Sun Protection Outreach Teaching by Students (SPOTS)—Evaluating the Efficacy of Skin Cancer Prevention Education for Adolescents

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BACKGROUND The Sun Protection Outreach Teaching by Students (SPOTS) program addresses an unmet need by training medical students to teach adolescents about skin cancer prevention and early detection.

OBJECTIVE To measure (1) changes in adolescents' knowledge, attitudes, and behaviors regarding sun protection and (2) the impact on medical students' confidence in skin cancer preventive counseling.

METHODS Pre-SPOTS and 1-month post-SPOTS program surveys were completed by adolescent participants and medical student instructors.

RESULTS Amongst adolescent students, analysis of 1,142 pre-program surveys and 618 post-program surveys revealed statistically significant improvements in knowledge, attitudes, and behaviors. Among the favorable results, 26%, 41%, and 20% improvements over baseline were observed in SPF knowledge, preference for natural untanned skin, and intent to wear sunscreen, respectively ($p < .001$). One-third of adolescents reported having tried to increase sunscreen use. Amongst medical students, analysis of 78 pre-teaching and 74 post-teaching surveys revealed an increase in feeling "very confident" in counseling patients, from 23% pre-teaching to 82% post-teaching ($p < .001$).

CONCLUSION SPOTS demonstrated a dual benefit to adolescents and medical students. The program is available for dermatologists to implement in their communities.

Skin cancer affects an estimated 4.9 million people annually in the United States and costs approximately $8.1 billion health care dollars each year.[1–3] The rates of skin cancer are increasing.[4,5] Melanoma in particular is affecting our younger generations because it is the second most common type of cancer in female population aged 15 to 29 years.[6]

Ultraviolet radiation (UVR) exposure is the single most preventable risk factor for skin cancer.[7–11] The damage from UVR during childhood and adolescence is substantial.[12–14] Experiencing even one blistering sunburn nearly doubles the risk of melanoma.[15] Regrettably, sunburns in adolescents are common,[16] making early interventions crucial.

Adolescence (aged 10–19 years) is a particularly important time for skin cancer prevention programs because many high-risk behaviors increase. Seventeen percent of adolescents report tanning bed use, which is associated with a 59% increase in melanoma risk.[17–21] Furthermore, sunscreen application declines.[22,23] Youth become more responsible for personal health practices while experiencing increased peer pressure to appear tan.[24,25]

Despite multiple medical organizations supporting the need for such programs, there is a paucity of effective skin cancer prevention programs targeting adolescents.[26–30] The SunWise program, created by the US Environmental Protection Agency (EPA) for grades K-8, is the largest of its kind in the United States.[31] However, evaluators reported that SunWise participants aged 13 to 15 years did not improve their attitudes toward tanning or sunscreen use nor their intent to wear sunscreen during the summer.[22]

In response to a regional and national need to better protect youth from skin cancer, the Sun Protection Outreach Teaching by Students (SPOTS) program was developed in 2006. SPOTS was a collaboration between a community leader from a melanoma advocacy organization and dermatology faculty and medical students at 2 medical schools. As a community outreach program, dermatology faculty train medical students to teach middle and high school students about skin cancer prevention and early detection.

Designed for teenagers, the program implements an interactive multimedia curriculum in the school setting. Understanding that adolescents are highly driven by physical appearance,[32,33] the SPOTS program uses both health-based and appearance-based motivators to encourage sun protection and tanning avoidance. Because teens are highly influenced by peers,[25,34] the program incorporates a

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video of 2 teenagers describing their personal journey with melanoma and deploys young medical students as SPOTS instructors.

To the best of our knowledge, this is the only medical student-led program with over a decade of implementation experience. The SPOTS program has been provided to 39,000+ adolescent students in 34 different schools across the St. Louis region; 600+ medical students have participated. Seven additional medical schools across the country have also taught the program.

The purpose of this study was to quantify the effectiveness of SPOTS in improving adolescents' knowledge, attitudes, behaviors, and intended sun protective practices. We also examined the impact on medical students' confidence in educating future patients about skin cancer.

Methods

To evaluate the SPOTS program effectiveness, a survey study was conducted during 2 consecutive academic years, 2016 to 2017 and 2017 to 2018. The SPOTS program was offered throughout the school year, during both fall and spring semesters. The study was conducted at 6 middle schools within one public school district where eighth graders received the SPOTS program. The 5-minute electronic surveys (pre-SPOTS and 1-month post-SPOTS) were administered during class time through a personal tablet computer. The project team collaborated with the school district, using classroom teachers to voluntarily distribute surveys during class time.

A brief pre-program and post-program survey was also distributed to the medical students who served as SPOTS instructors during the evaluation period. The surveys assessed confidence in sun protection counseling and skin cancer recognition.

Pre-program and post-program surveys response options were collapsed into 2 levels, as shown in Table 1. Statistical comparisons between the 2 groups (pre vs post) were performed using a Pearson chi-square because all surveys were anonymous for purposes of analysis. An alpha of 0.05 was considered significant. All results were rounded to the nearest integer. The participating school district and the institutional review boards at both medical schools approved this study.

