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Is initiating tanning bed use as a minor associated with increased risky tanning behaviors and burning? An exploratory study

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ABSTRACT

Tanning bed use is most common among youth and young adults, and is associated with an increased risk of skin cancer. Recently, numerous states have adopted restrictions on minors' access to tanning beds; however, little has been reported on how such policies may impact tanning behaviors and burning. The purpose of this study was to examine the associations between age of indoor tanning initiation and risky tanning behaviors and burning. Female students (n = 567) attending a large southeastern public university completed a questionnaire (spring of 2015) assessing tanning bed use history, including age of initiation. The analytic sample was limited to participants reporting past year indoor tanning (n = 134). Multivariable logistic regression was used to compare the odds of risky tanning behaviors and burning among those initiating indoor tanning before and after their 18th birthday. Participants initiating indoor tanning as a minor had significantly ($ps < 0.05$) greater odds of using a tanning bed 10 or more times in the previous year, typically indoor tanning for ≥10 min, ever indoor tanning without wearing goggles, and ever fallen asleep inside a tanning bed. Further, those that initiated as a minor had significantly greater odds of ever burning from indoor tanning ($p < 0.05$). Indoor tanning initiation as a minor was associated with several risky tanning behaviors and burning. Youth access restrictions may help reduce the harms caused by tanning beds.

1. Introduction

Tanning bed use in the United States contributes to >400,000 cases of skin cancer each year, including over 6000 cases of melanoma (Wehner et al., 2014). Despite these risks, 15.2% of non-Hispanic white female high school students report using a tanning bed in the previous year (Kann et al., 2016). Tanning bed use at younger ages has been shown to be more strongly associated with skin cancer risk, possibly due to a greater lifetime accumulation of exposure and younger skin's increased susceptibility to UV damage (Cust et al., 2011; Lazovich et al., 2010; Boniol et al., 2012). Alarmingly, rates of melanoma have been increasing among young women over the past four decades (Purdue et al., 2008; Reed et al., 2012).

Adolescence is a developmental period characterized by increased risk-taking (Steinberg, 2008). During childhood and teenage years, changes occur in the brain's socio-emotional system, which contribute to increased sensation-seeking and engagement in risky behaviors (Romer and Hennessy, 2007; Zuckerman, 1994). Impulse control is relatively immature during this period, and responsiveness to incentives and emotional processing is elevated. This is especially true in the presence of peers (Steinberg, 2008).

Because adolescents are more likely to engage in risky behaviors, individuals that initiate indoor tanning at younger ages may be more likely to engage in risky tanning behaviors (e.g., increased number of tanning sessions, longer tanning sessions, tanning without eye protection, falling asleep inside a tanning bed, tanning completely nude), compared to those that initiate tanning at later ages. Engaging in risky tanning behaviors may in turn increase the harms caused by tanning beds, including burning.

The purpose of this investigation was to assess the relationship between age of indoor tanning initiation and engagement in risky tanning behaviors and burning.

2. Methods

2.1. Sample

A convenience sample of female college students ($n = 567$) who were members of sororities at a large public university in the southeastern United States completed an online questionnaire assessing tanning bed use history, including age of initiation, and engagement in a variety of risky tanning behaviors, as well as burning. Email invitations were

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sent to a total of 1889 female students (30.0% response rate). The analytic sample was limited to participants that had used a tanning bed within the past year ($n = 134$). Among the participants excluded, 359 had never used a tanning bed and 74 had used a tanning bed more than one year ago. All questionnaires were completed in the spring of 2015.

2.2. Data description

Participants were asked about engaging in five risky indoor tanning behaviors: 1) using a tanning bed 10 or more times in the previous year, 2) typically tan indoors for ≥10 min, 3) ever tanned indoors without eye protection, 4) typically tan indoors completely nude, and 5) ever fallen asleep while tanning indoors. In addition, participants were asked how many times they had burnt from using a tanning bed. Two binary burn outcomes were created: 1) ever burnt from indoor tanning, 2) ever burnt ≥3 times from indoor tanning. Thus, a total of seven binary dependent outcomes were examined.

