International Journal of Research in Dermatology
Sakoufaki M et al. Int J Res Dermatol. 2017 Sep;3(3):306-314
http://www.ijord.com

DOI: http://dx.doi.org/10.18203/issn.2455-4529.IntJResDermatol20172505

Original Research Article

Design and implementation of a health promotion program to prevent the harmful effects of ultraviolet radiation at primary school students of rural areas of Greece

Maria Sakoufaki[1]*, Aravela Stergiopoulou[2], Alexander Stratigos[2]

[1]Department of Public Health, Attica Region, Greece
[2]Department of Dermatology - Venereology, Andreas Sygros Hospital, National and Kapodistrian University of Athens, Athens, Greece

Received: 07 May 2017
Revised: 20 May 2017
Accepted: 23 May 2017

***Correspondence:**
Dr. Maria Sakoufaki,
E-mail: msakoufaki@yahoo.com

ABSTRACT

Background: Skin cancer is the most common type of cancer presenting with a dramatic increase in its incidence among Caucasian populations worldwide. Primary prevention in childhood and early detection is important in reducing the risk of skin cancer later in life. The objectives of the study were to investigate the effect of a focused educational intervention in school children aiming to increase their knowledge about the harmful effects of sun exposure and promote prevention behaviors regarding skin cancer.
Methods: The study consisted of a before/after 6-month assessment of a school intervention program applied in two hundred children from four primary schools (Grades 3-6) at a rural area in Western Greece. The program included the presentation and distribution of educational material (activity guide, manual for pupils, posters). A detailed questionnaire with close-ended questions was distributed before and after the intervention. Both between and in groups analysis was conducted.
Results: Of the participating pupils, 48% were boys, whereas 78.5% reported a fair skin complexion and 79% reported freckles and 1-20 nevi. After the intervention, an increased number of pupils were taught to enjoy sun exposure while avoiding its harmful effects. A significantly greater number of children stated proper use of sunscreen (74% vs. 31%, p=0.001) and sun avoidance at the intense hours of daily UV exposure (65% vs. 25.5% prior to the intervention). Melanoma awareness was also significantly raised.
Conclusions: Students' knowledge about the effects of sun exposure as well as the need for sun protection increased following a targeted and well-designed educational intervention. The development of preventive educational programs on skin cancer for school children is important to increase awareness in this sensitive age group.

Keywords: School health promotion, Skin cancer prevention, Sunscreen, Sun protection, Sun effects

INTRODUCTION

According to epidemiological studies, there is a dramatic increase in the incidence of skin cancer in Caucasian populations worldwide.[1-3] Moreover, extended sun exposure during childhood, as well as the incidence of sunburn at this sensitive age increases the probability of skin cancer occurrence later in life.[4,5] Approximately 50% of solar radiation is accumulated by the age of 18.[6]

Primary prevention starting in childhood can contribute substantially to effective adoption of adequate sun protection attitude and consequently prevention of skin cancer.[4] The school environment is an essentially

effective area where health promotion through intervention programs can be implemented.

The aim of the current study was to explore students' attitudes, awareness and knowledge on the effects of sun exposure in a "high risk" rural area of Greece and to assess the change in these parameters following a targeted educational interactive process. The interventional health program was adapted to primary school children (8-12 years old) in order to provide them with knowledge, new attitudes and skills for the reduction of the harmful effects of sun exposure and the prevention of skin cancer.

METHODS

The study was a questionnaire-based, before/after case control study, exploring a school health intervention program. The program included two hundred children from 4 primary schools (Grades 3-6, ages 8-12) at a rural area in Western Greece (Municipality of Xiromero, schools at Astakos, Kandila, Mytikas and Thyrreio) in 2011-2012. An intervention program was applied to the students of 3 out of 4 schools. The intervention was not applied in one of the schools (Thyrreio) which was used as a control group (non-intervention school). The program consisted of oral presentations and distribution of educational material (activity guide, manual for pupils and poster display in classrooms). Educational material was identical in all cases, whereas oral presentations were conducted by the same person.

A detailed questionnaire with close-ended questions was distributed before and after the intervention. All areas are located near the sea and are characterized by long sunshine periods with intense solar radiation levels. The climate is Mediterranean with mild winters and hot summers.