Results

All Adolescent Participants

A total of 1,142 pre-surveys and 618 post-surveys were collected during the study. Adolescent demographics were similar between groups (Table 1). The mean age was 13.5 years. Female population comprised 50% of all survey respondents. About 82% self-reported as Fitzpatrick type 1 to 3 using a descriptive color gradient chart. Pre-SPOTS, 2% to 3% of participants had used a tanning bed and 34% had lain out in the sun with intention to tan during the past year.

Statistically significant changes were observed from pre-program to post-program for key outcomes in knowledge, attitudes, and behaviors (Table 2).

Knowledge of Recommended Sun Protection Factor

There was an 11 percentage point gain in those who choose sun protection factor (SPF) 30 or higher, increasing from 38% to 49% ($p < .001$); this represents a 26% improvement over baseline.

Belief in Sunscreen Effectiveness

Belief that sunscreen is effective in preventing skin cancer increased from 65% to 78%. This 13-point gain translates to a 19% increase over baseline belief.

Health Dangers of Tanning

After SPOTS, there was a 61% improvement in the belief that a tan is unhealthy ($p < .001$). This is attributable to at 21-point increase from the 34% to 55% of participants who disagreed or strongly disagreed that a tan is a sign of healthy skin. Post-SPOTS, 59% of participants said they would avoid tanning beds in the future.

Attractiveness of Tanned Skin

The percentage of participants who preferred a natural skin color (i.e., without any tan) increased 11 points from 27% to 38% ($p < .001$), representing a 41% improvement.

TABLE 1. Adolescent Demographics

	Pre-survey (N = 1,142)	Post-survey (N = 618)
Age in years (mean)	13.5	13.6
Sex, N (%)		
Female	548 (48%)	328 (53%)
Male	594 (52%)	290 (47%)
Fitzpatrick skin type, N (%)		
Types 1–3	930 (81%)	510 (83%)
Types 4–6	212 (19%)	108 (17%)
Family history of skin cancer, *N* (%)	263 (23%)	155 (25%)

TABLE 2. All Adolescent Participants

	% Pre (n = 1,142) *	% Post (n = 618) *	Absolute % change	Percent improvement	p
Knowledge					
Chose correct SPF 30+	38%	49%	11%	26%	<.001
Tanning causes premature aging of the skin i.e., wrinkles and dark spots (strongly agree/agree)	45%	67%	22%	50%	<.001
Attitudes and beliefs					
Sunscreen can prevent skin cancer in my skin (strongly agree/agree)	65%	78%	13%	19%	<.001
A tan is a sign of healthy skin (strongly disagree/disagree)	34%	55%	21%	61%	<.001
Most attractive look is natural skin color (i.e., without any degree of a tan)	27%	38%	11%	41%	<.001
Behaviors and intended behaviors					
I do not use sunscreen	17%	9%	8%	44%	<.001
Tried to increase sunscreen use after the SPOTS program	NA	33%			
Will avoid tanning beds	NA	59%			
Intent to wear sunscreen often/always during the upcoming summer	56%	67%	11%	20%	<.001

Premature Aging from Ultraviolet Radiation

Participant's understanding that tanning is associated with premature aging of skin increased by 50%. There was a 22 percentage point improvement from 45% to 67% for those who agreed or strongly agreed that tanning can cause facial wrinkles or dark spots ($p < .001$).

Intended Behavior to Wear Sunscreen

An 11 percentage point gain was observed for participants' intent to wear sunscreen often/always during the upcoming summer, increasing from 56% to 67% ($p < .001$). This represents a 20% improvement.

Intended Behavior to Wear Sunscreen by Fitzpatrick Skin Type

Statistically significant ($p < .01$) increases in intent to wear sunscreen often/always during the upcoming summer among adolescents with Fitzpatrick skin types 1 to 3 and Fitzpatrick types 4 to 6 were observed. Adolescents with Fitzpatrick skin types 4 to 6 had a 34% increase over baseline in intent to wear sunscreen compared with an 18% improvement over baseline for Fitzpatrick types 1 to 3.

Sunscreen Use Behavior

Approximately 17% of adolescents reported "I do not use sunscreen" before SPOTS; this behavior was reduced by almost half to only 9% among the post-program respondents ($p < .001$). Moreover, 33% of adolescents reported they had tried to increase sunscreen use after participating in the SPOTS program.

Medical Students as SPOTS Instructors

A total of 78 pre-teaching and 74 post-teaching surveys from medical student instructors were collected over 2 years. Seventy-four percent of SPOTS instructors were first-year medical students, and 25% were fourth-year students. Women comprised 55% of the presurveys and 57% of the postsurveys. At baseline, 16% of medical students reported a history of tanning bed use.

