Sun Protection Education in the United States: What We Know and What Needs To Be Taught

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The incidence of skin cancers in the United States is rising. This has correlated with a lifetime of sun exposure and cumulative damage of repetitive sun-related injuries such as tanning and sunburning. It is estimated that 80% of sun damage occurs before the age of 18 years. This relates to excessive tanning, blistering sunburns, and ineffective sun protection. It has been demonstrated that children can be taught to protect themselves from the sun. However, teaching of sun protection needs to begin at an early age. Such education requires that parents enforce protection in the household and through their actions in sunny situations. It has become apparent from the literature in the United States that we have made strides in sun education, but we have not yet instituted an effective nationwide education plan. This article reviews the data we have in the United States on sun protection, with a focus toward helping to design better education programs for the future. Based on the literature, it would seem that sun education should combine teaching mothers about sun protection in the nursery and teaching schools how to educate youngsters on the need for sun protection, beginning in nursery school. Improvements in education will have a latency of many years for reducing skin cancer incidence but will be an excellent investment in the future cutaneous health of today's children.

Skin cancer is one of the most preventable malignancies. Over the past decades, the risk of skin cancer has risen steadily from 300,000 new cases in the United States in 1977 to more than 1 million in 1996. The estimated lifetime risk of developing skin cancer has reached 20%.[1] In particular, the lifetime risk of malignant melanoma has been estimated to be 1 in 87, an increase of 1800% since the 1930s, and the incidence is expected to rise over the next 2 decades.[2] Skin cancer is reaching epidemic proportions and, clearly, sun exposure is the critical risk factor. Numerous studies have demonstrated evidence that early, excessive sun exposure increases the risk of developing skin cancer.[3-7] It has been estimated that a single, severe, blistering sunburn during childhood may increase the risk of malignant melanoma 2-fold.[8] However, current practices in the United States are not addressing protection against this potentially fatal disease. In North America, young children spend an average of 2.5 to 3.0 hours daily outdoors.[9,10] Furthermore, 82% of adolescents have reported sunburn in the previous summer, and 53% of infants and young children have had a sunburn in the past.[9,11] One large study demonstrated an embarrassing lack of sun protection behavior: only 53% of those polled used sunscreen.[12] However, it is estimated that the regular use of sunscreen with a sun protection factor of 15 or greater during the first 18 years of life could reduce the lifetime incidence of nonmelanoma skin cancer by 78%.[13]

To address this grave problem, the American Academy of Dermatology and the US Centers for Disease Control and Prevention cohosted a consensus meeting of the National Skin Cancer Prevention Program to develop a skin cancer prevention and early detection agenda.[14] At the conference, methods of sun protection were proposed for adults and children older than 6 months and included the following: avoidance of deliberate tanning by either natural or artificial light; limitation of exposure to UV radiation, especially between 10:00 AM and 4:00 PM; use of protective clothing when exposed to the sun; use of sunscreen with a sun protection factor of 15 or greater; and use of lip balm. Children younger than 6 months were advised to stay in the

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shade rather than have sunscreen applied because of the possibility of allergic reactions. However, the understanding of sun protective behaviors and education about skin cancer in general, even at the parental level, is lacking. Weinstein et al[15] surveyed 254 parents at pediatric and dermatology clinics and examined their knowledge, attitudes, practices, and sources of information. The mean score of general skin cancer knowledge was only 61%, with only 49% able to answer specific UV index questions. Interestingly, 78% disagreed with the statement that a suntan is healthy, but only 57% disagreed with the statement that their children look healthier with a suntan. Their sources were primarily media (television, magazines, radio), yet they wanted to obtain information in the future from their primary care physicians. Education about skin cancer needs to be disseminated and the sun protection strategies outlined by the American Academy of Dermatology and the US Centers for Disease Control and Prevention at the National Skin Cancer Prevention Program need to be practiced. More recently, some communities in the United States have created sun protection awareness programs to educate society about the dangers of sun exposure and strategies to prevent excessive sun exposure.

