Sun Protection of Children at the Beach

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Background: **We wanted to determine the frequency with which sun protection measures are used by children at the beach.**

Methods: **A cross-sectional study was undertaken that combined a brief, structured interview with direct observation of the sun protection methods (sunscreen, clothing, hats, shade) used for children at a public beach in Florida.**

Results: **Of the 139 children observed, 97 (69.8%) had some form of sun protection used on all three body regions (head, torso, legs), while only 8 (5.8%) had none of the three body regions protected. Sunscreen was the most common method of sun protection (84.9%), and other methods were less frequently used (shirt 11.5%, pants 26.6%, hat 8.6%, shade 14.4%). Sun protection use differed by sex, with girls having better protection of their head and torso, and boys slightly better protection of their legs.**

Conclusions: **Using direct observation, we found that parents frequently use sun protection measures (mainly sunscreen) for their children while at the beach. Parents primarily rely on the use of sunscreen, rather than such measures as avoiding the sun, using shade, or protective clothing. (J Am Board Fam Pract 2002;15:112–7.)**

Skin cancer is becoming a major public health problem. In the year 2000 there were approximately 47,700 new cases of melanoma, with 7,700 deaths.[1] The lifetime risk of acquiring melanoma is now estimated to be about 1 in 87.[2] The number of nonmelanoma skin cancers that occur each year is in excess of 1 million.[3,4]

Excessive sun exposure during childhood is a major factor associated with subsequent development of skin cancers.[5,6] The US Preventive Services Task Force has concluded that "avoiding sun exposure or using protective clothing is likely to decrease the risk of malignant melanoma and nonmelanoma skin cancers."[7] Stern and colleagues[8] have calculated that routine sunscreen use by children could reduce subsequent skin cancer development by 78%. Thus an important strategy to prevent skin cancer involves sun protection during childhood to avoid excess sun exposure by wearing protective clothing when outdoors and using appropriate sunscreen.

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The frequency with which children use sun protection measures is uncertain. Almost all studies that have assessed sun protection for children have relied solely on the self-report of the parent.[9–17] This approach is vulnerable to bias, as persons typically overreport their preventive activities, including the use of sun protection measures.[18] We could find only three studies that supplemented self-report with direct observation.[19–21] Two of these studies were conducted in northern climates, which might not be representative of other parts of the country.

Because of these limitations, it is still not entirely clear how frequently or what type of sun protection methods are used for children. We conducted a pilot study of direct observation and parent interview in Florida, a state with a very high incidence of skin cancer.[22] We sought to ascertain the frequency with which parents use sun protection for their children while at the beach.

Methods

Study Population, Setting, and Measurements

Observations and interviews were performed at a public beach in Clearwater, Florida. To allow for consistency, one representative segment of the beach was defined using visible and stable landmarks (a pier, for example). All persons within this section were systematically approached for inter-

view. Adults or caregivers of children 16 years old or younger were eligible for the study. The nature of the study was explained and consent to participate was requested. If there were more than 1 child in the party, only the youngest child was included in the sample.

Research assistants conducted a brief, structured interview that determined the child's age, sex, place of residence, length of time at the beach, and sun protection methods used for the their child. Research assistants also determined the child's Fitzpatrick skin type (I through VI) and confirmed by direct observation the methods of sun protection used.

Sun protection methods were defined using criteria similar to those described by Olson et al.[20] We examined three methods of sun protection: the use of shade, coverage of the skin by clothing or a hat, and the use of sunscreen. Coverage of a body region with clothing was defined as follows: wearing a hat with at least 2 inches of forward brim; wearing a shirt covering the torso, shoulder, and at least 50% of the upper arm; and wearing either pants, a long shirt, or skirt to just above the knee or lower. Caretakers were asked whether they had used sunscreen for their child, and if so, for what body regions (face, chest and back, arms, legs). They were also asked whether the sunscreen had been reapplied since their arrival at the beach. Research assistants also asked to examine the sunscreen applied and recorded its sun protection factor (SPF) and whether the product was waterproof.

