RESEARCH ARTICLE

Assessing a Sun Protection Program Aimed at Greek Elementary School Students for Malign Melanoma Prevention

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Abstract

Introduction: Numerous countries have launched campaigns regarding sun protection in the last decades. Aim: The aim of the present study was to assess an intervention program aimed at higher knowledge and healthier attitudes regarding sun protection. Materials and Methods: The sample consisted of 4,133 students aged 8-12 years from a single Greek province. Results: In most items, knowledge levels after the intervention were found to be higher than those before (2.8±0.9 *vs* 3.3±0.9), while knowledge about sun protection factors seems to have had the highest improvement (27.1% *vs* 56.6%). However, student attitudes did not appear to improve, with the exception of applying sunscreen with a higher SPF (29.7% *vs* 54.8%). Girls seemed to have healthier attitudes compared to boys, but gender played no role with regard to knowledge levels. Also, place of residence did not play any role regarding knowledge levels, although those living in semi-urban areas seemed to have more unhealthy attitudes. Logistic regression by correlating knowledge and attitudes established that higher knowledge levels are usually accompanied by healthier attitudes, albeit marginally. Conclusions: The intervention had a positive contribution to the student knowledge level regarding sun protection and also led to small improvements regarding some attitudes. Continuous similar interventions could lead to better results and the adoption of healthier attitudes.

Keywords: Prevention - skin cancer - child health - school health - sun exposure - malign melanoma

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Introduction

Ultraviolet radiation, besides its beneficial effects, without the necessary protection measures may cause serious damages, the most significant being the emergence of malign melanoma, an aggressive type of skin cancer with high case fatality rates (Armstrong and Kricker, 2001). Skin cancer cases have been increasing in several countries, and the most alarming fact is that melanoma cases in people under 40 years are also increasing (Siegel et al., 2012; WHO, 2013). The incidence rates in Australia and New Zealand are two to three times as high as those found in Canada, USA and United Kingdom (IARC, 2008). Also in the South-East Asian Region there was an estimated incidence of 2800 cases of melanoma of the skin in 2008, a staggering 20782 cases in the Western Pacific Region and in Russian Federation, melanoma is the third tumor type by the annual increase rate-next to renal cancer and brain tumors (Baldwin et al., 2013; Gyrylova et al., 2014). Finally similar findings concerning demographical features, histological variables and survival analyses for patients with cutaneous melanoma were found in Turkey too (Uysal-Sonmez at al., 2013).

Among the most common risk factors, the following have been included: Excessive and cumulative sun exposure during childhood and adolescence, existence of at least one severe sunburn during those periods, ozone depletion, genetic predisposition, e.t.c. (Purdue et al., 2008; Cheng et al., 2010; Saridi et al., 2013). The WHO has issued several recommendations regarding protection measures, especially for children and teenagers. The right clothing, sunglasses and wearing hats are hugely important sun protection measures. But the most important measure is the correct use of sunscreen. For children and adolescents, the SPF should be 30 or higher, and younger children and toddlers should use sunscreens with SPF 50 (Lucas, 2010; WHO, 2013).

In the last decades, several countries have designed and launched campaigns and interventions regarding solar radiation-related damages. Such programs take place in a coordinated manner starting from preschool children to older ages, and are adjusted to the needs of the target population (Saridi et al., 2014). Such programs involve not only schoolchildren and their teachers, but aim also at other social structures such as families, mass media, and recently the Internet which is nowadays the most effective way to inform the public about such interventions. Some of the most important programs include Sun Smart from

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Australia and New Zealand, Sun Wise from the USA, and Solsano from Spain, which indicates that these countries have focused on the prevention of skin cancer and also other UVR-related skin disorders (Livingston et al., 2007; Gilaberte et al., 2008; EPA, 2013).

Such programs are based on learning by acting as focus, and aim at changing unhealthy attitudes and behaviours by reinforcing the students' knowledge, beefing up their self-esteem and responsibility, mainly following the social-cognitive learning model. According to this model, learning results from observing other people's behaviours and their consequences. Thus, a person tends to adopt the observed behaviour, if its outcomes are deemed positive. Consequently a person may adopt a behaviour just after having observed it, and not gradually through a trial and error phase, as is the case with behaviourism (Bandura, 1997).