In evaluating the existing programs in the United States, it is helpful to examine Australia's skin protection programs. Australia has the highest incidence of skin cancer of any country in the world.[16] Fifty percent of all Australians will be treated for skin cancer during their lifetime, and melanoma is the third most common potentially fatal cancer among Australians.[17] In the state of Victoria, beginning in the 1960s, the Anti-Cancer Council of Victoria was developed. Since then, several sun protection campaigns have been created. The council developed National Skin Cancer Awareness Week and the "Slip! Slop! Slap!" campaign, which featured an animated seagull urging Victorians to "slip on a shirt, slop on some sunscreen, and slap on a hat."[18] More recently, the council implemented the SunSmart program, which attempts to reduce the incidence of skin cancer and its associated morbidity and mortality by changing personal attitudes and behaviors, promoting institutional changes, and controlling existing disease.[19] Results of questionnaires have demonstrated a significant change in attitudes toward suntans since the implementation of SunSmart. From 1988 to 1998, the proportion of Victorians likely to get a suntan dropped from 61% to 35%, and the proportion agreeing that "friends think a suntan is a good idea" also fell from 69% to 36%.[20,21] In addition to changing attitudes, behavioral modifications also have been noted. Victorians are now more apt to seek shade, avoid midday exposure, and use a hat and sunscreen.[21-23] A SunSmart accreditation process also has been developed for primary schools whereby schools can receive accreditation as SunSmart schools. Accredited SunSmart schools must adopt a sun protection policy, which includes mandatory hat wearing for children playing outside; commit to changing times of outdoor activities; and implement a sun protection curriculum.[24] In a 1993 study, more than 75% of kindergartens in Victoria had sun protection policies. With the help of these society-wide programs geared toward children and various other programs at the government level, skin cancer incidence rates are beginning to plateau after many years of increase. Furthermore, earlier detection is leading to better long-term outcomes.[25-28]

Compared to Australia, most of the childhood sun protection programs in the United States are in their infancy. Many of the programs in the United States are targeted toward schools or other childcare centers and healthcare environments. A North American survey showed that only 36% of childcare centers have more than half of their play area shaded, and only 56% of centers have adequate sun protection policies.[29,30] One program in Colorado, which used the slogan "Block the Sun, Not the Fun,"[31] primarily focused on teaching improved sun protection behaviors for children at child care centers. The program was aimed at children and parents and promoted sun avoidance behaviors, including applying sunscreen twice per day; encouraging play in shady areas; and emphasizing the importance of wearing long sleeves, pants, and hats. Workshops educated staff members of the child care centers, and tote bags containing sun protection brochures, children's learning activities, sunscreen samples, and "Block the Sun, Not the Fun" kitchen magnets were provided for the parents. Following the intervention, center directors showed significant improvement in sun protection knowledge. They also were more likely to report sending home sun protection materials and applying sunscreen to children year-round compared with a control group. However, no changes were noted in clothing practice or use of shade at the centers. The investigators theorized an over-reliance on the use of sunscreen as a "magic bullet" for sun protection and reduction of skin cancer risk, and, although overall knowledge was improved, the program was found to have no impact on sun protection practices by parents.

Another recent example of a school sun protection program is Sun Smart Day implemented in Tucson, Arizona.[32] Three schools were assigned randomly to receive either an in-school teacher-driven curriculum, an interactive sun safety fair, or neither

(control). The immediate results showed significant effects on student knowledge, with the students receiving the in-school curriculum learning the most and the children at the fair developing a less positive attitude toward tanning. All children who received the Sun Smart Day intervention reported that their parents did more to protect them from the sun and to regularly examine their skin compared with those in the control group. However, 3 months after the intervention, skin cancer knowledge was the only parameter that persisted in the children who participated. The effect of the interventions on children's attitudes toward tanning and parental protection behavior was no longer present.

Certainly, knowledge is an important parameter and an essential first step. Through knowledge comes awareness, which is an important precursor to achieving behavioral change. Thus, programs such as "Block the Sun, Not the Fun" and Sun Smart Day may be important first steps in altering attitudes and thus achieving behavioral change in the form of preventative action.

Another potential method for promoting sun protection practices is targeting the healthcare system. Participants of the 1995 National Skin Cancer Prevention Program[14] called for pediatricians and their staff to begin integrating sun protection counseling into well-child visits. Results from a survey of Massachusetts pediatricians revealed that almost 70% recommended safe sun practices to more than 50% of patients and their patients' parents during the summer months.[33] Results from a survey of primary care physicians serving children in New Hampshire showed about half of the 261 physicians provided sun protection counseling "most of the time" or "almost always" during summer well-care visits. However, doctor's self-reporting of their practices may differ from a patient's recollection of receiving sun protection information. One Texas study reported that only 18% of Texas parents recalled receiving sun protection information from their child's primary care physician.[34]

A primary care component was instituted as part of New Hampshire's SunSafe community-wide intervention.[35] This portion of the program consisted of a continuing education meeting on sun protection held at local hospitals. In addition, a research assistant would visit physicians' offices, provide free materials related to sun protection of children, and assist in establishing an office system for sun protection. The office staff was given free sunscreen samples, patient brochures, posters, reward stickers, and removable tattoos. A control town was used to demonstrate any differences. Prior to intervention, 25% of control town parents and 26% of intervention town parents stated they had received sun protection information at their physician's office. Two years later, although only 27% of control parents indicated that they had received information, 34% of intervention parents recalled receiving sun protection information. Although this represents only a modest increase, physicians are a good, desirable source of sun protection information.

