

# Impact of Skin Cancer Prevention on Outdoor Aquatics Staff: The *Pool Cool* Program in Hawaii and Massachusetts<sup>1</sup>

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**Background.** Aquatic staff, including lifeguards, are exposed to intense sunlight for many hours each day and are likely to be at a relatively high risk for developing skin cancer. However, no interventions have been specifically directed to staff at outdoor swimming pool sites.

**Methods.** We conducted a randomized controlled trial among aquatic staff at 28 outdoor pool sites in Hawaii and Massachusetts. Intervention pools received sun protection education and control pools received education on child injury prevention. Staff in both arms received orientation sessions and led instruction during swim lessons. Analysis of covariance was used to compare and test for changes in outcome variables (sun protection habits and sunburning rates of aquatic staff) and pool protection policies. Surveys were completed at the beginning and end of the summer.

**Results.** Surveys were completed by 220 aquatics staff at baseline; 194 surveys were completed at post-test. Compared with staff at control pools, sun protection policies ( $P < 0.04$ ) and sunburning rates ( $P < 0.05$ ) improved at sun protection pools from baseline to post-test. However, the difference in the mean score of all sun protection habits between the two study groups was nonsignificant.

**Conclusion.** The *Pool Cool* sun protection intervention had significant effects on lifeguards' sunburn rates and pool sun safety policies but did not improve reported sun protection behaviors. More intensive

strategies may be needed to influence aquatics workers who have already begun to adopt skin cancer prevention practices. © 2001 American Health Foundation and Academic Press

**Key Words:** sun protection; randomized trials; outdoor workers; melanoma; prevention.

## INTRODUCTION

Skin cancer is the most common cancer in the United States and now accounts for 1.3 million new cases per year [1]. While skin cancer has become a common cancer, it is also one of the most preventable cancers [2]. Behavioral recommendations for skin cancer prevention include limiting time in the sun during peak hours; using sunscreen with at least SPF 15; wearing protective clothing, including hats and shirts; and avoiding sunburn [3].

Melanoma has been linked to high-intensity ultraviolet exposure, particularly before the age of 20, and severe sunburns during this period roughly double the risk of melanoma [4]. Preventive practices, such as using sunscreen, have been shown to reduce the proliferation of nevi, a strong risk factor for melanoma [5]. The greatest potential benefit is for children; for those who work outdoors, such as aquatic staff, including lifeguards; and in settings where people are minimally clothed and with few shaded areas.

Outdoor pool workers are important targets for sun protection education for several reasons. They are among a few occupational groups with much of their skin exposed to the sun, particularly at an early age. Since they are also in daily contact with people who are also routinely exposed to the sun, they can actively influence change by providing and advocating better sun protection for children in their care. Third, they

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can provide the necessary supports to promote better sun protection behavior and recommend use of sun protection to pool goers. Estimates from the American Red Cross and the National Recreation and Parks Association indicate that several hundred thousand people (generally of young age) work as lifeguards. Thus, this age group is important for instilling habits relatively early.

Randomized trials have not tested the efficacy of population-wide prevention programs for melanoma. However, mortality rates have begun to decrease in Australia, where intensive sun protection educational programs have been under way since 1979 [6]. Multi-component interventions in Australia have resulted in behavioral change for sun protection and reduction in sunburns [6]. In the United States, sun protection programs have been initiated in different settings, with schools being the most common setting [7]. Locales such as pools, beaches, and coastal towns where people receive maximum unprotected sun exposure are promising settings for primary prevention [8–13]. Following a randomized trial directed at young children at swimming pools in San Diego, Mayer et al. found greater use of hats in the intervention group, but no differences in other sun protection habits [8].

We developed and evaluated a randomized trial of sun protection education directed at children ages 5–10 years, their parents, and aquatics personnel at outdoor swimming pools in Hawaii and Massachusetts. Here, we describe the program entitled *Pool Cool* and present results from surveys completed by aquatics personnel (lifeguards and aquatics instructors). Our objective was to compare changes in sun protection and sunburning rates between aquatics staff at pools receiving specific training in sun protection and staff at control sites receiving education on child injury prevention.

