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Skin Cancer Prevention in Outdoor Recreation Settings: Effects of the Hawaii SunSmart Program

ORIGINAL ARTICLE

KAREN GLANZ, PhD, MPH
Cancer Research Center of Hawaii
University of Hawaii
Honolulu, Hawaii

ROBERT A. LEW, PhD
Harvard Medical School
Boston, Mass

VALERIE SONG, BA
Cancer Research Center of Hawaii
University of Hawaii
Honolulu, Hawaii

LYNN MURAKAMI-AKATSUKA, MPH
Hawaii State Department of Health
Honolulu, Hawaii

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CONTEXT. Skin cancer is the most common form of cancer in the United States, and it is one of the most preventable. Interventions for young children and their parents can help prevent future cases of skin cancer.

OBJECTIVE. To determine whether a skin cancer prevention program implemented at outdoor recreation sites improved children's sun-protection behaviors and site sun-protection policies.

DESIGN. Randomized trial of 14 outdoor recreation sites on the island of Oahu, Hawaii. The trial had three arms: control, education only, and education/environment.

INTERVENTION. The education arm included staff training, on-site activities, take-home booklets, behavior-monitoring boards, and incentives. The education/environment arm included all education components plus provision of sunscreen and promotion of sun-safe environments.

PARTICIPANTS. Children 6 to 8 years of age and their parents.

OUTCOME MEASURES. Reports from parents of children's sun-protection behaviors and the sun-protection policies of recreation sites. The cohort for analysis from baseline to 6 weeks after testing had 383 participants; the cohort from 6 weeks after testing to 3 months of follow-up had 285 participants.

RESULTS. Program implementation was high in the education only and the education/environment sites. Compared with control sites, children's sun-protection behaviors and, in particular, the use of sunscreen improved significantly at sites where the two interventions were implemented. In addition, sun-protection policies of recreation sites were markedly higher at intervention arm sites. The education/environment intervention was not superior to education alone. Changes were partly maintained at 3 months of follow-up.

CONCLUSION. A creative, engaging, multicomponent skin cancer prevention program in outdoor recreation settings can lead to modest improvements in children's sun-protection behaviors.

Approximately 1 million new cases of skin cancer occur each year in the United States.[1] It is estimated that protection from the sun's rays can prevent about 90% of all cases of skin cancer. Because sun exposure during childhood accounts for

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about 80% of the total lifetime exposure,[2] children have great lifetime potential to benefit from sun-protection habits.

Several behaviors are important for primary prevention of skin cancer. These behaviors include limiting time in the sun, avoiding peak sun hours, using broad-spectrum sunscreen, wearing protective clothing and sunglasses, seeking shade when outdoors, and avoiding sunburn.[3] There is a critical need for better skin cancer prevention in the United States, especially in sunny and tropical locations.

Most skin cancer prevention efforts aimed at children have involved school-based curricula; few controlled studies of prevention strategies for children have been reported.[4] Although school settings allow skin cancer education to be integrated into existing learning situations, appropriate sun-protection practices should also be promoted outside the classroom in home and recreation settings. Supervised recreation and sports programs are conducted mostly or entirely outdoors; therefore, parents and recreation leaders can introduce children to the importance of sun-protection habits and facilitate their adoption.

This article describes the methods and results of a randomized trial to evaluate the impact of SunSmart, a program for children, their parents, and recreation site staff. The main objectives of SunSmart were to increase skin cancer prevention practices among 6- to 8-year-old children and to increase policies and environmental support for skin cancer prevention in outdoor recreation settings. Skin cancer prevention practices included consistently using sunscreen with a sun-protection factor SPF of 15 or more; wearing protective clothing, including shirts and hats; and avoiding excessive sun exposure during midday hours. Policy and environmental supports included scheduling reduced sun exposure, providing shaded areas, providing sunscreen, requiring use of hats or shirts (or both), providing information about sun-protection to parents, and using permission slips for children to be able to use sunscreen at program sites. The SunSmart program also sought to improve knowledge, norms, and sun-protection practices among parents and recreation staff.

Methods

Design and Setting

SunSmart was evaluated in a three-arm randomized trial conducted at 14 outdoor recreation sites ("Summer Fun" programs) on the island of Oahu, Hawaii, during the summer of 1996. The program was for children 6 to 8 years of age, their parents, and recreation leaders.