Many studies address specific areas of society within which sun protection education efforts should be concentrated. Yet, it seems that, as in Australia, a diversified, widespread approach may be a more successful one. The ultimate goal is not only knowledge and awareness but a profound attitude and behavioral change. One such comprehensive, multidimensional, community-based skin cancer prevention program is the Falmouth Safe Skin Project.[36] This program, which took place in Falmouth, Massachusetts, focused its intervention at many levels within the community. It has been demonstrated that if the entire family adopts skin cancer prevention behaviors, the risk of skin cancer in young children can be reduced.[37] A subset of the Safe Skin Project was the New Moms Project, which took place in the maternity ward of Falmouth Hospital.[36] Trained nurses educated new mothers on sun protection and handed out educational kits, which included tip sheets, pamphlets, bibs, hats, magnets, and sand pails with the Falmouth Safe Skin Project "Ban the Burn" logo. The information emphasized seeking shade; avoiding sun during peak hours; and protecting babies with hats, umbrellas, long shirts, and pants. One year later, 136 of the 187 mothers were contacted and surveyed. The newborn nursery program was the only source of sun protection information from a provider for 64% of the mothers. Nearly 90% of mothers reported that their child spent less than 3 hours per week outdoors in direct sunlight and always or almost always wore a hat. Because there was no control group in this study, the information is of limited value. However, the data still suggest that most mothers are receptive to early sun protection education, even in the newborn nursery, despite the immediate postdelivery emotional stresses that are so common. Another branch of the Falmouth Safe Skin Project focused on the local media, including newspapers and cable television stations, which presented regular skin cancer prevention messages. Local volunteers provided age-specific tip sheets, which provided skin cancer prevention information at local stores, pools, beaches, little league games, and fairs.

This community-wide intervention lasted 3 years, and questionnaires were administered to parents of children 13 years and younger before and after the program. History of painful sunburn was reported by 18.6% of participants prior to the intervention and

fell to 3.2% afterward. Sunscreen use was consistently higher at follow-up as the number of parents buying at least 3 tubes of sunscreen increased by 50%. Furthermore, sunbathing was reported as less frequent, skin cancer knowledge increased, and early detection practices through self-examination or physician skin examinations increased. However, there was little change in older children's interest in getting a suntan, and the practice of wearing a shirt or hat at the beach decreased slightly. Despite the lack of a control group in this study, the results were impressive. Because parental influence on children's sun protection behaviors is well known,[10,38,39] the findings of this program, which show demonstrable improvement in parental knowledge, attitudes, and practices, are encouraging. Parents also reported that children's knowledge improved, with twice the number of children aware that sunscreen prevents sunburn and skin cancer. Unfortunately, the children's attitudes about tanning and sun protection were unchanged, and almost one third were averse to using sunscreen.

It is imperative that education about sun protection be implemented early enough to affect lifetime attitudes and behaviors. It has been suggested that children begin to discriminate between chance and controlled outcomes and may begin to recognize their own ability to affect their health by 8 years of age (third grade level).[40] Thornton and Piacquadio[40] investigated the use of an educational children's book, *A Day With Ray*, for sun protection education in this age group. The book is written in rhyme and uses age-appropriate situations to stress the dangers of suntanning and the benefits of sun protection. Questionnaires demonstrated a significant increase in sun protection knowledge, both immediately after reading the book and 6 weeks later. Interestingly, the investigators compared the current sun protection situation to that of the public health position of dental healthcare several decades ago. Elementary school students in Canada with the most knowledge of dental care report receiving most of their information from their dentists and schools. In addition, advertisements aimed at dental hygiene during children's programming have contributed to the success of the campaign. Thornton and Piacquadio suggest that young children can be taught to apply sunscreen as routinely as they brush their teeth.

