



Melanoma Knowledge and Sun Protection Attitudes and Behaviors Among College Students by Gender and Skin Type

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ABSTRACT

The purpose of this study was to evaluate the melanoma and sun protection knowledge, attitudes and behaviors of college students attending a large Midwestern university. Further, gender and skin type (fair, medium, or dark) were examined as potential intervening variables. Results indicate that the college students studied had low knowledge levels related to melanoma and sun prevention behaviors. Their attitudes toward sun protection were in the medium range, being neither strongly positive nor negative. Their general sun protection behaviors and specific sunscreen use behaviors were fairly poor. Both gender and skin type were found to have a significant impact on melanoma knowledge and sun protection attitudes and behaviors. Females and those with fair skin were more knowledgeable and had better attitudes and behaviors. Implications of these findings for health educators are thoroughly discussed.

Malignant melanoma continues to present a significant public health threat. It is one of the few cancers that still has an increasing incidence rate,¹ and its incidence is rising faster than any other cancer in the United States. In the 1930s, the lifetime risk of developing melanoma in America was 1 in 1,500. By 1980 the lifetime risk had increased to 1 in 250, and in 2000 the risk was 1 in 74.^{2,3} It was estimated that 29,900 males and 25,200 females would develop melanoma in 2004 and that 5,050 males and 2,860 females would die from the disease.⁴

The good news is that “melanoma may be virtually preventable with simple behavioral changes.”³ The most important of these behavioral changes include avoiding the intense midday sun (10 a.m.–4 p.m.), wearing tightly woven protective clothing when exposed to the sun, applying a broad spectrum high sun protection factor (SPF) sunscreen, and avoiding artificial sources of ultraviolet light such as tanning booths and

sun lamps.^{3,4} In addition to prevention, early detection is extremely important for melanoma survival. The five-year survival rate for patients with early melanoma (less than 1 mm in depth) is 94% versus a five-year survival rate of less than 50% for those with more advanced melanoma (greater than 3 mm in depth).⁵

Adolescents and college students are in the age range when sun prevention behaviors are extremely important. Heffernan & O’Sullivan⁶ report that the majority of people receive most of their lifetime sun exposure before the age of 21, and this sun exposure can greatly increase the risk of melanoma. Unfortunately, research shows that adolescents and young adults are not practicing sun prevention behaviors.^{7,8} Although adolescents and young adults are aware of the risk of skin cancer due to excessive sun exposure and lack of protection, this knowledge is not sufficient to change their behaviors.⁷⁻¹⁰ Neither is a family his-

tory of skin cancer sufficient to lead to sun prevention behaviors.⁸ Finally, although characteristics such as skin types more susceptible to burning,^{7,9,10} female gender,⁷⁻⁹ and higher socioeconomic status⁹ are correlated with higher levels of sun prevention behaviors, these levels still are not sufficient to reduce risk for skin cancer effectively. Health educators are challenged to develop effective sun prevention programs for the college age population that enjoys being outdoors

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and believes that a dark tan is attractive.

The purpose of this study was to assess the melanoma and sun protection knowledge, attitudes, and behaviors of college students attending a large Midwestern university. Further, gender and skin type were examined as potential intervening variables.

METHODS

Subjects

This study was directed at undergraduate college students between the ages of 18 and 24 enrolled in either an introductory English or sociology course at the main campus of a large Midwestern university. English and sociology courses were selected as they were required of most undergraduate students attending the university and thus provided the best representative cross-section of students. All students in the study were registered for spring quarter, 2002. Permission to use students in these classes was granted by the heads of the English and sociology departments. After granting permission, each head provided a list of professors teaching introductory English or sociology classes in their respective departments. An appropriate number of English and sociology classes were randomly selected from the lists that were generated. Four hundred and fifty of the 5,100 students in the target group needed to complete the survey to reach a 95% confidence interval that the sample would be representative of the group from which they were selected.¹¹

Instruments

The Melanoma Risk Behavior Survey (MRBS) was specifically developed by the researchers for use in this study. The instrument included 44 questions focused on knowledge about melanoma and risk reduction behaviors, attitudes associated with sun safety, and behaviors associated with reducing sun exposure. In addition, five demographic questions were included covering age, sex, race, skin type, and family history.

The knowledge section of the instrument contained 24 multiple-choice questions. Each question related to a different aspect of melanoma or sun protection prevention and

had a definite correct answer. Each question was scored as either correct or incorrect. The total number of correct questions served as the score on the knowledge section of the instrument. Potential scores ranged from 0–24, with a high score denoting a high melanoma knowledge level.