## METHODS

### *Design and Setting*

The *Pool Cool* program was evaluated in a randomized trial conducted at 28 outdoor pool sites in Hawaii ( $n = 14$ ) and Massachusetts ( $n = 14$ ) during the summer of 1999. The 28 pools were randomized into eight sun protection (SP) and six child injury prevention (IP) sites in Hawaii and seven SP and seven IP sites in Massachusetts. The SP pools were the intervention sites and the IP pools were the control sites. The program was for children 5 to 10 years of age, their parents, and lifeguards and aquatics instructors. The swimming pool was the unit of randomization and intervention.

Evaluation was based on a self-administered survey that aquatics staff completed at baseline and posttest. Data collection involved cross-sectional samples; all staff attending the orientation sessions were eligible to complete the baseline survey, and all staff who were at

the pool site at the end of summer were eligible to complete the posttest survey. Due to confidentiality procedures that did not require names on surveys, the samples were treated as two cross-sectional surveys. Also, because some staff members left before the final week of the season when posttests were completed, it was not possible to obtain repeat surveys from all individuals.

### *Pilot Test*

The *Pool Cool* sun protection intervention was pilot tested at six pools (three each in Hawaii and Massachusetts) during the summer of 1998. Results of the pilot testing showed high acceptance of the program by site staff, including willingness to attend orientation sessions and lead sun protection education during swim lessons. We refined the program based on feedback from aquatics staff.

During the pilot year, we also explored study design options for the summer of 1999 and decided to conduct a randomized trial of sun protection education coupled with control education for child injury prevention. Pool managers and community advisors noted that participation would be limited if the control group was asked only to collect data and did not receive a program benefit.

### *Procedures*

*Sun protection pools.* At sun protection pools, intervention components included: (1) a lifeguard/aquatic instructor training module; (2) Leader's Guides; (3) an eight-lesson curriculum on sun safety to be presented by aquatics instructors in their classes; (4) interactive activities on sun protection with children ages 5–10 and their parents (led by *Pool Cool* project staff); (5) provision of sunscreen dispensers at the pool; and (6) incentives, such as sunscreen and hats. Incentives were provided to aquatic staff separately for survey completion (weeks 1 and 6–8) and for teaching of activities or participation in activities. The SP pools also received environmental supports, including shade structures, and signage that included posted sun protection tips.

Training sessions for aquatics staff lasted 45–60 min. Sessions were held at the individual pool site and were provided by trained *Pool Cool* staff. Aquatic staff at SP and IP sites were informed about the randomized nature of the study.

At sun protection pools, training concentrated on:

- (a) types of skin cancer, melanoma and skin cancer rates, and key sun protection messages;
- (b) appropriate sun protection methods, including sunscreen and its correct application, protective clothing, minimizing exposure, and seeking shade wherever possible;

(c) teaching children about the importance of sun protection, reducing and avoiding sunburns, and using sun protection daily and the need for environmental supports;

(d) an overview of the *Pool Cool* program, a review and demonstration of sun protection lessons, and a description of evaluation of *Pool Cool* activities; and

(e) motivating lifeguards to be role models for children.

*Child injury prevention pools.* Aquatics staff at IP pools received a parallel lifeguard/aquatic instructor training module, Leader's Guide, curriculum on injury prevention, activities, and incentives. There were no environmental supports promoting sun protection provided to IP pools. The structure and format of training sessions at the IP pools were similar to those at the SP pools, with differences only in the teaching content. Injury prevention topics included walking safety, traffic safety, playground safety, poisoning prevention, bicycle safety, fire safety, choking prevention, and rollerblade safety.

### *Recruitment and Randomization*

*Pool Cool* sites were enlisted with the use of a recruitment protocol and meetings with individual recreation leaders and pool directors. The pools included various types of organizational sponsorships, including public municipal and suburban pools, private pools, YMCAs, and military pools. We approached a total of 35 pools, 32 of which were eligible based on size and provision of swimming lessons. Twenty-eight pools (87.5% of those eligible) agreed to participate in the randomized trial.