All observations were made on 3 separate days between 12 noon and 4:00 PM during late July and early August of 1999. During observation periods, the temperature (degrees Farenheit) was in the high 80s to low 90s and was consistently sunny, with only rare clouds and no precipitation. Of 151 persons approached, 139 (92%) agreed to participate.

Analysis

Sun protection by specific body region and method of protection were determined. We examined whether sun protection of body regions was correlated using the Pearson correlation coefficient. We also examined associations between participant characteristics and methods of sun protection using the χ^2 test, or *t* test, as appropriate. We examined sun protection by any method (shade, clothing, or sunscreen) for three body regions: head, torso, and legs. We also defined complete sun protection as each of the three body regions being protected by any of the three methods. Sun protection methods were also examined separately for male and female children. We examined bivariate predictors of complete sun protection using the χ^2 test and *t* test, and multivariate predictors using multiple logistic regression. The University of South Florida Institutional Review Board approved this study.

Table 1. Characteristics of Children and Sun Protection Methods.

Characteristics	Number	Percent
Sex (n = 137)		
Male	64	46.7
Female	73	53.3
Fitzpatrick skin type (n = 137)		
I	5	3.7
II	9	6.6
III	55	40.2
IV	52	38.0
V	15	11.0
VI	1	0.7
Length of time at beach (n = 139)		
<15 minutes	23	16.6
15–60 minutes	49	35.3
1–2 hours	45	32.4
>2 hours	22	15.8
Use of sunscreen (n = 139)		
Face	112	80.6
Arms	111	79.9
Back	112	80.6
Legs	91	65.5
Use of clothing or shade (n = 139)		
Shirt	16	11.5
Pants	37	26.6
Hat	12	8.6
Shade	20	14.4
Sun protection by body region by any method (n = 139)		
Head	115	82.7
Torso	119	85.6
Legs	112	80.6
Overall protection level (n = 139)		
None	8	5.8
Partial	34	24.5
Complete	97	69.8

Results

Table 1 displays characteristics of the children observed and their methods of sun protection. The

Table 2. Sun Protection Use According to Sex of Child.

Sun Protection Method	Male (n = 64) No. (%)	Female (n = 73) No. (%)	*P* Value
Sunscreen			
Face	46 (79.1)	64 (87.7)	.02
Arms	46 (79.1)	63 (86.3)	.04
Back	46 (79.1)	64 (87.7)	.02
Legs	35 (54.7)	54 (74.0)	.02
Clothing or shade			
Shirt	10 (15.6)	6 (8.2)	.18
Pants	34 (53.1)	1 (1.4)	<.001
Hat	2 (3.1)	10 (13.7)	.03
Shade	9 (14.1)	11 (15.1)	.87
Sun protection by body region (by any method)			
Head	47 (73.4)	66 (90.4)	.01
Torso	50 (78.1)	67 (91.8)	.02
Legs	54 (84.4)	56 (76.7)	.26
Overall protection level			
None	4 (6.3)	4 (5.5)	.44
Partial	19 (29.7)	15 (20.6)	
Complete	41 (64.1)	54 (74.0)	

average age of children observed was 5.5 years (SD 3.5 years), and a preponderance of the children were female. About one half of the children had Fitzpatrick skin types I-III, those most susceptible to sunburn. One half of the sample had been at the beach for less than 1 hour.

Sunscreen was the most common form of sun protection used on children, with 118 of 139 (84.9%) having sunscreen applied to at least one body region. Sun block was applied with similar frequency to the face, arms, and back, but was less likely to have been applied to the legs ($\chi^2 = 72.0$, $P < .001$). The body regions to which sunscreen was applied tended to correlate with one another. Correlations were highest between the back and arms ($r = 0.89$), next highest were face and arms ($r = 0.80$), then face and back ($r = 0.77$). Use of sunscreen on the legs correlated less strongly with the other three body regions (face, $r = 0.52$; back, $r = 0.60$; arms, $r = 0.65$). Protective clothing and shade were used less frequently.