The attitude section of the instrument contained 11 questions with 5-point Likert-type responses ranging from strongly disagree to strongly agree. Each question was scored so that desirable responses received more points than the less desirable responses. Scores for each question ranged from one to five. Five questions were worded in the negative direction and scoring was reversed so that the most appropriate response always scored five points and the most inappropriate response scored one point. The total number of points for the 11 questions was the attitude score. Potential scores ranged from 11 to 55 with a high score denoting a more positive attitude toward sun safety.

The behavioral section of the instrument contained nine questions related to sun safety. Five of these questions related to general sun safety and included such behaviors as avoiding the sun during prime times, covering up with tightly woven clothes and seeing a doctor for skin checks. The other four questions related directly to the proper use of sunscreen such as, “How often do you reapply sunscreen after being in the water?” and “How often do you use a sunscreen with a SPF of 15 or higher?” This provided for a general sun safety behavior sub-score and a sunscreen use sub-score. All nine of the behavioral questions provided a range of potential responses from never (zero compliance) to always (100% compliance) with gradients in between. Scores ranged from one to five for each behavioral question with one representing zero compliance and five indicating complete compliance. Thus, potential scores on the general sun-safety behavior questions ranged from 5 to 25 and potential scores on the sunscreen section ranged from 4 to 20.

The MRBS was specifically designed to determine sun-related knowledge, attitudes,

and behaviors among university students. Consensual validity was determined through review by a panel of experts (n=5). The panel consisted of a dermatologist, an oncologist, a primary care physician and two professors of health education. The panel was instructed to complete the instrument and to make suggestions or comments directly on the instrument. Their criticisms of the instrument were minimal, but several comments concerning question wording were incorporated into the final instrument.

Stability reliability for the MRBS was established using a test-retest procedure.¹² Test-retest reliability measures the degree of association between two sets of measurements taken on the same instrument by the same people at two points in time. The MRBS was given to 26 students in a Personal Health class two weeks apart. Pearson correlation coefficients¹³ were calculated to establish the reliability score for each subscale: knowledge = .867, attitude = .632, behavior = .924.

Procedure

After receiving permission from the university's human subjects committee, the researcher obtained the approval of the department heads of the English and sociology departments to conduct the study in these classes. It was determined that at least 27 classes would have to be surveyed to obtain the 450 students needed to complete the questionnaire. These classes were randomly selected from lists provided by the department heads. Any professor refusing to allow his/her class to participate was replaced with another randomly selected class. If permission was granted to administer the questionnaire in a class, a date and time to administer the questionnaire was confirmed.

The researcher distributed the questionnaire and a cover letter to each student. The cover letter reiterated the verbal information given by the researcher concerning the approximate amount of time to complete the survey, assured anonymity, assured voluntary participation, and noted that completion of the questionnaire implied consent to participate in the study. The letter also thanked students for participating



in the study. When students completed the questionnaire they were instructed to turn it face down on their desk. The researcher collected the completed questionnaires. Prior to leaving the class, the researcher offered to answer any questions students may ask related to melanoma and/or sun protection.

Data Analysis

The researcher entered the data into SPSS 11.0 for data analysis. Separate variables for the subscales of knowledge, attitudes, general sun protection behaviors, and sunscreen use behaviors were created. Descriptive statistics, t-tests, and one-way ANOVAs were run to summarize the data and determine statistical significance of hypothesized differences.

RESULTS

Data were collected from 27 freshman-level classes during spring term, 2002. Four hundred and seventy completed questionnaires were obtained. All of the students present in the classes on the days the surveys were administered completed the survey. (response rate = 100%). Of the 470 completed questionnaires, 17 did not meet the age inclusion criteria (18–24) and were eliminated from the study. This left 453 completed questionnaires to be analyzed for this study.

Overall the mean age of participants was 19.2 with an age range of 18–24. There was a fairly even distribution of participants based on gender with 242 females (53.4%) and 211 males (46.6%). During the spring quarter at this large Midwestern university, 72.3% of the students were Caucasian and 15.5% were African-American. Within this study 86% of participants were Caucasian and only 8% were African-American. This indicates a higher Caucasian population and a lower African-American population in the study sample than within the entire university. For the study population, 105 students (23.2%) reported fair skin (type I), 271 (59.8%) reported medium skin (type II), and 77 (17%) reported having dark skin (type III). Further, 123 students (27.2%) reported having a relative who had been

diagnosed with melanoma while 330 (72.8%) reported no family members diagnosed with melanoma.