These studies demonstrate the varied approaches to promoting sun protection behavior. Because children receive 3 times the annual sun exposure of adults[41,42] and exposure as a child increases susceptibility of eventually developing skin cancer, continued efforts need to be focused on children through direct teaching of sun protection strategies and parental education. A better understanding of primary skin cancer prevention should result in an increased use of sun protective practices. However, these studies show that intermittent, brief interventions at schools or at the doctor's office do relatively little to influence long-term behavioral change. Instead, society as a whole must embrace a change of attitude regarding suntanning to improve sun protection behavior. As demonstrated in the Australian study, a multidimensional campaign encompassing schools and day care centers, workplaces, healthcare providers, and media can influence society's attitudes regarding suntanning. Although sun protection behavior should be promoted for all ages, influencing children's attitudes toward sun exposure at an early age should be stressed. Because many adults already have formed positive opinions regarding suntanning, behavioral modification would be most effective if introduced at an early age. Just as a developing child is more susceptible to carcinogens that could potentially cause cancer, children also are more likely to acquire sun awareness attitudes and behaviors at an early age. Hopefully, these children will adopt new attitudes and thus utilize more sun protection behaviors and, subsequently, promote these habits to future generations.

REFERENCES

1. Rigel DS, Friedman RJ, Kofp AW. Lifetime risk of development of skin cancer in the US population: current estimate is now 1 in 5. *J Am Acad Dermatol.* 1996;35:1012-1013.
2. Rigel DS, Friedman RJ, Kofp AW. The incidence of malignant melanoma in the United States: issues as we approach the 21st century. *J Am Acad Dermatol.* 1996;34(5 pt 1):839-847.
3. Marks R. Annotation: role of childhood in the development of skin cancer. *Aust Paediatr J.* 1988;24:337-338.
4. Holman CDJ, Armstrong BK. Cutaneous malignant melanoma and indicators of total accumulated exposure to the sun: analysis separating histogenic types. *J Natl Cancer Inst.* 1984;73:75-82.
5. Marks R, Jolley D, Lectas S, et al. The role of childhood exposure to sunlight in the development of solar keratoses and non-melanocytic skin cancer. *Med J Aust.* 1990;152:62-66.
6. Lew RA, Sober AJ, Cook N, et al. Sun exposure habits in patients with cutaneous melanoma: a case-control study. *J Dermatol Surg Oncol.* 1983;9:981-986.
7. MacKie RM, Aitchison F. Severe sunburn and subsequent risk of primary cutaneous malignant melanoma in Scotland. *Br J Cancer.* 1982;46:955-960.
8. Elwood JM, Whitehead SM, Davison J, et al. Malignant melanoma in England: risks associated with naevi, freckles,

