which refers to comparative optimism or comparative risk judgment, the belief that one's own risk is lower than the comparable risk of others (Cho, Lee, & Lee, 2013; Popova & Halpern-Felsher, 2016). Comparative optimism was consistently found in individuals' health related risk perceptions (Skinner, Kreuter, Kobrin, & Strecher, 1998; Walker, Mertz, Kalten, & Flynn, 2003; Weinstein, 1980), and this bias has predicted health risk behaviors and protection behaviors (Chapin, 2001; Dillard, McCaul, & Klein, 2006; Masiero, Riva, Oliveri, Fioretti, & Pravettoni, 2016).

Little research has applied the conceptual framework of optimistic bias in understanding smokeless or other alternative tobacco users' risk assessment of their own product in comparison with cigarettes, despite the tobacco industry's increasing messages reinforcing the comparative optimism. More importantly, the potential impact of smokeless tobacco users' comparative risk assessment on their cessation efforts has not been identified. The present study focuses on cessation information-seeking, which is known as an important indicator of cessation intent (Van Der Rijt & Westerik, 2004), but that have been unexplored in previous research. Using a nationally-representative tobacco user sample, we examined (1) smokeless tobacco users' assessment of health and addiction risks involved in their own tobacco product compared to cigarettes and (2) the effects of comparative optimism on cessation information-seeking.

2. Literature review

2.1. Comparative optimism in health and addiction risk assessment

Optimistic bias is defined as the tendency for human beings to underestimate risk when it pertains to themselves compared to the risk pertaining to their counterparts (Masiero et al., 2016). Individuals distinguish risks to themselves and to others, and assess their chance of experiencing negative consequences in the future at a lower rate than others (Weinstein, 1980). People's desire to sustain or enhance self-esteem, to create a sense of personal control, and to have psychological distance from problematic other individuals, lead to the illusion that they are less vulnerable (Cho et al., 2013; Weinstein, 1980). Studies have suggested that optimistic bias is a prevalent phenomenon that appears across members of all age, gender, and socio-economic status groups (Klein & Helweg-Larsen, 2002; Weinstein, 1987) as well as across different cultures (i.e., U.S. and Japan; Rose, Endo, Windschitl, & Suls, 2008).

The concept has long been used to understand individuals' health risk perceptions and behaviors related to cancer, diabetes, smoking, and alcohol use (Skinner et al., 1998; Walker et al., 2003; Weinstein, 1980). In the context of tobacco use, cigarette smokers have persistently presented optimistic bias by using other smokers as a comparison target; two types of optimistic biases have been observed among smokers that are about their health risks and addiction risks. For example, current cigarette smokers tend to believe they are less susceptible to smoking-related harms (e.g., cancer, heart attack) than other smokers (Strecher, Kreuter, & Kobrin, 1995; Weinstein, 1980), while this bias was not found among non-smokers and former smokers (McCoy et al., 1992). Smokers presented bias about not only their health risks but also their chances of being addicted to cigarettes or the ability to quit smoking, compared to others (Masiero et al., 2016; Popova & Halpern-Felsher, 2016; Twigg & Byrne, 2015).

During an assessment of health and addiction risks involved in tobacco use, smokeless tobacco users may use cigarettes as a comparison target. Cigarettes have long been the most conventional tobacco product, and many of smokeless tobacco users are current or former cigarette smokers (Lee, Hebert, Nonnemaker, & Kim, 2014; Vijayaraghavan, Pierce, White, & Messer, 2014). Additionally, tobacco companies have consistently compared smokeless tobacco and cigarettes in promoting smokeless tobacco products as mentioned previously (Carpenter et al., 2009; Gartner et al., 2007). Tobacco promotional messages are known to heavily influence a user's perception (Romito & Saxton, 2014; Sterling, Fryer, Majeed, & Duong, 2015).

