SKIN

ORIGINAL RESEARCH

Sunscreen Knowledge and Sun Protective Behaviors among Medical Students at a Southern US Institution

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ABSTRACT

Introduction: Literature has demonstrated that medical students have discrepancies in their knowledge and their execution of best practices concerning sun protection. Additionally, despite knowing the harms of tanning, medical students acknowledge they desire tan skin.
Methods: A survey was sent to medical students at a Southeastern institution to determine their knowledge of sun safety and their personal practices. The survey was distributed through institutional emails and student messaging applications. Current medical students at the home institution were eligible to complete the survey. The survey was designed with guidelines from the American Academy of Dermatology in mind. Chi square analysis was performed by SPSS Version 28.0.1.1 (14).
Results: The majority of medical student are knowledgeable of best sun protective practices, though many students do not carry out these practices. For example, 88% of students know to reapply sunscreen every 2 hours; however, only 29% of students always reapply at the correct interval.
Conclusion: Medical students are knowledgeable of best practices for preventing sun damage; however, their personal behaviors can deviate and societal pressure for some students to have “tanned” skin is challenging to overcome.

INTRODUCTION

Skin cancer is the most common malignancy in the United States. Though it is largely preventable, few adults regularly use sunscreen on their face[1]. Sun protection is crucial because research indicates that sunburn, regardless of age, increases the risk of skin cancer[2]. Practices such as seeking shade and wearing protective clothing are also vital to reduce ultraviolet (UV) radiation[3]. Previous literature highlights that sun protection and sunscreen use is different among demographic groups. For example, females are more likely to apply sunscreen than their male counterparts[4] and certain ethnic groups, including Black individuals, are less likely to apply sunscreen than white individuals[5]. Additionally, among those that wear sunscreen, correct application is not consistent. For example, in a study by Holman et al., 40% of participants that wore sunscreen were uncertain if they applied broad spectrum[5].

Compared to the general adult population, medical students are uniquely positioned in their level of knowledge to carry out best health practices in a multitude of areas.

Though previous research demonstrates that medical students are knowledgeable of best sun protective practices, medical students have discrepancies in their knowledge and their execution of those practices[6,7]. Although students in a study by Novitasari et al. knew that applying sunscreen every 2 hours while outdoors was recommended, less than 50% of students adhered to this recommendation in their daily practice[6]. Additionally, despite knowing the harms of tanning, medical students still acknowledge they desire tan skin[7].The purpose of this study was to ascertain the knowledge of sun protection and the implementation of these practices by medical students at a United States Southeastern institution.

METHODS

An online survey was developed to ascertain students' knowledge and sun protective behaviors. The survey was created on Qualtrics with questions sourced from previous literature, the American Academy of Dermatology, and investigator collaboration. All current medical students at the University of Alabama at Birmingham Heersink School of Medicine during the academic year of 2021 – 2022 were included. Students were recruited through institutional listserv emails, class messaging boards, and posters on campus. Responses were coded before analysis. Participants' self-reported race was broken down into white and non-white students. Questions regarding objective knowledge were classified as correct or incorrect. In terms of behavior questions, responses were classified as "more often" if a student selected "always" or "sometimes." All other responses were coded as "less often." Chi-square analysis was performed on SPSS Version 28.0.1.1 (14).

RESULTS

With 268 out of 744 students responding, the survey had a response rate of 36%. The majority of responding medical students were white (75%), female (63%), and belonged to the first-year class (36%). The median age was 24. Full demographic information is outlined in **Table 1**. Medical students are well-versed in best practices for sun protection (**Table 2**). For example, 98% of students endorse that sunscreen can protect against skin cancer. Only two questions out of seven had less than 80% of students responding correctly. 70% of students endorse that a "base tan" does not protect against further sun damage. In addition, 59% of students state that sunscreen should be applied 15 minutes before going outdoors. Demographic differences were identified through chi-square analysis (**Table 3a-c**). Female students are more likely to correctly identify the photo aging benefits of sunscreen ($p=0.022$) and that a "base tan" does not protect from further sun damage ($p=0.006$). White students were more likely to correctly identify >30 as the recommended SPF level ($p<0.001$) and that a base tan does not protect skin from further sun damage ($p=0.010$). Dermatology patients are more likely to correctly state the recommended level of SPF ($p=0.017$).

