ORIGINAL
ResearchJulie Williams Merten, PhD, MCHES, Jessica L. King, MS,
Melissa J. Vilaro, MPH, PhD, and Erin Largo-Wight, PhDLifestyle Factors Associated With
Sunscreen Use Among Young
Adults

Abstract: *Background.* Skin cancer is the most common cancer in the United States with melanoma rates increasing. Sunscreen use is an effective way to protect the skin and reduce skin cancer risk. Limited research has been conducted examining the relationship between sunscreen use and other lifestyle factors. Interventions aimed at multiple lifestyle factors have shown promise for prevention and reduced health care costs. *Objective.* This study explores the relationship between sunscreen use and lifestyle factors associated with mortality and morbidity among young adults. *Lifestyle factors examined included physical activity, substance abuse, smoking, sexual behavior, unintentional injury, and mental well-being.* *Methods.* A convenience sample of 747 college students was surveyed about sunscreen use and other health risks. *Data were analyzed using SPSS 19.* *Results.* White, female students older than 21 years were more likely to use sunscreen. Texting while driving, low life satisfaction, and binge drinking were associated with inadequate sunscreen use. *Limitations.* Convenience sampling limits

generalizability and surveys are subject to recall, self-report, and self-selection bias. *Conclusions.* The findings provide the framework to develop multiple risk factor interventions.

Keywords: sunscreen; skin cancer; risky health behaviors; young adults

to 29 years of age, Caucasian, and from Western societies.³⁻⁶ The World Health Organization report global incidence of more than 2 million nonmelanoma skin cancers, 200 000 malignant melanomas, and 60 000 melanoma-related deaths each year.⁷ The incidence of malignant melanoma continues to rise globally, in

The developmental ages between high school and college are significant in the fostering of health behaviors that will have a long-lasting effect into adulthood.

Skin cancer is the most common form of cancer in the United States especially for young adults.^{1,2} The American Dermatology Association found that women younger than 40 years are 8 times more likely to get melanoma than they were in 1970 and excessive ultraviolet (UV) radiation exposure is of particular concern for those who are 18

strong correlation with the frequency of recreational sun exposure, history of sunburns, and exposure to UV radiation from tanning beds.⁸

Despite the fact that many Americans are knowledgeable about the dangers of UV radiation, skin cancer, and ways to protect themselves from excessive exposure, American young adults have

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the lowest skin protection rates of all age groups and receive large amounts of intentional and unintentional exposure to UV radiation either from the sun or indoor tanning.^{9,10}

Healthy People 2020 recognized skin cancer as a pressing national public health issue and set objectives for adolescents and adults to reduce high-risk behaviors.¹¹ Specific to college students, Healthy Campus 2020 provides a roadmap for researchers to efficiently study college health risks by categorizing the health indicators that represent the most pressing issues facing college students. The developmental ages between high school and college are significant in the fostering of health behaviors that will have a long-lasting effect into adulthood. This is, in fact, an excellent time to intervene with young people to establish and maintain healthy behaviors.^{12,13} The leading causes of morbidity and mortality among the college population include inadequate physical activity, smoking, substance abuse, high-risk sexual behavior, unintentional injury, and mental health.

Problem-behavior theory is a social psychological framework specific to young adults that uses the interaction between 3 major systems to explain risk behavior: personality, environment, and behavior.^{14,15} The theory suggests that the social life of young people presents constant opportunities to learn new behaviors and then social expectations reinforce these behaviors.¹⁶ Multiple health behavior risk research based in problem-behavior theory is showing great promise to improve public health in a cost-effective manner by providing a framework to address many clustered health risk behaviors within a single intervention.¹⁷

In summary, 4 out of 5 cases of skin cancer could be prevented by reducing UV radiation exposure and practicing simple protective measures such as applying sunscreen. However, less than 50% of people engage in adequate levels of sun protection based on government guidelines, according to a 2010 article by Craciun et al.¹⁸ Given these numbers, it is crucial to determine what motivates

people to engage in sunscreen use so that effective interventions can be implemented. It is the aim of this study to identify the lifestyle factors associated with poor sunscreen usage among young adults.