Given that the literature points to optimistic bias as a pervasive human tendency, smokers' bias in perceiving health and addiction risks, and widespread messages comparing smokeless tobacco and cigarettes, we predicted that smokeless tobacco users would present comparative optimism in assessing health risks (hereafter, "health bias") and addiction risks (hereafter, "addiction bias") of their own tobacco product (hereafter, "own product") in comparison with cigarettes. Therefore, the following hypotheses were posited:

H1. Smokeless tobacco users will assess the health risks of their own product as lower than cigarettes.

H2. Smokeless tobacco users will assess the addiction risks of their own product as lower than cigarettes.

2.2. Cessation information seeking

Optimistic bias can be maladaptive in health contexts as it may reinforce negative health behaviors over time, as well as demotivate individuals to engage in protective behaviors due to the illusion of self-invulnerability (Weinstein, 1980). This idea has been supported by empirical research. For example, optimistic bias was linked to sexual risk-taking, sexual intentions, and attitudes toward sexual activity among youths (Chapin, 2001). Also, college students who are unrealistically optimistic about the consequence of alcohol use reported greater alcohol use (Klein, Geaghan, & MacDonald, 2007). Specific to tobacco use, cigarette smokers with high optimistic bias were less likely

to quit smoking or plan to quit smoking (Borrelli, Hayes, Dunsiger, & Fava, 2010; Dillard et al., 2006).

Information-seeking about a health protective behavior is an important indicator of actual practice of that behavior, as supported by several theories, such as integrative model of health behavior (Fishbein, 2008), structural influence model (SIM) of communication (Kontos, Bennett, & Viswanath, 2007), and the risk information seeking and processing model (Kahlor, Dunwoody, Griffin, & Neuwirth, 2006). In all of these models, an active search for health-related information is shown to directly or indirectly influence health behaviors (Bigsby & Hovick, 2017). Additionally, a number of empirical findings support the role of information seeking in predicting health behaviors, such as engagement in cancer screening (Gibson et al., 2016; Shneyderman et al., 2016; Tan et al., 2014), fruit/vegetable intake, physical activity (Lee, Boden-Albala, Jia, Wilcox, & Bakken, 2015), and vaccination (Lee & Kim, 2015). This relationship is also applied in tobacco use. Studies show that online health-information searchers are less likely to be current daily smokers (Killian, 2012), and a past information search about smoking cessation increases an intention to undergo a smoking cessation treatment (Van Der Rijt & Westerik, 2004).

The available evidence showing how optimistic bias is associated with an individual's active search for information about protective behaviors is limited. However, previous studies have suggested that optimistically biased individuals are less likely to pay attention to health information given to them. For example, individuals with high optimistic bias tended to avoid exposure to information highlighting their sexual health risk and deny its relevance, while their counterparts expressed more interest in viewing the contraceptive information and acknowledged its relevance (Wiebe & Black, 1997). It was also found that individuals with high optimism are less likely to learn about personal health risks or protective behaviors from new information (Davidson & Prkachin, 1997; Radcliffe & Klein, 2002).

Given the role of optimistic bias demotivating protective behaviors, including smoking cessation, as well as previous findings that individuals with high optimistic bias show less interest in learning about protective behaviors, it is predictable that comparative optimism would have a negative effect on cessation information-seeking among smokeless tobacco users. Hence, the following hypotheses were posited:

H3. Health bias will be negatively associated with cessation information-seeking.

H4. Addiction bias will be negatively associated with cessation information-seeking.

3. Methods

3.1. Data

The Health Information National Trends Survey (HINTS) FDA dataset was employed for analyses to assess the hypotheses. HINTS is nationally-representative data regarding health communication, knowledge, and risk behaviors, and has been administered by the U.S. National Cancer Institute since 2003 (NCI, 2017). The HINTS-FDA was a special round of data collection conducted in partnership with the Food and Drug Administration (FDA) from May 2015 through September 2015 through a self-administered mailed questionnaire. Risk perceptions about new tobacco products, perceptions of tobacco product harm, tobacco product claims, and tobacco use status were additional topics included in the HINTS-FDA. The current study utilized the final sample weight of HINTS-FDA to calculate population estimates. HINTS data are publicly available and contain no personal identifiers or sensitive information. Therefore, this study was exempt from the need for Institutional Review Board approval at the researcher's institution.