Before SPOTS training and teaching, only 23% of medical students reported feeling "very confident" in counseling patients on the importance of sun protective practices and tanning bed avoidance. After teaching, 82% felt "very confident" in their counseling skills ($p < .001$). When rating their confidence in recognizing a potentially malignant skin lesion on physical examination, 69% of medical students improved in their confidence score ($p < .001$). In addition, knowledge of melanoma significantly increased. At baseline, only 50% of medical students could name at least one of the ABCDE warning signs of melanoma (mean correct 2.0). Post-SPOTS, the mean correct increased to 4.7. The medical students personal intention to wear sunscreen often or

always during the upcoming summer increased from 75% at baseline to 88% post-teaching ($p = .059$). Medical students were asked to describe in 3 words their experience as SPOTS instructors. The 3 most common responses were: informative, fun, and interesting.

Discussion

The SPOTS program's mission is to educate and motivate adolescents to protect their skin. Its curriculum integrates appearance-based and health-based education, which may enhance effectiveness.[35–38] This pre-program and post-program analysis has demonstrated multiple dimensions of benefit to its participants—learners and instructors. Significant improvements were seen in adolescents' knowledge, attitudes, behaviors, and intended behaviors toward sun protection and tanning bed avoidance. The SPOTS program joins other sun protection programs that have been studied and reported, most notably the EPA's SunWise program. However, we note significant differences in the results attributed to SPOTS versus SunWise. Our comparison to SunWise focuses on their subgroup analysis of similarly aged participants (i.e., aged 13–15 years; SunWise presurvey $n = 494$ and SunWise post-survey $n = 471$).[22]

Tanning. SPOTS showed a statistically significant 21 percentage point gain in disagreement that a tan is a sign of healthy skin and 11-point reduction in tanned skin attractiveness. By comparison, SunWise reported no statistically significant change in attitude that a "sun tan is good for my skin" or in the belief that "people look healthier with a tan." The demonstrated ability of SPOTS to affect attitudes and beliefs is of particular importance because the perceptions of a tanned appearance are precursors to tanning behaviors.[25]

Sunscreen Behavior. SPOTS and SunWise approached measurement of sunscreen use behavior in different ways. SunWise reported no improvement in "routine" sunscreen practices, whereas one-third of SPOTS participants reported increased use of sunscreen attributable to the program—a bright spot among all results—given that program delivery occurred primarily in winter months. Incremental behavior change is valuable for building sustained behavior.

Sunscreen Intention. SPOTS and SunWise used very similar survey items to assess intent to wear sunscreen. SPOTS performed better than SunWise. Although SunWise had no statistically significant improvement in intention to wear sunscreen during the upcoming summer, SPOTS participants reported an 11 percentage point improvement ($p < .001$). Given the design and school setting of the SPOTS and SunWise studies, intention to wear sunscreen is a relevant indicator of program performance.

SPOTS also seems to have resonated with a diverse group of students, given that significant improvements in intent to wear sunscreen were seen across all Fitzpatrick skin types, with the highest gains in darker Fitzpatrick skin types 4 to 6. Sun Protection Outreach Teaching by Students may serve as one of many needed tools in addressing the current health disparities in skin cancer prevention and detection affecting people of color.[35,39]

SPOTS offers a dual advantage because it also benefitted medical students serving as instructors. Medical students reported significant confidence gains in their ability to counsel patients and recognize malignant lesions. We even detected a small change in medical students' intention to wear sunscreen during the upcoming summer, suggesting a direct health behavior improvement to them. As a field-based, service learning experience, SPOTS was designed to make an enduring impact on future physicians' desire to incorporate skin protection education in their practice.

Motivating adolescents is challenging, as parental and adult influence wanes during this time.[25] SPOTS addresses this challenge with the medical student-as-instructor model, which has a number of key strengths. First, medical students are closer in age to adolescents and may be more relatable yet credible enough to be taken seriously. Second, medical students provide an alternate and complementary voice for sun protection in addition to parents, teachers, and physicians. Third, medical students help keep the program cost-effective and sustainable. Finally, SPOTS enhances the sponsoring medical schools' efforts to serve its surrounding communities with health education.

One limitation to this study was a survey methodology that depended on voluntary administration by classroom teachers and voluntary adolescent participation. Thus, there was an imbalance in the count of presurveys and postsurveys available. In addition, the results, although favorable, are limited to a 1-month follow-up period. The school district generously provided access to data collection and supported program implementation within their guidelines and capacity. Mandatory administration of the in-classroom survey or a longer follow-up period was not feasible in this case and remains a challenge for future school-based research. Yet, additional research on the durability of SPOTS is warranted and will be pursued to measure if improvements are sustained over a longer period.

Although the long-term impact is yet to be measured, SPOTS has demonstrated improvements in adolescents' knowledge, attitudes, and behaviors toward sun protection. After the completion of this study, SPOTS has received an educational grant from the American Skin Association to help expand the program and fund future research. We recognize that school-based health education programming is one component of a comprehensive, multipronged approach to skin cancer prevention. Because only a minority of US schools have sun protective policies to protect their students,[40,41] a role exists for dermatologists to advocate for such policies and offer educational interventions.[42] We invite dermatology leaders to expand the reach of their medical school's mission by implementing SPOTS in their communities. For more information about SPOTS, visit www.SpotsEducation.org.

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