A knowledge score was obtained for each participant based on the total number of correct responses to the 24 multiple choice knowledge questions. The potential range of knowledge scores was 0–24. The actual range of knowledge scores among the participants in this study was 0–21 with a mean knowledge score of 10.1. This would indicate a fairly low melanoma knowledge level among study participants.

An attitude toward sun protection score was calculated from 11 5-point Likert-type questions. The potential range of scores was 11–55. The actual range for study participants was 18–55 with a mean score of 43.46 (standard deviation = 5.5). Attitudes toward sun protection appeared to be in the medium range, being neither strongly positive nor strongly negative.

The behavior section of the questionnaire was split into two sections: general sun protection behaviors and sunscreen use behaviors. The general sun protection behavior section of the questionnaire contained five questions. Each question provided a range of possible behavioral responses from 1 (most negative behavior) to 5 (most positive behavior). Thus, the possible range of scores for the general melanoma risk reduction section of the questionnaire was 5–25. The actual range obtained from study participants was 5–24 with a mean score of 12.14 (standard deviation = 3.4). In this study sample, 44% reported they always avoid the sun between 10 a.m. and 4 p.m., 48% always attempt to cover up with tightly woven clothes, 6% reported always using sunscreen, 3% indicated they see a doctor for skin checks, and 17% indicated they use a tanning bed at least monthly.

The sunscreen use section of the questionnaire contained four questions scored from 1 (most negative behavior) to 5 (most positive behavior). The potential and actual range of sunscreen use scores was 4–20. The mean sunscreen use behavior score was 12.66 (Standard deviation = 5.1). Eleven percent (11%) of the participants in this

study reported using a shot glass full of sunscreen with each application, 4% indicated they reapply sunscreen at least once every three hours when in the sun, 5% indicated they always reapply sunscreen after being in the water, and 32% reported they use a sunscreen with SPF of 15 or higher.

Overall, it would seem this population of college students had low knowledge levels related to melanoma and sun prevention behaviors. Their attitudes toward sun protection were in the medium range being neither strongly positive nor negative. Their general sun protection behaviors and specific sun protection behaviors related to sunscreen use were fairly poor.

In looking at gender as a factor related to knowledge, attitude and behavior, no gender differences were found related to attitude or general sun risk reduction behaviors. Differences were found related to knowledge and the use of sunscreen. Male participants had a mean knowledge score of 9.54 (Standard deviation = 3.9) while female participants had a mean knowledge score of 10.57 (Standard deviation = 3.8). Using a t-test ($t(451) = -2.825, p = .005$), it was determined that the difference in male and female knowledge scores was significant. Female college students in this study had better melanoma knowledge levels than male college students.

Sunscreen use is important to reduce skin cancer risk and prevent skin damage. With a maximum sunscreen behavior score of 20, male students in this study had a mean sunscreen behavior score of 11.93 (standard deviation = 4.68) and female students a mean sunscreen behavior score of 13.29 (standard deviation = 5.35). Using a t-test¹³ ($t(451) = -2.847, p = .005$), it was determined that the differences in male and female sunscreen behavior was significant. Females were better users of sunscreen than were males.

It was felt that students with higher melanoma knowledge levels might be better users of sunscreen than students with lower melanoma knowledge levels. A comparison was made examining sunscreen use scores between students scoring at or above



the mean knowledge score with students scoring below the mean knowledge score. No significant differences were found and it was concluded that for this group of students knowledge of melanoma did not impact sunscreen use. This may be due to the fact that students in this study were all fairly low in melanoma knowledge with a mean of 10.1 (standard deviation=3.90) correct answers out of 24 questions.

Attitude toward sun protection was a factor in sunscreen use. Students who scored at or above the mean attitude score were placed in the positive attitude group and students that scored below the mean attitude score were placed in the less positive attitude group. The positive attitude group had a mean sunscreen use score of 14.02 (standard deviation=5.27), while the less positive attitude group had a mean sunscreen use score of 11.37 (standard deviation = 4.56). Using a t-test ($t(451)=5.736$, $p<001$), the difference in sunscreen scores between the positive attitude group and the less positive attitude group was significant. Students in this study with a more positive attitude toward sunscreen use were more likely to practice positive sunscreen use behaviors than were students with less positive attitudes toward sunscreen use.

Skin type was another variable used to examine difference that might exist in knowledge, attitudes, and behavior. On the questionnaire, students were asked to self-select their appropriate skin type based on the following categories as modified from the American Academy of Dermatology¹⁴: Skin type I—Fair—blonde or red hair, blue eyes, pale skin, burn easily; Skin type II—Medium—brown or black hair, blue or brown eyes, will burn if not careful, gradually tans to light brown; Skin type III—Dark—brown or black hair, brown eyes, dark skin, rarely burns.