Figure 1 illustrates our study design. The recreation site was the unit of randomization and intervention. Sites in the education arm received staff training, on-site activities, and interactive take-home booklets. Sites in the education/environment arm received the education arm components plus sunscreen, portable shade tents, and policy consultations. Sites in the control arm participated in the evaluation and received a condensed educational program package after the second survey.

The main evaluation was based on self-administered surveys that parents completed for themselves and their children. Surveys were conducted at baseline, the end of the 6-week program (posttest), and 3 months later (follow-up). Data collection for the first two surveys involved cross-sectional samples; thus, all eligible parents were invited to respond on the second occasion, regardless of whether they had completed the baseline survey. The follow-up survey was sent to parents who responded to the second survey and provided a mailing address. Additional evaluation data came from monitoring forms completed by outdoor recreation staff and observations conducted by SunSmart program staff.

SunSmart Intervention

Theoretical Foundations and Pilot Test

Strategies used in the project were based on two theories of health behavior: social cognitive theory and the stages of change construct.[5, 6] Materials and methods were selected and completed by using a social marketing process.[7, 8] Intervention strategies addressed multiple levels of factors that contribute to sun-protection and skin cancer prevention practices: knowledge and practices, and environmental supports and organizational policies.

In the summer of 1995, we conducted a pilot study of SunSmart at five recreation sites. Results of the pilot study showed high levels of program implementation and short-term improvements in knowledge, sun-protection habits, and sun-protection policies.[9]

Procedures

The SunSmart educational intervention was provided in both the education arm and the education/environment arm. The educational intervention had three main components: training for recreation leaders, on-site activities for children, and take-home interactive educational activities. Program materials for SunSmart included a leader's guide for recreation staff with information, sun safety messages, and activities (a separate leader's guide was created for each intervention arm); two family fun guides with stories, games, and puzzles

