



Published in final edited form as:

Pediatr Dermatol. 2010 ; 27(2): 182–188. doi:10.1111/j.1525-1470.2009.00940.x.

Assessment of Elementary School Students' Sun Protection Behaviors

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Abstract

Introduction—Emerging studies suggest that excessive sun exposure in childhood contributes to the development of skin cancer later in life. Children rarely wear a wide-brimmed hat when outside although these hats offer the best protection to the areas on the face where children are most likely to be sunburned. The current study explores 4th grade student assessment of their sun protection behaviors outside at school and at times other than when they are at school.

Method—This study utilized baseline data collected in the Fall of 2006 for the Sun Protection for Florida's Children (SPF) project. In brief, the SPF project is a group randomized trial to test the effectiveness of a school based intervention promoting sun protection in general, and hat use in particular. The project targets all 4th grade students in Hillsborough County Schools, FL. The data reported in this study were collected at baseline before any intervention activities was initiated. Approximately 2,086 4th grade students completed self-report surveys evaluating sun protection behaviors. Trained research assistants carried out 99 direct observations of physical education classes over a five week period during Fall 2006 in Tampa, Florida.

Results—In general, the self-reported use of various methods of sun protection was low. Approximately one third of students reported that they wore sunscreen (32.8%) or sunglasses (32.3%) before leaving home for school. Only a small percentage of students wore long sleeves (15.0%) or a hat with a brim (16.4%) before leaving for school. In addition, few students wore a hat with a wide brim when outside but not at school (16.4%). Students spent an average of 59.1 minutes per week outdoors while attending school and 35.5 minutes during peak sun exposure. In general, female students and Hispanic, African American, and students of other racial and ethnic groups were more likely to practice sun protection behaviors at school than white or male students. Students who attended schools with a mandatory uniform policy were less likely to wear hats with brims.

Discussion—A single sunburn heightens a child's risk of developing skin cancer later on in life. Sun exposure at school poses a significant risk to student health and more needs to be done to promote the use of a wide-brimmed hat and limiting student sun exposure. A wide brimmed hat shows the most promise in helping students to protect the face at neck areas where sunburns are most likely to develop. More needs to be done to promote hat use and limiting sun exposure while children are at school.

INTRODUCTION

Excessive sun-exposure in childhood has been found to be strongly related to the development of skin cancer later in life. [1, 2] It has been reported that as few as one or two sunburn(s) heightens a child's risk of developing basal cell carcinoma [3, 4]. Excessive sun exposure may also contribute to the development of nevi, one of the early indicators of melanoma. Previous studies have concluded that childhood may be the best time to intervene to prevent children from developing the most dangerous forms of skin cancers [3, 5–8]. These studies point to a number of ways that children can be protected from the harmful effects of ultraviolet (UV) radiation. Protective measures include use of sunscreen, wearing protective clothing (hats, long sleeves, sun glasses), staying in the shade, and limiting outdoor activities during peak UV exposure times.

The wide-brimmed hat is least frequently promoted as a sun protection method although the areas of the head, neck and face that it protects is the site where melanocytic nevi and basal cell cancers most often appear [9–11]. Other preventive benefits of wearing a wide-brimmed hat include minimizing sun damage to the scalp, eye damage such as cataracts and melanoma of the uveal tract [12]. Although there is limited research on hat use as a sun protection method, the available literature suggest that wearing a wide-brimmed hat offers the best protection for areas where children are most at risk of developing nevi and ultimately skin cancer.

Schools are an important setting to study sun protection behaviors for several reasons. First, children may receive significant sun exposure during outdoor activities while at school. Sun exposure at school, therefore, may represent an important public health problem for children. In addition, schools are of interest as a potential vehicle for health communication about sun protection.[13, 14] There is much that is unknown regarding sun exposure in school settings however. It is uncertain, for example, what steps children and schools take to limit sun exposure. Few studies have described children's use of sunscreen, hats, and protective clothing or the predictors of such behavior in typical school environments. The extent to which schools limit sun exposure by providing shade and limiting outdoor activities during times of peak UV exposure is also unknown. The present study attempts to build on efforts to promote the use of sun protection among elementary school children. We seek to better understand the sun protection behaviors that 4th grade students utilized when they are outside at school and at times other than when they are at school. In addition, the present study evaluated the ambient conditions that students were exposed to while attending school.