CONTINUED ON PAGE 77

CONTINUED FROM PAGE 74

social class, hair color, and sunburn. *Int J Epidemiol*. 1990;19:801-810.
9. Foltz AT. Parental knowledge and practices of skin cancer prevention: a pilot study. *J Pediatr Health Care*. 1993:7:220-225.
10. Buller DB, Callister MA, Reichert T. Skin cancer prevention by parents of young children: health information sources, skin cancer knowledge, and sun-protection practices. *Oncol Nurs Forum*. 1995;22:1559-1566.
11. Banks BA, Silverman RA, Schwartz RH, et al. Attitudes of teenagers toward sun exposure and sunscreen use. *Pediatrics*. 1992;89:40-42.
12. Robinson JK, Rigel RS, Amonette RA. Sun-protection behaviors used by adults for their children-United States, 1997. *J Am Acad Dermatol*. 1998;280:317-318.
13. Stern RS, Weinstock MC, Baker SG. Risk reduction for nonmelanoma skin cancer with childhood sunscreen use. *Arch Dermatol*. 1986;122:537-545.
14. Goldsmith L, Hoh HK, Bewerse B, et al. Full proceedings from the Conference to Develop a National Skin Cancer Agenda, American Academy of Dermatology and the Centers for Disease Control and Prevention; April 8-10, 1995; Washington DC. *J Am Acad Dermatol*. 1996;35:748-756.
15. Weinstein JM, Yarnold PR, Hornung RL. Parental knowledge and practice of primary skin cancer prevention: gaps and solutions. *Pediatr Dermatol*. 2001;18:473-477.
16. National Medical Research Council. *Primary Prevention of Skin Cancer in Australia: Report of the Sun Protection Programs Working Party*. Canberra, Commonwealth of Australia: 1996.
17. Montague M, Borland R, Sinclair C. Slip! slop! slap! and SunSmart, 1980-2000: skin cancer control and 20 years of population-based campaigning. *Health Educ Behav*. 2001;28:290-305.
18. Sinclair C, Borland R, Davidson M, et al. From Slip! Slop! Slap! to SunSmart: a profile of a health education campaign. *Cancer Forum*. 1996;18:183-187.
19. Anti-Cancer Council of Victoria. *SunSmart Evaluation Studies No. 1: The Anti-Cancer Council's Skin Cancer Control Program 1988-89*. Melbourne, Australia: Anti-Cancer Council of Victoria; 1989.
20. Hill D, White V, Marks R, et al. Changes in sun-related attitudes and behaviours and reduced sunburn prevalence in a population at high risk of melanoma. *Eur J Cancer Prev*. 1993;2:447-456.
21. Anti-Cancer Council of Victoria. *SunSmart Campaign 2000-2003*. Melbourne, Australia: Anti-Cancer Council of Victoria; 1999.
22. Hill D, White V, Marks R, et al. Melanoma prevention: behavioural and non-behavioural factors in sunburn among an Australian urban population. *Prev Med*. 1992;21:654-669.
23. Hill D, Boulter J. Sun protection behaviour: determinants and trends. *Cancer Forum*. 1996;20:203-211.
24. Dobbinson SJ, Peipers AM, Borland R, et al. Are Victorian schools SunSmart: the ongoing development of the SunSmart schools program. *Health Prom J Aust*. 2000;10:43-50.
25. Hill D, Dixon H. Promoting sun protection in children: rationale and challenges. *Health Educ Behav*. 1999;26:409-417.
26. Giles GG, Thursfield V, Staples M. *Skin Cancer, Canstat*. Melboune, Australia: Anti-Cancer Council of Victoria; 1995.
27. Giles GG, Armstrong BK, Burton RC, et al. Has mortality from melanoma stopped rising in Australia: analysis of trends 1931-1994. *Br Med J*. 1996;312:1121-1125.
28. Giles GG, Thursfield V. Trends in skin cancer in Australia. *Cancer Forum*. 1996;20:188-191.
29. Grin CM, Pennoyer JW, Lehrich DA, et al. Sun exposure of young children while at day care. *Pediatr Dermatol*. 1994;11:304-309.
30. Crane LA, Marcus AC, Pike DK. Skin cancer prevention in preschools and daycare centers. *J Sch Health*. 1993;63:232-234.
31. Crane LA, Schneider LS, Yohn JJ, et al. "Block the Sun, Not the Fun": evaluation of a skin cancer prevention program for child care centers. *Am J Prev Med*. 1999;17:31-37.
32. Buller MK, Goldberg G, Buller DB. Sun Smart Day: a pilot program for photoprotection education. *Pediatr Dermatol*. 1997;14:257-263.
33. Geller AC, Robinson J, Silverman S, et al. Do pediatricians counsel families about sun protection? *Arch Pediatr Adolesc Med*. 1998;152:372-376.
34. Maducdoc LR, Wagner RF Jr, Wagner KD. Parents' use of sunscreen on beach-going children: the burnt child dreads the fire. *Arch Dermatol*. 1992;128:628-629.
35. Dietrich AJ, Olson AL, Sox CH, et al. Sun protection counseling for children. *Arch Fam Med*. 2000;9:155-159.
36. Miller DR, Geller AC, Wood MC, et al. The Falmouth safe skin project: evaluation of a community program to promote sun protection in youth. *Health Educ Behav*. 1999;26:369-384.
37. Buller DB, Burgoon M, Hall J, et al. Using language intensity to increase the success of a family intervention to protect children form ultraviolet radiation: predictions from language expectancy theory. Paper presented at: the World Conference for Cancer Organisations; March 1996; Melbourne, Australia.
38. Bennetts K, Borland R, Swerissen H. Sun protection behavior of children and their parents at the beach. *Psychol Health*. 1991;5:279-287.
39. Zinman R, Schwartz S, Gordon K, et al. Predictors of sunscreen use in childhood. *Arch Pediatr Adolesc Med*. 1995;149:804-807.
40. Thornton CM, Piacquadio DJ. Promoting sun awareness: evaluation of an educational children's book. *Pediatrics*. 1996;98:52-55.
41. Truhan AP. Sun protection in childhood. *Clin Pediatr (Phila)*. 1991;30:676-681.
42. Stern RS, Weinstock MC, Baker SG. Risk reduction for nonmelanoma skin cancer with childhood sunscreen use. *Arch Dermatol*. 1986;122:537-545.