The evaluation of the intervention is focused both on the procedure and, mainly, the results. The evaluation of the procedure is primarily concerned with the participants' reactions and feedback, as well as how successful the design and the implementation of the program was and whether random difficulties and obstacles could be overcome. The evaluation of the results, on the other hand, is focused on the quantitative data drawn from the assessment of the questionnaires (Geller et al., 2002; Glanz et al., 2009).

The aim of the present study was to assess an intervention targeted at knowledge levels and attitudes of elementary school students regarding sun protection.

Materials and Methods

The present non-experimental cross-sectional study aimed at evaluating the effectiveness of a sun protection intervention.

Sample

Elementary school students aged 8-12 years (n= 4 133), coming from a Greek province that combines coastal, urban and semi-urban areas comprised our sample. A minimum age of 8 years was set, since at that age children are fully able to read and write, so they could complete the questionnaire by themselves without much help from the research team. The maximum age of 12 years (equivalent in Greece with the 6th grade) was chosen, since after that, children go to junior high school, and their cognitive level will change.

In order to minimize sample variations before and after the intervention, the first time the questionnaires were handed to students who attended the 3rd, 4th and 5th grades, and next year the questionnaires were handed to the same students who then attended the 4th, 5th and 6th grade respectively. The final sample consisted of 2680 students from 14 elementary schools from urban and semi-urban areas. The same schools, of course, took place in the intervention. The research protocol was approved by the Pedagogical Institute of the Greek Ministry of Education.

Instruments

Questionnaire: The questionnaire was based on the WHO Intersun program (WHO, 2003; Lucas, 2010) as well as the Australian Sun Smart program (Livingston et al., 2007; EPA, 2013). The questionnaire was administered to the students before the intervention, and after summer vacation the same questionnaire was re-administered to the same students. The study took place from October 2009 to December 2010.

Besides the demographics, the questionnaire items aimed at assessing crucial knowledge about sun protection and behaviours adopted by schoolchildren regarding sun exposure.

The questionnaire comprised of 20 items, including demographics, individual characteristics (complexion, eye colour, etc) and questions regarding the students' knowledge and attitudes.

After its compilation, the questionnaire was pilot-tested in 50 students aged 8-12 years who were excluded from the sample. It was found that three items need to be put to minor adjustments. After the adjustments were made, the questionnaire was administered to 25 students of the previous group and 25 more who had not completed it previously, and no difficulties were observed.

Questionnaire validity and reliability

Internal consistency of reliability was estimated by Cronbach's a which was 0.79 and is deemed satisfactory. Reliability alpha of the attitude scale items was found to be rs= 0.78. Face validity was also satisfactory. More specifically, the items were evaluated by persons who had no previous knowledge of such subjects and they were fully and easily understood (Sproull, 1998).

Intervention program

The intervention program was designed according to the Australian one (Sun Smart) (Livingston et al., 2007) and minor adjustments were made after it was pilot-tested in 120 students. The intervention aimed at presenting to young students some basic sun protection measures, increasing their knowledge regarding sun exposure and encouraging them to adopt wiser behaviours regarding sun protection.

The intervention was designed according to the social-cognitive theory, focusing mainly on self-efficacy and reinforcement theories. In general, attitude change or at least its adjustment was something that naturally the researchers would be satisfied to see, but young people are known to be heavily influenced by their families at this age, so any changes were bound to be small (Bandura, 1997).

The evaluation of the intervention was made by asking the students to complete the questionnaire before and after the intervention took place. At first the students completed the questionnaire and then the intervention took place; after summer break (i.e. 4 months later) the same students were administered the questionnaire again.

Intervention description

After completing the questionnaire, the students were asked to draw anyway they wanted their preferred sun protection measures during a typical summer day. This simple creative activity aimed at making the students more

comfortable and at preparing them for the next stage of the intervention.

Next, the program was presented to them via a PowerPoint presentation. The presentation included the effects of solar radiation on humans as well as ozone's protective effects. Then, sun protection measures were presented focusing especially on correct sunscreen use and sun protection factor (SPF).

