



Sex differences and risk behaviors among indoor tanners☆

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ABSTRACT

Objective. The objectives were to examine (1) sex differences in factors associated with indoor tanning, and (2) the relationship between cancer risk perception and skin cancer screening among indoor tanners.

Methods. Data are from the 2010 National Health Interview Survey. The sample was limited to U.S. adults (≥18 years) using an indoor tanning device in the last year (N = 1177). We conducted bivariate and multivariate weighted analyses.

Results. Among indoor tanners, less than 30% of men and women reported having ever had a skin exam. Male sex was significantly associated with rarely/never using sunscreen (51.4% of men vs. 36.4% of women) and with binge drinking of alcohol (47.6% of men vs. 37.4% of women). No sex differences in smoking were present. Indoor tanners who perceived themselves “about equally likely” to develop cancer (any type) as similar others were less likely to have received a skin cancer examination than those with high perceived risk.

Conclusion. The relationship of cancer risk perception to skin cancer screening is complex. Rates of risk and protective behaviors observed among men and women who indoor tan suggest mixed-sex tanning prevention efforts should target multiple risk behaviors.

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1. Introduction

Intentional ultraviolet (UV) exposure via indoor tanning is a significant risk factor for melanoma and non-melanoma skin cancers (Coelho and Hearing, 2010). In 2009, the International Agency for Research on Cancer (IARC) classified use of UV-emitting tanning devices as a known carcinogen (“IARC Monographs-Classifications”, 2014). In addition, the U.S. Surgeon General recently issued a *call to action* to prevent skin cancer intended to increase awareness and reduce skin cancer risk (U.S. Department of Health and Human Services, 2014). Despite the well-established association between UV exposure and melanoma, indoor tanning remains popular (Guy et al., 2015), U.S. studies estimate 23.3%–35.1% of young women and 6.3%–6.5% of young men tan indoors (Amrock and Weitzman, 2014; Basch et al., 2014; Choi et al., 2010).

Indoor tanning presents a health risk to both sexes, although important sex differences may exist. For example, frequency of sun-protective behaviors such as sunscreen use is lower among men (Holman et al., 2015). In addition, higher frequency of multiple skin cancer risk behaviors (e.g., not seeking shade on sunny days) is seen among men (Buller et al., 2012; Janssen et al., 2015). Men are generally not targets of

sunscreen advertising (Lee et al., 2006) although men's magazines more often promote protective clothing to prevent sunburn (McWhirter and Hoffman-Goetz, 2015). One approach of current tanning interventions (e.g., Hillhouse et al., 2010) is to focus on negative impacts of tanning such as wrinkles, premature aging, and hyperpigmentation (Holman et al., 2013), but such cosmetic concerns may not effectively motivate behavior change in male tanners. Furthermore, risky behaviors associated with tanning differ between men and women. Boys who tan report participation on multiple sports teams, and consumption of adequate fruits and vegetables, although they also report a history of illicit steroid use (Miyamoto et al., 2012). These findings diverge from female tanning correlates such as smoking and risky alcohol use (Coups et al., 2008; Mosher and Danoff-Burg, 2010), low levels of physical activity, personal importance of thinness, weight concern, and frequent dieting (Holman and Watson, 2013), depression and poor body image (Gillen and Markey, 2012; Mosher and Danoff-Burg, 2010). Thus, aggregating data from men and women may obscure sex differences that could inform tanning prevention efforts.

Men and women also differ in their estimation of risk (Finucane et al., 2000; Flynn et al., 1994; Johnson, 2002; Palmer, 2003), a discrepancy that has been validated in national (Flynn et al., 1994) and international samples (Morioka, 2014). Perceived risk and perceived susceptibility to disease are considered important motivators of health protective behavior (Rosenstock et al., 1988). The possibility that sex differences in perceived risk contribute to differences in health protective behaviors such as skin cancer screening highlights a knowledge gap that may

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undermine cancer risk reduction efforts among indoor tanners. In order to better understand the behaviors of indoor tanners, our objectives were to examine (1) differences in distribution of factors associated with indoor tanning by sex, and (2) the relationship between cancer risk perception and skin cancer screening among indoor tanners.