3.2. Measures

3.2.1. Tobacco user groups

Participants who reported to currently use smokeless tobacco exclusively (e.g., chewing tobacco, snus, snuff, or dip) were included in analyses. In order to compare the health and addiction risk ratings, answers of current exclusive cigarette users and non-tobacco users were also included.

3.2.2. Comparative optimism

3.2.2.1. Health bias. Responses from two questions were used, including “How harmful do you think (1) cigarette smoking and (2) smokeless tobacco use is to a person's health [1 = not harmful at all ~3 = very harmful]?” The rating difference between cigarette and smokeless tobacco was tabulated to measure smokeless tobacco users' health bias.

3.2.2.2. Addiction bias. Similarly, answers from two questions; “Overall, how addictive do you believe (1) cigarette smoking and (2) smokeless tobacco use is [1 = not addictive at all ~3 = very addictive]?” were used to calculate the rating difference between cigarette and smokeless tobacco, which defines addiction bias.

3.2.3. Cessation information seeking

Responses to four questions were included in analyses: “Have you ever looked for quitting help or information?” (i.e., past searches for cessation information); “Did you look for quitting help or information in the most recent tobacco information search?” (i.e., recent searches for cessation information); “Have you ever called a telephone quitline or visited a website for help with quitting smoking?” (i.e., past trial of cessation support) [yes or no]; “How likely would you be to call a quitline or visit a website for help with quitting smoking in the future?” (i.e., intent to use cessation support) [1 = very unlikely ~4 = very likely].

3.2.4. Socio-demographics and tobacco use status

In previous studies, socio-demographic factors (Arnett, 2000; Borrelli et al., 2010) and tobacco use status (e.g., heavy or light use) (Ayanian & Cleary, 1999; Twigg & Byrne, 2015) were associated with a degree of optimistic bias, and socio-demographic factors were significant predictors of health information-seeking (Ramanadhan & Viswanath, 2006; Richardson, Allen, Xiao, & Vallone, 2012). Therefore, the following variables were included as covariates in the analyses: (1) gender; (2) race [White, Black, Hispanic, Asian]; (3) age; (4) education [less than high school graduate, high school graduate, some college, college graduate, post graduate]; (5) income [≤$20K, $20K < $35K, $35K < $50K, $50K < $75K, ≥ $75K]; (6) employment [currently employed, currently not employed]; (7) marital status [currently married, currently not married]; and (8) tobacco use status [heavy = use every day, light = use some days].

4. Results

4.1. Descriptive analyses

Table 1 presents results of descriptive analyses conducted to understand socio-demographics, tobacco use status, and cessation information-seeking among smokeless tobacco users (N = 59, weighted N = 3,934,951) and the reference groups; cigarette users (N = 411, weighted N = 27,592,169) and non-tobacco users (N = 2981, Weighted N = 191,794,440). Notable findings include a higher proportion of males (97.4%) and Whites (88.7%), and young adults (age of 18–34: 37.8%) among smokeless users. A majority of smokeless tobacco users (64.4%) reported to use their product every day.

Only 16.4% of the smokeless tobacco users answered that they have sought cessation information previously. 14.5% of the users looked for

Table 1
Descriptive analyses.

