Melanoma Prevention
Evaluation of a Health Education Campaign for Primary Schools

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Objective: To evaluate the effectiveness of an educational campaign aimed toward limiting children’s sun exposure.

Design: Prospective, multicenter trial with before-after comparison. A school-based campaign was presented as a game during a 4-week period (May 25 to June 1992) with primary school teachers as game hosts. Children were interviewed with a standardized questionnaire in September before (1991) and after (1992) the campaign. Comparisons between the children’s answers before and after the campaign were made using paired χ² tests and analysis of variance.

Setting: Five French primary schools.

Subjects: All children in their fourth year of primary school (228 children aged 9 years).

Main Outcome Measures: Changes after the campaign in children’s answers concerning their knowledge, attitude, and behavior toward the sun during summer holidays.

Results: Compared with the precampaign answers, more children after the campaign claimed to protect themselves from the sun with a hat (33.7% vs 23.8%; P = .01) or sunscreen (34.8% vs 25.4%; P = .03), avoided going outside during the sunniest hours (76.8% vs 66.0%; P = .02), reapplied sunscreens (22.1% vs 10.6%; P < .001), considered that a T-shirt and shade provided better protection than sunscreen (82.7% vs 74.8%; P = .05), considered sunlight as a risk factor for skin cancer (74.9% vs 50.7%; P < .001), and spent significantly less time in the sun with their arms (P = .005), trunk, legs, and head uncovered (P < .001). Children with a fair complexion, who were the target of this campaign, showed the best improvement in their responses.

Conclusion: Health education campaigns can be effective in terms of improving the knowledge, attitude, and behavior of young children.

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The incidence of melanoma is increasing dramatically by 5% to 7% yearly in terms of incidence in the white populations of the industrialized countries. Melanoma is now the second leading cause of cancer death in white men 15 to 35 years old in the United States. There is strong evidence that melanoma is linked to excessive sun exposure. Melanoma has been shown to be related to sunburn during childhood, a tendency to burn rather than tan, increased sun exposure, proximity to the equator, and holidays spent in a hot climate. This has lead to the hypothesis that melanoma could be prevented by intensive education of the general population about the deleterious effects of excessive sun exposure. Children and adolescents are probably important targets for educational programs for the following 4 reasons: early exposure to the sun has been shown to have a crucial impact on skin cancer incidence; children are probably more receptive than adults to prevention messages; sun habits acquired in childhood probably modify future behavior; and parents may be influenced through their children. Therefore, we developed an educational program for young children aged 8 to 10 years. Our aim was to assess the effectiveness of such a program on children’s knowledge, attitude, and behavior toward the sun.

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SUBJECTS AND METHODS

This study involved 228 children from 5 primary schools in the following areas of France: Paris, a suburb of Paris; Tours (located in the center of France); and Marseille (located in the south of France near the Mediterranean Sea). In these schools, all children in their fourth year of primary school were included in the study.

STUDY DESIGN

A prospective multicenter trial was conducted to compare the knowledge, behavior, and attitude toward the sun during the summer vacations before and after an educational school program. Summer holidays were used as a test period, since most of the sun exposure in France is received during this period.11 In September 1991, all children were interviewed separately at school with a structured standardized questionnaire. Nine months later, in June 1992, before the summer holidays, they received the educational program at their schools. Then, 3 months later, in September 1992, the same children were given the same standardized questionnaire. The educational program was presented as a game during a 4-week period. Dermatologists and health communication experts collaborated to develop the educational package. The main objective was to make children aware of the dangers of sun exposure. The elementary school teachers were the game hosts. The educational material consisted of a package given to each child and a teacher booklet with the solutions. Four themes were developed and summarized by the following slogans: le soleil chez lui, le soleil chez nous (sun in his country and sun in our country); a chacun son soleil (to each his/her sun); soleil adore, soleil à danger (dear sun and dangerous sun); and mon soleil à moi (my own sun). These themes were chosen to improve children’s knowledge of their skin and to teach them about the dangers and benefits of the sun. One of the 4 themes was studied every week, and children had to prepare a journal, a slapstick, or a poster or to play an interactive game with a top-secret file.

QUESTIONNAIRE

The same person interviewed children both years. The interviews conducted with the standardized questionnaire consisted of questions regarding the children’s color of eyes and hair; skin type (defined according to the Fitzpatrick classification13); ability to tan; knowledge about the sun, protective measures, and the risk for skin cancer; and attitude toward the sun, and how they behaved during the previous summer holidays in terms of sun exposure. Furthermore, to quantify the amount of sun exposure, children were asked about all their outdoor activities during the previous summer holidays (July and August) and whether their arms, trunk, and legs were uncovered. For each outdoor activity, the total number of hours during which their arms, trunk, and/or legs were uncovered and that a hat or sunscreen were used was recorded. Finally, they were asked about their interest in the campaign.