METHOD

The study was conducted at 22 public elementary schools in Hillsborough County Florida, and included direct observation and survey data collection. Our team utilized baseline data collected in the Fall of 2006 for the Sun Protection for Florida's Children (SPF) project. In brief, the SPF project is a group randomized trial testing the effectiveness of a school based intervention promoting sun protection in general, and hat use in particular. The project targets all 4th grade students of 22 participating schools. The data reported in this study was collected at baseline before any intervention activities were initiated.

Participating schools were chosen from Hillsborough County Florida, which includes Tampa and its surrounding suburbs, as well as largely rural areas in the southern and eastern areas of the county. To insure that schools selected for the project were representative of Hillsborough County, all K-5 schools in the Hillsborough County Public School System were enumerated and placed in random order using a random number generated by SAS

(SAS Version 9.1, SAS Institute, Cary, NC). Twenty two schools were then recruited for the study using this random ordered list. The number of schools was based on sample size requirements for the SPF project.

Principals, teachers, and physical education instructors were interviewed to ascertain times and activities during which 4th grade students were outdoors and school policies regarding sun exposure. Research assistants directly observed outdoor sessions and recorded their characteristics: time of day, duration of session (in minutes), ambient temperature, precipitation, cloud cover, and physical shading. Temperature, wind speed, and cloud cover at the time of outdoor sessions was assessed using data from the National Weather Service website which is updated hourly (<http://weather.noaa.gov/weather/current/KTPA.html>). Cloud cover was categorized using the National Weather Service categories clear/mostly sunny, partly cloudy, mostly cloudy. The degree of physical shade covering the activity area was assessed as full sun, partly shaded (<50% shading), mostly shaded (≥50 shaded), or fully shaded. We further designated outdoor activities as occurring during peak UV exposure if they occurred between the hours 10:00 AM to 2:00 PM.

Hat use during outdoor sessions was assessed by direct observation. Prior to actual measurement, all research assistants underwent standardized training in direct observation. Research assistants first underwent a training session in which wide-brimmed hats were defined and differentiated from other hats and other forms of head coverings. Each research assistant was then trained in a standardized method of assessing the number of students observed in an outdoor school setting and the number observed wearing wide-brimmed hats. Research assistants used a hand-held clicker to facilitate counting. To insure reliability of measurement, four research assistants conducted measurements simultaneously with the project director. There was perfect agreement between measures taken by the project director and each of the four research assistants in regard to observed hat use. During three subsequent sessions, the correlation coefficient between hat measures taken by the project director and research assistants was 0.99 which can be considered highly reliable.

We used self-administered surveys to capture sun protective behaviors that were not directly observable (wearing sunscreen for example). The Child's Sun Protection Behavior Survey was a 13 item self-administered instrument designed to assess the frequency with which children employ various sun protection methods at school and at home. The questions asked about use of long sleeve shirts, hats, sunscreen, and sun glasses and clarified the type of hat worn (wide-brimmed versus other types) if hat use was reported.

We undertook a series of steps to validate children's self-report of sun protection behaviors examining self-reported use of hats while outside of school as a representative behavior. First, the instrument was pre-tested with fourth grade students to verify that questions were clear and the concepts understood. Second, we pilot tested the instrument on a group of 137 4th grade students from three separate schools. We simultaneously administered the survey instrument to students and a similar instrument to parents asking them to assess their child's use of hats with a similarly worded question. We received responses from 114 parents. For 27 students and their parents, we repeated the measurements one week later to assess test, re-test consistency of their responses.