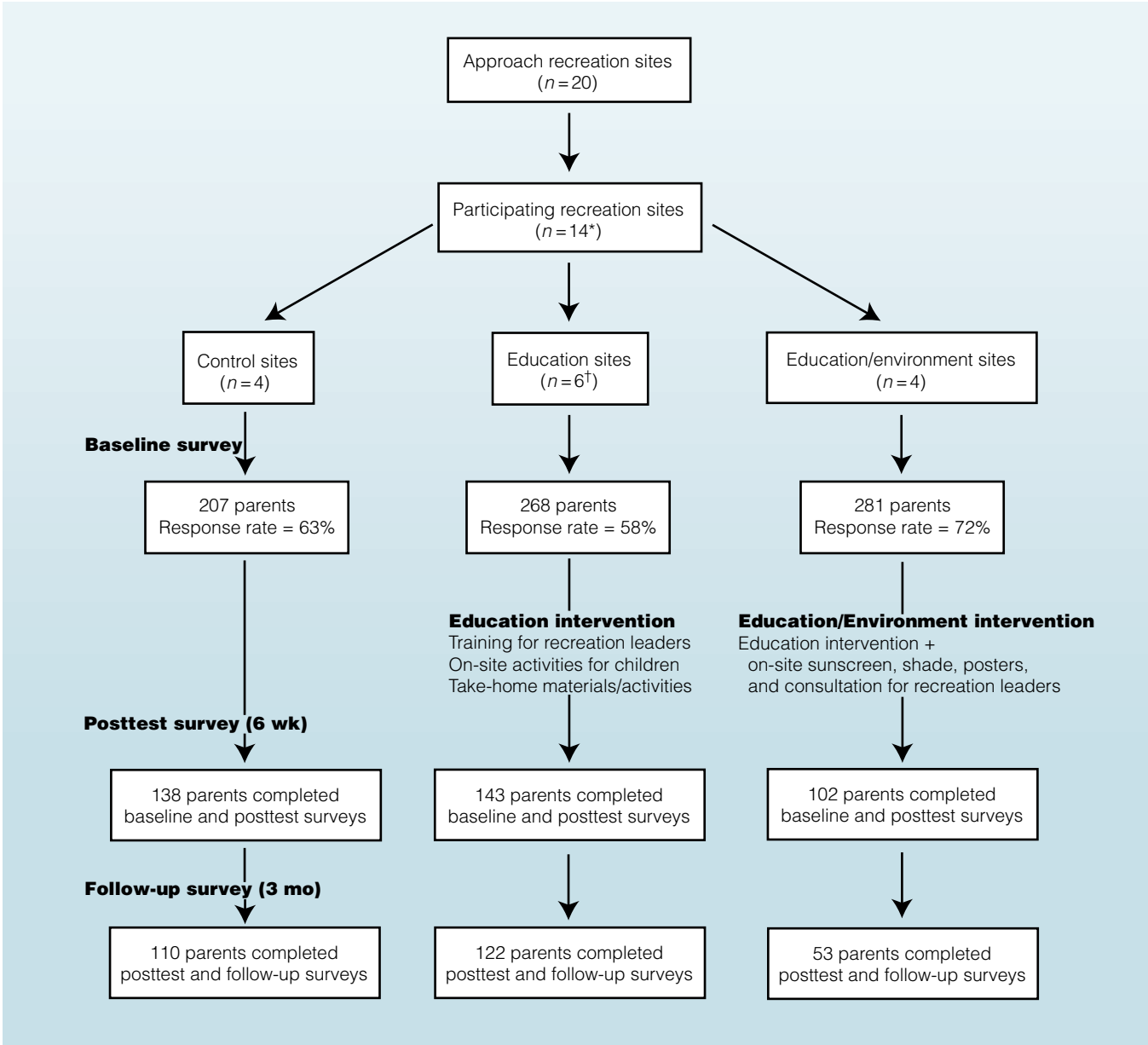

FIGURE 1. Study design. *Sixteen sites agreed to participate, but grant funding limited the sites to 14. †Four small sites were clustered to serve as the equivalent of two larger sites.

for children and parents to complete; and newsletters and brochures. Behavior-monitoring scoreboards (SunSmart scoreboards) listed each child's name and displayed logo stickers for each completed activity or returned survey. Incentives were used to increase program visibility, promote sun protection, and encourage completion of surveys. They included sunscreen samples, logo magnets and refrigerator note boards, school pencil packs, T-shirts, insulated lunch sacks, and SunSmart hats.

The SunSmart environmental intervention took place only in the education/environment arm. Environmental and policy supports included providing sunscreen in dispensers, posters, portable shade tents, and policy consultation. Some of the strategies were modeled after the Minnesota Home Team cardiovascular health promotion program.[10]

Recruitment and Randomization

Sites were recruited by means of a recruitment package and meetings with outdoor recreation program managers. Twenty sites were invited to participate; 16 sites agreed, but only 14 were included because of our limited staff and funding. The 14 participating sites were grouped into 12 clusters (two clusters had two small sites) for randomization into the three study arms.

Randomization was done by using a blocking strategy to balance size and geographic location. Both public (eight city parks and community centers) and private (six YMCA-based) outdoor recreation sites participated.

Data Collection

The main outcome measure was surveys completed by parents. Baseline surveys were completed at the beginning of the program. Posttest surveys were collected about 6 weeks later, during the last week of the program. Both surveys were distributed to children at the recreation sites, who were instructed to take the surveys home to their parents, to be completed and returned within 3 days. We made special efforts to achieve the best possible response rates to the parent surveys. Specifically, we instituted a SunSmart Scoreboard tracking system, in which children who returned the surveys received a logo sticker by their names, and we offered small incentive gifts for returning the surveys (lunch sacks, logo hats, and logo T-shirts). Three-month follow-up surveys were mailed directly to parents who indicated their willingness to complete a third survey after the outdoor recreation program ended.

Measures

The survey instrument included questions about demographic characteristics of the parent and child, the child's risk for skin cancer, the child's current sun-protection behaviors, and policies for sun protection at the outdoor recreation site. Measures for questionnaire items were selected and, if necessary, were adapted from previous surveys on this topic that were published in the literature[11, 12] or used in earlier studies conducted by the project team.[9, 13]

We combined selected survey items into composite measures. We assessed five sun-protection behaviors: wearing a shirt with sleeves, wearing sunglasses, seeking shade, wearing a hat, and using sunscreen. Each behavior was assessed on a 4-point scale ranging from 1 to 4 ("rarely or never" to "always"). The average score for all five behaviors served as the sun-protection habits index. Similarly, the sun-protection policies at the outdoor recreation sites were assessed by using an aggregate measure of seven survey items that queried parents about whether the sites required or encouraged various sun-protective actions (**Appendix**).