After obtaining permission from the Ministry of Education, a two-hour meeting with school directors and teachers was arranged in order to present the details of the program and the educational material to be distributed.[7] The questionnaires were distributed (1st time) to 200 pupils of the participating schools at January 2012. All 200 questionnaires were answered. The intervention program consisted of 13 concepts (twice a week of two hours educational meetings) including literature review about sun, solar radiation, descriptions of the sun, the sun and the human body, songs about the sun, "making my own" sun, the sun in the art, the sun in fairy tales, sun protection measures. The educational material that was distributed consisted of: (i) activity guide for teachers, (ii) manual for each student including several suggested activities, and (iii) a poster with recommendations on how to behave during sun exposure.[7]

Six months after the intervention (June 2012), and during the third phase of the program, the same questionnaire was redistributed to the targeted population in 3 schools in which the intervention was performed to the same 160 pupils of the above mentioned grades. The questionnaires were first distributed in January 2012 and redistributed after six months in June 2012.

The self-filled questionnaire consisted of 42 closed-ended questions that were grouped into 3 main sections: 1) demographic characteristics (sex, age, parents' education level, parents' profession, hair color, the presence of nevi, number of nevi, skin type and tendency to sunburn); 2) knowledge and attitude about the sun and sun exposure effects; sun protection measures and the period of the day that sun exposure is the most harmful and 3) behavior regarding the use of sunglasses, sunscreen, hats, shadow and clothes used in outdoor activities, SPF and the frequency of use of sunscreen. All questions were closed set and in some of them more than one option was eligible.

The collected data were analyzed with STATA software v. 13. Data were coded, quantified and processed. Descriptive statistics were calculated. Comparisons were made both in-group (answers of the intervention group before and after the intervention) and between groups (intervention group and control group both before and after intervention). Chi square test was conducted for categorical values. The results were considered statistically significant if p value was found lower than 0.05.

RESULTS

The demographic characteristics of the sample are summarized in Table 1. Of the 200 pupils, 96 (48%) were boys and 104 (52%) were girls. Pupils were 8 year old (n =30, 15%), 9 year old (n =47, 23.5%), 10 year old (n =55, 27.5%), 11 year old (n =55, 27.5%) and 12 year old (n =13, 6.5%). Most of the children (n =60, 30%) attended the 6th grade. Most parents were farmers and agricultural workers (60% of mothers and 66.5% of fathers). Finally, the vast majority of the children (189, 94.5%) lived with both their parents (Table 1). None of the differences between control and intervention groups was found to be statistically significant.

Table 2 depicts the phenotypic characteristics of the students. Most children had brown hair (n =109, 54.5%), whereas the majority (n =157, 78.5%) self-reported a pale skin with a tendency to burn and a difficulty in tanning. Only 5% reported dark skin and no history of sunburn. Also, most pupils reported having 1-20 nevi (n =158, 79%).

Knowledge

Before the intervention, family (132, 66%) and school (111, 55.5%) were the main source of information regarding the benefits and adverse effects of the sun. Mass media held a very small percentage as information

source, while 25% of the pupils were informed by healthcare occupants. After the intervention, the information source changed, with a shift from family to school (n =146, 73% and n =157, 78.5% accordingly), although not in a statistically significant level. Hence, overall distribution of knowledge sources was marginally not statistically significant (p=0.05). Differences with control group were not found statistically significant (p=0.31) (Table 3).

Table 1: Demographic data of participating students.

Characteristics	N (%)	
Sex		
Boys	96 (48)	
Girls	104 (52)	
Age (in years)		
8	30 (15.0)	
9	47 (23.5)	
10	55 (27.5)	
11	55 (27.5)	
12	13 (6.5)	
Location of residence/school		
Astakos	97 (48.5)	
Kandila	38 (19)	
Karaiskaki	1 (0.5)	
Mitika	29 (14.5)	
Thirrio	35 (17.5)	
School grade level		
3rd	47 (23.5)	
4th	52 (26)	
5th	41 (20.5)	
6th	60 (30)	
Parents' educational level	Mother	Father
Primary school	2 (1)	3 (1.5)
Junior high school	30 (15)	30 (15)
High school	46 (23)	59 (29.5)
Technological Education Institute	90 (45)	81 (40.5)
Higher education - university education	10 (5)	14 (7)
Illiterate	22 (11)	13 (6.5)
Parents' occupation	Mother	Father
Farmer	120 (60)	133(66.5)
Unemployed	0 (0)	2 (1)
Public servant	4 (2)	10 (5)
Teacher/professor	12 (6)	8 (4)
Free lancer	17 (8.5)	12 (6)
Trader	5 (2.5)	17 (8.5)
Worker	0 (0.0)	7 (3.5)
Private employee	4 (2)	7 (3.5)
Priest	0 (0)	1 (2.5)
Technician	0 (0)	3 (1.5)
Household	38 (19)	0 (0)
Parent status		
Two parents	189 (94.5)	
Father	8 (4)	
Other	3 (1.5)	