2. Methods

2.1. Data source

We analyzed data from the 2010 National Health Interview Survey (NHIS), an annual cross-sectional health survey of the U.S. civilian, non-institutionalized population. NHIS data collection follows a multi-stage clustered sampling design that includes oversampling of specific subpopulations. Interviews were conducted primarily in person and covered a broad variety of health topics. The NHIS 2010 sample included 27,157 adults (≥ 18 years), with a final adult response rate of 60.8%. The sample for analysis was limited to adults using an indoor tanning device in the last year ($N = 1,177$), hereafter referred to as indoor tanners. The NHIS methods, measures, and sampling scheme are described in detail elsewhere (“NHIS Survey Description”, 2010). Institutional Review Board approval was not needed, because this project utilized de-identified, publicly available data.

2.2. Measures

Socio-demographic variables included age, education, geographic region, and insurance status (covered by private or public health insurance or not). Questions also assessed skin response to one hour in the sun and frequency of sunscreen use on a warm, sunny day. Based on the response distribution, the *never* and *almost never* response categories for sunscreen use were collapsed into *low sunscreen use*; *always* and *almost always* were collapsed into *high sunscreen use* in some analyses. Because non-daily smoking is increasing in the U.S. (Shiffman et al., 2012), we defined smoking by whether or not participants had ever smoked one hundred cigarettes to capture smoking of a non-daily nature, in addition to frequent smoking. The measure of binge drinking was the average number of drinks consumed on a day when drinking; binge drinking was defined as 4 or more drinks for women and 5 or more drinks for men, as recommended by the National Institute of Alcohol Abuse and Alcoholism (2004). NHIS items measuring physical activity were recoded to reflect an activity level that either does not meet or meets recommendations of at least 150 min per week (Physical Activity Guidelines Advisory Committee, 2008). Participants indicated whether they had seen a mental health professional in the last 12 months. They also rated their general overall mental health, mood, and ability to think; responses of *good*, *fair* and *poor* were combined. Participants indicated their perceived likelihood of developing cancer (any type) compared to a person of similar age and sex (*more likely*, *about equally likely*, and *less likely*, hereafter referred to as *high*, *average*, and *low* risk perception, respectively). Participants who responded “don’t know” were combined with the *average* risk perception category ($n = 31$). The primary outcome was skin cancer screening, measured by whether or not the respondent reported ever receiving a skin cancer examination.

2.3. Analyses

Analyses were conducted using Stata, version 13.0 (StataCorp., 2013). Data were weighted using the sampling weights provided by NHIS. Except where noted otherwise, we coded *don't know* and *refused* responses as missing. All variables were determined to have a frequency of missingness lower than 3%. Patterns of missing data were analyzed by examining tabulations and summaries, and missing data were assumed to be missing at random. Analyses were performed using pairwise deletion, so all available data would be used for each analysis.

We assessed the association of each independent variable with sex in contingency tables, using Pearson's chi-squared test to assess statistical significance. We similarly examined the bivariate association between cancer risk perception and skin cancer screening among all indoor tanners and stratified by sex. We next examined the adjusted associations between select independent variables and skin cancer screening using hierarchical multiple logistic regression. A priori, we included sex and cancer risk perception, and tested for an interaction between these variables. The interaction term was not significant and, therefore, was not included in subsequent analyses. Other variables were included if they were associated with skin cancer screening in bivariate analyses; variables that met this criterion were education, insurance status, and sunscreen use. In this analysis, education was treated as an ordinal variable based on its linear association with screening. A significance level of $p < 0.05$ was set for all analyses.

