



Published in final edited form as:

Am J Prev Med. 2021 May ; 60(5): e213–e220. doi:10.1016/j.amepre.2020.12.011.

The Context of Sunburn Among U.S. Adults: Common Activities and Sun Protection Behaviors

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Abstract

Introduction: Sunburn increases skin cancer risk and is common among U.S. adults. However, little is known about the contexts in which sunburns often occur. The purpose of this study is to examine the contextual factors surrounding sunburns among U.S. adults.

Methods: Cross-sectional data from a 2018 online panel survey were analyzed. A total of 4,088 panel members were recruited by mail using probability-based, random sampling by address. Respondents were asked about their most recent sunburn, and analyses were limited to those who remembered their most recent sunburn (N=3,106). Data were weighted to match the U.S. Current Population Survey proportions; analyses were conducted in 2018 and 2019.

Results: Participants' age ranged from 18 to 93 years. About half (50.8%) were women, and most (82.3%) were non-Hispanic White adults. Swimming or spending time in water (32.5%), working outside at home (26.2%), traveling/vacationing (20.7%), and engaging in nonswimming physical activity (14.2%) were the most frequently reported activities. Using sunscreen on the face, neck, and chest (38.8%) and on the body (19.9%) and wearing sunglasses (34.2%) were the most frequently reported sun safety behaviors. Wearing clothes to the ankles (6.6%) and a long-sleeved shirt (4.5%) were least frequently reported.

Conclusions: This study provides new information about the contexts in which adult sunburns often occur, especially about contexts unrelated to intentional tanning, which was relatively infrequent. The results suggest the need to promote multiple forms of sun protection tailored to specific outdoor activities and develop innovative solutions for outdoor physical and aquatic activities, which present unique sun safety challenges.

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No financial disclosures were reported by the authors of this paper.

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/j.amepre.2020.12.011>.

INTRODUCTION

Sunburn is a sign of excessive exposure to ultraviolet (UV) radiation.¹ UV exposure is a known cause of skin cancer,¹ and epidemiologic research findings indicate that sunburns that occur in adulthood are associated with an increased likelihood of a future skin cancer diagnosis.^{2,3} Each year, about one third of U. S. adults experience at least 1 sunburn, and sunburn prevalence is even higher among certain demographic groups, including adults aged <30 years (47.2%) and non-Hispanic White adults (42.6%).⁴ Previous studies have used national surveillance data to examine behaviors associated with sunburn.^{5–7} Findings indicate that physical activity (PA), alcohol consumption, binge drinking, indoor tanning, and the use of sunless tanning products are associated with an increased likelihood of reporting at least 1 sunburn in the past year.^{5,7} However, these data do not provide information on the temporal relationship and specific contexts in which the sunburns occurred. The purpose of this study is to examine the contextual factors surrounding the most recent sunburns among U.S. adults, including the sun protection strategies adults were using, activities in which adults were engaging, amount of time spent outside during 10:00AM–4:00PM when the sunburn occurred, and parts of the body that were sunburned.

METHODS

Study Sample

Cross-sectional data from the Porter Novelli⁸ 2018 SummerStyles survey were used. The survey was conducted through the Growth from Knowledge KnowledgePanel,⁹ an online panel that is representative of the non-institutionalized U.S. population and was fielded from June 12, 2018, to July 7, 2018.¹⁰ Panel members were recruited from 5,584 adults aged 18 years who completed the 2018 SpringStyles Survey. Panel recruitment was done by mail using probability-based sampling by address to reach respondents regardless of whether they had landline phones or Internet access. If needed, households were provided with a laptop or tablet and Internet access. A total of 4,088 adults (of the 5,584 who completed the Spring Styles survey) completed the SummerStyles survey, for a response rate of 73.2%.

Measures

SummerStyles participants were asked questions about their experience with sunburn. Those who reported having a history of sunburn and that their most recent sunburn was caused by the sun (as opposed to an indoor tanning device) were asked closed-ended questions about their most recent sunburn. They were asked about the amount of time they were outside (10:00AM–4:00PM), the location(s) on their body where the sunburn occurred, the activities they were engaged in when the sunburn occurred, and the sun protection methods they were using when the sunburn occurred (Table 1).