Variables		Smokeless Tobacco User	Cigarette Users	Non-Users
		$N = 59$	$N = 411$	$N = 2981$
		(Weighted $N = 3{,}934{,}951$)	(Weighted $N = 27{,}592{,}169$)	(Weighted $N = 191{,}794{,}440$)
Socio-demographics		%		
Gender[a]	Male	97.4	49.7	46.2
Race[a]	White	88.7	78.4	63.0
	Black	0.7	11.5	10.7
	Hispanic	5.9	6.5	17.5
	Asian	0.0	1.1	6.6
	Other	4.8	2.4	2.2
Age[a]	18–34	37.8	32.7	29.5
	35–49	16.7	21.7	26.6
	50–64	27.9	31.9	24.1
	65–74	13.1	11.1	10.7
	75 +	4.5	3.4	9.0
Education[a]	Less than high school	5.1	20.0	8.8
	High school graduate	26.2	30.8	19.6
	Vocational/technical	15.4	9.9	8.5
	Some college	28.4	26.8	23.3
	College graduate or more	24.8	12.5	39.8
Income[a]	< $20K	14.7	36.1	17.9
	$20K < $35K	10.0	18.8	14.1
	$35K < $50K	30.4	9.7	13.4
	$50K < $75K	6.8	11.6	17.0
	≥ $75 K	38.1	23.8	37.6
Employed[a]		48.9	55.2	58.4
Currently married[a]		39.1	39.9	55.1
Use Status		%		
	Heavy (every day)	64.4	77.5	n/a
	Light (some day)	35.6	22.5	
Cessation information seeking		%		
Have looked for quitting info[b]		16.4	41.1	n/a
Recently looked for quitting info[b]		14.5	46.8	
Have tried quitting call/websites[b]		12.9	22.3	
Likely to try quitting call/websites[b]		24.4	33.1	

Note: The final weight from HINTS data controlled by NCI was used for all analyses.
[a] Chi-square test identified a significant difference among three groups ($p < 0.01$).
[b] Chi-square test identified a significant difference between smokeless tobacco users and cigarette users ($p < 0.01$).

cessation information in the recent time of tobacco information search. A total of 12.9% of smokeless tobacco users reported to have tried cessation hotlines or websites and about one fourth of smokeless tobacco users (24.4%) indicated an intent to use cessation hotlines or websites.

4.2. Comparative optimism

Table 2 present the results of paired *t*-tests that were performed to test the first two hypotheses, which predicted that smokeless tobacco users would assess health (H1) and addiction risk (H2) of their own product as lower than cigarettes. The analyses indicated that smokeless tobacco users' health risk assessment for smokeless tobacco ($M = 2.39$, $SD = 0.60$ [1 = not harmful at all, 3 = very harmful]) is lower than cigarette ($M = 2.72$, $SD = 0.52$). The gap between these two ratings ($M = 0.33$, $SD = 0.48$) was statistically significant ($t = 1323.588$, $p < 0.001$). Additionally, the health risk rating gap among smokeless tobacco users was significantly greater than that of cigarette users ($M = -0.30$, $SD = 0.53$) and non-tobacco users ($M = 0.25$, $SD = 0.48$). Therefore, H1 was supported.

Smokeless tobacco users' rating of the addiction risk involved in smokeless use ($M = 2.44$, $SD = 0.67$) was lower than cigarette

Table 2
Comparative risk assessment.

		Smokeless users		Cigarette users		Non-users	
		M (*SD*)	*t* (*d.f*)	*M* (*SD*)	*t* (*d.f*)	*M* (*SD*)	*t* (*d.f*)
Health	Smokeless Tobacco[a]	2.39 (0.60)	1323.5***	2.48 (0.60)	2795.4***	2.67 (0.52)	7011.8***
	Cigarettes[a]	2.72 (0.52)	(1, 3,809,457)	2.77 (0.43)	(1, 24,979,485)	2.92 (0.28)	(1, 184,816,939)
	Gap (comparative optimism)	0.33 (0.48)		0.30 (0.53)		0.25 (0.48)	
Addiction	Smokeless Tobacco[a]	2.44 (0.67)	288.6***	2.44 (0.61)	3131.8***	2.58 (0.61)	5393.5***
	Cigarettes[a]	2.53 (0.77)	(1, 3,660,955)	2.83 (0.37)	(1,17,491,780)	2.83 (0.45)	(1,124,579,267)
	Gap (comparative optimism)	0.09 (0.47)		0.43 (0.57)		0.24 (0.50)	

*** $p < 0.001$.
[a] ANOVA identified a significant difference among three groups ($p < 0.01$).

Table 3
The effect of comparative optimism on cessation information seeking among smokeless tobacco users.