Data Analysis

After creating composite indexes, we completed univariate analyses by study group at each time point. Next, we examined the similarity of the three study arms at baseline and sought correlates of sun-protection practices[14] to identify relevant covariates for the impact analyses. This was necessary because the literature on factors associated with skin cancer prevention behaviors is too limited to provide guidance on this matter.[11]

Principal study outcomes were intervention effects, defined as the difference between change in intervention sites (education and education/environmental arms) and change in control sites. The main dependent variables were children's sun-protection habits index, sunscreen use, and site sun-protection policies. Outcomes were treated as continuous measures.

The data covered three periods: baseline, posttest, and follow-up. The analyses focused on determining whether changes occurred from baseline to the posttest time point and the pattern of maintenance or change between the posttest and follow-up surveys. All multivariate models were run as mixed-model analyses of variance by using the PROC MIXED function in the SAS software package (SAS Institute, Cary, North Carolina).[15] Simple linear contrasts were used to make post hoc pairwise comparisons of the three treatment means.[15] We controlled for parent age, education, ethnicity, income, child's skin cancer risk, recreation site, and baseline level of the dependent variable of concern. Treatments were randomly assigned to recreation sites, thereby nesting the sites within treatments. Because the factor "treatment" was a fixed effect and "site" was a random effect, treatment effects were estimated directly and variation among sites was included in the unexplained variation.

Primary conclusions about changes in sun-protection practices and program policies are presented (as reported by the parents) for the principal study cohort of 383 children—those who completed both a baseline and posttest survey. The definitive posttest–to–follow-up results are based on a cohort of 285 children. Because the multivariate adjustment had little effect, all reported results are unadjusted means.

The multivariate results were validated by running alternative models with different sets of assumptions (described below). For each mixed model, a general linear model (ANOVA) was run after dropping the random factor "site" to determine the effect of removing the nesting of factors and removing a source of variation. Whenever crucial continuous variables displayed non-normal distributions, as determined by the Shapiro-Wilk criterion,[16] the variable was transformed, the model rerun, and the results compared.

Missing values for predictive factors were imputed in two ways to examine how various imputation schemes might affect the multivariate results. Parallel analyses were run with no imputation (hence a reduced sample size), with missing values for a factor imputed by using the mean value within each site (site-

mean), and with missing values set equal to the grand mean. The sets of results for these parallel comparisons provided another view of the robustness of the primary conclusions.

Results

Table 1 shows the demographic characteristics of parents who responded to the baseline survey, and their children, by study group. Seven hundred fifty-six parents (64.0% response rate) completed the baseline survey. Responses to posttest and follow-up surveys were 52% and 57%, respectively (**Figure 1**). The typical parent respondents were mothers in their 30s who were long-time residents of Hawaii. The children were equally divided between boys and girls. Their ethnic backgrounds were white, Hawaiian, and Asian. Most parents were married, had at least some college education, and had household incomes over $20,000 per year. To account for differences among the three study groups in some of the variables measured at baseline, the analysis of program impact adjusted for those variables. We also performed a nonresponse analysis to determine whether response bias was introduced by the varying response groups over the course of the study. The findings revealed few significant differences between persons who completed one survey and those who completed more than one survey.

Sun-Protection Behaviors

Figure 2 shows the effects of the intervention on five sun-protection behaviors and on the aggregate sun-protection habit index. Compared with the control arm, significant baseline to posttest changes on the children's sun-protection habits index were seen in the education and education/environment arms (adjusted intervention effect, 0.20 ± 0.06 [$P < 0.001$] and 0.19 ± 0.06 [$P < 0.01$], respectively). The education arm and the education/environment arm did not differ significantly. Sunscreen use also increased significantly among children in the education group (adjusted intervention effects, 0.16 ± 0.08 [$P < 0.05$]) but not among children in the education/environment group. The posttest to follow-up differences narrowed between the groups for all behaviors except sunscreen use.