Results demonstrate that students are less likely to apply their knowledge (**Table 4**). For example, only 48% of students more often wear sunscreen when spending time outdoors. Just 10% of students will wear long sleeves to protect themselves. Some demographic differences were found through chi-square analysis (**Table 5a-c**). Female students were more likely to wear sunscreen outdoors ($p=0.003$) and indoors ($p<0.001$) and wear long sleeves when in the sun ($p=0.04$). White students were more likely to reapply sunscreen every 2 hours ($p<0.001$) and wear sunscreen indoors ($p=0.016$). Non-white students were more likely to wear long

Table 1. Demographics of survey respondents.

	Percentage	Frequency
Medical Student Year		
MS1	36	91
MS2	35	88
MS3	15	37
MS4	14	34
Gender Identity		
Male	37	92
Female	63	157
Non-Binary	1	2
Prefer Not to Say	0	0
Race		
White	75	188
Black	6	14
American Indian or Alaskan Native	1	3
Asian	15	38
Native Hawaiian or Pacific Islander	0	0
Other	3	7
Ethnicity		
Hispanic or Latino	10	23
Non-Hispanic or Latino	90	127
Age		
Mean	25	
Median	24	
Minimum	22	

Table 2, 3a-c. Medical students are well-versed in best practices for sun protection. Female students are more likely to correctly identify the photoaging benefits of sunscreen (p=0.022) and that a "base tan" does not protect from further sun damage (p=0.006). White students were more likely to correctly identify >30 as the recommended SPF level (p<0.001) and that a base tan does not protect skin from further sun damage (p=0.010). Dermatology patients are more likely to correctly state the recommended level of SPF (p=0.017).

Table 2. Student's Knowledge of Sun Protection	
Correct Response	**% Correct**
Sunscreen should be reapplied every 2 hours when outdoors	87
Sunscreen be applied 15 minutes before going outdoors	59
The recommended level of SPF in sunscreen products is >SPF 30	81
Sunscreen can protect against skin cancers	98
Sunscreen can protect against photo-aging	92
A "base tan" *does not* protect skin from further sun damage	70
People with dark (brown/black) skin need to wear sunscreen	97

Table 3a. Students' Knowledge of Sun Protection: Males v Females					
Correct Response	**% M**	**% F**	**Pearson X^2**	**df**	**Asymptotic significance**
Sunscreen can protect against photo-aging	85	95	7.631	2	0.022
A "base tan" *does not* protect skin from further sun damage	55	78	14.440	4	0.006
Table 3b. Students' Knowledge of Sun Protection: White vs Non-White					
Correct Response	**% W**	**% NW**	**Pearson X^2**	**df**	**Asymptotic significance**
The recommended level of SPF in sunscreen products is >SPF 30	86	64	14.931	1	0.000
A "base tan" *does not* protect skin from further sun damage	74	54	9.188	2	0.010
Table 3c. Students' Knowledge of Sun Protection: Dermatology Patient vs Non-Dermatology Patient					
Correct Response	**% W**	**% NW**	**Pearson X^2**	**df**	**Asymptotic significance**
The recommended level of SPF in sunscreen products is >SPF 30	85	75	8.208	2	0.017

Table 4, 5a-c. Results demonstrate that students are less likely to apply their knowledge. Female students are more likely to wear sunscreen outdoors (p=0.003) and indoors (p<0.001) and wear long sleeves when in the sun (p=0.04). White students are more likely to reapply sunscreen every 2 hours (p<0.001) and wear sunscreen indoors (p=0.016). Non-white students are more likely to wear long sleeves when in the sun (p=0.045). Dermatology patients are more likely to report wearing sunscreen outdoors (p=0.036)

Table 4. Students' Sun Protective Behaviors	
Students "Always" or "Most of the Time" …	**%**
Wear sunscreen when outdoors	48
Wear sunscreen when indoors	22
Reapply sunscreen every 2 hours during outdoor activities	29
Wear long sleeves when spending time in the sun	10
Seek shade	43

Table 5a. Students' Sun Protective Behaviors: Male vs Female					
"I more often…"	**% M**	**% F**	**Pearson X^2**	**df**	**Asymptotic significance**
Wear sunscreen when outdoors	33	55	11.333	2	0.003
Wear sunscreen when indoors	9	27	17.362	2	<0.001
Wear long sleeves when spending time in the sun	5	12	6.229	2	0.044