Statistical Analysis

Data were weighted to match the U.S. Current Population Survey proportions on the basis of age, race/ethnicity, sex, education, household income, household size, census region, and metropolitan status. Analyses included only those with a history of sunburn who could recall their most recent sunburn and who reported that the sunburn was from being outside in the

sun (not from an indoor tanning device). Weighted percentages of all study variables were calculated overall and by gender. Differences by gender were calculated using chi-square tests and were considered statistically significant at $p < 0.05$. Statistical analyses were performed using SPSS, version 2017, and were conducted in 2018 and 2019.

RESULTS

Of the 4,088 adults who completed the survey, about one fourth (24.8%) reported that they either could not remember their most recent sunburn or had never had a sunburn, and 23 (0.6%) reported that their most recent sunburn was from an indoor tanning device. These 2 groups were excluded from the main analyses, resulting in a final analytic sample of 3,106 adults who reported that their most recent sunburn was from the sun. Appendix Table 1 (available online) compares the complete adult sample and the final group included in the main analyses with the 2017 Census estimates for select demographic variables. Non-Hispanic Black adults were significantly less likely to remember their most recent sunburn (21.8%) than adults of other races and ethnicities, including non-Hispanic White adults (75.2%). This resulted in a lower proportion of non-Hispanic Black adults in the analytic sample used for the main analyses than the proportion used in the original study sample. Of the 3,106 respondents included in the main analyses for this study, 50.8% were women. Most (82.3%) were non-Hispanic White, 8.5% were Hispanic, 2.5% were non-Hispanic Black, and 6.7% self-identified as non-Hispanic and of a race other than Black or White. Participants' age ranged from 18 to 93 years; of the participants 17.8% were aged between 18 and 34 years, 18.2% were aged between 35 and 44 years, 19.3% were aged between 45 and 54 years, 23.2% were aged between 55 and 64 years, and 21.6% were aged between 65 and 93 years.

Most respondents were outside for >1 hour during 10:00AM–4:00PM when their sunburn occurred, with 50.7% outside for >1 hour (up to 3 hours) and 38.9% outside for >3 hours (up to 6 hours). The neck or shoulders (66.2%) and face or head (52.6%) were the most frequently reported sunburn locations, followed by arms or hands (40.1%) and back (24.0%) (Table 2). Men were more likely to report sunburn on their face or head (54.7%) than women (50.7%). Women were more likely to report sunburn on their chest or abdomen (17.8%) than men (12.5%).

Swimming or spending time in water (32.5%) was the most frequently reported activity participants were engaging in when their most recent sunburn occurred (Table 3). Other frequently reported activities included working outside at one's own home or a friend's or family member's home (26.2%), traveling or vacationing for leisure (20.7%), and engaging in nonswimming PA (14.2%). Only 5.5% reported that they were trying to get a tan when their sunburn occurred. Compared with men, women were more likely to report swimming or spending time in the water (35.4% vs 29.3%), traveling or vacationing for leisure (23.0% vs 18.1%), attending an outdoor event (15.2% vs 11.1%), relaxing (13.6% vs 8.6%), or trying to get a tan (6.8% vs 4.1%). Compared with women, men were more likely to report working outside at their home or a friend's or family member's home (31.6% vs 21.3%), engaging in nonswimming PA (16.5% vs 12.08%), working at a job (7.2% vs 2.3%), or drinking alcohol (4.4% vs 2.0%).

Most (79.6%) participants reported that they were using sun protection when their most recent sunburn occurred. The use of sunscreen on the face, neck, and chest was the most frequently reported protective behavior (38.8%). The use of sunscreen on the body (19.9%) and the use of makeup containing sunscreen (8.9%) were less frequently reported. About one third (34.2%) of adults reported wearing sunglasses, 15.7% reported wearing a baseball cap or visor, 15.4% reported staying in the shade, and 12.3% reported wearing a wide-brimmed hat (Table 4). The use of protective clothing options was least frequently reported, with 6.6% of the participants reporting wearing clothing to the ankles (e. g., pants or skirt), and 4.5% reporting wearing a long-sleeved shirt. Compared with men, women were more likely to report wearing sunscreen on their face, neck, and chest (43.8% vs 33.2%) or body (25.0% vs 14.4%), wearing sunglasses (36.9% vs 31.5%), and wearing makeup containing sunscreen (16.2% vs 1.0%). Compared with women, men were more likely to report wearing a baseball cap or visor (22.3% vs 9.8%), a wide-brimmed hat (14.3% vs 10.5%), clothing to the ankles (7.9% vs 5.3%), and a long-sleeved shirt (5.6% vs 3.5%). Men were also more likely to report not using any sun protection than women (22.7% vs 18.2%).