Methods

Study Population and Sample

Data were used from an annual comprehensive health behavior survey delivered at a mid-sized comprehensive university in the coastal Southeast. The instrument was modified for the college population from the Centers for Disease Control's (CDC) Youth Risk Behavioral Surveillance System for high school students. Given the change in population from high school students to college students, efforts were made to ensure validity and reliability by conducting cognitive interviews with college students, pilot testing the instrument, and having a panel of content experts review the survey. By using cognitive interviewing, we were able to assess the interpretation of the survey questions to assure the questions were clear and measuring the construct of interest—phrasing edits were made based on feedback. Pilot testing revealed that the original instrument was too long and students were not finishing so researchers removed extraneous and redundant questions. The content experts advised researchers on emerging health behavior trends that may have been omitted such as hookah use, new birth control methods, and newly classified eating disorders. In addition to the health behaviors questions, the researchers added several questions from the National Cancer Institute's Core Skin Cancer Prevention questionnaire, including information about sun exposure, sun protection, and indoor tanning behaviors.¹⁹

All 16343 undergraduate and graduate students enrolled at the university received an email invitation to participate. The 20-minute survey was delivered by the Institutional Research Office to protect participant privacy. The extensive 121-item survey yielded an

11% response rate with 1774 participants. To be included in the study sample, participants must have been between the ages of 18 and 25 years and responded to all demographic and variables of interest, which reduced the sample size to 747 (4.5% response rate).

After application of the sample inclusion criteria, the students were 21 years old on average ($M = 21.14$ years, $SD = 1.98$), mostly female (73.6%), white (74.8%), in their third year of school (32.6%), and not working while in school (32.1%). See Table 1 for demographic characteristics. The sample was reflective of the overall population at the university with a largely female (56.5%) and white (70.9%) student body.

Study Measures

To operationalize the dependent variable, sunscreen use, the question "How often do you use sunscreen with an SPF of 15 or higher when you are outside on a warm sunny day?" was used. Responses were "never," "rarely," "sometimes," "often," or "always." Consistent with CDC guidelines, adequate sunscreen use is considered answering "often" or "always" to indicate regular use of sunscreen when outside on a sunny day. "Sometimes," "rarely," or "never" are considered inadequate use. Responses were dichotomized into those answering "often" and "always" wearing sunscreen when outside to be considered low risk and those answering "never," "rarely," or "sometimes" considered high risk. The independent variables included physical activity, smoking, alcohol and drug use, safety, and mental health. Independent variable dichotomization followed CDC methodology and is depicted in Table 3.

Analysis

Sunscreen prevalence rates prior to dichotomization into high and low risk by race, gender, and age were calculated and are reported in Table 2. Pearson's chi-square analysis was conducted between the dependent variable sunscreen use (low risk/high risk) and all dichotomized independent variables. Table 3 illustrates the results of

Table 1.

Demographic Characteristics of the Study Sample (n = 747).

Characteristic	n	Percentage
Sex		
Male	197	26.4
Female	550	73.6
Age, years		
18	74	9.9
19	103	13.8
20	123	16.5
21	140	18.7
22	110	14.7
23	88	11.8
24	66	8.8
25	43	5.8
Race/Ethnicity		
White	559	74.8
Hispanic	63	8.4
Black	48	6.4
Biracial/Multiracial	26	3.5
Other races	51	6.8
Classification		
Freshman	131	17.6
Sophomore	114	15.3
Junior	244	32.6
Senior	195	26.1
Graduate	63	8.4
Insurance		
Insured	579	77.5
Uninsured	134	18.0
Unsure	34	4.4
Hours worked per week		
I do not work	238	31.9
1-10	84	11.2
11-20	152	20.4
21-30	144	19.3
31-40	98	13.1
>40	31	4.2
Relationship status		
Single	269	36.0
In a committed relationship	418	56.0
Married	54	7.2
Divorced/widowed/separated	6	0.8

chi-square analysis of sunscreen use by health behavior risk. A multiple logistic regression analysis using backward stepwise elimination was conducted in SPSS 19.1 on the statistically significant ($P < .05$) variables identified in the chi-square analysis. The Wald statistic, standard error, corresponding P value, odds ratio, and confidence intervals of the final model are presented in Table 4.

Results

Overall sunscreen use was inadequate among respondents, with 66.3% reporting using sunscreen less than half the time when they were outside on a sunny day. Only 12.4% of students reported always using sunscreen. Gender ($P = .000$), age ($P = .009$), and ethnicity ($P = .006$) were significantly associated with sunscreen use. Males were significantly less likely to use sunscreen than females. Inadequate sunscreen use peaked among 18- to 20-year-olds compared with those aged 21 to 25 years ($P = .009$). White students were 5 times more likely to use sunscreen than Blacks and Hispanics and demonstrated better sunscreen use than Blacks ($P = .001$).