	Past search for cessation information		Recent search for cessation information		Past trial of cessation support		Intent to use cessation support	
	r	*β* (SE)	*r*	*β* (SE)	*r*	*β* (SE)	*r*	*β* (SE)
Socio-demographics								
Age	−.067***	.002 (.000)***	−.201***	.002 (.000)***	−.129***	−.005 (.000)***	−.260***	−.006 (.000)***
Gender (Female)	.130***	.476 (.001)***	.045***	.317 (.001)***	.181***	.410 (.001)***	−.066***	−.033 (.003)***
Education	−.087***	.021 (.000)***	−.215***	−.061 (.000)***	−.354***	−.024 (.000)***	.117***	.141 (.000)***
Income	.284***	.117 (.000)***	.392***	.198 (.000)***	−.315***	−.052 (.000)***	−.152***	.014 (.001)***
Race (White)	−.053***	−.340 (.000)***	−.036***	−.242 (.001)***	−.459***	−.641 (.001)***	.211***	.459 (.002)***
Employed	.182***	−.033 (.000)***	.145***	−.110 (.001)***	.060***	249 (.000)***	.042***	.013 (.002)***
Married	−.140***	−.092 (.000)***	−.359***	−.380 (.001)***	−.230***	.030 (.000)***	−.396***	−.799 (.002)***
ΔR^2		.222		.474		.462		.298
Tobacco use status								
Heavy use	.142***	.132 (.000)***	.235***	.151 (.001) ***	.358***	.467 (.000)***	-	-
ΔR^2		.050		.036		.230		-
Optimistic bias								
Health risks	.002***	.336 (.000)***	−.207***	.173 (.001)***	−.102***	.164 (.000)***	−.522***	−.577 (.001)***
Addiction risks	−.526***	−.551 (.000)***	−.482***	−.338 (.001)***	−.235***	−.033 (.000)***	.184***	.741 (.002)***
ΔR^2		.296		.077		.028		.209
Total ΔR^2		.568		.586		.720		.507

- Tobacco use status was deleted from the analysis as it had missing correlations with intent use quitting call/websites.
*** Correlations and coefficients are significant at $p < 0.001$.

($M = 2.53$, $SD = 0.77$). The difference was small but statistically significant ($M = 0.09$, $SD = 0.77$, $t = 288.588$, $p < 0.001$). Hence, H2 was supported. However, it should be noted that the addiction risk rating gap among smokeless tobacco users was less than that of non-tobacco users ($M = 0.24$, $SD = 0.50$) and cigarette users ($M = 0.43$, $SD = 0.57$).

4.3. The effect of comparative optimism on cessation information seeking

Table 3 presents the result of regression analyses conducted to examine the effects of health bias (H3) and addiction bias (H4) on cessation information seeking. The dependent variables include (1) past searches for cessation information, (2) recent searches for cessation information, (3) past trial of cessation support, and (4) intent to use cessation support. Data were analyzed using a three-step hierarchical regression analysis. In all models, the covariates of gender, race, age, education, income, employment, and marital status were entered in the first block, and tobacco use status was entered in the second block. Two optimistic biases were entered in the last block.

4.3.1. Health bias

The health bias was negatively associated with recent searches for cessation information ($r = -0.207$, $p < 0.001$), past trial of cessation support ($r = -0.102$, $p < 0.001$), and intent to use cessation support ($r = -0.522$, $p < 0.001$) at the bivariate level. However, this relationship remained only for the intent to use cessation support ($\beta = -0.577$, $SE = 0.001$, $p < 0.001$), when socio-demographics and tobacco use status were included in the model. Given these, H3 was partially supported

4.3.2. Addiction bias

The addiction bias was negatively associated with past searches for cessation information ($r = -0.526$, $p < 0.001$), recent searches for cessation information ($r = -0.482$, $p < 0.001$), and past trial of cessation support ($r = -0.235$, $p < 0.001$) at the bivariate level. This relationship remained for the past searches for cessation information ($\beta = -0.511$, $SE = 0.000$, $p < 0.001$) and recent searches for cessation information ($\beta = -0.338$, $SE = 0.001$, $p < 0.001$), when all other covariates were entered. Given these, H4 was also partially supported.