DISCUSSION

Large-scale studies of sunburn have traditionally not captured contextual factors.⁵⁻⁷ This study provides new information about the activities adults are often engaged in and the sun protection strategies they often use when they get sunburned. This study also provides new information about the length of time adults tend to be in the sun when they get sunburned and which body parts are most frequently sunburned. This information can be used to develop messaging and intervention strategies to help prevent sunburn among adults.

The findings regarding the most commonly sunburned body parts (head, neck, shoulders, arms, and back) support the need to encourage the use of wide-brimmed hats and long-sleeved shirts for protection. These clothing items, when used together, can help to protect all of these body parts. These items were also some of the least frequently reported forms of sun protection in use when the sunburns occurred.

Other than wearing sunglasses, sunscreen use was the most frequently reported sun protection behavior. Although sunscreen is an important sun safety tool, the U.S. Food and Drug Administration states that sunscreen products work best when combined with other forms of protection, including clothing, hats, and shade. This study did not examine how thickly respondents applied their sunscreen or how often they reapplied (if at all), both of which can influence the level of protection conferred by a sunscreen product.¹¹

Although about 2 in 5 adults reported wearing sunscreen on their face, neck, and chest when they got sunburned, only about 1 in 5 were wearing sunscreen on other exposed skin. This finding is consistent with past research that found that some people, particularly women, regularly use sunscreen on their faces but not on other exposed skin.¹² These findings suggest that this pattern of use is prevalent among men as well. Some adults, particularly women, reported that they were wearing makeup containing sunscreen when they got sunburned. Many makeup products containing sunscreen are now widely available. However, these products are often not designed to be applied at a level of thickness that

would convey adequate sun protection.¹³ Future messages about sunscreen use could encourage consumers to apply sunscreen to all sun-exposed skin and discourage reliance on makeup products alone for facial sun protection.

Nearly one third of adults were swimming or spending time in water when they got sunburned. This finding highlights the challenges of sun protection during outdoor aquatic activities. Swimwear that covers large portions of the body, such as rash guards or swim shirts, can help minimize the amount of skin exposed to UV. Sunscreen can help to protect exposed skin but requires frequent reapplication during aquatic activities. Wide-brimmed hats can offer additional protection but may not always be practical or feasible in the context of certain water-related activities. The addition of shade structures to aquatic environments has been proposed to help reduce UV exposure.¹⁴ However, the high reflectivity of water, sand, and concrete pool decks is an acknowledged limitation to the amount of UV protection conferred by shade in these settings. The application of less reflective materials to pool decks as a UV reduction strategy may merit study. Findings from research conducted at aquatic resorts suggest limited effectiveness of sun safety messaging in these settings.¹⁵ Evidence from research conducted at outdoor swimming pools suggests that a combination of educational and environmental approaches (e.g., shade, sun safety signage, sun-safe policies, and free sunscreen) could help reduce sunburns among those spending time in certain aquatic settings.^{16,17} Additional efforts could identify other practical sun safety solutions for those spending time in and around water; for example, promotion of morning and evening swim events at outdoor aquatic venues.

One fifth of adults experienced their most recent sunburn while traveling or vacationing for leisure. Past research has indicated suboptimal sun safety behaviors among patrons of outdoor recreation and leisure venues.¹⁸ Travel may create sun safety challenges, and social norms that promote tanning behaviors may lead some to see a vacation as an opportunity to develop a tanned appearance.¹⁹ Some popular travel destinations such as beaches and ski resorts typically have environmental features that can increase UV exposure, such as highly reflective surfaces (e.g., sand, snow) and limited shade availability. Past research findings suggest that sun safety messages may help to improve the sun protection behaviors of ski resort patrons and staff.^{20,21} Future research could examine other potential strategies and partnerships to influence UV exposure among travelers.