The majority of children (113, 56.5%) before the intervention were aware of all the negative effects of ultraviolet radiation), while a relatively small percentage (5.5%) was not able to name one.

A significant percentage of children (44.5%) were unable to name all sun's harmful effects on the skin, such as burns, redness, and freckles (Table 4). After the intervention, the percentage of pupils who were aware of the sun's benefits increased (from n =115, 57.5% to n =125, 62.5%, NS), as well as the percentage of pupils who knew the sun's negative effects (from n =113, 56.5% to n =127, 63.5%, NS) and the long-term effects of sun exposure (from n =100, 50% to n =124, 62%, NS). These results are constant in all three schools, although difference was not found statistically significant.

A small percentage was aware of the individual importance of sunglasses (n =4, 2%), clothing (n =8, 4%), sunscreen (n =27, 13.5%) and hat (n =34, 17%) in sun protection, while most of them (n =120, 60%) responded that sun protection is achieved by a combination of measures.

Behavior

Knowledge about sun protection factor and proper sunscreen use year-round increased (from n =128, 64% to n =72, 86% and from n =106, 53% to n =164, 82% respectively). There was a statistically significant ($p<0.001$) decrease of the number of pupils that thought that sunscreen should only be used during the summer (from n =54, 27% to n =13, 6.5%) or only at the beach (from n =34, 17% to n =20, 10%), (Table 5).

The increased knowledge of the sun's harmful effects led to a statistically significant ($p<0.001$) reduction of the number of pupils reporting more than 4 hours of sun exposure (from n =23, 11.5% to n =10, 5%). Awareness about sunscreen use at the beach also significantly increased (from 58% to 88%, $p<0.001$). Following the intervention, a higher number of children reported re-applying the sunscreen immediately after swimming (n =176, 74% vs. 31%, before the intervention, $p<0.001$) and knew that the right time for application was 1 hour before exposure (n =130, 65% vs. 25.5% before the intervention, $p<0.0001$), (table 5). The children's knowledge about the "risky" swimming hours also increased as more children reported swimming in the morning up to 10:00a.m. (n =46, 23% vs. 9% before) and after 5p.m. (n =80, 40%, vs. 14.5 before), while there was a reduction of the number of students who reported swimming from 12-4 PM (n =25, 12.5%) (Table 5). The knowledge percentage about sunscreen use after swimming increased (from 31% to 74%, $p<0.001$) as well as the wearing of a hat (from 40.5% to 73%, $p<0.05$), the use of clothing after swimming (from 31% to 73%, $p<0.05$) and of sunglasses for eye protection (from 28% to 37%, $p<0.05$) (Table 5).

As for the frequency of sunburns, the percentage was held unchanged for all students before and after the intervention because the short 6-month time frame of the study did not permit the long-term monitoring of sunburns over the next years. After the intervention, students significantly increased their level of knowledge about melanoma (from n =95, 47.5% to n =149, 74.5%, p<0.001). The knowledge level of the pupils on the above parameters at the school where no intervention had taken place remained stable and unchanged, as shown in Tables 5 and 6.

Table 2: Participants' phenotypic features.

	n (%)
Hair colour	
Blond	35 (17.5)
Brown	109 (54.5)
Red	7 (3.5)
Black	17 (8.5)
Not answered	32 (16)
Number of moles	
None	27 (13.5)
1-20	158 (79)
20-50	10 (5)
50-100	3 (1.5)
>100	2 (1)
Skin type	
Very fair, pale white skin – always burns–never tans	157 (78.5)
Fair white skin – burns easily – tans minimally	11 (5.5)
Moderate brown skin – burns – tans easily	11 (5.5)
Dark brown – tans	16 (8)
Don't know	5 (2.5)

Table 3: Information source on sun-induced effects reported by participants.