An interactive conversation followed, basically a role-play game with questions and answers regarding sun protection. Finally, an age-appropriate illustrated pamphlet on sun protection was given out to the students.

Out of the initial sample (n=2680), 2163 students completed the questionnaire before the intervention and 1970 after the intervention had taken place. The response rate was satisfactory, since before the intervention it was 80.7%, and after the intervention it reached 73.5%.

Statistical analysis

Means, standard deviations, medians and interquartile ranges were used for the description of quantitative variables. Absolute and relative (%) frequencies were used for the description of qualitative variables. Student's t-test was used for the comparison of quantitative variables among two groups, while parametric analysis of variance (ANOVA) was used for the comparison of quantitative variables between three or more groups. Logistic regression analysis was used for the calculation of differences among knowledge scores before and after the intervention, odds ratios with 95% confidence intervals were calculated taking into account age, gender, nationality, distance from the beach, participation to prior studies, risk groups, knowledge score and attitude score. Significance level was set to 0.05. The SPSS 17.0 software was used for the statistical analysis (Levesque, 2007).

Results

Demographics

Our sample comprised of 4133 students with an average age of 9.9 (±1.1). Questionnaires before the intervention were administered to 2163 (52.3%) of them, and 1970 (47.7%) of them were administered the questionnaires after the intervention had taken place. 72% of the participants (n= 2977) lived 0-5km away from the beach, 72% (n= 2977) lived in urban areas and 28% (n= 1156) in semi-urban areas. 49.6% (n= 2051) of the participants were females, and 84.2% (n= 3480) were of Greek nationality, while 15.8% (= 652) were of non-Greek nationality. Finally, 48.3% (n=1996) of them had taken part in a previous relevant study over the past two years.

Regarding the high risk group, specific individual traits were taken into account. Thus, the authors included in that group students who had at least four out of five high-risk characteristics (fair complexion, light hair and eye colour, freckles, and number of moles). More specifically, 52.6% (n= 2174) of the students had a sunburn-prone fair complexion and 25.6% (n= 1058) had light eye colour. Also, 34.2% (n=1414) of the children had light hair colour and 19.4% (n= 800) had freckles while 69.2% (n= 2860) had moles on their body or face. All in all, 14.8% (n= 610) of the participants were included in the high-risk group.

Level of knowledge before and after the intervention

Students who completed the questionnaire after the intervention had had significantly higher knowledge scores compared to those who completed the questionnaire before the intervention. In general knowledge levels got higher after the intervention had taken place (Table 1). There was a statistically significant difference regarding all of the items. More specifically, after the intervention 92.9% of the students answered that the sun can be more dangerous between 10.00 a.m. and 16.00 p.m., compared to 83.9% before the intervention. Also when they were asked whether sunscreens can protect them efficiently from sunburns, the percentages of those who answered correctly were higher after the intervention than before (95.2% *vs* 94% respectively). Regarding the correct SPF for children, the participants scored higher after the intervention than before (56.6% *vs* 27.1%), and the same happened regarding damages due to prolonged sun exposure (85.5% *vs* 76.8% respectively).

On the basis of the above mentioned questions, the total knowledge score (which would range from 0 to 4) could be calculated. The average knowledge score of the students was: Mean ±SD 3.0 ± 0.9 (Figure 1).

Attitudes before and after the intervention

It was found that there was a significant difference

Table 1. Students' Knowledge about Sun Protection Measures before and after the Intervention

	Values			
	Before		After	
	N	%	N	%
Sun exposure may be more dangerous...				
Between 8-10 a.m.	178	8.2	84	4.3
Between 10 a.m.-4 p.m.	1814	83.9	1831	92.9
Between 5-8 p.m.	124	5.7	30	1.5
The sun is never dangerous	46	2.1	25	1.3
Sunscreen				
Help us tan	129	6 0	95	4 8
Protects us from sunburns	2033	94.0	1875	95.2
A Sun Protection Factor appropriate for children should be…				
50 or more	585	27.1	1115	56.6
15-20	531	24.6	400	20.3
I don't know	1046	48.4	455	23.1
Frequent sun exposure may cause…				
Skin and eye damage	1660	76.8	1685	85.5
No damage at all	122	5.6	109	5.5
I don't know	380	17.6	176	8.9