In looking at knowledge score related to skin type, those with fair skin (type I) had an average knowledge score of 10.88 (standard deviation=3.58), medium skin (type II) had an average knowledge score of 10.03 (standard deviation=3.85), and dark skin (type III) had an average knowledge level

of 9.25 (standard deviation=4.31). A one-way ANOVA ($F=4.02$, $p=.019$) indicated that there were significant differences in knowledge level based on skin type. A post-hoc analysis using the Tukey test¹³ determined significant knowledge level differences between fair skin (type I) and dark skin (type III) ($p=.015$). No significant differences were noted between fair skin (type I) and medium skin (type II) ($p=.137$) or between medium skin (type II) and dark skin (type III) ($p=.266$).

Attitude toward sun protection was also related to skin type. Those with fair skin (type I) had an average attitude score of 44.88 (standard deviation=5.27), those with medium skin (type II) had an average attitude score of 43.04 (standard deviation=5.14), and those with dark skin (type III) had an average attitude score of 43.01 (standard deviation=6.72). A one-way ANOVA ($F=4.56$, $p=.011$) indicated that skin type was significantly related to differences in attitude score. Using a post-hoc Tukey test, it was determined that those individuals with fair skin (type I) had a more positive attitude toward sun safety than did those with medium skin (type II) ($p=.010$). Fair-skinned (type I) individuals did not have a more positive attitude than those with dark skin (type III) ($p=.061$). There were also no significant differences in attitude between those with medium skin (type II) and those with dark skin (type III) ($p=.999$).

Skin type was also related to general sun safety behaviors. Those with fair skin (type I) had a general sun safety behavior score of 13.23 (standard deviation=3.62) while those with medium skin (type II) and dark skin (type III) had general safety behavior scores of 11.98 and 11.27 (standard deviations = 3.35 and 2.99, respectively). A one-way ANOVA was used to determine that these differences were significant ($F=8.40$, $p<001$). Post-hoc analysis using the Tukey test demonstrated significant differences in general sun safety behaviors between those with fair skin (type I) and those with medium skin (type II) ($p=.004$) and those with dark skin (type III) ($p<001$). Differences in

general sun safety behaviors between those with skin medium (type II) and those with dark skin (type III) were not significant ($p=.236$).

Differences in sunscreen use behaviors were also closely related to skin type. Those participants with fair skin (type I) had a mean sunscreen behavior score of 14.88 (standard deviation=4.90); those with medium skin (type II) had a mean sunscreen behavior score of 12.53 (standard deviation=4.73), and those with dark skin (type III) had a mean sunscreen behavior score of 10.10 (standard deviation=5.32). A one-way ANOVA confirmed that these differences in sunscreen behavior scores based on skin type were significant ($F=21.52$, $p<001$). Post-hoc analysis using the Tukey test found significant differences in sunscreen use behaviors between those with fair (type I) and medium (type II) skin ($p<001$), fair (type I) and dark (type III) skin ($p<001$), and medium (type II) and dark (type III) skin ($p<001$).

DISCUSSION

Several important findings emerged from this study. First, among participants in this study, melanoma knowledge level was very low and sun prevention behaviors were poor. Since the students in this study were primarily in their first year of college, these results indicate that participants did not receive sufficient education on melanoma or the dangers of sun exposure while in elementary, junior high, or high school. At least they did not remember the information or put prevention recommendations into practice. Further, it would appear that these students did not receive melanoma information or adopt sun exposure prevention practices while in their first two terms at the university.

These results substantiate the need for the university to initiate efforts to educate students about the risk and severity of melanoma, and to encourage behavioral practices to reduce sun exposure risk. Both classroom instruction and initiatives coordinated by the student wellness center should be implemented. Perhaps free samples of



sunscreen could be distributed at freshman orientation and at outdoor campus-wide events. Further, promotional campaigns using recognized campus personalities such as athletes, coaches, administrators, and student government leaders might be utilized.

In addition, health educators need to advocate for better education concerning melanoma and sun exposure risks in public and private K-12 schools. How many junior and senior high school health education curricula contain significant information about the dangers of sun exposure and how to prevent skin cancer? It would also be important to inform parents of young children about the dangers of sun exposure so that they can initiate preventive behaviors early in their children's lives. An additional program target should be youth sports. If youth coaches encourage the use of sunscreen and other sun protection behaviors among their young soccer, baseball and football players, many youth could be impacted. Participants in these sports receive significant sun exposure through their many practices and competitive events.