In bivariate analysis, binge drinking $\chi^2(1, N = 747) = 12.254, P = .000$, life satisfaction $\chi^2(1, N = 747) = 12.240, P = .000$, texting while driving $\chi^2(1, N = 747) = 6.431, P < .011$, depression $\chi^2(1, N = 747) = 6.556, P = .010$, and seatbelt use $\chi^2(1, N = 747) = 4.485, P = .034$ were found to be significantly related to poor sunscreen use. Marginally significant variables included driving after drinking $\chi^2(1, N = 747) = 2.890, P = .089$ and sadness during the past 30 days $\chi^2(1, N = 747) = 2.972, P = .085$. A backward stepwise elimination logistic regression analysis was conducted to predict inadequate sunscreen use using binge drinking, life satisfaction, texting while driving, depression, seatbelt use, driving after drinking, past 30-day sadness, age, gender, and ethnicity as predictors. The Wald criterion demonstrated that gender ($P = .000$), ethnicity ($P = .006$), age ($P = .009$), texting while driving ($P = .030$), low life satisfaction ($P = .001$), and binge

Table 2.

Sunscreen Prevalence Rates by Race, Gender, and Age (n = 747).

	Sunscreen Use While Outside on a Warm Sunny Day, n (%)				
	Always	Often	Sometimes	Rarely	Never
Age, years					
18	7 (7.5)	10 (6.3)	16 (9.6)	21 (10.9)	20 (14.7)
19	6 (6.5)	17 (10.7)	22 (13.2)	32 (16.7)	26 (19.1)
20	17 (18.3)	26 (16.4)	28 (16.8)	34 (17.7)	18 (13.2)
21	17 (18.3)	32 (20.1)	30 (18.0)	42 (21.9)	19 (14.0)
22	14 (15.1)	28 (17.6)	30 (18.0)	18 (9.4)	20 (14.7)
23	12 (12.9)	20 (12.6)	21 (12.6)	22 (11.5)	13 (9.6)
24	11 (11.8)	15 (9.4)	14 (8.4)	16 (8.3)	10 (7.4)
25	9 (9.7)	11 (6.9)	6 (3.6)	7 (3.6)	10 (7.4)
Gender					
Female	83 (89.2)	127 (79.9)	130 (77.8)	135 (70.3)	75 (55.1)
Male	10 (10.8)	32 (20.1)	37 (22.2)	57 (29.7)	61 (44.9)
Ethnicity					
White	68 (73.1)	135 (84.9)	139 (83.2)	138 (71.9)	79 (58.1)
Hispanic	10 (10.8)	8 (5.0)	11 (6.6)	20 (10.4)	14 (10.3)
Black	4 (4.3)	1 (0.6)	4 (2.4)	12 (6.3)	27 (19.9)
Multiracial	2 (2.2)	9 (5.7)	5 (3.0)	8 (4.2)	2 (1.5)
Other	9 (9.7)	6 (3.8)	8 (4.8)	14 (7.3)	14 (10.3)

drinking ($P = .005$) significantly predicted inadequate sunscreen use. Past 30-day sadness, driving after drinking, depression, and seat belt use were not significant predictors. Males had more than 2 times the odds to not use sunscreen than females; blacks had more than 5 times the odds than whites to not use sunscreen; and students between the ages of 21 and 25 years are more likely to use sunscreen than students aged 18 to 20 years. Students that text while driving more likely to not use sunscreen than those who don't text while driving. Those who binge drink are more than two times the odds to also not use

sunscreen than those who do not regularly binge drink. Students reporting low life satisfaction are more than two times the odds to not use sunscreen than students reporting being satisfied with their life. Table 4 presents the odds ratios for all demographic and independent variables.

Conclusions

The purpose of this study was to identify other lifestyle factors associated with inadequate sunscreen use to provide insight on behavioral patterns of young adults. Consistent with other

studies, this study found that sunscreen usage rates remain unacceptably low among young people.^{9,10,20} Furthermore, binge drinking, low life satisfaction, and texting while driving were associated with poor sunscreen use. Males, blacks, and those younger than 21 years were also significantly more likely to engage in poor sunscreen behaviors. The demographic trends are consistent with other findings.^{9,10,20}

Similar trends in alcohol use correlates were found in studies examining other age groups. Adolescents that did not use sun protection were more likely to use alcohol and high school students that

Table 3.