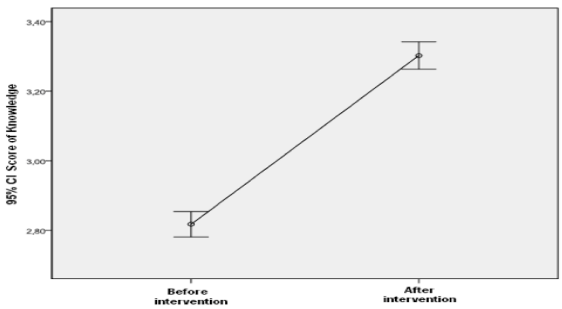

Figure 1. Knowledge Scores before and after the Intervention

before and after the intervention regarding how often the students apply protection measures (Table 2). Students who completed the questionnaire after the intervention reported a less frequent adoption of protection measures compared to the students who had completed the questionnaire before the intervention. Nevertheless, significantly more children applied sunscreens with SPF 30 or higher after the intervention compared to those who had completed the questionnaire before the intervention (p<0.001). Also, the percentage of children who re-applied sunscreen after every time they got out of the sea was much higher among those who completed the questionnaire after the intervention.

v 3 illustrates sun protection measures during several activities. It was found that those students who completed the questionnaire before the intervention scored higher compared to those who completed it after the intervention.

Correlation of knowledge and attitudes with demographics before and after intervention

After the intervention, knowledge scores increased both for males and females. The percentage of correct answers increased for boys (2.8 ±0.9 *vs* 3.2±0.9, p<0.001 Student's t-test) and girls alike (2.9±0.8 *vs* 3.4±0.8, p<0,001 Student's t-test) (Figure 2). Regarding attitudes towards sun protection measures, both males and females showed worse behaviours after the intervention. Both boys (43% *vs* 31.38%,p<0.001) and girls (47.6% *vs* 39%, p<0.001) reported that they failed to wear hats, and the percentages were worse after the intervention. Staying in the shade also showed slightly worse scores after the intervention for both males (43.6% *vs* 41.8%,p<0.405) and females (51.8% *vs* 47.8%, p<0.066). On the other hand, the use of sunscreen with SPF 30 or higher increased after the intervention for male (33.2% *vs* 47.2%, p<0,001) and

Table 2. Students' Attitudes before and After the Intervention

	Values				P Pearson's x^2 test
	Before		After		
	N	%	N	%	
Do you wear a hat when you are outside under the sun?					
Always	980	45.3	696	35.3	<0.001
Sometimes	1053	48.7	1121	56.9	
Never	129	6.0	153	7.8	
Do you wear long trousers and long-sleeve shirts when you are outside under the sun?					
Always	404	18.7	155	7.9	<0.001
Sometimes	1115	51.6	982	49.8	
Never	643	29.7	833	42.3	
Do you stay in the shade at the beach?					
Always	1033	47.8	881	44.7	0.049
Sometimes/Never	1129	52.2	1089	55.3	
Do you wear sun-glasses?					
Always	832	38.5	668	33.9	0.009
Sometimes	944	43.7	929	47.2	
Never	385	17.8	373	18.9	
Do you use sunscreens?					
Always	1690	78.2	1291	65.5	<0.001
Sometimes	409	18.9	567	28.8	
Never	63	2.9	112	5.7	
What SPF did your sunscreen have?					
I didn't use any sunscreens/15 or lower	191	8.8	178	9.0	<0.001
Over 15	331	15.3	286	14.5	
Over 30	641	29.7	1080	54.8	
I don't know	997	46.2	426	21.6	
Do you re-apply your sunscreen at the beach?					
Every 2 hours	659	30.5	641	32.5	0.037
Every time I get out of the sea	468	21.6	473	24.0	
Rarely	669	30.9	561	28.5	
Never	366	16.9	295	15.0	
Do you keep using a sunscreen even after you have got a tan?					
Always	1275	59.0	994	52.6	<0.001
Sometimes	588	27.2	600	31.7	
Never	299	13.8	297	15.7	
Do you like being tan?					
No	1242	57.4	647	34.2	<0.001
Yes	572	26.5	746	39.5	
I don't care	348	16.1	498	26.3	
Did some part of your face or body get reddish or a sunburn last summer?					
No	1256	58.1	1126	59.5	0.449
Yes	734	34.0	607	32.1	
I don't remember	172	8.0	158	8.4	