Initiating tanning bed use prior to 18th birthday, the main independent variable of interest, was coded as a binary variable. Age 18 was used as a cutoff because it is the legal age of adulthood in the United States, and thus many state laws and FDA's proposed nationwide youth access regulation apply to age 18 (Coups et al., 2016). Control variables included age, sunburn tendency, frequency of sun protective behaviors, and self-reported skin color (each measured with a separate and single item). Race and ethnicity (i.e., Hispanic or not) were not included as control variables due to lack of variation within these variables in the sample.

2.3. Analysis

Frequencies of each risky tanning behavior and burning outcomes were calculated for tanners that initiated indoor tanning prior to 18th birthday (early initiators) and for those that initiated at age 18 years or later (later initiators). Wilcoxan Rank Sum Test was used to assess significant differences between groups for age and Chi-square or Fisher Exact Tests were used to test for differences between all other characteristics.

Multivariable logistic regression models were used to compare the odds of each risky tanning behavior and burning outcome among early and later initiators. Pregibon's Link Test was not significant for each model (linear predicted value squared for each model was not significant; all ps ≥ 0.116), indicating no evidence of incorrect model specification.

For all analyses, the significance level was set at $p < 0.05$. The University of North Carolina at Chapel Hill's Office of Human Research Ethics exempted this study from review.

3. Results

3.1. Sample description

The median age of participants was 20, 96% identified as white, 6% identified as Hispanic. A total of 55% reported tanning for the first time prior to 18th birthday. A majority of participants (84%) reported protecting their skin from the sun (e.g., wearing sunscreen or a hat) half or more than half of the time when out in the sun, and a majority (51%) reported always, usually, or sometimes burning if out in the sun with no protection. Further, 52% of participants reported having fair or very fair skin. Table 1 describes the characteristics of early and later initiators.

3.2. Risky tanning behaviors

Chi-square tests revealed that a significantly greater proportion of early initiators tanned ≥10 times in the past year ($p = 0.001$), typically used a tanning bed for ≥10 min ($p = 0.023$), ever used a tanning bed without eye protection ($p = 0.006$), and ever fallen asleep while using a tanning bed ($p < 0.001$). The difference found between early and later initiators for typically tanning while nude ($p = 0.052$) approached significance.

Table 1
Characteristics of female university students reporting tanning bed use in previous year stratified by early ($n = 74$) and later ($n = 60$) initiators.

Characteristic	Early initiator (<18)	Later initiator (≥18)	p-Value
Median age of tanning bed initiation	16	18	<0.001
Median age at time of survey	20	20	0.138
% White	97.3	95.0	0.656
% Hispanic	8.1	3.3	0.296
% Always, usually or sometimes burn when out in the sun	41.9	63.3	0.014
% Very fair or fair skin	50.0	55.0	0.564
% Protect skin from sun (e.g., sunscreen or hat) half or greater than half the time when out in the sun	81.1	86.7	0.385

Note: Data collected in spring of 2015; all students attended a large public southeastern university.

Similar results were found for the multivariable logistic models. Table 2 summarizes the frequency of each risky behavior and burning variable among early and later initiators, and presents the results from the multivariable logistic regression models. Controlling for demographic characteristics and potential confounders, early initiators were found to have significantly greater odds of tanning ≥10 times in the past year (OR = 3.21; 95% CI = (1.52, 6.80)), typically using a tanning bed for ≥10 min (OR = 2.36; 95% CI = (1.06, 5.22)), ever used a tanning bed without eye protection (OR = 4.16; 95% CI = (1.37, 12.62)), and ever fallen asleep while using a tanning bed (OR = 9.36; 95% CI = (3.88, 22.60)). Odds of typically tanning nude were not significantly different between early and later initiators (OR = 1.73; 95% CI = (0.80, 3.75)).

3.3. Burning

Overall, 75% of indoor tanners reported ever experiencing a burn from a tanning bed, and 26% reported experiencing ≥3 burns from a tanning bed. Chi-square tests reveal that there were no significant differences in frequency of ever burning ($p = 0.194$) or burning ≥3 times from a tanning bed ($p = 0.065$) between early and later initiators. In multivariable models, differences in the odds of ever burning (OR = 2.42; 95% CI = (1.01, 5.83)) were significantly higher for early initiators compared to later initiators, and differences in odds of ever burning three or more times (OR = 2.36; 95% CI = (1.00, 5.56)) from a tanning bed approached significance ($p = 0.05$).