Pools were randomized in matched pairs, within Hawaii and Massachusetts. Matching variables included size of the pool (length of the pool in meters), number of children registered for swimming lessons (by children in age groups 5–10 and those with fewer than 45 children and greater than 45 children), and the socioeconomic status of the community (low, middle, and high), using census data on median household income.

### *Data Collection*

Aquatics staff completed baseline surveys before the training session and a follow-up survey upon completion of the final swim lessons. The time between baseline and posttest surveys was 6 to 8 weeks. More than 90% of staff who were present for the sessions completed surveys both at baseline and at posttest. There were fewer SP surveys collected at posttest than at baseline (116 versus 142), as poor weather conditions caused two pools in Massachusetts to close early, so we could not collect some posttest surveys.

### *Measures and Scales*

A skin cancer risk measure included the following items: personal history of skin cancer, severe sunburning during childhood, sun sensitivity after 30 min of sunlight exposure, and color of untanned skin. Aquatics staff were categorized into three different risk groups: low risk (scores of 18 and less), moderate risk (scores 19–22), and high risk (23 and higher). Similar risk measurement indices have been published elsewhere [9,10,13].

Several knowledge and attitude variables were assessed. Measures for questionnaire items were selected and/or adapted from previous surveys [9,13]. Eight knowledge questions were asked and a mean summary score was tabulated, ranging from a low of 0 to a high of 8. Aquatics staff were asked about barriers to sun safety: if people were more attractive if they have a tan, if it was too much bother to put on a hat, and if it was difficult to protect oneself from the sun. Questions on social norms asked whether the lifeguards used sunscreen or hats or covered up when they were outdoors. Responses to attitude and social norm items were added together and mean scores were computed.

Sun protection behaviors, including sunscreen, shade, hats, shirts, and sunglasses, was measured with a 4-point scale ranging from 1 ("rarely or never") to 4 ("always"). Respondents were asked, "when you are outdoors in the sun, how often do you do each of the following: wear a shirt with sleeves, wear sunglasses, stay in the shade or under an umbrella, wear sunscreen, wear a hat?" The average score for all five behaviors comprised the sun protection habits index. The reliability of this instrument has been tested in prior studies. Glanz et al. found that the Cronbach  $\alpha$  coefficients of reliability for child sun protection habits and parent sun protection habits were determined to be acceptable at 0.70 and 0.70, respectively [9].

Sunburn was defined as "how many times last summer did you get a sunburn?" with responses being none, 1, 2, 3, 4, or 5 or more. At baseline, aquatic personnel were asked about the total number of times they had received a sunburn last summer (summer, 1998). At posttest, respondents were asked to record the number of sunburns they had during the current summer, i.e., 1999. Since aquatic staff were asked to compare two very different time periods, we could not control for the impact of weather in the former period since aquatic staff could have lived outside of Massachusetts and Hawaii. There was not a specific question on the number of hours of sun exposure for each lifeguard since most staff in intervention and control pools worked full-time shifts and spent the entire summer as lifeguards.

Questions on sun protection policies asked whether the pool encouraged swimmers to stay in the shade

when not swimming, reminded children to wear sunscreen, reminded parents to send children with sunscreen, and provided sunscreen for swimmers who forgot to put it on beforehand. The sun protection policy composite measure was an additive index of responses to these four survey items, with possible scores of 0 to 4.

At posttest, aquatics staff were asked the frequency with which they taught SP or IP lessons, used various teaching methods, and received incentives. The number of teaching encounters were categorized as 0, 1 to 4, 5 to 8, or more than 8.

### Data Analysis

We began by examining frequency distributions of individual variables and means of composite indices overall and then performed bivariate analyses by study group and by study site (Hawaii/Massachusetts). For comparisons of baseline characteristics, we used  $\chi^2$  analyses for categorical variables and *t* tests for continuous variables. The primary outcome analysis was a comparison of sun protection practices and sunburn rates between study groups over time (baseline to posttest). Analyses of covariance techniques were used to compare and test for changes in outcome variables over time between the two study groups adjusted for ethnicity, sex, and risk group. Adjusted means were calculated for these outcome variables. In a second series of analyses, we used random effects modeling (mixed modeling) to account for clustering in responses by pool sites.