Other common activities adults were engaged in when they got sunburned included working outside of their home or a friend's or family member's home and engaging in nonswimming PA. Nonswimming outdoor PA can present its own unique challenges to sun safety. For example, many outdoor activities such as outdoor sports may occur in areas with limited shade, and adults may be hesitant to wear sunscreen or protective clothing if they believe it would negatively interfere with the activity (e.g., reduce their athletic performance). In addition, perspiration may increase the skin's sensitivity to UV exposure and reduce the amount of UV exposure required to induce a sunburn.^{22,23} Past research findings indicate an association between PA and the risk for sunburn⁵ and melanoma.²⁴ These relationships may be explained, at least in part, by the challenges of maintaining adequate sun protection during both aquatic and nonaquatic outdoor PA.

More than 1 in 10 adults were attending an outdoor event when their most recent sunburn occurred. Studies have shown that communities can help reduce sunburn risk among patrons of outdoor events by ensuring that plenty of shade and sunscreen are available.^{1,14,25} During warmer months, shade has the added benefit of providing relief from the heat. Shade audits have been used to ensure optimal design and placement of shade—particularly permanent structures—to maximize the amount of UV protection provided.¹⁴ Many communities have recently installed free sunscreen dispensers in outdoor community spaces.²⁵ Research is needed to better understand how this type of free sunscreen gets used by community members and to determine the effectiveness of this strategy for sun safety promotion.

Although less frequently reported than some of the other behaviors, alcohol use was reported by nearly 5% of men and 2% of women during their most recent sunburn. Preliminary research findings suggest that at certain levels, alcohol consumption may increase susceptibility to sunburn and skin cancer.^{26,27} Additional research to better understand the mechanisms by which alcohol consumption could be related to increased sunburn and skin cancer risk may be warranted.

Only 5% of adults reported that they were trying to get a tan outdoor when their most recent sunburn occurred. These data are noteworthy because respondents had the opportunity to report co-occurring activities (e.g., working outside and trying to get a tan), but intentional tanning was still relatively infrequent. This finding suggests a need to address unintended UV exposure as well as intentional tanning behaviors. Some demographic groups (e.g., young women) may benefit from messages that counter social norms that encourage suntanning,²⁸ and previous research findings suggest that the use of sunless tanning products (e.g., bronzing lotions or sprays) may be a harm reduction strategy that could reduce UV tanning among women.²⁹ However, for many adults, developing a tan may not be a primary motive in behaviors that result in excessive sun exposure. Future research could test sun safety messages and solutions that are tailored to specific demographic groups such as men, who were more likely than women to employ no sun safety measures, and address the unique barriers to sun safety that various outdoor activities may create.

In addition to shaping future efforts to promote sun safety, these results could be used to guide the development of survey questions for research and public health surveillance purposes. For example, sun safety questions on past national surveys have asked about the use of sun protection when spending 1 hour outside in the sun.^{5–7} The findings of this study suggest that most people are outside for extended periods from 10:00AM to 4:00PM when they get sunburned, which suggests that the continued use of the hour or more timeframe on surveys may be useful. However, about 1 in 10 adults experienced their most recent sunburn after <1 hour of sun exposure, and the data from this study cannot be used to draw conclusions about the amount of time in the sun required to cause a burn. Thus, sun safety recommendations for shorter intervals of sun exposure may be warranted.

Limitations

This study relied on self-reported data, which have the potential for biases, such as inaccurate recall, and the provision of socially desirable responses. The study focused on participants' most recent sunburn but did not ask when this sunburn occurred. Depending on

how long ago the sunburn occurred, recall of the contextual details may have been challenging for respondents. The data on the use of sun protection did not include certain details of sunscreen use that could influence its effectiveness, such as the sun protection factor of the sunscreen, thickness or evenness of the sunscreen application, or whether the sunscreen was ever reapplied.

CONCLUSIONS

This study fills a gap in the sun safety behavior literature by providing new information about the contexts in which adult sunburns often occur, including the amount of time spent outside, activities, sun protection behaviors being used, and parts of the body that were burned. The findings have implications for future work to improve sun safety behaviors, prevent sunburns, and reduce skin cancer risk, including research to test the effectiveness of new and innovative messaging strategies. The findings also suggest that sunburns occur frequently in situations that do not involve intentional tanning. Thus, there is a need for interventions that consider unintended sun exposure as well as intentional tanning and for interventions that emphasize the use of multiple forms of sun protection. Interventions may need to be tailored for specific demographic groups and behavioral contexts. Innovative solutions are needed to better support sun safety during outdoor PA and aquatic activities, which present unique challenges. Communities may be able to help promote sun safety by providing shade, free sunscreen, and sun safety signs that can serve as both a reminder and an educational opportunity. Evidence-based interventions will ultimately need to be scaled up to maximize and sustain positive effects at a population level.³⁰

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or NIH.