Bivariate Analysis of Sunscreen Use by Health Risk Behaviors (n = 747).

Health Risk Behavior	Sunscreen Use*		P
	Adequate, n (%)	Inadequate, n (%)	
Met weekly physical activity requirement			.146
Met	148 (58.7)	263 (53.1)	
Not met	104 (41.3)	232 (46.9)	
Cigarette use during past 30 days			.977
No	182 (72.2)	357 (72.1)	
Yes	70 (27.8)	138 (27.9)	
Frequency of binge drinking			.000
Sometimes, rarely, or never	227 (90.1)	396 (80.0)	
Always or often	25 (9.9)	99 (20.0)	
Marijuana use during past 3 months			.584
No	170 (67.5)	324 (65.5)	
Yes	82 (32.5)	171 (34.5)	
Cocaine use during past 3 months			.534
No	240 (95.2)	466 (94.1)	
Yes	12 (4.8)	29 (5.9)	
Methamphetamine use during past 3 months			.375
No	251 (99.6)	490 (99.0)	
Yes	1 (0.4)	5 (1.0)	
Prescription drug (without prescription) during past 3 months			.358
No	229 (90.9)	439 (88.7)	
Yes	23 (9.1)	56 (11.3)	
Lifetime sexual partners			.506
<4	153 (60.7)	288 (58.2)	
>4	99 (39.3)	207 (41.8)	
Condom use during last intercourse			.861
Yes	122 (48.4)	243 (49.1)	
No	130 (51.6)	252 (50.9)	
Intercourse under the influence in past 3 months			.370
No	139 (55.2)	290 (58.6)	
Yes	113 (44.8)	205 (41.4)	

(continued)

Table 3. (continued)

Health Risk Behavior	Sunscreen Use*		P
	Adequate, n (%)	Inadequate, n (%)	
Driving after drinking alcohol			.089
No	230 (91.3)	431 (87.1)	
Yes	22 (8.7)	64 (12.9)	
Use seatbelt			
Always or often	247 (98.0)	469 (94.7)	.034
Sometimes, rarely, or never	5 (2.0)	26 (5.3)	
Text while driving			.011
Sometimes, rarely, or never	213 (84.5)	379 (76.6)	
Always or often	39 (15.5)	116 (23.4)	
Depression symptoms			.010
No	168 (66.7)	282 (57.0)	
Yes	84 (33.3)	213 (43.0)	
Felt sad in the past 30 days			.085
No	120 (47.6)	203 (41.0)	
Yes	132 (52.4)	292 (59.0)	
General life satisfaction			.000
Very satisfied or satisfied	225 (89.3)	391 (79.0)	
Neither, dissatisfied, or very dissatisfied	27 (10.7)	104 (21.0)	
Antidepressant prescription or currently taking			.700
No	215 (85.3)	417 (84.2)	
Yes	37 (14.7)	78 (15.8)	

*The question asks when the participant is outside on a warm, sunny day and answers are on a 5-point Likert scale ranging from *Never* to *Always*. *Always* or *Often* is considered adequate use; *Sometimes*, *Rarely*, *Never* is considered inadequate use.

reported never using sunscreen were more likely to consume alcohol.^{21,22} In a US study of more than 28 000 adults, men who consumed more than 15 drinks a week, and women who consumed more than 8 drinks a week used less sunscreen than those considered low-risk drinkers.²³ While binge drinking is widespread across college campuses, the potential hazards are well documented and include unprotected sexual intercourse, being unable to recall having

sex, missing classes and examinations, driving drunk, serious bodily injury, rape, and assault.^{24,25}

To date, no other studies have included texting while driving or life satisfaction as correlates to sunscreen use so this represents 2 new findings that warrant further investigation. As lifestyle factors among college students, binge drinking and texting while driving share several important characteristics. Both behaviors are widely recognized as high risk, both

are socially acceptable despite the risks and texting while driving being illegal in most states, both are impulsive in nature, and both involve social interaction. Texting while driving does not have the long research history of binge drinking given it did not become a health problem of concern until recently when smart phones became prolific and telephone communication dwindled in favor of text communication. Yet, many states have banned texting while

Table 4.

Relationship Between Inadequate Sunscreen Use and Selected Health Risk Behaviors.