STATISTICAL ANALYSIS

The children’s answers before and after the campaign were compared. Paired analyses were conducted to take into account the evolution of the responses of each child. For that purpose, the answers to questions about knowledge, attitude, and behavior during both summers were grouped as follows: incorrect both years, correct both years, progression (incorrect to correct), and regression (correct to incorrect). Paired \( \chi^2 \) test was performed. To evaluate the impact of the campaign according to skin type, sex, and region, 2 scores were attributed to each child. These scores consisted of proportions of correct answers in 1991 and 1992. Data are presented as means (±SD). The 1991 and 1992 mean scores; the mean duration of 1991 and 1992 outdoor activities with arms, trunk, and/or legs uncovered; and the mean duration with hat and sunscreen use were tested using 2-way analysis of variance for model with repeated measures testing for time (measure of repetition), skin type, sex, and region (BMDP software [BMDP Statistical Software Inc, Los Angeles, Calif], analysis of variance and covariance with repeated measures [ANOVA 2V]). If an interaction between time and another factor (sex, region, or skin type) was observed, a complementary analysis was performed for each level of the covariate. The same analysis was then performed considering only the waterside activities.

second questionnaire in 1992. Their mean age in 1991 was 9.2 years (±0.6 years). The male to female sex ratio was 0.98. According to the Fitzpatrick classification, 84 (41.4%) children had a fair complexion (I and II), 71 (35.0%) had an intermediate complexion (III), and 48 (23.6%) had a dark complexion (IV-VI).

We observed mostly improvement in the responses to questions regarding their behavior and attitude toward the sun (Table 1). The children wore a hat and used sunscreen more frequently in the postcampaign period (1992) but did not wear a T-shirt more frequently. In addition, after the campaign, they used more protective sunscreens and renewed the applications more often. A significantly greater proportion of children avoided going outside during the sunniest hours, and erythema and/or desquamation developed in fewer children; only 1 child in 1992 reported severe sunburns (erythema and blisters) compared with 4 children in 1991. A similar proportion of children sunbathed both years, but they reported that both parents significantly reduced their sunbaths. Nevertheless, in 1992 most mothers (57.4%) still sunbathed. Considering the 7 major questions related to sun behavior, 136 children (76.6%) improved at least 1 sun-related behavior. Of these, 52 (25.6%) improved only 1 sun-related behavior; 55 (27.1%), 2 behaviors; and 49 (24.1%), 3 or more. After the campaign, a significantly greater proportion of children declared that all sunscreens did not provide equivalent sun protection and thought that the protection of shade or a T-shirt was more effective than the protection of sunscreen (Table 2). Furthermore, they more frequently said that they had a reason to avoid the sun and that the sunlight could cause skin cancer and skin aging.
The mean score was significantly higher in 1992, representing an improvement in responses (Table 3). The progression was significantly more pronounced among the children from Tours (data not shown). The improvement of the score was limited to children with fair and intermediate complexions who were the target of the campaign (Table 3).

The mean duration of outdoor activities was similar both years (Table 4). In 1992, the children significantly reduced the time spent outdoors with arms, trunk, and/or legs uncovered and wore a hat and/or used sunscreen more frequently. This decrease in sun exposure of the trunk was only observed among children with fair or intermediate complexions, and was more pronounced in children from Tours and Paris than in those from Marseille (data not shown). Considering the waterside activities, similar results were observed (data not shown). In fact, during these activities, girls more frequently wore a hat the second year (24 ± 41 hours vs 41 ± 53 hours; P = .02), whereas boys did not change their habits (28 ± 42 hours vs 27 ± 46 hours).

Most children found the study pleasant (89.2%) and useful (83.3%). Half of the children (52.2%), however, said they had modified their behavior toward the sun after the campaign.

Many health-education campaigns have been developed during the last 10 years to educate the public about the association between sun exposure and skin cancer, most of which have been geared toward adolescents and adults. Few studies have assessed the effect of such an educational program on very young children.

The comparison of young children’s answers before and after a campaign with educational material relating to sun exposure showed an impact on their knowledge and on their responses about their attitude and behavior toward the sun. The impact of this campaign was evaluated based on modification of clothing protection, use of sunscreen, attitude toward the sun, and knowledge about skin cancer. Responses concerning clothing protection showed that this message was not perfectly integrated. Whereas during outside activities children covered their arms, trunk, and legs and wore a hat more frequently after the campaign, no improvement was observed for the answers to the question about wearing a T-shirt.

The educational program was to be used again, the message about the importance of clothing would need to be reinforced.
Table 3. Changes of the Scores Before and After Campaign According to Sex and Skin Type

| Skin Type† | 1991 | 1992 | Mean Difference, % of Initial Value | P  
|---|---|---|---|---
| Total | 49.5 ± 13.5 | 60.7 ± 14.1 | 22.7 | <.001
| Sex | | | |  
| Boys | 48.5 ± 12.8 | 61.3 ± 15.5 | 26.4 | .001
| Girls | 50.4 ± 14.0 | 60.1 ± 13.2 | 19.2 | .20
| Skin type† | | | |  
| Clear (I, II) | 49.2 ± 14.3 | 65.7 ± 13.9 | 33.5 | .015
| Intermediate (III) | 48.7 ± 12.1 | 60.2 ± 12.2 | 23.6 | .015
| Dark (IV, V, VI) | 51.1 ± 13.9 | 52.8 ± 14.4 | 3.0 | .15

* For each child, the number of correct answers was reported to the total number of answers (score). The individual difference of score was compared with 0; P is the value of the paired analysis of variance.  
† A significant interaction between skin type and year was observed (P < .001); the improvement of the score was limited to children with fair and intermediate complexions.