3. Results

Among indoor tanners, sex was significantly associated with binge drinking, with more men reporting binge drinking (Table 1). Male and female indoor tanners also significantly differed in their sunscreen use; a greater proportion of men rarely or never used sunscreen, and a smaller proportion used sunscreen always or most of the time. No significant sex differences in skin cancer screening were found.

Cancer risk perception was significantly associated with skin cancer screening ($\chi^2 = 14.02$, $p = 0.01$). Skin cancer screening was lowest among the *average* risk perception group (18.3%); among the *high* and *low* risk perception groups, 30.6% and 24.4%, respectively, reported skin cancer screening. Similarly, the association was significant among women ($\chi^2 = 12.47$, $p = 0.02$); 17.4% of the *average* risk perception group reported skin cancer screening, and 29.8% and 23.9% of those with *high* and *low* cancer risk perception, respectively, reported screening. Cancer risk perception was not significantly associated with skin cancer screening among men.

Hierarchical multiple logistic regression models indicated that skin cancer screening was significantly more likely among indoor tanners with *high* risk perception compared to those with *average* risk perception, but the *low* and *average* risk groups did not significantly differ (Table 2). Greater education was associated with having ever been screened for skin cancer. Sex and insurance status were not significantly associated with skin cancer screening.

4. Discussion

The low rate of cancer screening observed among those with *average* cancer risk (i.e., those perceiving their cancer risk to be “about the same” as similar others), although not statistically significantly different from that observed among the *low* risk perception group, suggests a non-linear relationship of cancer risk perception to skin cancer screening behavior. One possible explanation for the observed relationship is that the *average* risk perception response may reflect the absence of opinion or adequate reflection on the topic, or a low level of health information, which precludes recognition of the cancer risk inherent in indoor tanning. If so, these individuals may be at the highest risk for poor health outcomes compared with those with high or low perceived risk.

Although men and women tanners differed on some variables, the similar levels of cancer risk perception, smoking, and alcohol use, as well as low levels of screening, observed in a clearly high-risk group suggest that female tanners mirror men in risky health behaviors. These patterns may clarify whether men and women should be treated as a single population for indoor tanning intervention. In line with our findings, women who tan indoors have been reported to drink alcohol more commonly and in larger quantities than their non-tanning counterparts (Bagdasarov et al., 2008; O’Riordan et al., 2006), yet women in the general population binge drink much less than men (Nolen-

Table 1
Weighted percentages among all indoor tanners and by sex: subsample of 2010 National Health Interview Survey participants (N = 1177).

	Weighted % Unweighted (n)	Male %	Female %	p-Value
Sex				
Male	19.6% (225)			
Female	80.3% (952)			
Age				p = 0.40
18–29	45.8% (507)	41.5%	48.3%	
30–39	18.3% (247)	19.8%	18.6%	
40–49	20.1% (225)	27.0%	23.2%	
50+	15.7% (198)	11.8%	9.9%	
Geographic region				p = 0.82
Northwest	12.9% (140)	11.4%	13.3%	
Midwest	36.2% (424)	37.2%	35.9%	
South	35.2% (420)	36.8%	34.6%	
West	15.9 (193)	14.7%	16.2%	
Education				p = 0.50
H.S. graduate or less	32.6% (375)	34.7%	32.0%	
Some college	44.1% (514)	40.1%	45.0%	
Bachelor's or more	23.4% (288)	25.2%	23.0%	
Insurance status				p = 0.72
Not covered	17.2% (202)	17.4%	16.7%	
Covered	82.7% (969)	82.6%	83.3%	
Cancer risk Perception				p = 0.15
High	16.6% (187)	14.1%	17.2%	
Average	55.0% (618)	50.1%	55.4%	
Low	29.0% (331)	35.0%	27.4%	
Skin response 1 h of sun				p = 0.61
Burns severely	4.8% (55)	3.8%	5.1%	
Moderate burn	27.1% (297)	25.0%	27.7%	
Mild burn/tan	32.0% (372)	32.0%	32.0%	
Dark tan, no burn	27.4% (339)	27.2%	27.4%	
No change	8.3% (105)	11.3%	7.6%	
Don't go in sun	0.4% (3)	.7%	.3%	
Sunscreen use				p = 0.004
Always	17.3% (209)	13.0%	18.4%	
Most of time	13.4% (207)	11.3%	19.3%	
Sometimes	18.8% (298)	24.5%	26.0%	
Rarely	10.4% (143)	17.7%	11.8%	
Never	40.2% (319)	33.7%	24.6%	
Physical activity				p = 0.15
Below RDA	44.6% (506)	39.7%	45.8%	
Meets RDA	55.4% (671)	60.3%	54.2%	
Smoked 100 cigarettes				p = 0.28
No	45.7% (549)	50.8%	55.2%	
Yes	54.3% (628)	49.2%	44.8%	
Binge drinking				p = 0.02
No	60.6% (724)	52.4%	62.6%	
Yes	39.4% (453)	47.6%	37.4%	
Mental health visit				p = 0.30
Had visit(s)	10.1% (131)	12.3%	9.6%	
No visit(s)	89.9% (1,046)	87.7%	90.4%	
Mental health				p = 0.059
Excellent	33.6% (370)	41.4%	31.7%	
Very good	34.8% (409)	31.4%	35.7%	
Good, fair or poor	31.6% (389)	27.2%	32.7%	
Skin exam				p = 0.19
No	77.8% (923)	74.0%	78.8%	
Yes	22.2% (251)	26.0%	21.2%	