Among participants reporting the use of sunscreen, almost one half (54) reported having reapplied the sunscreen since arriving at the beach. The likelihood of having reapplied sunscreen was not related to the length of time at the beach (Mantel-Haenszel $\chi^2 = 1.4$, $P = .24$). Children having skin types I-III were also no more likely to have sunscreen reapplied than those with types IV-VI (52.8% vs 46.4%, $P = .50$). For 115 children we were able to examine the sunscreen product used. The average SPF was 32.7, with 107 children (95.6%) having used an SPF of at least 15. All the sunscreens examined reported to be waterproof.

Overall, the three body regions specified (head, torso, and legs) were protected by at least one method (sunscreen, clothing, shade) with similar frequencies. Of the 139 children observed, 97 (69.8%) had some form of sun protection used on all three body regions, whereas only 8 (5.8%) had none of the three body regions protected. There were no differences in the average age of children having complete, partial, or no protection (mean age 5.5 years for each group, F value = 0, $P = 1.0$). Sun protection (by any method) of the head and torso were correlated ($r = 0.73$), whereas protection of the legs was less likely to correlate with the other two body regions (head, $r = 0.26$; torso, $r = 0.32$).

Sun protection methods used varied by sex (Table 2). Sunscreen was more frequently used for girls than boys for each body area. Hats were more frequently used for girls, while pants were worn by a substantial number of boys for sun protection of their legs. Overall, girls had greater sun protection of their heads as a result of more frequent use of sunscreen and hats. Girls were more likely to have sun protection of the torso primarily as a result of

Table 3. Predictors of Complete Sun Protection.

Characteristic	No. (%)	*P* Value
Sex		
Male	54/73 (74.0)	.21
Female	41/64 (64.1)	
Fitzpatrick skin type		
I, II	10/14 (71.4)	.66
III	42/55 (76.4)	
IV	34/52 (65.4)	
V, VI	11/16 (68.8)	
Residence		
Tampa Bay area	33/43 (76.7)	.03
Other areas of Florida	9/20 (45.0)	
Southern United States*	5/9 (55.6)	
Other states	39/59 (70.9)	
Outside United States	11/12 (91.7)	
How long at the beach		
<15 minutes	17/23 (73.9)	.97
15 minutes–1 hour	34/49 (69.4)	
1–2 hours	31/45 (68.9)	
>2 hours	15/22 (68.2)	

Note: Defined as all three body regions (head, torso, legs) protected by either shade, clothing, or sunscreen.
*Georgia, Alabama, Louisiana, Texas, South Carolina, North Carolina.

more frequent sunscreen use. Sun protection of the legs was similar for boys and girls, but was achieved in different manners. For girls protection was almost entirely the result of sunscreen, whereas for boys protection was also frequently attained by using pants. Overall sun protection levels were similar for boys and girls.

Table 3 summarizes characteristics that predicted complete sun protection, defined as each of the three body regions (head, torso, legs) protected by at least one sun protection method (sunscreen, clothing, shade). Complete sun protection was unrelated to the child's sex, skin type, or length of time at the beach and, as mentioned earlier, was unrelated to the child's age. The likelihood of complete sun protection varied by the child's place of residence, with non-US residents being more likely to have complete protection, and residents of Florida outside the Tampa Bay area being least likely to have full protection.

In multivariate analysis that considered the child's age, sex, skin type, length of time at the beach, and place of residence, only one variable was associated with complete sun protection. Residents of the immediate Tampa Bay area had four times greater odds of sun protection compared with all other children (odds ratio = 4.00, 95% confidence interval 1.2–13.9, $P = .03$). No other variable was statistically associated with sun protection.

