Assessment of sun protection and skin cancer prevention among preschool children

Avaliação dos cuidados de proteção solar e prevenção do câncer de pele em pré-escolares

Avaluación de los cuidados de protección solar y prevención de cáncer de piel en preescolares

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ABSTRACT

Objective: To investigate parental care of their children's skin by using sunscreen and physical sun protection methods.

Methods: A cross-sectional study was conducted with preschool children in Tubarão, Southern Brazil. Children's parents or caregivers from randomly selected private and public schools were recruited to participate in the study, with the permission of the school directors. A self-report questionnaire was administered to the parents. The tool included data on demographic and socioeconomic characteristics, use of sunscreen and physical barriers for sun protection, and timing of sun exposition. Pearson's chi-squared and Fisher's exact tests were used to examine associations between the variables of interest, being significant $p<0,05$.

Results: 361 children were studied and 228 (63.2%) of them attended public schools. Skin color was predominantly white (78.8%). Of the total, 16 (4.4%) used sunscreen every day and year-round, and 253 (70.1%) were under physical sun protection. White-skinned children used more sunscreen than dark-skinned ones, especially in the summer ($p=0.001$), and they were more prone to reapply the product ($p=0.04$). High household income showed a positive association with daily use of sunscreen ($p<0.001$). Sunscreen reapplication was also associated with children attending private schools ($p=0.01$).

Conclusions: Findings revealed that the use of sunscreen among preschoolers was incorrect and insufficient.

Key-words: child; child, preschool; solar radiation; skin neoplasms.

RESUMO

Objetivo: Investigar os cuidados dos pais com a pele de seus filhos, especialmente quanto ao uso do filtro solar e de métodos físicos de proteção solar.

Métodos: Estudo transversal com pré-escolares de Tubarão, Santa Catarina, Brasil. Após sorteio de escolas das redes pública e privada e mediante a autorização da direção das entidades, os pais ou responsáveis foram convidados a participarem do estudo. Os questionários foram autoaplicáveis. O instrumento continha dados sobre características demográficas e socioeconômicas, uso de filtro solar, uso de barreiras físicas de proteção solar, além dos horários em que a criança ficava exposta ao sol. Para verificar a associação entre as variáveis de interesse, foram utilizados os testes do qui-quadrado de Pearson ou exato de Fisher, sendo significante $p<0,05$.

Resultados: Foram estudadas 361 crianças, sendo 228 (63,2%) matriculadas na rede pública de ensino. A cor branca da pele foi predominante (78,8%). Do total, 16 (4,4%) faziam uso do filtro solar todos os dias do ano e 253 (70,1%) usavam barreiras físicas de proteção solar. Crianças de pele branca usavam mais filtro solar do que as negras, principalmente no verão ($p=0,001$), e costumavam reaplicar o produto ($p=0,04$). Foi encontrada uma associação positiva entre renda familiar elevada e uso de filtro solar ($p<0,001$). A reaplicação do filtro solar também esteve associada com crianças que frequentavam escolas da rede privada ($p=0,01$).

Conclusões: Os achados revelam que o uso de filtro solar em pré-escolares é incorreto e insuficiente.

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RESUMEN

Objetivo: Investigar los cuidados de los padres con la piel de sus hijos, en especial el uso de filtro solar y los métodos físicos de protección solar.

Métodos: Estudio transversal con preescolares de Tubarão, en Santa Catarina, Brasil. Después del sorteo de las escuelas públicas y privadas y mediante la autorización de la dirección de las entidades, los padres o guardianes fueron invitados a participar del estudio, recibiendo cuestionarios autoaplicables que fueron devueltos a los investigadores durante los días subsiguientes. El instrumento contenía datos sobre características demográficas y socioeconómicas, uso de filtro solar, uso de barreras físicas de protección solar, y también sobre los horarios de exposición al sol del niño. Para verificar la asociación entre las variables de interés, se utilizaron las pruebas chi-cuadrada de Pearson o exacta de Fisher, con significancia estadística preestablecida en 95%.

Resultados: Fueron estudiados 361 niños, 228 (63,2%) de los cuales inscritos en escuelas públicas. El color de piel blanca fue predominante (78,8%). Del total, 16 (4,4%) utilizaban filtro solar todos los días del año, y 253 (70,1%) usaban barreras físicas de protección solar. Niños de piel blanca usaban más filtro solar que los de piel negra, principalmente en verano (p=0,001), y solían reaplicar el producto (p=0,04). Hubo asociación positiva entre ingresos familiares altos y uso de filtro solar (p<0,001). La reaplicación del filtro solar también estuvo asociada a los niños de escuelas privadas (p=0,01).