Note: Total sample size varies for some analyses due to missing data. The following variables had missing responses: Insurance status (n = 6), cancer risk perception (n = 44), skin response to 1 hr. of Sun. (n = 6), sunscreen use (n = 1), mental health (n = 9), and skin exam (n = 3).
Not all percentages add to 100 due to rounding.

Hoeksema, 2004). Only 18% of women in a recent California sample reported binge drinking (Banta et al., 2014). In our study, although a sex difference in drinking was significant, nearly half (47.6%) of men reported binge drinking, and the proportion of women reporting binge drinking (37.4%) was greater than has been found among women in the general population. Thus, in risky drinking behavior and smoking, male and female indoor tanners may be more similar than men and women in general, suggesting future interventions may efficiently address the behaviors in tandem.

Table 2
Results of hierarchical multiple logistic regression predicting skin exam status, NHIS 2010 (N = 1159).

Exam status	Model 1 OR [95% Conf. Interval.]	p-Value	Model 2 OR [95% Conf. Interval.]	p-Value
Cancer risk perception:				
High	1.97 [1.21–3.23]	0.01	2.23 [1.32–3.59]	0.01
Average (Ref.)	1.00	–	1.00	–
Low	1.42 [0.93–2.15]	0.10	1.43 [0.94–2.17]	0.08
Sex:				
Male (Ref.)	1.00	–	1.00	–
Female	0.79 [0.53–1.18]	0.25	0.75 [0.50–1.14]	0.19
Education	–	–	1.28 [1.04–1.58]	0.02
Insurance status	–	–	1.62 [0.96–2.74]	0.07
Sunscreen Use:				
Low use (Ref.)	–	–	1.00	–
Sometime use	–	–	1.21 [0.80–1.82]	0.36
High use	–	–	1.50 [0.97–2.35]	0.07

Note: Model 1 includes only cancer risk perception and sex, and Model 2 also includes education, insurance status and sunscreen use.

Female tanners also smoke more than women who do not tan (Coups and Phillips, 2011). Because men in the U.S. smoke more than women overall (Jamal et al., 2012), the similar frequency of smoking we observed suggests that smoking is another risky behavior in which the sexes are more similar among tanners than in the general public. These findings may, however, be due to the broad classification of smoking used. We classified smoking broadly with the intention of including low-frequency or casual smokers, because the motivational profile of infrequent smokers includes social and weight-control reasons (Shiffman et al., 2012), which are gender-specific and contribute to indoor tanning (Holman and Watson, 2013). In contrast, Guy and colleagues recently conducted an examination of characteristics of indoor tanners and found no association between tanning and smoking status (Guy et al., 2015), when groups were defined as never smokers, former smokers or current smokers. Our findings nonetheless have implications for intervention. Specifically, because smoking narrows blood vessels in the dermis, inducing wrinkling and premature aging (Doshi et al., 2007; Helfrich et al., 2007; Martires et al., 2009), smoking prevention might be effectively incorporated into appearance-focused tanning prevention strategies.