Finally, we provided students with hats that contained a pedometer placed within a zippered pocket. As students walked or played while wearing the hat, the pedometer recorded the cumulative number of steps taken. Thus the pedometer reading of steps provided a proxy measure for the length of time each child wore their hat. Students were provided a pedometer-affixed hat to be worn during one designated weekend. The following Monday the pedometer reading of steps was recorded for each child and was compared to their self-

reported measure of hat use. There were 86 children for whom pedometer readings were available. Pedometer readings were not normally distributed so the natural log was taken yielding a normal distribution.

For 102 children, we had simultaneous measures available of children's use of hats outside of school by their own self-report and by the report of their parents, and for 79 students we had simultaneous pedometer measures from their hats. Children's self-reported hat use correlated with their parent's report of their hat use (Spearman Correlation=0.57, $P<0.0001$) and with pedometer measures of steps obtained from their hats (Spearman Correlation = 0.27, $P=0.01$). Measures of self-reported hat use taken one week apart were also correlated for both students (Spearman Correlation=0.42, $P=0.03$) and parents (Spearman Correlation=0.59, $P=0.04$).

This study was approved by the University of South Florida Institutional Review Board and by the Hillsborough County School System. Informed consent was obtained from parents/guardians and participating children provided written assent.

STATISTICAL ANALYSIS

Frequencies and means were calculated to provide descriptive information on 4th grade participants, participants' self-reported sun protection behaviors, and observation data regarding the amount of sun exposure that students received during physical education. Multivariable logistic regression analyses were conducted to determine whether demographic and school characteristics predicted each of self-reported sun protection behaviors at school. Variables related to self-reported sun protection behaviors include wearing long sleeves, a wide-brim hat, sunscreen, and sunglasses. The following variables were included as predictors in these regressions: age (continuous variable), gender (male as referent group), race/ethnicity (white as referent group), location of school (metropolitan area as referent group), type of school (public as referent group), and uniform policy (requiring uniforms as referent group). Predictor variables were selected using a backwards elimination selection algorithm and odds ratios with 95% confidence intervals were reported from the final logistic models.

RESULTS

Amount of Sun Exposure

Interviews with school principals and teachers indicated that the majority of time that the students took part in activity outdoors was during physical education classes. Therefore, all observations were conducted during physical education classes. A total of 99 observations of physical education classes were conducted from September 3, 2006, to October 10, 2006. The amount of time per week that students spent outside in physical education classes ranged from 30 minutes to 90 minutes, with a mean time of 59.1 (standard deviation: 13.8) minutes. The amount of time per week that students spent outside in physical activity that was held during peak sun exposure times ranged from 0 minutes to 90 minutes, with a mean of 35.5 (standard deviation: 32.4) minutes. Data collected during the observation indicated that most physical education classes were held during clear conditions (67.0%) and in full sun (53.5%; Table 2).

Observed Hat Use

Students were observed during physical education classes to determine whether they were wearing hats and what types of hats they were wearing. A total of 1,985 students were observed, and 36 students were observed wearing hats that had either no brim at all or

baseball caps with a brim only in the front (1.8%). No student was observed wearing a wide-brimmed hat during physical education.

Characteristics of Participants

Table 1 summarizes demographic and school characteristics of the study participants. A total of 2,123 students were contacted for this study, and 2,086 participants (98%) agreed to participate. Participants ranged in age from 8 years to 12 years, with a mean age of 9.5 (SD: 0.66) years. Participants were more likely to be white (40.7%), attend a public school (88.2%), attend a school located in a metropolitan area (70.9%), and attend a school that requires school uniforms (64.2%; See Table 2 for more details).

Self-Reported Sun Protection Behaviors

In general, the self-reported use of various methods of sun protection was low. Approximately one third of students reported wearing sunscreen (32.8%) or sunglasses (32.3%) before leaving home for school. Only a small percentage of students reported wearing long sleeves (15.0%) or a hat with a brim (16.4%) before leaving for school. In addition, few students reported wearing a hat with a wide brim when outside but not at school (16.4%; Table 3).