All authors contributed to the study concept, development of survey questions, and critical review and revision of the manuscript. DMH conducted the analyses and drafted the initial manuscript.

Preliminary findings from this work were shared as a poster presentation at the Society of Behavioral Medicine Annual Meeting on March 7, 2019.

The authors' work on this study was done as part of their official duties as federal employees (DMH, FMP) and fellows (KRR, AKJ).

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Table 1.

Survey Questions Used to Assess the Context of Respondents' Most Recent Sunburns

Question	Response options
Think about the most recent time you got sunburned, even if it happened more than 12 months ago. Did you get the sunburn from being outdoors in the sun or from using an indoor tanning device such as a sunlamp, tanning bed, or booth?	<ul style="list-style-type: none"> I got a sunburn from being outdoors in the sun I got a sunburn from using an indoor tanning device I don't remember/never had a sunburn
The most recent time you got sunburned...	
How long were you outside between the hours of 10AM and 4PM?	<ul style="list-style-type: none"> Less than half an hour (more than half an hour) up to 1 hour (more than 1 hour) up to 2 hours (more than 2 hours) up to 3 hours (more than 3 hours) up to 4 hours (more than 4 hours) up to 5 hours (more than 5 hours) up to 6 hours
Which parts of your body were sunburned? (select all that apply)	<ul style="list-style-type: none"> Face or head Neck or shoulders Back Chest or abdomen Arms or hands Legs or feet Other None of the above
Were you doing any of the following activities? (select all that apply)	<ul style="list-style-type: none"> Working outside at your home or a family/friend's home Working at your job Traveling or vacationing for leisure Swimming or spending time in the water Engaging in physical activity other than swimming (such as walking, running, sports) Attending an outdoor event (sporting event, concert, festival, etc.) Relaxing (e.g., laying out, reading, napping, etc.) Trying to get a tan Drinking alcohol Other Don't know/don't remember
Which of the following sun protection strategies were you using? (select all that apply)	<ul style="list-style-type: none"> Wearing sunscreen on your face, neck, and chest (do not include makeup products that contain sunscreen) Wearing makeup that contained sunscreen on your face, neck, and chest Wearing sunscreen on exposed skin other than your face, neck, and chest Wearing a hat that shaded your face, ears, and neck such as a hat with a wide brim all around Wearing a baseball cap or sun visor Wearing a long-sleeved shirt Wearing long pants or other clothing that Reached your ankles Wearing sunglasses Staying in the shade None of the above Don't know/remember

Table 2.

Locations on the Body Where the Most Recent Sunburn Occurred

Variables	Overall (N=3,106) % (95% CI)	Men (n=1,529) % (95% CI)	Women (n=1,577) % (95% CI)	p-value ^a
Neck or shoulders	66.2 (64.4, 67.9)	65.9 (63.4, 68.4)	66.4 (64.0, 68.7)	0.79
Face or head	52.6 (50.8, 54.4)	54.7 (52.1, 57.3)	50.7 (48.2, 53.1)	0.03
Arms or hands	40.1 (38.3, 41.9)	40.5 (37.9, 43.1)	39.8 (37.3, 42.2)	0.68
Back	24.0 (22.5, 25.6)	24.9 (22.6, 27.1)	23.2 (21.1, 25.3)	0.30
Legs or feet	19.3 (17.9, 20.7)	19.1 (17.0, 21.1)	19.5 (17.5, 21.5)	0.75
Chest or abdomen	15.3 (14.0, 16.6)	12.5 (10.8, 14.3)	17.8 (15.9, 19.7)	0.0001
Don't know/don't remember	2.8 (2.2, 3.4)	2.5 (1.7, 3.3)	3.1 (2.2, 4.0)	0.31
Another body part	0.6 (0.4, 0.9)	0.8 (0.3, 1.3)	0.5 (0.1, 0.8)	0.37
None of the above	0.1 (0.0, 0.3)	0.1 (-0.1, 0.3)	0.1 (0.0, 0.3)	0.93

^aDifferences by gender were calculated using chi-square tests and were considered statistically significant at $p < 0.05$.