In the analysis of knowledge, attitudes, sun protection habits, and policies, we included all aquatic staff. In the analysis of sunburns, we excluded low-risk staff from the analysis due to their low risk for sunburning. Although randomization was by pool, data analyses by

individual were deemed suitable; for other analyses of child and parent sun protection habits and pool sun protection policies from this study, we found very small intraclass correlations of 0.024, 0.026, and 0.083, respectively.

## RESULTS

### Baseline Characteristics of Aquatics Staff

Two hundred twenty baseline surveys were completed (142 SP and 78 IP). Compared with Hawaii, lifeguards in Massachusetts were more likely to be female (80% vs 56%;  $P < 0.001$ ), to be white (92% vs 28%,  $P < 0.001$ ), and to have a higher risk for skin cancer (44% vs 25%,  $P < 0.001$ ). More than 75% of respondents were lifeguards, 10% were pool managers or directors, and the others were ancillary aquatic staff (e.g., junior lifeguards). There were no differences in sun protection behaviors between lifeguards and other aquatic staff.

Table 1 shows the baseline characteristics of SP and IP respondents. More than two-thirds of respondents were female, and the mean age was 20.9. There were no differences at baseline between the groups in demographics, knowledge, attitudes, social norms, and pool sun protection policies. Baseline IP staff respondents were significantly more likely to report being at moderate to high risk for skin cancer and to have higher sun protection habit scores than were SP group respondents.

About 50% of the aquatics staff had a history of a severe sunburn; and almost 80% had at least one sunburn the previous summer. Also, they were nearly twice as likely to use sunscreen and sunglasses as to use hats, use shirts, and stay in the shade.

TABLE 1  
Baseline Characteristics of Lifeguards, by Treatment Group

Characteristic	Total <sup>a</sup> (N = 220)	Sun protection (N = 142)	Injury prevention (N = 78)	P value <sup>b</sup>
Gender (% female)	68.7	68.1	69.9	n.s.
Age (mean $\pm$ SE)	20.9 (0.60)	21.0 (0.76)	20.8 (0.96)	n.s.
Ethnicity (% Caucasian)	62.5	58.9	69.3	n.s.
% High school education or less	52.6	50.4	56.8	n.s.
% Moderate or high risk	68.1	62.9	77.6	$P < 0.05$
% Hair color red/blonde	19.3	18.4	20.8	n.s.
% History of severe sunburn	49.8	50.7	48.1	n.s.
% Color of untanned skin (very fair/fair)	67.9	65.3	72.7	n.s.
% with $\geq 1$ sunburns last summer	79.8	78.0	83.1	n.s.
Sun protection habits score (mean $\pm$ SE)	2.45 (0.04)	2.39 (0.04)	2.56 (0.07)	$P < 0.05$
Knowledge score (mean $\pm$ SE)	6.83 (0.08)	6.82 (0.10)	6.86 (0.11)	n.s.
Attitude score (mean $\pm$ SE)	3.25 (0.04)	3.23 (0.05)	3.29 (0.08)	n.s.
Social norms (mean $\pm$ SE)	3.44 (0.06)	3.50 (0.07)	3.35 (0.10)	n.s.
Pool sun protection policy (mean $\pm$ SE)	2.10 (0.09)	2.18 (0.11)	1.96 (0.14)	n.s.

<sup>a</sup> Sample sizes smaller for some items due to missing data.

<sup>b</sup>  $\chi^2$  for categorical variables; *t* tests for continuous variables.

### Effects of Pool Cool Intervention

At posttest, 194 surveys were completed (116 SP and 78 IP). There were no significant differences by age, sex, race, or education between SP and IP aquatics staff at follow-up. There were no differences in risk status between the two groups at posttest. As in the baseline survey, Massachusetts staff were much more likely to be female and white. Table 2 shows the effects of the *Pool Cool* Sun Protection intervention. While there was a trend toward more frequent shirt use in the SP group ( $P = 0.06$ ), differences in the mean score of all sun protection habits between the two groups were not significant.