4.3.3. Socio-demographics and tobacco use status

Age was negatively associated with all cessation information seeking variables ($r = -0.260 \sim -0.067$, $p < 0.001$) at the bivariate level, but these relationships did not remain or the effect size became negligible when all other covariates were entered. Gender (being female) was positively related with most dependent variables (except for the intent to use cessation support) in the final model ($\beta = 0.317$–0.476, $SE = 0.001$, $p < 0.001$). Education was negatively associated with recent search for cessation information ($r = -0.215$, $p < 0.001$) and past trial of cessation support ($r = -0.354$, $p < 0.001$) at the bivariate level, but the effect size became small when other covariates were included. Race (being White) was negatively associated with past search for cessation information ($\beta = -0.340$, $SE = 0.000$, $p < 0.001$), recent search for cessation information ($\beta = -0.242$, $SE = 0.001$, $p < 0.001$) and past trial of cessation support ($\beta = -0.641$, $SE = 0.001$, $p < 0.001$), but positively with intent to use cessation support ($\beta = 0.459$, $SE = 0.002$, $p < 0.001$). Additionally, those who are employed were more likely to have tried cessation support compared to their counterpart ($\beta = 0.249$ $SE = 0.000$, $p < 0.001$). People who are married were less likely to look for cessation information recently ($\beta = -0.380$, $SE = 0.001$, $p < 0.001$) and to report lower intent to use cessation support ($\beta = -0.799$, $SE = 0.002$, $p < 0.001$). Heavy users were more likely to have tried cessation support in the past ($\beta = 0.467$, $SE = 0.000$, $p < 0.001$).

5. Discussion

Despite the increasing prevalence of smokeless tobacco trial and daily use, little research is available to help understand the psychological factors associated with smokeless tobacco use and cessation, as most research continues to focus on cigarette smoking and cessation. This research examines smokeless tobacco users' comparative optimism and its influence on cessation information-seeking in application of the conceptual framework, optimistic bias.

The current study revealed the presence of comparative optimism in assessing health and addiction risks among smokeless tobacco users, consistent with previous studies that found cigarette smokers' optimistic bias (Arnett, 2000; McCoy et al., 1992; Strecher et al., 1995; Twigg & Byrne, 2015; Weinstein, 1980). Smokeless tobacco users perceived the health risk of their own product as significantly lower than cigarettes. Additionally, smokeless tobacco users' health and addiction risk ratings

for smokeless tobacco were lower than the ratings of non-tobacco users. The comparative optimism among smokeless tobacco users is not a surprising result, given the prevalence of promotional messages discounting the risks of smokeless tobacco by the tobacco industry. A sharp increase in marketing for smokeless tobacco products has been observed in recent years, as reflected in the commercial presence on the most widely read magazines in the country (Timberlake, Pechmann, Tran, & Au, 2011) and various marketing events (e.g., sports events, car races, concerts, urban nightclubs) (Mejia & Ling, 2010), as well as in advertising expenditure across media (Federal Trade Commission, 2017). Greater exposure to tobacco advertisements was associated with lower risk perception (Pokhrel, Fagan, Kehl, & Herzog, 2015; Romito & Saxton, 2014; Sterling et al., 2015) as well as increased odds of using tobacco (Dai & Hao, 2016). Tobacco companies in the U.S. are prohibited from making reduced harm claims, and Swedish March's application to the U.S. Food & Drug Administration to market their products as having modified or reduced risks was denied in 2016 (FDA, 2016). However, it is possible that advertisements suggest reduced risks to individuals through graphics. It was found that people pay more attention to graphics than warning labels in snus advertisements, and an exposure to the advertisements was associated with decreased perceptions of snus addiction (Kaufman et al., 2016).