Regression Analyses Predicting Self-Reported School Sun Protection Behaviors

In the multivariable logistic regression analysis, the one variable that was significantly associated with wearing long sleeves to school was racial or ethnic group: When compared to white students, African American students and students of other races/ethnicities were more likely to report wearing long sleeves to school (Table 3).

Two variables, racial or ethnic group and school uniform policy, predicted wearing a hat with a brim to school in multiple logistic regression analysis. The strongest predictor of wearing a hat with a brim to school was school uniform policy. When compared to students who attended schools with a mandatory school uniform policy, students who attended schools with a voluntary school uniform policy were more likely to report wearing hats with brims. In addition, African American students and students of other racial and ethnic backgrounds were more likely to report wearing hats with a brim than white students (Table 3).

Two variables, racial or ethnic group and female gender, predicted self-report of wearing sunscreen to school in multiple logistic regression analysis. Female gender was statistically significant factor on self-reported sunscreen). A weak association was observed between self-reported sunscreen use and Hispanic ethnicity, with Hispanic students being slightly more likely to report wearing sunscreen to school than white students.

In multivariable logistic regression analysis, two variables, racial or ethnic group and female gender, were significant predictors of self-reported wearing of sunglasses to school: Females were more likely to report wearing sunglasses to school than males, and African American and Hispanic students were more likely to report wearing sunglasses to school than white students.

DISCUSSION

Consistent with previous studies, our baseline results suggest that sun protection methods are infrequently utilized among children and when used most often consisted of using sunscreen and sunglasses rather than protective clothing such as a wide-brimmed hat [15–19]. Our analysis also revealed that students frequently participated in outdoor activities

during periods where the risk of exposure to harmful UV rays was at its highest. Whereas gender was found to be the strongest determinant of whether a child used sunscreen and wore sunglasses to school, school uniform policy best predicted the likelihood that a child will wear a brimmed hat to school. Non-white race/ethnicity was the best predictor of wearing long sleeves to school.

The finding that students reported using sunscreen as their primary method of sun protection was hardly a surprise to our team. This finding has been confirmed repeatedly by a number of other studies [15–19]. Sunscreen is heavily marketed to both parents and children and is seen by parents as the best way to prevent their child's skin from getting sunburned. Pediatricians and other physicians actively encourage parents to apply sunscreen to their children before sending them outside [20–22]. More recently, findings suggest that sunscreen may have limited effectiveness in preventing sunburn and could lead to increased exposure due to the feeling that one is protected [23–25]. In most elementary schools in Florida, sunscreen is subjected to the same controls that are placed on medication requiring students to get permission from school officials before bringing it to school. If sunscreen is brought to school, it must be administered by the teacher making it not readily accessible when a child needs it before going outside. What is most likely to occur is that children and parents will apply sunscreen prior to leaving home for school but it will not then be reapplied throughout the day even after children are outside for extended periods of time such as during physical education class.

In other studies, the use of protective clothing such as wearing long sleeves and a wide-brimmed hat were more effective in reducing the development of nevi—the single strongest indicator that one will develop melanoma later on in life [15, 16, 19, 26, 27]. Further, it is hardly conclusive that even if sunscreen is used correctly it will ultimately reduce one's skin cancer risk. This may explain why a number of national and international organizations in the United States, Britain and Australia are beginning to recognize that even amidst high-profile campaigns to promote sunscreen use, the incidence of skin cancer continues to increase [28, 29]. This alarming finding has led these organizations to begin promoting alternatives to sunscreen such as limiting the amount of time spent outside in the sun, seeking shade, and wearing a wide-brimmed hat. Australian public health authorities made a shift away from sunscreen as the primary method of sun protection in 1996 and are now beginning to see the prevalence of skin cancer being reduced in their country [30].