Improved sun protection policies were more likely to be reported at SP pools. SP staff were more likely than IP staff to report improvements in policies for encouraging swimmers to stay in the shade when not swimming, reminding children to wear sunscreen, and reminding parents to send children with sunscreen ( $P < 0.001$  for all three variables). From pretest to posttest, the mean number of policies increased from 2.17 to 2.78 at SP pools and only from 1.99 to 2.07 at IP pools ( $P = 0.04$ ).

We examined reports of sunburn among the moderate and high-risk respondents. Postintervention SP staff were less likely than IP staff to report having had a sunburn during the program summer (64.3% SP vs 75.0% IP). In the multivariate analysis, controlling for risk group, ethnicity, and sex, SP staff had fewer sunburns at the end of the summer (1.42 versus 2.07 for IP,  $P < 0.05$ ).

Eighty-seven percent of SP staff reported that their pool taught sun protection in swim lessons, nearly 66% used the *Pool Cool* Leader's Guide, and 60% used sunscreen provided in a dispenser. At IP pools, 83% reported that their pool taught child injury prevention

lessons, and 70% used the *Pool Cool* Leader's Guide. Finally, because the response samples were not a cohort, we examined the association between frequency of teaching *Pool Cool* lessons and posttest sun protection habits. There was a trend toward higher sun protection habits scores with more frequent teaching of lessons/activities. The mean score was 2.30 for not teaching lessons, 2.40 for 1 to 4 times, 2.60 for 5 to 8 times, and 2.59 for more than 8 times. This trend was not statistically significant.

### DISCUSSION

Our multicomponent sun protection intervention in two states resulted in a significantly greater decrease in the mean number of sunburns among aquatics staff receiving a Sun Protection program than at control pools. Sunburn is the most common and preventable risk factor for melanoma [4], and at baseline, 50% of all staff reported a history of a severe sunburn. Aquatics staff also reported significant improvements in the sun protection policies at SP swimming pools compared with those at IP (control) pools. However, there were no greater increases in knowledge, attitudes, and sun protection habits among lifeguards and aquatic instructors at SP pools. With lifeguards having many key responsibilities at the pool site, we designed an intervention that could be flexibly woven into their schedule without compromising their major responsibilities. It was expected that this lower dose intervention would have had a smaller effect compared with a more intensive one for children.

Hawaii and Massachusetts have varying climates; however, both are among the U.S. states ranked highest in melanoma mortality [14–16]. Year-round intense solar exposure (in Hawaii) and intermittent exposure

TABLE 2

Effect of *Pool Cool* Intervention on Lifeguard Sun Protection Habits, Norms, Knowledge, Pool Sun Protection Policies, and Sunburns<sup>a</sup>

Variable: adjusted means (SE) <sup>b</sup>	Sun protection		Injury prevention		P value
	Baseline	Follow-up	Baseline	Follow-up	
Sun protection habits					
Use sunscreen <sup>c</sup>	2.73 (0.08)	2.71 (0.09)	2.93 (0.12)	2.93 (0.12)	0.94 (n.s.)
Wear a shirt	2.14 (0.08)	2.41 (0.08)	2.33 (0.11)	2.25 (0.11)	0.06 (n.s.)
Wear a hat	2.15 (0.08)	2.08 (0.09)	2.24 (0.11)	2.28 (0.11)	0.54 (n.s.)
Stay in shade	2.17 (0.06)	2.31 (0.07)	2.34 (0.09)	2.42 (0.09)	0.70 (n.s.)
Wear sunglasses	2.88 (0.08)	2.96 (0.09)	3.07 (0.12)	3.27 (0.12)	0.55 (n.s.)
Sun protection habits index	2.41 (0.05)	2.50 (0.05)	2.58 (0.07)	2.63 (0.07)	0.75 (n.s.)
Norms, knowledge, policies, and sunburns					
Social norms	3.52 (0.07)	3.60 (0.08)	3.42 (0.10)	3.62 (0.10)	0.49 (n.s.)
Knowledge (range 0 to 8)	6.71 (0.09)	6.84 (0.10)	6.81 (0.13)	7.03 (0.13)	0.68 (n.s.)
Pool sun protection policies (range 0 to 4)	2.17 (0.11)	2.78 (0.12)	1.99 (0.15)	2.07 (0.15)	0.04
Sunburns <sup>d</sup>	2.22 (0.18)	1.42 (0.18)	2.10 (0.22)	2.07 (0.23)	0.05

<sup>a</sup>  $N = 414$ ;  $n$  for separate analyses lower due to some missing values.