Conclusiones: Los hallazgos revelan que el uso de filtro solar entre preescolares es incorrecto e insuficiente.

Palabras clave: niño; preescolar; radiación solar; neoplasias cutáneas.

Introduction

The human skin plays an important role to protect the body and to regulate body temperature, sensitivity, and absorption of substances. It is daily exposed to external and internal aggression, forming a physical barrier to external agents such as the ultraviolet radiation (UVR)[1,2]. This may imply therapeutic and beneficial effects, like the production of vitamin D, but it can also cause damage to the integument, such as erythema, burns, skin pigmentation, photoaging, photosensitivity, and skin malignancies[3-6].

Nonmelanoma skin cancer (NMSC) includes basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). It is the most common malignancy and accounts for 90% of primary malignant neoplasms of the skin. Malignant melanoma (MM) represents only 4% of malignant neoplasms of the skin, however it accounts for three-quarters of deaths from primary cancer of the skin[5,7]. NMSC is directly linked to continuous sun exposure over the years and to white-skinned people[5,6]. MM is related to intense and intermittent sun exposure throughout childhood, with painful burns and blisters, which require special care among children and adolescents[8].

In the United States of America, more than two million new cases of NMSC are diagnosed every year[9], and MM is the fifth most common cause of cancer among men and the seventh among women[10]. In Brazil, 53,410 new cases of NMSC were estimated for the year 2010 among men and 60,440 among women, according to the Brazilian National Cancer Institute (INCA, acronyms in Portuguese). In the state of Santa Catarina, in that same year, 4,050 cases of NMSC were estimated, resulting in a rate of 128.8 cases per 100,000 people[11].

In Southern Brazil, several factors favor the development of NMSC and MM among the population, including the deterioration of the ozone layer; the latitude of the region that is in a high incidence of UVR zone; the proximity to the coast, where people go to the beach more often and are more exposed to the sun, plus the large number of white-skinned people due to the European colonization[5,6].

On average, the first 18 years of age account for 25% of sun exposure of an individual[7]. Sun exposure at this stage is more frequent and intense, and involves the accumulation of UV-induced damage between 50 and 80%[12,13]. It is important to avoid prolonged sun exposure and to wear appropriate sun protection through physical barriers and sunscreen starting at six months of age[14].

This study investigated the attention that parents have towards their children's skin by using sunscreen and monitoring sun exposure. A comparison of skin care was made between preschool children studying at public and private schools in Tubarão, state of Santa Catarina, Brazil.

Method

This study was approved by the Ethics Committee of the Universidade do Sul de Santa Catarina, under protocol number 10.586.4.01.III.

A cross-sectional population-based study was conducted with preschool children aged between zero and five years-old selected from public and private schools in Tubarão, state of Santa Catarina. This city is located in the coastal area of Southern Santa Catarina at latitude 28º28'00"S and longitude 49º00'25"W. Its population is predominantly white-skinned due to the European colonization.

From a list of 42 public and private preschools operating in the municipality in 2010, the OpenEpi software (version 2.3.1 Emory University, Rollins School of Public Health.) was used to calculate the sample size based on the number of children enrolled (1,387 in private schools and 2,628 in public ones, totaling 4,015). Considering a prevalence rate of 21.3%[15] of sunscreen use in Southern Brazil, with a margin of error of ±5%, the minimum sample size required included 240 students for a 95% confidence interval.

Based on the calculation of sample size, a proportional stratified sampling was chosen to represent the universe of children enrolled. This meant that 65% of the sample should consist of students enrolled in public schools and 35% of students enrolled in private schools. Fifteen schools were selected by drawing lots from the 42 preschools registered in the municipality. All children who fulfilled the eligibility criteria were invited to participate in the study. Inclusion criteria were: consenting parents or caregivers of children aged from zero to five years-old, enrolled in one of the selected schools. Some questions were not answered by the participants, however, these questionnaires were not excluded, and the valid answers were analyzed.