4. Discussion

Among a sample of young female indoor tanners, initiating tanning bed use prior to 18th birthday was significantly associated with several risky tanning behaviors, including more frequent indoor tanning, longer indoor tanning sessions, not wearing eye protection, and ever falling asleep inside a tanning bed. In addition, early initiators had significantly greater odds of ever burning from a tanning bed. These findings suggest that postponing tanning bed initiation may lower skin cancer risk by reducing risky tanning behaviors, cumulative UV exposure, and burning.

Numerous countries (e.g., France, England, Belgium) have adopted age restrictions on tanning bed use to protect young people from the dangers of indoor tanning (Pawlak et al., 2012). Surveys of indoor tanners in the US reveal strong support for such policies (Seidenberg et al., 2016a; Mays et al., 2016). To date, 17 US states and the District of Columbia have banned minors under age 18 from using tanning beds

Table 2
Frequency of engaging in risky tanning behaviors and burning among early ($n = 74$) and later ($n = 60$) initiators and results from multivariable logistic regression.

		Frequency	AOR	95% CI
Risky behavior				
≥10 indoor tanning sessions in previous year	Later initiator (≥18)	30.0	–	
	Early initiator (<18)	58.1	3.21**	(1.52, 6.80)
Tanning sessions typically ≥10 min	Later initiator (≥18)	58.3	–	
	Early initiator (<18)	76.7	2.36*	(1.06, 5.22)
Ever not worn eye protection	Later initiator (≥18)	8.3	–	
	Early initiator (<18)	27.0	4.16*	(1.37, 12.62)
Ever fallen asleep while using a tanning bed	Later initiator (≥18)	16.7	–	
	Early initiator (<18)	62.2	9.36***	(3.88, 22.60)
Typically tan nude	Later initiator (≥18)	60.0	–	
	Early initiator (<18)	75.7	1.73	(0.80, 3.75)
Burning				
Ever burnt from indoor tanning	Later initiator (≥18)	70.0	–	
	Early initiator (<18)	79.7	2.42*	(1.01, 5.83)
Ever burnt ≥3 times from indoor tanning	Later initiator (≥18)	18.3	–	
	Early initiator (<18)	32.4	2.36	(1.00, 5.56)

Notes: Data collected in spring of 2015; all students attended a large public southeastern university. Models controlled for age, sunburn tendency, frequency of sun protective behaviors, and self-reported skin color.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

(National Conference of State Legislatures, 2017). Further, the US Food and Drug Administration (FDA) has announced a proposal for a nationwide under 18 ban (Coups et al., 2016). Based on the findings described here, such policies may help reduce the harms caused by indoor tanning.

With 62.2% of early initiators and 16.7% of later initiators reporting having ever fallen asleep inside a tanning bed, this risky tanning behavior differed the most between the two groups (OR = 9.36). It is not known why such a large discrepancy was found for this behavior between early and later initiators, and given that this was assessed as 'ever,' we do not know precisely when it occurred. However, one possible explanation is that falling asleep inside a tanning bed may have occurred for early initiators during their high school years, and most high school students do *not* get recommended levels of sleep – i.e., only 24.4% of female high school students get 8 or more hours of sleep on an average school night (Kann et al., 2016). Since tanning is viewed as relaxing (Noar et al., 2014), high school girls may be more prone to fall asleep in tanning beds compared to college students who have more flexible schedules and more ability to sleep late or nap on school days. However, further research is needed to fully understand the relationship between age of initiation and falling asleep inside a tanning bed.

Nearly half (45%) of participants initiated indoor tanning at age 18 or older. While prohibiting minors' (under 18) access to tanning beds may prevent some youth from ever initiating, some young people will delay initiation until they reach the legal age. Therefore, additional efforts will be needed to prevent tanning bed initiation. Other policies, such as taxing tanning bed use, restricting indoor tanning advertising, and educational media campaigns describing the dangers of tanning, have been proposed (Seidenberg et al., 2015; Sontag and Noar, 2017). Further, research is also needed to understand how young people respond to indoor tanning age restrictions, and whether such policies encourage those affected to tan outdoors.