<sup>b</sup> Means calculated with adjustment for covariates: sex, risk group, and ethnicity.

<sup>c</sup> Range of values: 1 = rarely to 4 = always.

<sup>d</sup>  $N = 291$ ; includes only lifeguards at moderate/high risk.

among fair-skinned persons (in Massachusetts) have been associated with high skin cancer rates in these states. Also, melanoma is one of the most common cancers among young adults in the United States [17]. Thus, there is an urgent need for low-cost, targeted sun protection education for young adults, particularly those receiving maximal sun exposure.

Young adults pose a key challenge in sun protection education. While there have been numerous studies on sun protection habits of adolescents, there have been few on young adults (ages 18–25). In the largest study to date of sunbathing and sunscreen use in the United States, Koh et al. found that most adults (59%) reported sunbathing during the past year, and 25% reported frequent sunbathing (11 or more times in the previous year). Frequent sunbathing was most common among the youngest respondents (ages 16–25), and routine sunscreen use was also least common in this age group [18]. As for adolescents, “pro-tanning” attitudes and peer group norms among young adults may be in conflict with sun protection recommendations [6].

In the only other intervention study targeting aquatic staff, Lombard et al. found that lifeguards increased their use of all the protective behaviors from a baseline mean of 16.7 to 63.5% during an intervention [12]. However, in that study the intervention was significantly more intensive, shorter term, and conducted in just two pools, and no control group comparison was included. In another study, conducted at 14 outdoor recreation sites in Hawaii, participating in a sun safety program for children ages 6 to 8 years was found to result in significant positive changes in knowledge, sun protection habits, norms, and reported pool sun protection policies [10]. An apparent difference between that study and this trial seems to be that the staff were practicing fewer sun safety behaviors at baseline than in the *Pool Cool* trial, in which a “ceiling effect” may have muted the observed intervention effects. This study followed numerous interventions at beaches, pools, and recreation sites and in communities with close proximity to water [8–13].

While previous studies have examined the influence of peer sun protection education on students, this is one of the few studies to investigate whether the teachers of sun protection improve their own sun protection habits [10,19]. Our finding of a nonsignificant trend for improved sun protection habits among aquatic staff in the SP group, with a relatively small sample size, holds some promise for further interventions with more intensive interventions and larger samples.

It is worth noting that SP staff had fewer sunburns than IP staff but little change in sun protection habits. While we believe that the likelihood of receiving a sunburn is related to sun protection practices, they are not perfectly correlated. A salient experience, such as sunburns, may be recalled with greater reliability than

sun protection practices. Our survey instrument has certain limitations. For example, we asked only one general question on sunscreen use and did not ask more specific questions regarding the frequency of reapplication or how thoroughly it was applied. Probing these aspects of sunscreen use in future intervention trials may shed light on its’ effects in reducing sunburn.

Other limitations of the study include its cross-sectional design, reliance on brief self-report measures of behaviors and psychosocial factors, and relatively short intervention period of only 6–8 weeks. The validity of young adults’ reports of sun protection practices has not been reported; however, previous studies suggested that adolescent self-report of solar protection is relatively valid and may be used with a degree of confidence to assess behavior [20]. We did not consider using the diary approach in this context since it would have required aquatic staff to compromise their observation of children’s water safety.

The need for a national policy for sun protection has been recently advocated [21]. Outdoor aquatic staff are routinely exposed to adverse sun exposures, particularly at an age when the proliferation of new and more frequent moles occurs [22]. Thus, policies to improve the sun protection of aquatic staff should be an important part of this strategy and could include protective measures such as shading around pool sites, umbrella stands, UV protective shirts, and adequate supplies of sunscreen with SPF 15 or higher. Targeting high-risk individuals, such as aquatic staff, appears to be a viable and important strategy for sun protection education as they are also in close proximity to families, who are also generally unprotected from the sun. Future studies might do well to emphasize and evaluate more focused interventions to reach lifeguards and aquatic instructors.