Table 5b. Students' Sun Protective Behaviors: White vs Non-White					
Response	**% W**	**% NW**	**Pearson X^2**	**df**	**Asymptotic significance**
Wear sunscreen when outdoors	86	64	14.931[a]	1	0.000
Wear sunscreen when indoors	74	54	9.188[a]	2	0.010
Reapply sunscreen every 2 hours during outdoor activities	35	11	11.443	1	0.001
Wear long sleeves when spending time in the sun	8	17	4.018	1	0.045

Table 5c. Students' Knowledge of Sun Protection: Dermatology Patient vs Non-Dermatology Patient					
Response	**% D**	**% ND**	**Pearson X^2**	**df**	**Asymptotic significance**
Wear sunscreen when outdoors	56	37	6.657	2	0.036

Table 6, 6a. White students were more likely to feel more attractive with tan skin ($p<0.001$), tan their skin in the sun during the summer ($p=0.004$), and tan their skin in sun before a vacation ($p=0.013$).

Table 6. Students' Tanning Practices	
Responses	**% More True**
I feel more attractive with tanned skin	50
I think others look more attractive with tanned skin	41
I believe skin looks healthier when it is tanned	27
In the winter, I purposely tan my skin in the sun	2
In the summer, I purposely tan my skin in the sun	17

Table 6a. Students' Tanning Practices: White vs Non-White					
Response	**% W**	**% NW**	**Pearson X^2**	**df**	**Asymptotic significance**
I feel more attractive with tanned skin	76	67	14.500	1	0.000
Purposely tan skin in the sun before I go on vacation	10	0	6.107	1	0.013

sleeves when in the sun (p=0.045). Dermatology patients were more likely to report wearing sunscreen outdoors (p=0.036).

In terms of tanning practices (**Table 6**), 50% of students responding feel more attractive with tan skin. White students were more likely to feel more attractive with tan skin (p<0.001), tan their skin in the sun during the summer (p=0.004), and tan their skin in sun before a vacation (p=0.013) (**Table 6a**).

DISCUSSION

The majority of medical students surveyed at this Southeastern institution were knowledgeable of best sun protective practices and the risks of sun exposure. Although knowledge among the general student population was strong, there were some significant differences in their understanding of guidelines among demographic groups. Female students being more likely to identify that sunscreen protects against photo-aging and that a base tan does not protect from further sun damage correlates with previous research that highlights differences between males and females in sun-protective behaviors. For example, a study by Abroms, revealed that female participants, when asked about their reasoning for sunscreen use, acknowledged the role of sunscreen in preventing photo-aging[4]. In their study, this desire to utilize sunscreen for cosmetic factors was not present among the male participants[4]. Our study also demonstrated differences in knowledge when controlling for race. Literature that discusses differences in race and skin cancer knowledge should be viewed with nuance. In some studies, Black and Hispanic participants demonstrate less knowledge of sun protection than their white counterparts[8]. Still, more recent data demonstrates that further differences among Black and Hispanic knowledge can be better attributed to their region of residency than their ethnicity[9]. Our data correlates with a difference in knowledge between white and non-white students; however, further studies would need to be conducted to understand why this difference was found in the studied medical student population.

Though the students' understanding of sun protection was strong, the application of the practices was varied. For example, 87% of students endorse that sunscreen should be reapplied every two hours; however, only 29% of students "more often" reapply at this interval. Only 48% of students apply sunscreen when they spend time outdoors. Despite having the cognitive tools to protect themselves from UV damage, medical students at this institution are not consistent in sunscreen application and avoiding risky behavior. There were some demographic differences in student sunscreen application. For example, data that female-identifying students were more likely to wear sunscreen overall is consistent with studies conducted in the general population. Holman et al. found that women were more likely than men to wear sunscreen on their face[1]. They found that women were more likely than men to adopt sun protective practices including wearing sunscreen, wearing protective clothing, and seeking shade[10]. A study by Chen et al. demonstrates this trend persists even among melanoma survivors[10].

In terms of race and sun protective behaviors, no difference was found between white and non-white students in applying sunscreen outdoors. When accounting for reapplication and wearing sunscreen indoors, white students were more likely to adhere to these practices. When comparing these findings to other studies, there has been literature documenting that Black

patients are more likely to perceive themselves at low risk of skin cancer and have lower engagement with sun protective practices[1,9]. In a study by Lunsford et al., Black and Hispanic individuals were more likely to report never or rarely using sun protection[9]. Though non-white medical students may have more understanding of the risks of UV radiation, cultural practices may take precedence.