Site Sun-Protection Policies

Figure 3 shows the effects of the intervention on the site sun-protection policies index. These questions asked parents about what sun-protection policies were required or encouraged by the recreation site. Compared with sites in the control arm, significant increases were found for sites that implemented the education arm and those that implemented the education/environment arm (adjusted intervention effect, 1.17 ± 0.39 and 1.42 ± 0.39, respectively). Again, the education and the education/environment arms did not differ significantly. Because the outdoor recreation programs closed at the end of the summer, we did not include questions about sun-protection policies on the 3-month follow-up survey.

Process Evaluation and Implementation

To determine the extent of program implementation and reactions to SunSmart, recreation staff completed weekly monitoring forms and posttest survey questions about program implementation. SunSmart staff conducted observations to assess program implementation and fidelity in all three study arms.

TABLE 1
Baseline Characteristics of Parents and Children*

CHARACTERISTIC	CONTROL (*n* = 207)	EDUCATION (*n* = 268)	EDUCATION/ENVIRONMENT (*n* = 281)	*P* VALUE
Parents (survey respondents)				
Female	90%	85%	83%	NS
White	22%	21%	17%	NS
Mean age, *yr*	38	40	37	< 0.001
Children				
Female	52%	52%	44%	NS
Mean age, *yr*	7	7	7	NS
Skin cancer risk index (0 to 4)	1.38	1.39	1.21	< 0.05