	Wald	SE	P	OR	95% CI
Health risk behavior					
Binge drinking	7.986	0.248	.005	2.017	1.240-3.280
Texting while driving	4.717	0.212	.030	1.586	1.046-2.405
Low life satisfaction	10.443	0.239	.001	2.167	1.356-3.464
Gender					
Female	Ref	Ref	Ref	Ref	
Male	14.963	0.202	.000	2.187	1.471-3.252
Age, years					
18-20	Ref	Ref	Ref	Ref	
21-25	6.756	0.169	.009	1.553	1.114-2.164
Ethnicity					
White	Ref	Ref	Ref	Ref	
Black	11.380	0.488	.001	5.181	1.992-13.475
Hispanic	0.222	0.266	.637	1.134	0.673-1.909
Other	1.292	0.301	.256	1.408	0.780-2.540

operating a motor vehicle, a recent study found that 80% of college students text while driving.^{26,27} As a result, more than 1000 people are injured in distracted driving accidents every day in the United States, which has surpassed alcohol-related crashes.²⁶ Despite the warnings, college student's desire to remain connected to their social life outweigh the risk.

Problem-behavior theory offers insight into the reciprocal relationship between binge drinking and texting while driving because the theory posits that the social life of young adults presents the opportunities to learn behaviors and then social expectations reinforce them.¹⁶ There is a disconnect between perceived susceptibility of a negative outcome given the very clear social message that texting while driving and binge drinking is dangerous. The deliberate dismissal of these behaviors indicates a high-risk

individual more interested in social acceptance than their health.

When examining life satisfaction's role in predicting poor sunscreen use, it important to note that life satisfaction is a subjective measure of happiness and widely considered a cornerstone of mental health. Life satisfaction makes a lot of sense as a correlate of sunscreen use with binge drinking and texting while driving because of impression management, a social psychology construct. Within the realm of impression management, self-presentation efforts are goal-oriented to shape other's impressions of self during social occasions.²⁸ Those with higher self-presentation concerns will be more concerned about how they are perceived and alter their behavior to positively improve their social identity. People with high self-presentation concerns tend to be high social monitors, publicly

self-aware, and hyperconscious. When people are more concerned about what others think of them, rather than their own self-view, they are more likely to experience lower life satisfaction.²⁸ While it is helpful to be aware of social image and public perception to adapt to new environments, constant vigilance about social judgment can negatively affect life satisfaction.

Social influence appears to play a significant underlying role in the lifestyle factors (binge drinking, texting while driving, and low life satisfaction) associated with inadequate sunscreen use. This finding is important because the results of this study can guide targeted interventions that focus on the latent psychological constructs of life satisfaction to address binge drinking, texting while driving, and sunscreen that are detrimental to the health and well-being of young adults. The results

have long-term implications to improve existing skin cancer prevention programs that have been marginally effective at improving sunscreen adherence rates by aiming resources at the individuals at most risk. Specifically, the 2013 US Community Preventive Services Taskforce report noted there are insufficient skin cancer prevention programs designed for young adults and it is a significant area of need.²⁹ The early identification of clustered lifestyle factors offers health care providers and public health professionals the opportunity to focus resources and programs on specific individuals at greater risk for a host of health behaviors, rather than a general audience. This will lead to more precise, cost-effective interventions with better quality-of-life outcomes.

Improving clustered lifestyle factors offers the opportunity to offer more significant quality-of-life outcomes, reduce health care utilization, and save money by using a bundled health care approach. This is becoming more essential given, the likelihood of having multiple health risk factors increases with age.³⁰ Furthermore, targeting clustered lifestyle factors aligns with the Affordable Care Act's emphasis on efficient preventative care "bundled" in a clinical setting.^{31,32}

Limitations

This study has a number of potential limitations that should be considered. Although the sample size is robust, the response rate was low (roughly 4.5% after applying the inclusion criteria) given the lengthy survey was sent to all 16343 students enrolled at the university. Furthermore, male participation (26.4%) was lower than university male enrollment (43.5%) and that is consistent with survey response research findings that males are less likely than females to respond to online surveys.³³⁻³⁵ Response rate and the convenience sampling methodology used limits generalizability. Also, studies using self-report surveys are subject to self-report, self-selection bias, and recall error.³⁶ Additionally, proper

use of sun protective behaviors cannot adequately be assessed because there are nuances to sun protection, including amount of sunscreen used per application, frequency of reapplication, and environmental variables such as reflection from water when seeking shade. Also, the study did not include questions about complexion, sun sensitivity, indoor tanning use, or family history of skin cancer—all of which contribute to skin cancer risk. **AJLM**

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