When considering tanning practices, 50% of students endorse that it is more often true of them to feel more attractive with a tan. In our study, there was no statistical difference between men and women in terms of likelihood to tan or their personal feelings of being attractive with a tan. This result deviates from research in the general population. Though women are more likely to engage in sun protection than men, studies reveal that women are more likely to use report a desire to be tan, sunbathe, and use tanning beds[11,12,13].

Differences emerged when accounting for the race of responding students. White students were more likely to report "feeling more attractive" with tan skin and more likely to tan their skin during the summer and before a vacation. These findings are consistent with behaviors identified in other studies[14]. Reasons for tanning are a subject of curiosity given the wide public knowledge of its dangers. In a study by Neenan et al. among community college students, the most often cited reason for using tanning beds was "I think I look better when I am tan"[11]. A similar study conducted at the Ohio University Heritage College of Osteopathic Medicine in Athens had similar findings among the medical student population. Most participants were aware of how to use sunscreen properly and how to avoid excess sun; however, many students participating in tanning and perceived tan skin as healthier[7]. This demonstrates further that while medical students may be uniquely poised in their understanding of healthy practices, they are still subject to cultural norms. Our study deviated from these findings, given less than half of respondents endorsed that their skin appeared healthier when tan.

The desire to be tan is well documented in western culture. Though using sunscreen has been emphasized as an important tool for anti-aging to maintain the cultural beauty standard of youth, media can display conflicting messages[15]. McWhirter and Hoffman-Goetz conducted an analysis of skin cancer and UV behaviors in U.S. magazines[15]. They found that women's magazines were more likely to endorse sun protective behaviors and promote the use of sunscreen than men's magazines[15]. Though explicit messaging was different between groups, the implicit messaging of tan skin being desirable was present in both[15]. Both men's and women's magazines contained images of models sporting the tanned look[15]. These tanned images impact cultural norms and continue to emphasize that those with tan skin are attractive[16]. Medical students even with their knowledge of skin cancer and preventing disease are not immune to the cultural pressure to adhere to a particular standard of beauty.

In research in the general public, a study by Williams et al. demonstrates that giving individuals information about photo-aging and showing participants UV photos of themselves is effective motivation for future indoor tanning but no significant impact on future UV exposure intentions[17]. Mahler et al. similarly assessed the effects of appearance based tactics on sun protection. In their follow-up, they determined that participants had reduced incidental sun exposure during the subsequent year[18]. Additionally, they reported had increased sun protection

behaviors and spectrophotometric evidence decreased skin darkening at the post-summer follow-up and one-year later[18]. Studies conducted in the medical student population have yielded similar results. Students at the University of Western Ontario retained sunscreen knowledge at the one-year follow-up and reported fewer sunburns; however, they continued to perceive a tan appearance as healthy[19].

Our study also highlighted the role that dermatologists play in contributing to patients' knowledge of sun protection and influencing their daily behaviors. Of graduating seniors at this Southeastern institution, 36% matched into a primary care specialty in 2022, while only 2% matched into dermatology[20]. While dermatologists are particularly positioned to counsel, intervene, and manage skin disorders, primary care providers also play an important role in screening for skin cancer and helping their patients form healthy habits. Research has shown that physicians who carry out healthy practices themselves have improved behavioral counseling for their patients[21]. Additionally, research has shown that many patients are never counseled on the importance of wearing sunscreen[22]. They were more likely to receive counseling from a dermatologist (35%), and only 5.2% report that they were counseled by their primary care provider[22]. The importance of medical students understanding and adhering to best sun protective practices is paramount not only for their personal health, but for overall public health.

Limitations of this study include the sample size and population. The majority of the responding students were white and other self-reported race groups were too small for meaningful analysis. Repeating this study at other institutions with a more diverse student population would allow for more meaningful breakdown among individual groups.

CONCLUSION

The majority of medical students are aware of safe sun practices and know the benefits, such as preventing skin cancer and photo-aging, that can result. Though there is broad awareness across demographic groups, students still endorse the desire to be tan and do not fully adhere to sun protective guidelines. These results demonstrate that medical students are not immune to the cultural pressure to adhere to the dominant standard of beauty. Physicians who carry out healthy practices themselves have improved behavioral counseling for their patients[20,21]. Given that more medical students will match into primary care specialties than dermatology, fostering healthy behaviors in all students is imperative**.** Medical students that regularly protect themselves from UV radiation may be more likely to counsel their patients to do the same. Continuing to improve education for medical students not only improves personal health, but also benefits their future patients.

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