**NS = not significant.*

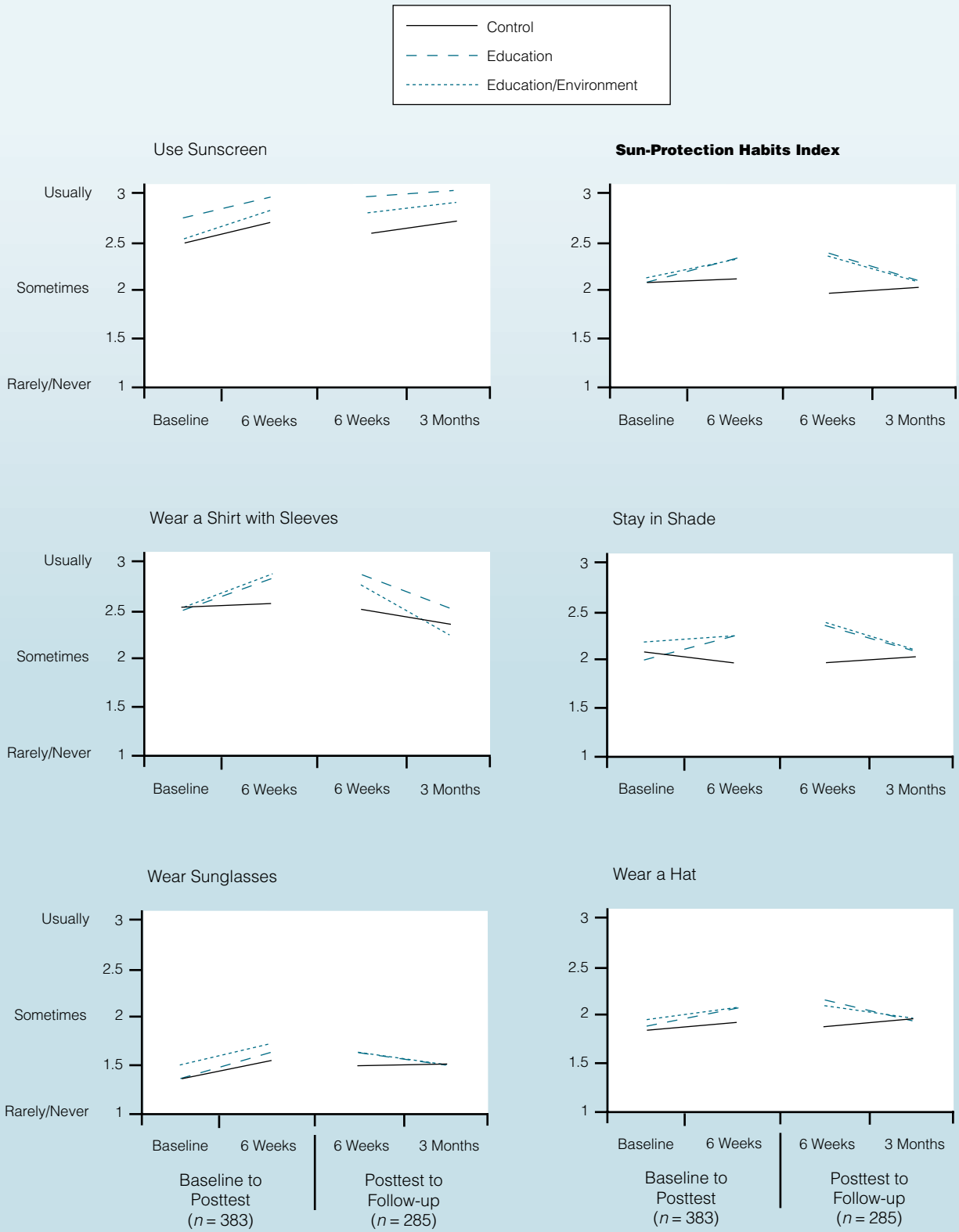

FIGURE 2. Effect of the intervention on five sun-protection habits and the composite sun-protection habits index. Behaviors were reported by the children's parents.

On-site observations showed that SunSmart activities were conducted often and were enthusiastically received by the children. Monitoring forms indicated that all sun safety messages were presented, SunSmart scoreboards and stickers were used regularly, and group activities were completed. Activities were rated favorably (from 5 to 7 on a 7-point scale). Monitoring forms and staff surveys indicated equally high levels of program implementation in the two treatment groups. There was, however, a nonsignificant trend toward higher implementation in the education arm for three of the four program components.

The take-home activities were also widely implemented. The last page of the family fun guides asked children and parents to complete activities within 1 week and to sign and return the inside back page to their outdoor recreation leader. The return rates for the family fun guide signature pages (intervention sites only) were 42% for guide 1 (487 of 1149) and 41% for guide 2 (435 of 1071).

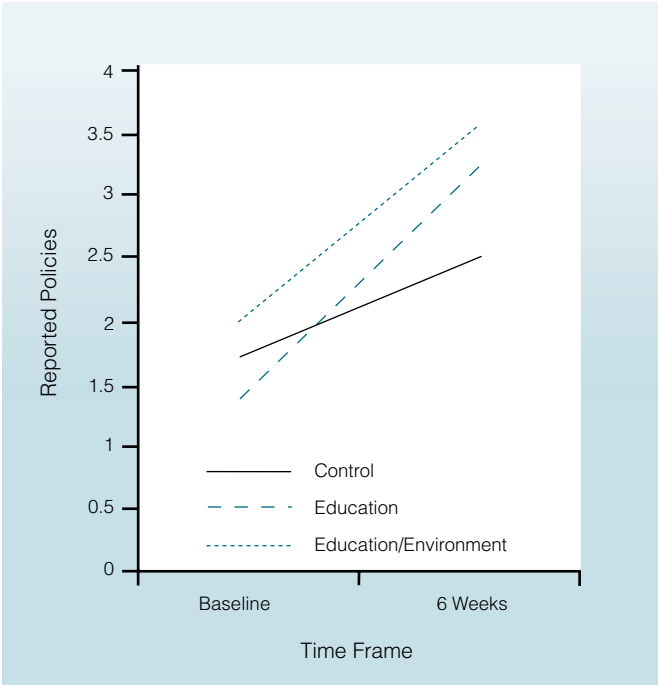

FIGURE 3. Site sun-protection policies reported by 383 parents.

Discussion

The randomized evaluation of SunSmart showed that the two interventions—education and education/environment—resulted in modest improvements in sun-protection practices in children and substantially increased the sun-protection programs and policies used at the participating outdoor recreation sites. Both intervention groups had outcomes that were for the most part significantly better than those in the control arm, but the education/environment intervention was not significantly better than the education intervention. Small changes were observed in the sites in the control arm, perhaps as a result of secular trends, participation in surveys, or mass media attention to sun safety. The finding of such changes underscores the importance of using an experimental design with a control group to accurately assess program effects.

Program implementation was high, as indicated by surveys, monitoring forms, and observation. Children responded enthusiastically to the SunSmart activities. Findings from the 3-month follow-up survey showed that some favorable changes were sustained into the fall. The SunSmart program is intended for children in the lower primary school grades (1 through 3), or those who are approximately 6 to 8 years of age. This age group was selected because such children can complete activities involving reading but are dependent on parents for clothing, sunscreen, and supervision.