Table 3. Activities Adults Were Engaged in When They Experienced Their Most Recent Sunburn

Variables	Overall (N=3,106) % (95% CI)	Men (n=1,529) % (95% CI)	Women (n=1,577) % (95% CI)	p-value ^a
Swimming or spending time in water	32.5 (30.8, 34.2)	29.3 (26.9, 31.7)	35.4 (33.0, 37.8)	0.0001
Working outside own/family/friend's home	26.2 (24.6, 27.8)	31.6 (29.1, 34.0)	21.3 (19.3, 23.4)	0.0001
Traveling or vacationing for leisure	20.7 (19.2, 22.1)	18.1 (16.1, 20.1)	23.0 (20.9, 25.1)	0.001
Engaging in nonswimming physical activity	14.2 (12.9, 15.5)	16.5 (14.6, 18.5)	12.1 (10.5, 13.7)	0.001
Attending an outdoor event	13.2 (12.0, 14.5)	11.1 (9.5, 12.7)	15.2 (13.4, 17.0)	0.001
Relaxing (e.g., reading, napping)	11.2 (10.1, 12.4)	8.6 (7.2, 10.1)	13.6 (11.9, 15.3)	0.0001
Trying to get a tan	5.5 (4.7, 6.3)	4.1 (3.0, 5.1)	6.8 (5.6, 8.1)	0.001
Working at job	4.7 (3.9, 5.4)	7.2 (5.9, 8.6)	2.3 (1.6, 3.1)	0.0001
Drinking alcohol	3.2 (2.5, 3.8)	4.4 (3.3, 5.5)	2.0 (1.3, 2.7)	0.0001
Doing another activity	2.6 (2.1, 3.2)	2.6 (1.8, 3.4)	2.7 (1.9, 3.5)	0.96
Don't know/remember	6.3 (5.4, 7.2)	6.3 (5.1, 7.6)	6.3 (5.1, 7.5)	0.97

^aDifferences by gender were calculated using chi-square tests and were considered statistically significant at $p < 0.05$.

Table 4. Sun Protection Methods Adults Were Using When Their Most Recent Sunburn Occurred

Variables	Overall (N=3,106) % (95% CI)	Men (n=1,529) % (95% CI)	Women (n=1,577) % (95% CI)	p-value ^a
Sunscreen on face, neck, and chest	38.8 (37.0, 40.5)	33.2 (30.8, 35.7)	43.8 (41.3, 46.3)	0.0001
Sunglasses	34.3 (32.6, 36.0)	31.5 (29.0, 33.9)	36.9 (34.5, 39.3)	0.002
Sunscreen on body	19.9 (18.5, 21.4)	14.4 (12.6, 16.3)	25.0 (22.8, 27.1)	0.0001
Baseball cap or visor	15.7 (14.4, 17.0)	22.3 (20.1, 24.4)	9.8 (8.3, 11.2)	0.0001
Staying in the shade	15.4 (14.1, 16.7)	15.0 (13.1, 16.9)	15.7 (13.9, 17.5)	0.60
Wide-brimmed hat	12.3 (11.1, 13.5)	14.3 (12.4, 16.1)	10.5 (9.0, 12.1)	0.002
Don't remember	11.3 (10.2, 12.4)	11.6 (9.9, 13.3)	11.0 (9.5, 12.6)	0.63
Makeup containing sunscreen	8.9 (7.9, 10.0)	1.0 (0.5, 1.5)	16.2 (14.3, 18.0)	0.0001
Clothing to the ankles (e.g., pants, skirt)	6.6 (5.7, 7.5)	7.9 (6.5, 9.3)	5.3 (4.2, 6.5)	0.004
Long-sleeved shirt	4.5 (3.8, 5.3)	5.6 (4.4, 6.8)	3.5 (2.6, 4.4)	0.006
At least 1 form of sun protection	79.6 (78.2, 81.1)	77.3 (75.1, 79.4)	81.8 (79.8, 83.7)	0.002

^aDifferences by gender were calculated using chi-squared tests and were considered statistically significant at $p < 0.05$.