Sex differences observed among tanners confirm previous findings that men use sunscreen less than women (Falk and Anderson, 2013; Holman et al., 2015). However, recent research indicating that women apply products containing an SPF more consistently to the face than to other exposed skin (Holman et al., 2015) offer a possible explanation for the gender difference, if respondents affirm sunscreen use based on facial application only. Our findings may also be due to the incorporation of sunscreen in many women's facial skin care products, more frequent marketing of sunscreen to women (Lee et al., 2006), the use of sunscreen among women to prevent aging, or perceptions that sunscreen product use is at odds with masculinity (Courtenay, 2000). Of greater interest is the proportion of female tanners reporting regular sunscreen use, despite engaging in intentional, paid UV exposure. Data describing the context of tanning and sunscreen use, or whether sunscreen was used during indoor tanning, were not available. Conflicting media messages regarding tanning safety, however, including information about UV-induced vitamin D synthesis, may confuse otherwise sun-safe individuals, leading to concurrent sunbed and sunscreen use. Tanning salons commonly make false health claims and minimize the risks of tanning (U.S. House of Representatives Committee on Energy and Commerce, 2012). Therefore, tanning may be health-motivated, a possibility which supports stronger indoor tanning industry regulation. Additionally, the NHIS sunscreen use question does not differentiate between facial and bodily sunscreen use, but as recent research suggests

(Holman et al., 2015), affirmative responses among women may represent strictly facial application.

Also of interest, 26% of male tanners had been screened for skin cancer compared to 21.2% of female tanners. So, despite engaging in behavior that puts them at higher than average skin cancer risk, tanners' frequency of screening is comparable to the low frequency (13%–25%) reported in national samples (Coups et al., 2010; Lakhani et al., 2014). Although routine skin cancer screening is not recommended at the population level, indoor tanners are a high-risk group that could benefit from periodic skin exams. Additional research is needed to determine the potential benefits and harms of routine screening among individuals with a history of intense UV exposure from indoor tanning.

Several limitations of the study should be noted. The cross-sectional nature of NHIS data limit causal inference, and the variables available do not include all potential covariates such as social or attitudinal variables. Further, the measure of cancer risk perception is not specific to skin cancer, so risk perception categories may reflect perceived risk of other types of cancer. In addition, the risk perception measure assessed comparative risk; alternatively worded items may yield more predictive validity (Janssen et al., 2011).

Risky health behaviors coupled with low levels of skin cancer screening make indoor tanners a critical target for strategic risk reduction efforts. Recent rules proposed by the Food and Drug Administration (FDA) recommend restricting tanning to adults 18 and older, and strengthening device performance standards to reduce risk of accidental burns. This proposed policy change reflects an essential step toward reducing modifiable skin cancer risk (FDA, 2015). Beyond regulatory efforts, the infrequent skin cancer screening and similar risky behavior we observed among men and women who practice indoor tanning suggest that mixed-sex tanning prevention efforts may be adapted to target multiple risk behaviors. The consistent sunscreen use reported by some indoor tanners merits examination using qualitative approaches, which would allow deeper exploration of tanners' practices and motives in engaging in concurrent UV exposure and protection behavior. These contradictory behaviors may be due to conflicting feelings about UV exposure, misinformation about various types of exposure, or contextual variables. Further clarity about the context of sun protection behaviors among indoor tanners would offer insights for tanning prevention.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

Transparency document

The Transparency document associated with this article can be found, in online version.

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