After authorization from the respective school management, the children's parents or caregivers were invited to participate in the study, and after parental consent was obtained, the questionnaire was administered between March and June, 2010. The invitation to participate in the study was made by the researchers or teachers responsible for the children, who were properly trained to obtain the consent form and help data collection. In the absence of researchers, school teachers handed out the questionnaires and consent forms. They addressed the children's parents or guardians at the entrance or exit of the school, and explained the study objectives. The questionnaire was filled out at home and returned to the researchers in the subsequent days. The semistructured questionnaire was developed by the authors, and contained information on the children and their families, such as age, gender, eye and hair color, skin color, habits and hours of sun exposure, use of sunscreen, and other physical methods of protection such as hats, caps, and clothes. We also investigated age, education and income of parents, and the request of sunscreen in the school supply checklist.

Daily use of sunscreen was considered adequate. Using it sometimes and the lack of use were regarded as inappropriate. The participants were also asked about the use of other physical barriers for sun exposure protection, such as hats, caps and clothes, but this was only an additional measure and not the primary outcome of this study. Therefore, this variable was analyzed separately from sunscreen use.

Sun exposure before 10 a.m. and after 4 p.m. was considered proper, and between 10 a.m. and 4 p.m. was considered inappropriate[7,16]. It should be emphasized that data collection occurred during the period of the year in which the hours of sun exposure had no influence of daylight saving time or summer time shifting.

The collected data were entered into the Epi-Data software, version 3.1 (EpiData Association, Odense, Denmark), and statistical analysis was performed using the Statistical Package for Social Sciences (SPSS for Windows, version 16, Chicago, IL, USA). Qualitative variables were described in absolute values and percentage, and the quantitative ones were expressed as mean, median, and standard deviation. Comparisons between two or more proportions were made by Pearson's chi-squared or Fisher's exact tests, when appropriate, with statistical significance preset at the 0.05 level.

Results

None of the parents invited to participate in the study declined, but 30 questionnaires were not returned, out of which 18 were related to children enrolled in private schools and 12 in public schools, resulting in a loss of 7.7%. The sample consisted of 361 children, 228 (63.2%) of whom studied in public schools. Of the total, 179 (52.6%) were female. Most of them (50.1%) attended school in the afternoon. Regarding skin type, 78.8% of the participants reported that they were white-skinned. Demographic data and physical aspects of the surveyed children are presented in Table 1.

Regarding the data of parents or guardians, mean age of the mothers was 30.7±6.6 years-old, ranging from 19 to 55 years. Mean age of the fathers was 33.2±7.8 years-old, ranging between 20 and 70 years. Regarding the education level of the parents or guardians, 43% held a college degree, and 39.1% had attended secondary school. However, parents of children enrolled in private schools had higher levels of education ($p<0.001$) than those whose children were enrolled

in public schools. The household income among children attending public schools was BRL 493, on average, with a median of BRL 900. Among children attending private schools, the household income was BRL 1,745, on average, with a median of BRL 3,000.

Concerning sun exposure habits, the vast majority of children (70.8%) was exposed at inappropriate hours; and of the seven children who performed outdoor extracurricular activities, most were exposed at inappropriate hours.

White-skinned children were more likely to use sunscreen, especially in the summer (p=0.001). Table 2 shows the data on skin care and sun exposure habits among the surveyed children, as well as the different means of sun protection. In this study, white skin color was also associated with the high rate of sunscreen reapplication (p=0.04), which was reported more frequently by private school children (p=0.01) than by those studying in public schools. There was no statistically significant association between parental education and the use of sunscreen. There was no statistically significant association between skin type and sun protection factor (SPF) number (p=0.90). Regarding the characteristics of parents, age and education level were not associated with daily use of sunscreen, though the household income had a positive association with the use of sunscreen every day and year-round (p<0.001).

Discussion

Parents' awareness of the risk factors for the development of NMSC and MM is extremely important for the adoption of preventive care. A study conducted in Germany found that 90.9% of parents were aware that sun exposure was a risk factor for skin cancer, and this information was acquired mainly through the media or medical advice[16]. Since the surveyed children are enrolled in preschool, it is important that dermatologists and pediatricians provide proper guidelines on sun protection habits, not only for the use of sunscreen and protective physical barriers, but also regarding the peak sun hours of solar radiation. In a survey assessing 882 American pediatricians, 88.1% reported that they provided clarification to parents and patients on sun protection care[7].