Our findings suggest that the health and addiction biases are negatively associated with most cessation information-seeking variables at the bivariate level. We also found cases where health or/and addiction biases explain a significant size of variances of the outcome variable (i.e., past searches for cessation information, intent to use cessation support). However, these two biases were not consistent predictors of all cessation information-seeking variables, when other background variables were considered together in the final regression models. Socio-demographics were stronger predictors in some cases. For instance, gender and race explained more variances of past search for cessation information, recent search for cessation, and past trial of cessation support than health bias. The effect size of tobacco use status for past trial of cessation support was bigger than health bias and addiction bias combined. Also, marital status explained the most of intent to use cessation support.

A notable finding is that smokeless tobacco users' health bias was significantly associated with decreased intent to use important cessation support, cessation hotlines or websites in the future. Highly-biased smokeless tobacco users tend to avoid cessation support and information, which may contain evidence threatening their existing beliefs. People often choose to avoid health information to maintain optimism (Brashers, Goldsmith, & Hsieh, 2002), and there is evidence showing that even people who are diagnosed with cancer do not always actively seek information about their disease (Czaja, Manfredi, & Price, 2003; Ramanadhan & Viswanath, 2006). Our result supports the view that optimistic bias can demotivate individuals to engage in protective behaviors due to the illusion of self-invulnerability (Weinstein, 1980). Also, it is consistent with previous research that identified the negative causal link between smokers' optimistic bias and cessation intent and behavior (Borrelli et al., 2010; Dillard et al., 2006). As previously mentioned, health or cessation information is an important predictor of tobacco use and cessation intent (Killian, 2012; Van Der Rijt & Westerik, 2004). Taken together, our results may suggest that optimistic bias has not only direct, but also indirect effects on cessation behaviors, and cessation information-seeking moderates the direct relationship between optimistic bias and behavior. Due to the use of secondary data collected through surveys, a long-term cessation behavior was not incorporated in the present study. By employing longitudinal research designs, future research may obtain a complete picture of the relationship between comparative optimism, cessation information-seeking, and cessation behavior of smokeless tobacco users.

The addiction bias was a stronger predictor than the health bias for most cases (except for the past trial of cessation support). According to Arnett (2000), there is a large disparity between smokers' perceptions of addiction risks to themselves and the risk that others face. Smokers' tendency of underestimating their chance of becoming addicted and misjudging their ability to quit smoking anytime they want may be the missing link in explaining why individuals continue smoking despite their awareness of the health risks. Out results indicate that this relationship can be applied to cessation information behaviors. Smokeless tobacco users who believe their own product is much less addictive than cigarettes were less likely to have searched for cessation information. It should be noted that although smokeless tobacco users rated the addiction risk of their own product as lower than cigarettes, the rating for cigarettes was notably lower than that of cigarette users and non-tobacco users. Also, the addiction risk rating gap between smokeless tobacco and cigarettes was bigger among cigarette users and non-tobacco users than smokeless tobacco users. This result indicates that there is a prevalent perception that smokeless tobacco is less addictive than cigarettes among people regardless of their tobacco use status. Also, it indicates that smokeless tobacco users underestimate addiction risks for not only smokeless tobacco but also cigarettes.

Positive correlations between health bias and past/recent cessation information searches were observed, which indicate that people who have searched for cessation information reported higher biases. According to Cho et al. (2013) who examined the influence of risk communication on changes in optimistic bias over time, optimistic bias is resilient and difficult to change once it forms. Likewise, smokeless tobacco users may continue to have health bias irrespective of available evidence or information. The other explanation is that the currently available cessation information may not adequately address the health risk of smokeless tobacco, as it focuses on cigarette cessation strategies only; in addition, the quality of the information is inadequate. It was found that 16.5% of news articles referred to smokeless tobacco as possibly being less harmful than cigarettes, and these reduced harm claims were attributed as frequently to scientists or public health professionals as to tobacco company representatives (Wackowski, Lewis, Delnevo, & Ling, 2013). Exposure to news messages framing smokeless tobacco as a safer alternative to cigarettes significantly influenced smokers' smokeless tobacco harm perceptions and use intentions (Wackowski, Manderski, Lewis, & Delnevo, 2017).