	Before intervention N (%)	After intervention N (%)	Control group N (%)
Family	132 (66)	146 (73)	16 (45.7)
School	111 (55.5)	157 (78.5)	19 (54.3)
Magazines	6 (3)	5 (2.5)	1 (2.9)
Internet	16 (8)	16 (8)	4 (11.4)
TV	42 (21)	42 (21)	11 (31.4)
Radio	4 (2)	4 (2)	2 (5.7)
Friends	9 (4.5)	9 (4.5)	2 (5.7)
Doctor	50 (25)	49 (24.5)	8 (22.9)
	354	428	63

Overall distribution before vs. after p=0.05, School before vs. after p=0.11, before vs. control p=0.85, after vs. control p=0.31.

Table 4: Knowledge of sun's benefits, pre- and post- intervention.

	Before Intervention N (%)	After Intervention N (%)	Control group N (%)	Significance
Sun's benefits (light, photosynthesis, Vitamin D, warm up, all)	All 115 (57.5)	125 (62.5)	18 (51.4)	• Overall before vs. after p=0.39 (NS) • Control vs. before p=0.27 (NS) • Correct answer before vs. after p=0.07 (NS)
Name of the protective ozone layer (planet, stratosphere, comet, ozone, don't know)	Ozone 119 (59.5)	130 (65)	10 (28.6)	• Overall before-after p=0.6 (NS) • Control vs. before p=0.47 (NS)

				• Correct answer before-after p=0.78 (NS)
Negative effects of sun exposure (sunburns, redness, freckles, skin cancer, All, don't know	All (correct) 113 (56.5)	127 (63.5)	5 (14.3)	• Overall before-after p=0.21 (NS) • Control vs. after NS p<0.001* • Correct answer before-after p=0.17 (NS)
Knowledge about prolonged sun exposure effects (Burns, sunstroke, fever, skin cancer, all)	All (correct) 100 (50)	124 (62)	7 (20)	• Correct answer before-after p=0.121* • Overall before-after • p=0.63 (NS)

Percentage of correct answers before and after intervention. NS: non- significant.

Table 5: Knowledge of sun protection pre- and post- intervention.

	Target group		Control
	Before intervention, N (%)	After intervention, N (%)	Before intervention, N (%)
Sun protection factor			
Yes	128 (64)	172 (86)	17 (48.6)
No	34 (17)	14 (7.0)	6 (17.1)
Don't know	38 (19.0)	14 (7.0)	12 (34.3)
p value<0.001			
Proper use of sunscreen			
Only summer	54 (27)	13 (6,5)	8 (22.9)
Only at sea	34 (17)	20 (10)	16 (45.7)
All year	106 (53)	164 (82)	9 (25.7)
Don't know	6 (3)	3 (1.5)	2 (5.7)
p value<0.001			
Average time of sun exposure			
<2 hours	108 (54)	111 (55.5)	22 (62.9)
2-4 hours	64 (32)	74 (37)	8 (22.9)
>4 hours	23 (11.5)	10 (5)	5 (14.3)
Don't know	5 (2.5)	5 (2.5)	0 (0.0)
p value=0.6			
Sunscreen use at the beach			
Always	116 (58)	176 (88)	21 (60.0)
Almost always	35 (17.5)	15 (7.5)	6 (17.1)
Sometimes	25 (12.5)	3 (1.5)	3 (8.6)
Rarely	19 (9.5)	3 (1.5)	2 (5.7)
Never	5 (2.5)	3 (1.5)	3 (8.6)
p value<0.001			
Time of use of sunscreen			
1 hour before exposure	51 (25.5)	130 (65)	8 (22.9)
Just at the exposure	77 (38.5)	35 (17.5)	12 (34.3)
Sometimes before, Sometimes after	51 (25.5)	20 (10)	6 (17.1)
After each dive	21 (10.5)	15 (7.5)	9 (25.7)
p value<0.001			
Optimal time of swimming/sun recreation			
Till 10 a.m.	18 (9)	46 (23)	6 (17.1)
10-12 a.m.	45 (22.5)	27 (13.5)	12 (34.3)
12-4 p.m.	46 (23)	25 (12.5)	7 (20.0)
After 5 p.m.	29 (14.5)	80 (40)	2 (5.7)
Not special hours	62 (31)	22 (11)	8 (22.9)