Previous research has identified burning as a consequence of indoor tanning (Stapleton et al., 2013; Seidenberg et al., 2016b). In this sample of female college students, 75% reported ever burning from a tanning bed. Burning was common among both early (80%) and later initiators (70%). Thus, delaying age of initiation of indoor tanning will not eliminate the risk of burning from indoor tanning. Therefore, health communication campaigns and additional tanning bed regulations may be needed to reduce the prevalence of burning by indoor tanning.

Using a tanning bed without eye protection can cause serious eye injury (Guy et al., 2015). Nineteen percent of participants reported ever using a tanning bed without eye protection, and doing so was more common among early initiators. In a previous study reviewing Twitter posts describing burns caused by tanning beds, fear of "raccoon eyes" (i.e., uneven tan circles around the eyes) and a desire to use a mobile phone while tanning were reported as reasons why tanners did not wear eye protection (Seidenberg et al., 2016b). The indoor tanning industry has also acknowledged the problem of tanners not wearing eye protection due to mobile phone use (Fishbaugh, 2015). Included with the recently proposed FDA regulation that would prohibit minors' access to tanning beds nationwide, was a provision that all indoor tanners sign a "risk acknowledgement" certification prior to tanning bed use and every 6 months thereafter. By signing, tanners acknowledge that they understand the risks (including eye damage) of tanning bed use (Coups et al., 2016; Department of Health and Human Services, Food and Drug Administration, 2015). It remains unclear whether this will increase protective tanning behaviors such as use of eye protection, or potentially deter young women from tanning indoors.

Given their age, early initiators are more likely to live at home with their parents, and parents may have a strong influence on early tanning. Previous research suggests that parents generally play a role in inhibiting – or in some cases facilitating – indoor tanning behavior (Noar et al., 2014; Stanganelli et al., 2016). Studies find that young women who tanned the first time with their mother – typically as adolescents – are more likely to become higher frequency tanners than those that did not (Baker et al., 2010; Kelley et al., 2016). Therefore, for some adolescents, tanning for the first time with their mother may signify a 'stamp of approval' on the behavior that leads to more frequent and casual use of tanning beds. Furthermore, behaviors initiated with a parent may become more normalized, and thus less receptive to risk messages and behavioral change. While the present study did not assess parental approval of tanning or tanning with a parent, future research on the relationship between parents and risky tanning behaviors is warranted.

The findings of this study may have limited generalizability due to the use of a small ($n = 134$) and homogenous sample (all female college students and 96% white). However, tanning bed use is most common among non-Hispanic white females and university students, and our sample is reflective of precisely this demographic group (Wehner et al., 2014; Guy et al., 2011). Despite a small sample size, several significant differences were found between early and later initiators, underscoring the apparent robust differences in tanning behaviors between these groups. Because it would be unethical to randomize participants to initiate tanning beds at a particular age, the two groups may differ by unmeasured confounding factors, though we controlled for

measured factors (e.g., demographic characteristics, skin color, and sunburn tendency) in the multivariable analyses. In addition, age of initiation was dichotomized into <18 or ≥18 because of policy interest around under 18 bans. Consequently, these findings do not assess relationships between risky tanning behaviors and initiation at earlier ages (e.g., 16). Finally, data on precisely when risky tanning behaviors and burning occurred were not collected. It is possible that risky behaviors and burning occur with experience with indoor tanning, and because early initiators have been tanning longer, this group has had more opportunities to engage in risky tanning behaviors and burn. A longitudinal study design that examines risky behaviors among early and later initiators over time is needed to confirm the findings described here, as are studies that utilize nationally representative samples.

5. Conclusions

This is the first study to assess the relationship between age of initiation and engagement in risky tanning behaviors and burning. Among a sample of female college students, early tanning bed initiation was associated with engaging in a variety of risky tanning behaviors and burning. Youth access restrictions, such as under 18 bans, may help reduce the harms caused by tanning beds.

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