Findings in this study revealed that only 16 children (4.4%) used sunscreen every day; 310 (86.6%), only in the

Table 1 - Demographic data and physical aspects of the surveyed children, Tubarão, Santa Catarina State, 2010

Characteristics	Total	School		*p*-value
		Public n (%)	Private n (%)	
Gender (n=340)				0.06
Male	161 (47.4)	112 (49.1)	49 (40.5)	
Female	179 (52.6)	107 (46.9)	72 (59.5)	
Study period (n=359)				<0.001
Full time	150 (41.8)	117 (51.8)	33 (24.8)	
Morning	29 (8.1)	22 (9.7)	7 (5.3)	
Afternoon	180 (50.1)	87 (38.5)	93 (69.9)	
Skin color (n=269)				0.1
White	212 (78.8)	113 (74.8)	99 (83.9)	
Mulatto	39 (14.5)	24 (15.9)	15 (12.9)	
Black	18 (6.7)	14 (9.3)	4 (3.4)	
Eye color (n=254)				0.09
Light-colored	69 (27.2)	45 (31.5)	24 (21.6)	
Brown	157 (61.8)	80 (55.9)	77 (69.4)	
Dark-colored	28 (11.0)	18 (12.6)	10 (9.0)	
Hair color (n=264)				0.3
Blond	47 (17.8)	26 (17.7)	21 (17.9)	
Light brown	118 (44.7)	70 (47.6)	48 (41.0)	
Dark brown	75 (28.4)	42 (28.6)	33 (28.2)	
Black	24 (9.1)	9 (6.1)	15 (12.8)	

summer; and 32 (8.9%), never. In a study conducted in Germany, parents were asked about the use of sunscreen; 89.4% reported that their children always used it, and 15% said that their children only used sunscreen during vacation and holidays.

In similar studies, even among people of different ages, the use of sunscreen was associated with skin color[17-19]. In this study, white-skinned children used sunscreen more often than dark-skinned ones, especially in the summer (p=0.001). White skin color was also associated with the product reapplication practice (p=0.04). There was no statistical association between skin type and SPF, although dark-skinned children used lower SPF. Sunscreen use was not statistically associated with gender of the surveyed children (p=0.06). Some scientific literature data indicate the prevalence of sunscreen use among females[17,18,20,21]. However, it should be emphasized that, in those studies, the sample consisted of participants older than schoolchildren. The lack of gender association can be attributed to the fact that the lower the age, the greater the dependence on parental care. Protective measures would be determined by the parents or guardians, not by the children.

There was no statistically significant association between parental education and use of sunscreen. Abeck *et al*[16] evaluated the care of parents regarding the use of sunscreen in preschool children, and also found no association between parental education and frequency of sunscreen application. Other studies have reported that parents with higher levels

Table 2 - Skin care and sun exposure among the surveyed children, according to the use of sunscreen, Tubarão, Santa Catarina State, 2010

Skin care	Total	Daily use of sunscreen		*p*-value
		Yes	No	
School (n=358)				0.9
Public	227 (88.0)	10 (4.4)	217 (95.6)	
Private	131 (22.0)	6 (4.6)	125 (95.4)	
Sun exposure (n=350)				<0.001
Appropriate hours	100 (28.6)	13 (13.0)	87 (87.0)	
Inappropriate hours	250 (71.4)	2 (0.8)	248 (99.2)	
Sunscreen use (n=258)				0.3
Once a day	80 (31.0)	7 (8.8)	73 (91.3)	
More than once a day	178 (69.0)	9 (5.1)	169 (94.9)	
SPF (n=311)				0.18
≤15	15 (4.8)	2 (13.3)	13 (86.7)	
>15	296 (95.2)	14 (4.7)	282 (95.3)	
SPF for children (n=319)				0.5
Yes	264 (82.8)	13 (4.9)	251 (95.1)	
No	55 (17.2)	3 (5.5)	52 (94.5)	
Physical barriers for sun exposure* (n=358)				0.4
Yes	250 (69.8)	12 (4.8)	238 (95.2)	
No	108 (30.2)	4 (3.7)	104 (96.3)	
Wear sunscreen before going to school (n=357)				0.02
Yes				
No	73 (20.4)	7 (9.6)	66 (0.4)	
	284 (79.6)	9 (3.2)	275 (96.8)	
Bring sunscreen to school (n=358)				0.3
Yes	7 (2.0)	1 (14.3)	6 (85.7)	
No	351 (98.0)	15 (4.3)	336 (95.7)	
Past experience of sunburn (n=358)				0.04
Yes	63 (17.6)	-	63 (100.0)	
No	295 (82.4)	16	279 (94.6)	