p value<0.001			
Sunscreen use after swimming			
Always	62 (31)	148 (74)	17 (48.6)
Almost always	30 (15)	11 (5.5)	3 (8.6)
Sometimes	48 (24)	17 (8.5)	7 (20.0)
Rarely	60 (30)	24 (12)	8 (22.9)
p value<0.001			
Wearing hat			
Always	81 (40.5)	146 (73)	16 (45.7)
Almost always	44 (22)	19 (9.5)	7 (20.0)
Sometimes	75 (37.5)	27 (13.5)	12 (34.3)
Rarely	0 (0)	8 (4)	0 (0.0)
p value<0.001			
Protective clothing after swimming			
Always	62 (31)	146 (73)	16 (45.7)
Almost always	33 (16.5)	18 (9)	7 (20.0)
Sometimes	34 (17)	12 (6)	6 (17.1)
Rarely	22 (11)	8 (4)	0 (0.0)
Never	49 (24.5)	16 (8)	6 (17.1)
p value<0.001			
Wearing sun glasses			
Always	56 (28)	74 (37)	9 (25.7)
Almost always	23 (11.5)	31 (15.5)	7 (20.0)
Sometimes	56 (28)	42 (21)	8 (22.9)
Rarely	29 (14.5)	22 (11)	6 (17.1)
Never	36 (18)	31 (15.5)	5 (14.3)
p value=0.027			
Wearing proper sun protection			
Hat	34 (17)	20 (10)	14 (40.0)
Sun glasses	4 (2)	2 (1)	0 (0.0)
Sunscreen	27 (13.5)	19 (9.5)	6 (17.1)
Light colour T-shirt	8 (4)	8 (4)	4 (11.4)
All	120 (60)	146 (73)	9 (25.7)
Don't know	7 (3.5)	5 (2.5)	2 (5.7)
p value=0.07			

Table 6: Knowledge about melanoma.

	Total		Control
	Before intervention, N (%)	After intervention, N (%)	Before intervention, N (%)
Knowledge about melanoma			
Yes	95 (47.5)	149 (74.5)	12 (34.3)
No	88 (44.0)	39 (19.5)	13 (37.1)
Don't know	17 (8.5)	12 (6.0)	10 (28.6)
p value<0.001			

DISCUSSION

Studies conducted in rural populations have shown a high risk of melanoma and other skin cancers.[8-11] In Greece, the collection of information on the occurrence of melanoma in rural areas is limited because there is no updated national cancer registry. Roussaki-Shulze et al evaluated the incidence of melanoma in central Greece (Thessalia) from January 1988 to December 1998.[12] There was a rapid incidence increase of melanoma in the region in 1998 mainly in people with phenotype II and III. According to their occupation status, farmers accounted for 56.3% of the cases. Melanomas frequently appeared on sun-exposed areas such as the head and neck.[2] In Crete, another largely rural area in Greece, 102 persons were diagnosed with primary melanoma during the years 1999-2002, indicating a higher incidence compared to other areas of Greece.[13]

Sun exposure during childhood has proven to be a risk factor for skin cancer development, especially for Mediterranean populations.[14] Sun protection during childhood may be particularly beneficial since painful sunburns of early life increase the risk of skin cancer during adulthood.[15-17] Behaviors adopted early in childhood are more likely to be apparent in adulthood. Finally, children are more receptive to educational attitudes about sun protection and parental or other guidance.[4,18-21]

Our study was a before/after, school intervention program including students aged 8-12 at a rural area in Western Greece. The studied population exhibited a UVR-sensitive phenotype with more than 70% reporting a fair skin and a high number of freckles and moles. According to the findings of our study, a short-term and modest increase of the number of pupils being aware of the positive and negative effects of sun exposure. Children were also taught to enjoy moderate sun exposure while avoiding its harmful effects. The most important impact of the intervention was change of habits and behavior in regards to sun protection measures, sunscreen and time spent outdoors. Consequently, it can be stated that target population was effectively motivated and this is considered an important achievement, because it fulfills the main intervention's objective.