Another aspect of this study was to determine the conditions that students faced when outside at school that may place them at risk for exposure to UV rays. Our team directly observed students when they were outside for physical education and found that students spent roughly 30 to 90 minutes outside each week with the average time being about an hour. Most of these sessions were held during peak sun exposure hours on playgrounds that were either partly shaded (14.1% of school playgrounds) or not shaded at all (53.5% of school playgrounds). After spending about 20 minutes outside in a fully exposed play area, a child's skin will begin to show signs of sunburn [31]. Hillsborough County School students have mandated periods each week where they are required to have physical education class sessions and these sessions are held outside in areas where they are directly exposed to the sun and UV radiation.

In addition there are other opportunities for sun exposure that may not be captured by observing physical education classes but are significant in determining the level of sun exposure risk a child faces at school. First, the budgetary constraints at some schools do not allow them to hire enough physical education staff members to adequately service all students in a school and so regular classroom teachers are asked to take over some of these responsibilities and lead what has been termed “teacher directed physical education.” These

sessions are sporadic making it difficult to observe and thus limits our ability to fully understand the risk of sun exposure that students face at school. The risk of exposure to UV radiation that students face at school may be much greater than we report in this study. Secondly, the architectural design of most Florida schools is open and presents additional opportunities for students to be outside in the sun when traveling between buildings or during routine activities, such as going to the library or the cafeteria. In short, sun exposure at school makes up a significant amount of a child's overall exposure, and thus there is a need for programs to be implemented that teach students about staying safe when outside at school.

The results of the regression analysis suggest that African American and students in other ethnic groups were more likely to wear long sleeves to school when compared to white students. What is not known however is if it is being worn to protect the skin from the sun or for other reasons such as the classroom being too cold or for fashion. The answer to this question could go a long way in helping our team to determine a child's level of awareness about sun protection and their willingness to adopt sun protective behaviors. Sunscreen and use of sunglasses were best predicted by student gender and ethnicity. It may be that female students consider sunscreen a beauty product and may incorporate it into other preparatory regimes they do before leaving home for school. As it relates to wearing a brimmed hat, our team found that the strongest predictor was whether or not a school had a voluntary uniform policy. It appears that students who have the choice in whether to wear a uniform choose to wear a hat. In addition, it also appears that the wearing of hats outdoors is not required by schools that have a uniform policy. The simple changing of the school uniform policy to include the wearing of wide-brimmed hats outdoors may be an effective way to reduce skin cancer risk.

Despite the potential protective benefits of wearing a wide-brimmed hat when outside, community-based surveys show that parents do not yet see them as method for protecting their child from exposure to the sun and children don't often wear them when outside. Previous studies have demonstrated that when worn correctly, a wide-brimmed hat can significantly reduce the amount of UV radiation exposure to the areas on the face, scalp and neck regions [9, 26]. A wide-brimmed hat may also prevent damage to the eyes by limiting the eyes exposure to UV rays and thus lessening the possibility that one will develop melanoma of the uveal tract or macular degeneration [12]. Given the potential health benefits of wearing a wide-brimmed hat, the current intervention seeks to build on earlier attempts to implement a school-based project aimed at teaching children about sun protection. Previous studies that focused on education alone were successful in improving student attitude and knowledge about sun protection but had little impact on changing actual sun protective behaviors. Other studies were successful in getting students to use sunscreen but had no impact on getting them to wear a wide-brimmed hat or other protective clothing [32]. With these limitations in mind, the existing project builds on earlier studies by implementing a school-based program that incorporates sun protection education with an emphasis on the use of a wide-brimmed hat as the primary method of sun protection. While we do not attempt to discourage students from wearing sunscreen, we seek to get students to wear a wide-brimmed hat when they are outside at school and at home by working with administrators, teachers, students and parents.