Female participants in this study demonstrated higher knowledge levels and better sunscreen use behavior than male participants. This finding has been reported in several other studies of adolescents and young adults.⁷⁻⁹ The consistency with which women score higher on sun protection knowledge and behavior would indicate that some sun exposure prevention programs should be focused specifically on males. Further studies need to be conducted to determine why males are lower in sun prevention knowledge and behaviors. Perhaps sun protection messages need to be more gender specific. Perhaps sunscreen products themselves are perceived as being feminine with feminine scents as suggested by Abrams and colleagues.¹⁵ These issues need to be better understood. This study did find that those with a more positive attitude toward sun protection behaviors were more likely to use sunscreen. Male attitudes toward sun protection behaviors need to be examined and programs developed if indicated.

While males were lower than females in sun-related knowledge, attitudes, and behaviors, programs focused on females should not be diminished. Females did not have exceptionally high levels of knowledge or behaviors. There is much room to improve these factors in women as well as men. The attitude that a suntan is associated with beauty may still be pervasive among female college students and needs to be further explored.

This study indicated that those with fair skin were more knowledgeable, had better attitudes, and practiced more general sun protection and sunscreen behaviors than those with medium to dark skin. Other studies have reported similar findings related to skin type and sun related knowledge and behaviors.^{7,10} These findings are positive, indicating that the sun risk message has been received by some in the highest risk group. On the other hand, the message that those with darker skin complexions are also at risk may not have been heard. While a darker skin type lowers the risk, it does not eliminate it. Those with medium and dark skin still need to incorporate sun protection behaviors into their lives.

Finally, this study was conducted with students at one Midwestern university. These results may not be representative of students at other universities in other geographic areas. This study needs to be replicated at other universities and especially at universities in sun-intensive states such as Florida, Texas, California, and Hawaii. Students at these universities may have had different exposure to sun protection messages and may have different knowledge levels, attitudes, and behaviors than students attending universities in the north and Midwest.

REFERENCES

1. Greenlee RT, Murray T, Bolden S, et al. Cancer Statistics 2000. *CA Cancer J Clin.* 2000; 50 (1): 7-33.
2. Harris J. A Plan to Promote the Prevention and Early Detection of Melanoma. *Dermatol Nurs.* 2000; 12 (5): 329-334.

3. Rigel DS, Carucci JA. Malignant Melanoma: Prevention, Early Detection and Treatment in the 21st Century. *CA Cancer J Clin.* 2000; 50 (4): 215-236.

4. American Cancer Society. Cancer Facts and Figures 2004. Available at: www.cancer.org/docroot/med/content/med_1_1_Most-Requested_Graphs_and_Figures.asp. Accessed October 27, 2004.

5. National Institutes of Health. Diagnosis and Treatment of Early Melanoma. *NIH Consensus Statement.* 1992; 10: 1-26.

6. Heffernan AE, O'Sullivan A. Pediatric Sun Exposure. *Nurse Pract.* 1998; 23 (7): 67-86.

7. Mermelstein RJ, Riesenber LA. Changing Knowledge and Attitudes About Skin Cancer Risk Factors in Adolescents. *Health Psychol.* 1992; 11 (6): 371-376.

8. Banks BA, Silverman RA, Schwartz RH, Tunnessen WW. Attitudes of Teenagers Toward Sun Exposure and Sunscreen Use. *Pediatrics.* 1992; 89 (1): 40-42.

9. Robinson JK, Rademaker AW, Sylvester JA, Cook B. Summer Sun Exposure: Knowledge, Attitudes, and Behaviors of Midwest Adolescents. *Prev Med.* 1997; 26: 364-372.

10. Clarke VA, Williams R, Arthey S. Skin Type and Optimistic Bias in Relation to the Sun Protection and Suntanning Behaviors of Young Adults. *J Behav Med.* 1997; 20 (2): 207-222.

11. Krejcie RV, Morgan DW. Determining sample size for research activities. *Educ Psychol Meas.* 1970; 30: 607-610.

12. Cottrell RR, McKenzie JF. Health Promotion & Education Research Methods. Boston: Jones and Bartlett Publishers; 2005.

13. Kuzma JW, Bohnenblust SE. Basic Statistics for the Health Sciences. 4th ed. Mountain View, CA: Mayfield Publications; 2001.

14. American Academy of Dermatology. The Darker Side of Tanning. Available at: <http://www.aad.org/public/Publications/pamphlets/DarkerSideTanning>. Accessed October 27, 2004.

15. Abrams L, Jorgensen CM, Southwell BG, Geller AC, Emmons KM. Gender Differences in Young Adults' Beliefs About Sunscreen Use. *Health Educ Behav.* 2003; 30 (1): 29-43.