The magnitude of effects found in this trial were equal to or better than those in other studies conducted in recreation and community settings in the United States that reported on behavioral outcomes. Dietrich's community-wide skin cancer prevention program led to a similar magnitude of improvement in sun protection and sunscreen use.[17] Mayer and associates' SUNWISE intervention in aquatics lessons led to improvements in reported use of hats but not in parents' reports of sunscreen use.[18] Most of the other reported studies of children's sun-protection interventions in the United States have been conducted in classroom settings and have used nonrandomized designs or reported principally on changes in knowledge about sun protection.[4]

We expected to find greater program impact at sites that implemented the education/environment intervention than at those that implemented the education intervention alone. We hypothesized that the addition of environmental supports and policy consultation would reduce barriers and make it easier to increase sun safety habits. The sites that implemented the education/environment intervention showed slightly greater improvement in sun-protection programs and policies but did not produce greater behavioral change. Both theoretical and practical explanations may account for the lack of additional effect of the environmental supports and policies. The educational intervention was clearly formulated, easily implemented, and interactive; these qualities may have led to its success even without added environmental components. Staff and managers may not have had time to absorb, accommodate, or put into effect more than a limited amount of special activities for skin cancer prevention. In addition, it might take several seasons for environmental and policy strategies to achieve larger effects.

Thus, the hypothesis that an intervention consisting of education plus environmental changes would lead to better outcomes than an education-only intervention does not necessarily hold true in a busy child-recreation program. Future research using a factorial design might help sort out the relative effects of individual-oriented and environmentally focused intervention strategies.

The trial had some important constraints, principally reliance on self-reports of behavior to measure the primary outcomes; baseline differences in groups; and survey nonresponse, especially at follow-up. Special efforts were made to assess the likely effects of these limitations and to control statistically for them. It was impractical to complete physical assessments of the children's ultraviolet radiation exposure at outdoor recreation sites, and such measures are not well developed for nonwhite persons. The findings might not be generalizable to nontropical settings or areas with predominantly white children, although the public health message for SunSmart's multiethnic audience emphasized that all children should try to reduce their skin cancer risk. Data collection procedures were limited by the lack of definitive lists of children, parents, and staff and the need to rely on young children to collect data from their parents. Also, although outdoor activity occurs year-round in Hawaii, our intervention was limited to the outdoor recreation program summer season.

Take-Home Points

- **It is believed that most cases of skin cancer can be prevented by limiting sun exposure during childhood.**
- **We evaluated the impact of educational and environmental interventions on sun protection in children 6 to 8 years of age at 14 outdoor recreation sites in Hawaii, which were randomized into three arms.**
- **Compared with control sites, parents of children who attended the intervention sites reported that their children improved their sun-protection habits.**
- **The improvements were modest and were only partly maintained at 3 months of follow-up.**
- **A low-cost, easily adopted program significantly increased skin cancer prevention policies and programs in outdoor recreation sites.**
- **Providing educational programs at outdoor recreation settings may be an effective approach to reducing childhood sun exposure and skin cancer risk.**

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Correspondence

Karen Glanz, PhD, MPH, Cancer Research Center of Hawaii, University of Hawaii, 1236 Lauhala Street, Honolulu, HI 96813; telephone: 808-586-3076; fax: 808-586-3077; e-mail: kglanz@hawaii.edu. Samples of educational materials are available from Dr. Glanz on request.

Appendix: Site Sun-Protection Policies

To determine the sun-protection policies of the outdoor recreation sites, the survey of parents included the following yes/no questions:

1. Have you ever received information on sun protection from your child's Summer Fun program?

Does your child's Summer Fun program . . .

2. Make an effort to schedule outdoor playtime so that sun exposure is reduced?
3. Encourage children to play in the shade?
4. Advise parents to apply sunscreen before the child arrives at Summer Fun each morning?
5. Recommend that you include sunscreen in your child's carry-along bag or backpack?
6. Require use of a hat or other protective clothing for outdoor activities or field trips?
7. Use permission slips for children to be able to use sunscreen at the program site?

A summary index was created by scoring each "no" response as a 0 and each "yes" response as a 1. Thus, the highest possible site sun-protection policies score was 7.