Limitations

This study has a number of potential limitations. First, some outcomes were assessed by student self-report and could not be independently verified. In our validation study, correlations were low between self-reported hat use and hat use verified by pedometers. In addition, students were aware that they were participating in a sun protection study and some students were likely to have given answers that they perceived to be socially desirable.

As a result, we believe that students were likely to have over-reported their actual use of hats and other sun protection behaviors.

We conducted this study in Hillsborough County Florida and it is possible that results would vary in other school systems. Currently the Hillsborough County School District has no formal policy that either prohibits or encourages students from wearing a hat while outside during school. Other school systems may have different sun protection policies in place and it is also uncertain how administrative policies are interpreted at the classroom level and by parents and students. We conducted this study in Florida and sun protection behaviors may vary substantially by geographic region. Finally, we studied the sun protection behaviors of 4th grade students which may not be representative of other grades.

In conclusion, there appears to be agreement among scholars that exposure to UV radiation in childhood contributes the development of skin cancer in adulthood. The question we face now is what to do about it. Years of marketing and several national health education campaigns has contributed to sunscreen becoming synonymous with sun protection. These interventions have overlooked wide-brimmed hats in favor of sunscreen even though sunscreen has not been found to prevent the ultimate development of skin cancer, possibly because it is often used incorrectly and may increase UV radiation exposure. Schools are a natural setting for incorporating an intervention that focuses on hat use because students are in a captive setting making it possible to deliver sun protection educational sessions, hats, and readily measure changes in sun protective behaviors. Students are also at school during the periods when the threat of UV exposure is the highest.

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Table 1

Demographic and School Characteristics of Study Participants.

Characteristic	Number	<i>p</i>
Race/Ethnicity (n = 1,846)		
African-American	365	<.0001
Hispanic	327	
White	752	
Other	402	
Gender (n = 1,845)		
Female	895	.20
Male	950	
Type of school attended (n = 2,086)		
Magnet	247	<.0001
Public	1839	
Location of school (n = 2,086)		
Metropolitan area	1478	<.0001
Non-metropolitan area	608	
School uniform policy (n = 2,086)		
Required	1340	<.0001
Not required	239	
Voluntary	507	

Table 2

Degree of Sun Exposure and Ambient Conditions Observed During Physical Education At Participating Schools.

Characteristic	Number of (Observations)
Degree of Sun Exposure (n = 99)	
Full sun	53
Partly shaded	14
Mostly shaded	17
Fully shaded	15
Ambient Conditions (n = 94)	
Clear	63
Partly cloudy	19
Overcast	12

Table 3

Multivariable Logistic Regression Models Predicting Self-Reported School Sun Protection Behaviors (1. wear long sleeves, 2. hat with brim, 3. wear sunscreen, and 4. wear sunglasses).

Predictors	Odds Ratio	95% Confidence Interval	P value
1. Wear long sleeves (n = 1,725)			
Race: AA	1.59	1.11–2.26	.04
Hispanic	0.90	0.60–1.37	.03
Other	1.63	1.17–2.28	.02
White	REF		
2. Hat with brim (n = 1,725)			
Race: AA	1.91	1.33–2.72	.03
Hispanic	1.24	0.83–1.84	.20
Other	1.96	1.40–2.74	.009
White	REF		
School Uniform: No	0.95	0.58–1.54	.18
Voluntary	1.73	1.31–2.30	.0007
Mandatory	REF		
3. Wear sunscreen (n = 1,725)			
Age	0.87	0.74–1.02	.08
Gender: Female	1.56	1.27–1.91	<.0001
Race: AA	1.01	0.75–1.34	.20
Hispanic	1.41	1.06–1.87	.04
Other	1.22	0.94–1.59	.50
White	REF		
4. Wear sunglasses (n = 1,725)			
Gender: Female	1.39	1.14–1.71	.002
Race: AA	1.81	1.37–2.38	.004
Hispanic	1.59	1.19–2.12	.14
Other	1.22	0.93–1.60	.23
White	REF		

AA= African American