Additionally, they are several findings that raise concerns on the quality of tobacco cessation information on the internet, which is the primary source where tobacco users search cessation information and support (Cobb & Graham, 2006; Shahab, Brown, Gardner, & Smith, 2014). For example, when an individual searches with tobacco as a keyword on Google, more than half (n = 10) of first 19 websites that appear are about tobacco product advertisement or sales, while only two are about cessation (Morgan & Montagne, 2013). Also, it was found that when people search online with smoking cessation or quit smoking as a search word, six out of ten results lead to commercial therapy sites, and the searches can also connect to tobacco company sites (Cobb, 2010). The quality of cessation guidelines in smoking cessation websites has been questioned in a previous review (Bock et al., 2004), and some cessation websites recommend to use smokeless tobacco as a substitute when quitting smoking (Cheh, Ribisl, & Wildemuth, 2003). Given these, when smokeless tobacco users search for cessation information, they may also be exposed to the low health risk claims from unreliable sources, and anecdotal recommendations to use smokeless tobacco products to quit smoking; this experience may increase the health bias. This possibility can only be verified by further empirical research. We used comparative optimism as an independent variable to predict past and recent cessation information searches in regression analyses. However, this relationship could just as easily be the other way around. Emerging from the present study, there is a clear need for research to identify the causal relationship between exposure to current cessation information and health bias.

5.1. Strengths

The current study contributes to the limited body of literature examining risk perception and cessation efforts among smokeless tobacco users, while most research focuses on cigarette smokers. This research provides theoretical explanations for smokeless tobacco use, applying the conceptual framework of optimistic bias, and identified that the users' bias present in perceiving health risks, as well as addiction risks. Additionally, this revealed the relationship between comparative optimism and cessation information-seeking. To the best of the author's knowledge, this study is the first to test information-seeking variables as outcomes of comparative optimism. Another strength of this study is the use of nationally-representative data.

5.2. Limitations

Nevertheless, limitations of this study must be noted. Several limitations originate from one of its strengths; that is, the use of secondary survey data. First, the cross-sectional nature of HINTS data limited the ability to derive causal inferences among variables. It also relied on respondents' self-administration. Second, other important questions that would be useful for measuring comparative optimism and cessation information seeking/use could not be included in the analysis, as they were not present in the secondary data. Additionally, many HINTS information-seeking measures are based on dichotomous items; thus, it was not able to compare participants on the basis of their frequency or degree of cessation information seeking. Therefore, future research will benefit from more robust measurements for these constructs to further explore the relationships between comparative optimism and cessation information seeking.

5.3. Implications

This research has several implications for intervention efforts that aim at addressing hazardous misperceptions with regards to the risks of smokeless tobacco products, to prevent initiation, and to promote cessation. First of all, it demonstrates that smokeless tobacco users' optimistic bias should be addressed to promote cessation. To dispel the health bias, more information about the cigarette equivalency factor (e.g., the equivalent volume of chemicals consumed in each smokeless tobacco or cigar to the number of cigarettes) can be provided. To dispel the addiction bias, diverse dependence symptoms of smokeless tobacco (Ebbert et al., 2012), as well as evidence demonstrating that smokeless tobacco use is a step toward becoming lifetime cigarette smokers, not toward cessation (Lund & Scheffels, 2014) should be communicated. Second, more reliable cessation information/support programs specific to smokeless tobacco should be developed and located to be easily found on the internet. Third, consistent efforts to educate youth or young adults (who are the primary target of smokeless tobacco marketing) about health and addiction risks of new smokeless tobacco products, tobacco companies' anecdotal claims, and how to identify which of the reliable tobacco/health information sources are in demand.

Conflict of interest

The authors read and approved the final manuscript and have no competing interests to declare.

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