SPF: sun protection factor; *physical barriers for sun exposure protection: hats, caps and clothes.

of education were more likely to use sunscreen in children more frequently[20,22]. With respect to parental age, younger mothers reported applying sunscreen on their children only in the summer, while older mothers reported that they always applied sunscreen on their children. Nonetheless, studies published in the scientific literature have reported that younger mothers make greater use of sunscreen than older mothers, and raise the possibility that younger mothers had greater access to educational programs disseminated by the media in recent times, which explained the greater adherence to preventive measures[20,22]. It should be noted that the low percentage (4.4%) of sunscreen daily use found in this study may have influenced the outcome of these and other associations made.

Applying sunscreen before going to school was not associated with the type of school the children attended. Children who attended private schools reapplied the product throughout the day (p=0.01). In addition, higher household income also showed positive association with daily use of sunscreen (p<0.001). Similarly to other findings in the literature, this study concluded that the use of sunscreen was associated with household income[18,20]. Since sunscreens are expensive and are not provided by the Brazilian Unified Health System (SUS, acronyms in Portuguese), access and adherence to the product are lower among low-income families. Physical means of sun protection, such as hat, cap, clothing, among others, reflect the sociocultural behavior of the population, for they are more affordable. In this study, 70.1% of the participants used these means of sun protection, which is similar to the rates found in other studies[17-20].

None of the visited schools included sunscreen in their lists of school supplies. A study conducted in recreational centers in Australia, a country that has one of the highest incidence rates of melanoma, showed that most of them required the use of hats and sunscreen for children[12].

Some studies conducted by nondermatologists suggest that using sunscreen to prevent skin cancer could put people at risk of developing vitamin D deficiency, with patients subjected to changes in bone mineralization[23,24].

In this respect, a study conducted in Brazil found that sun protection practices were associated with lower concentrations of 25 hydroxyvitamin D (25OHD), compared with individuals exposed to sunlight, but not enough to cause 25OHD deficiency with consequent secondary hyperparathyroidism[25]. Therefore, attitudes that discourage the use of sunscreen and sun-protection physical barriers should not be tolerated.

Among the limitations of this study is the kind of instrument used. When the survey participants filled out the self-report questionnaire, they may have not answered it properly. In this kind of survey, some questions might be difficult to understande, but possible gaps cannot be solved due to the anonymity of the participants. The lack of information about the amount of sunscreen used for a certain period of time and the number of times that the product was reapplied have limited the analysis of some data. Because of the difficulty to classify skin color, the self-report skin color seems to be the best method. We chose not to exclude the questionnaires that were not entirely filled out, using the valid responses.

Despite the number of questionnaires that were not returned, and the questions that were not answered by the participants, the sample size was 50% higher than the minimum sample size required for a 95% confidence level.

Moreover, despite the established relationship between sun exposure and skin cancer, there are few studies on sun protection habits among this age group, especially in Brazil. Considering this is a tropical country and there is a greater predominance of white people in the Southern region, the risk of harmful effects of sun exposure is higher, mainly because of the cumulative effect, with increased rates of skin cancer later in life. Therefore, we emphasize the importance of this study to analyze sun-protective practices among preschool children to fill the knowledge gap on this issue.

In conclusion, of the 361 children surveyed, only 16 (4.4%) reported the use of sunscreen every day and year-round, 310 (86.5%) used it only during the summer, and 32 (8.8%) reported that they never use the product. With regard to other means of sun protection, most children (70.1%) reported the use of physical barriers, such as clothing, hat, or cap. White-skinned children used sunscreen more often, especially in the summer (p=0.001), and reapplied it (p=0.04). High household income showed positive association with daily use of sunscreen (p<0.001). The reapplication of sunscreen was also associated with children attending private schools (p=0.01).

The findings revealed that the use of sunscreen among preschoolers was incorrect and insufficient, and sun exposure occurred at inappropriate hours, despite the high education level of parents or guardians. Even so, physical barriers were used for sun protection, and sunscreen, when used, was specific for children and had a high SPF.

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