A number of studies have investigated the level of awareness of school students and the value of interventional educations programs in increasing awareness and in promoting sun-protection behaviors in school age groups. A similar study to ours conducted in Southern Greece (area of Korinthos) by Saridi et al surveyed 925 students, 15-18 years old, in 5 schools.[22] The frequency of sunscreen use was alarmingly low, with the majority of the adolescents not being familiar with its proper use, and 50% not using a sunscreen with sufficient sun protection factor. Television was an important source of information about protection from sun exposure, while the family was the most important provider of knowledge.

In Northern Italy between the years 2001 and 2002, 1309 children (8-9 years old) attended an educational program before summer in order to increase awareness about sun exposure and compared their results in 636 children (same age) in whom the program was not applied. Parents filled a questionnaire about their children's skin characteristics, sun protective behavior and sunburns. The program's application decreased the sunburns in the group of children who attended the program, indicating its educational and behavior-changing value.[23]

In Valencia (Spain), during the years 2007-2008, an educational intervention addressed 131 parents of primary school children, who filled a questionnaire regarding sun exposure practices for their children before and after structured educational intervention. The sunscreen was the most-commonly employed sun protection strategy while wearing clothes and avoiding sun at midday were less frequent. Nearly 70% of parents reported difficulties in implementing these instructions due to their children's refusal to cooperate. Despite the high level of parents' knowledge, the children's sun protection was not sufficient and sunburns were common. Fernadez et al evaluated the need for school campaigns and determined the level of pupils' awareness and behavior regarding sunlight exposure.[24,25] They surveyed 628 teenage students from 9 high schools in the city of Granada (Spain) and concluded that more than 60% of the pupils gave satisfactory answers about the awareness (girls better than boys) in contrast to responses about risk attitudes and behavior upon sun exposure.[24,25]

In addition, high school students in Palm Beach County (Florida) received 7 sun protection lessons and early detection course, followed by pretests and post-tests 6 months later.[26] 184 students out of 344, completed the post-intervention questionnaire and significant knowledge improvement was noted especially in the children's ability to correctly define the rules of early skin cancer detection. No significant differences were found in sunscreen use, hat or sunglass wearing, although there was a slight decrease in the use of always wearing sun-protective clothing. Consequently, a skin cancer prevention and early detection course integrated into a high school, resulted in knowledge gains maintained at least 6 months after classroom teaching.[6] Determinative factor for the observed difference with the present study with regards to behavioral changes could be the age of the population.

Finally, the Environmental Protection Agency's SunWise School Program, a national environmental and health education program in USA, was evaluated with surveys administered to participating students and faculty. Pretest (n =5,625) and posttest (n =5,028) questionnaires were completed by students in 102 primary and secondary schools (grades K-8) in 42 states of the USA.[27] The knowledge variables (wearing hat and shirt, always protect from the sun, use of the right number of SPF, sun protection measures and UV index) improved significantly.

The program that was implemented in the 4 schools of Western Greece showed that changes and improvements in sun-related attitudes can be produced through proper education even in young ages. In children, the change of attitude is not instant but requires constant awareness and motivation for the adoption of the necessary protective measures as they tend to be overexposed to sun, particularly during the hours of outdoor play. Strengths of our study was the homogeneity of the studied population, the nearly 100% response rate of all participants and the age group studied for which there is not sufficient literature available. Weaknesses of the study include the relatively small sample size and the lack of the long-term monitoring of the effects of the intervention program on student's knowledge and adopted behavior.

However, our study was able to show that a targeted and well-designed educational program with specific questions and answers can be essential -at least in the short-term- in increasing awareness in a "high" risk population and in promoting healthy attitudes regarding sun protection. Further expansion of these preventional programs in the entire school network and their consistent implementation from childhood through adolescence would contribute to the further containment of skin cancer cases by intervening at an early stage of life.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Sakoufaki M, Stergiopoulou A, Stratigos A. Design and implementation of a health promotion program to prevent the harmful effects of ultraviolet radiation at primary school students of rural areas of Greece. Int J Res Dermatol 2017;3:306-14.