Discussion

We found that parents frequently use some measure of sun protection for their children while at the beach. Of the children studied, 70% had all three body regions (head, torso, legs) protected by at least one sun protection method (shade, clothing, or sunscreen). Sunscreen was the most commonly used method of sun protection, whereas hats, shirts, and shade were much less frequently used.

Our rates of sun protection were higher than those found in similar studies conducted at the beach. Olson and colleagues[20] reported that only 54% of children at New Hampshire beaches observed in 1995 had all three body regions protected, compared with 70% in our study. Whereas our study found that 85% of children had used sunscreen, Maducdoc et al[19] reported 51% of children at a Galveston, Texas, beach in 1991 had used sunscreen, and Robinson and Rademaker[21] reported 76% of children at a Chicago, Illinois, beach in 1996 had used sunscreen. These studies, however, did not report whether children not using sunscreen had instead used some other method of sun protection, such as hats, clothing, or shade.

There are several reasons why rates of sun protection might be higher in Florida. The sun is more intense in Florida and therefore more likely to induce sunburn in unprotected skin. One would therefore expect more frequent use of sun protection, because preventing sunburn is the major motivation reported by parents.[19,23,24] It is also possible that parents receive more education about the importance of sun protection in states like Florida.

As in most other studies, we found that sunscreen is the most common method of protecting children.[10,12,16,17,20,25] Sunscreen is also the sun protection method that physicians most often discuss with parents.[26–29] Although our study population frequently used sunscreen with an adequate SPF (including waterproof), there are several problems with sunscreen as a sun protection strategy. Sunscreen allows children to be exposed to longer durations of ultraviolet radiation without experiencing burn and might paradoxically increase their overall risk of skin cancer.

Studies by Autier and colleagues,[30,31] for example, have found that the use of sunscreen by children was associated with overall greater sun exposure and the subsequent development of a greater number of nevi. Wearing protective clothing, on the other hand, was associated with a reduced number of nevi. Numbers of nevi in children are good indicators of past sun exposure and subsequent melanoma risk.[32,33] The US Preventive Services Task Force recommends, "avoidance of sun exposure, especially between the hours of 10:00 AM and 3:00 PM, and the use of protective clothing such as shirts and hats," but states "there is insufficient evidence to recommend for or against counseling patients to use sunscreens to prevent skin cancer."[7] Physicians and health education campaigns might need to stress other forms of sun protection (such as sun avoidance, hats, protective clothing, shade) rather than emphasize sunscreen.

The anatomic site that melanomas develop varies by sex. Men are much more likely to develop a melanoma on the trunk, while the most common site for women is the legs.[34–42] We found that boys were less likely to use sunscreen to the back and had lower levels of sun protection of their torsos than did girls. For girls, their legs were the body site least likely to be protected, and their overall level of protection of their legs (sunscreen or pants) was, although not statistically significant, lower than for boys. Sun protection habits in childhood might contribute to the distribution of melanomas in adults.

This study has several limitations. First, as a pilot study the sample size was necessarily small, and the amount of information obtained from parents and caretakers purposefully limited. We also did not ascertain the actual amounts of sunscreen applied (which are usually underused). We studied only one Florida beach at one time of the year. Extrapolating sun protection use at the beach could overestimate its use in other settings. In one study, for example, parents were much more likely to report using sunscreen while at the beach than in other outdoor settings.[15] Sun protection use will also probably differ in other seasons and other states.

Using direct observation, we found that parents frequently use sun protection measures for their children while at the beach. Sunscreen was the most commonly used method of sun protection, with other measures (hats, shirts, shade) much less frequently used. Sun protection methods varied by sex and often paralleled known sex-related differences in melanoma development. These findings raise the question of whether there has been too much emphasis placed on the use of sunscreen rather than measures that would better protect children's skin from damage, such as avoiding the sun, using shade, or wearing protective clothing.

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