Table 4. Comparison of the Children’s Precampaign and Postcampaign Behavior During Outdoor Activities

| No. of Hours, Mean ± SD | 1991 | 1992 | Mean Difference, % of Initial Value | P  
|---|---|---|---|---
| Total | 189 ± 78 | 187 ± 79 | −2 | .60
| With uncovered arms | 181 ± 6 | 165 ± 6 | −10 | <.01
| With uncovered trunk | 91 ± 72 | 62 ± 71 | −32 | .009
| skin type† | | | |  
| Clear | −38 | | | .95
| Intermediate | −38 | | | .95
| Dark | −5 | | | .95
| With uncovered legs | 167 ± 80 | 133 ± 92 | −32 | <.001
| With a hat | 78 ± 77 | 112 ± 90 | +4 | <.001
| With sunscreen | 68 ± 70 | 100 ± 85 | +40 | <.001

* The individual difference in hours of exposure was compared with 0; P is the value of the paired analysis of variance.  
† A significant interaction with skin type was observed; P = .06 is the value of this interaction.

All of the responses concerning sunscreen use were significantly improved. Since sunscreens reduce erythema and pain, a potential side effect of using sunscreen could be an increase in sun exposure; however, the mean number of hours spent outside for activities was similar both years.

To the question about the most effective protection, only 17.2% of children answered “sunscreen” the second year vs only 25.1% the first year, suggesting that even before this campaign, the awareness about sun-protective measures was good.

Most children said they avoided going out during the hottest hours of the day before and after the campaign. The number of children who said they experienced erythema and/or desquamation significantly decreased after the campaign. Since avoidance of sunburn is one of the most important aspects in the prevention of melanoma, this result indicates campaign effectiveness.

Although the number of children who suntanned was similar both years, children reported that their parents significantly reduced their exposure for tanning. Thus, such a campaign devoted to children may induce modifications of parents’ behaviors toward the sun. Children may have induced a change in their parents’ behaviors. However, we cannot discard the possibility that parents who were informed of the objective of the campaign were made aware by the campaign itself. Furthermore, information through television or newspapers may also have interfered with our results.

Although the level of children’s knowledge concerning skin cancer was high before the campaign, further improvement in their knowledge was observed after the campaign (50.7% vs 74.9%). Their knowledge about skin aging, although poor, also improved after the campaign. Since the risk for melanoma linked to sun exposure is higher for children with fair complexions, the significantly higher improvement of mean scores observed among these children is an important point of this campaign.

The efficacy of a campaign probably depends on the resources that are brought to bear; eg, a 4-week training course is more effective than a single 30-minute lecture. In the United States, several school campaigns have achieved success in raising the level of knowledge and changing attitudes but have had little effect on behavior. The relatively high impact of our campaign on children’s behavior (as described by themselves) can be explained by the long duration of our educational program.

The different geographic sites of the study were chosen to include a wide range of regional factors and to allow evaluation of the impact of the campaign on children living in different climates. Nevertheless, these children are not representative of the French population, since the participating schools were not selected randomly and were located in communities at rather higher socioeconomic levels.

As with all studies evaluating items before and after a campaign, there is some doubt whether the modifications observed were an effect of the campaign itself. The absence of a control group does not allow us to rule out the Hawthorne effect, ie, children may perform better because they are excited about taking part in an innovative evaluation study. In fact, the administration of the first questionnaire heightening children’s awareness of sun and aging could modify the answers of the second year. However, it must be emphasized that no information about the “good” answers was given to the children after the first questionnaire. The changes observed also might have been induced by factors not related to our campaign, such as advertising campaigns about sunscreens seen on television or in newspapers.

The paired analysis comparing the evolution of the children’s responses minimized the effect of a potential random improvement. Children were interviewed the same month both years; thus recollection of their behavior during the preceding summer was probably similar both years. Since most children (89.0%) answered both questionnaires, those unavailable for follow-up probably did not introduce any bias.

Ultimately, the value of such a program will depend on whether children say about their behavior corresponds to their actual behavior and on whether...
the behavior modifications are sustained. Objective evaluation of primary melanoma prevention campaigns is difficult. Campaigns aimed at primary melanoma prevention are hindered by the actual impact on behavior, the durability of changes, and the difficulty of measuring long-term effects.25

Our pilot study showed that this educational program could improve knowledge, attitude, and behavior of children. However, this teaching package has to be improved and reevaluated in a randomized study with a long follow-up before it is proposed at a national scale.

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