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#### REFERENCES

1. American Cancer Society. Facts and figures. New York: Am. Cancer Soc., 2000.
2. Koh HK. Cutaneous melanoma. *N Engl J Med* 1991;325:171–82.
3. U.S. Department of Health and Human Services. Healthy People 2000: national health promotion and disease prevention objectives. Washington: U.S. Govt. Printing Office, Public Health Service, 1991.
4. International Agency for Research on Cancer. Monograph on the evaluation of carcinogenic risks to humans. In: Ultraviolet radiation, Vol. 55. Lyon: IARC, 1992.
5. Gallagher RP, Rivers JK, Lee TK, et al. Broad-spectrum sunscreen use and the development of new nevi in white children. A randomized controlled trial. *JAMA* 2000;283:2955–60.

6. Hill D, Dixon H. Promoting sun protection in children: rationale and challenges. *Health Educ Behav* 1999;409-17.
7. Buller DB, Buller MK, Beach B, Ertl G. Sunny days, healthy ways: evaluation of a skin cancer prevention curriculum for elementary school-aged children. *J Am Acad Dermatol* 1996;35:911-22.
8. Mayer J, Slymen D, Eckhardt L, et al. Reducing ultraviolet radiation exposure in children. *Prev Med* 1997;26:516-22.
9. Glanz K, Lew RA, Song V, Murakami-Akatsuka L. Skin cancer prevention in outdoor recreation settings: effects of the Hawaii SunSmart Program. *Effect Clin Pract* 2000;3:53-60.
10. Glanz K, Maddock J, Lew R, Murakami-Akatsuka L. A randomized trial of the Hawaii SunSmart program's impact on outdoor recreation staff. *J Am Acad Dermatol*. In press.
11. Lombard D, Neubauer TE, Canfield D, et al. Behavioral community intervention to reduce the risk of skin cancer. *J Appl Behav Anal* 1991;24:677-86.
12. Rossi JS, Blais LM, Weinstock MA. The Rhode Island Sun Smart Project: skin cancer prevention reaches the beaches. *Am J Public Health* 1994;84:672-74.
13. Miller DR, Geller AC, Wood MC, Lew RA, Koh HK. The Falmouth Safe Skin Project: evaluation of a community program to promote sun protection in youth. *Health Educ Behav* 1999;369-84.
14. Kosary CL, Ries LAG, Miller BA, et al., editors. SEER cancer statistics review, 1973-1992: tables and graphs. Bethesda (MD): Natl. Cancer Inst., 1995. [NIH Publication No. 96-2789]
15. Atlas of cancer mortality in the United States: 1950-1994. Bethesda (MD): Natl. Cancer Inst., 1999. [Access at [www.nci.nih.gov/atlas/](http://www.nci.nih.gov/atlas/)]
16. Geller A, Miller D, Lew R, et al. Cutaneous melanoma mortality among the socio-economically disadvantaged in Massachusetts. *Am J Public Health* 1996;86:538-43.
17. SEER cancer incidence public use database 1973-1996. Bethesda (MD): Natl. Cancer Inst. [CD-ROM]
18. Koh HK, Bak SM, Geller AC, Mangione TW, Hingson RW, Levenson SW, Miller DR, Lew RA, Howland J. Sunbathing habits and sunscreen use in 2459 Caucasian adults: results of a national survey. *Am J Public Health* 1997;87:1214-7.
19. Buller DB, Borland R. Skin cancer prevention for children: a critical review. *Health Educ Behav* 1999;26:317-43.
20. Lower T, Girgis A, Sanson-Fisher R. How valid is adolescents' self-report as a way of assessing sun protection practices? *Prev Med* 1998;27:385-90.
21. Emmons KM, Colditz GA. Preventing excess sun exposure: it is time for a national policy. *J Natl Cancer Inst* 1999;91:1269-70.
22. Gilchrist BA, Eller MS, Geller AC, Yaar M. Mechanisms of disease: the pathogenesis of melanoma induced by ultraviolet radiation. *N Engl J Med* 1999;340:1341-8.