Table 3. Correlation of Attitudes before and after the Intervention

	Values				P Pearson's
	Before		After		x^2 test
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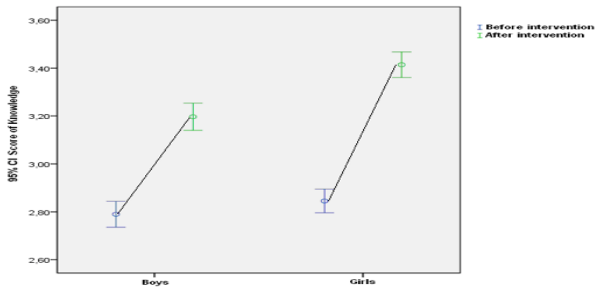

Figure 2. Correlation among Knowledge and Gender before and after the Intervention

female students as well (26.2% *vs* 62.9%, p<0,001). Re-applying the sunscreen also increased but not as much. In this case, male students after the intervention reported that they re-applied the sunscreen every two hours (30.7% *vs* 33.8%, p=0,030), but there was no considerable increase for female students (30.2% *vs* 31.2%, p=0.337).

As far as age was concerned, those who were 9 years old or younger had had the higher increase regarding knowledge levels (SD 2.6±0.9 *vs* 3.6±0.8, p<0.001), and it

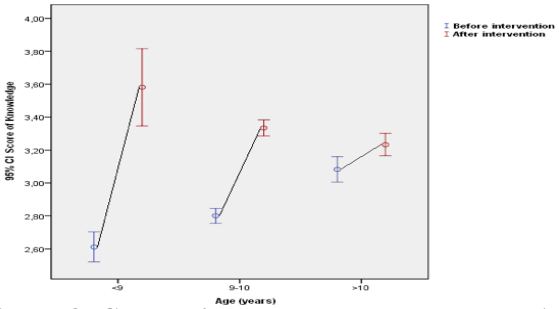

Figure 3. Correlation among Knowledge and Age before and after the Intervention

seems that the younger the age, the higher the knowledge levels (Figure 3). On the other hand, all three age groups showed worse attitudes after the intervention. Yet, the percentage of students aged 9 or younger who applied sunscreen with SPF 30 or higher was significantly higher after the intervention (18.3% *vs* 72.1%, p<0.001, Fisher's exact test). Similar positive results were also recorded for the age group 9-10 years (30.1% *vs* 57.2%, p<0.001), and the age group 10 years and older (39.1% *vs* 49.9%, p<0.001).

Knowledge scores were significantly higher after the intervention than before regardless of the students' nationality (p<0.001), or place of residence (urban/semi-urban). Nationality was also essentially irrelevant regarding attitude change after the intervention, excluding the use of sunscreen with SPF 30 or higher where students of non-Greek nationality scored much higher (20,5% *vs* 39,2% p<0.001) compared to their Greek fellow students (31%% *vs* 58.7%, p<0.001).

In what regards the students' participation in a previous relevant study, it was found that knowledge scores were much higher after the intervention than before regardless of any other previous studies or programs (3.3±0.9 *vs* 3.3±0.9), and also even if they belonged to a high-risk group did not make any statistically significant difference (2,8±0,9 *vs* 3,4±1, p Pearson's x^2 test <0,001). Nevertheless, previous participation in relevant programs did have an impact regarding sun protection attitudes: More specifically, those who had participated in previous programs showed better attitudes after the intervention compared to those who hadn't. The proportion of those students who used sunscreen with SPF 30 or higher and had participated in other programs increased (27.6% *vs* 54.9%, p<<0.001) and was much higher for students who completed the questionnaire after the intervention (32% *vs* 54.8%, p<0,001).

Place of residence (urban or semi-urban area) did not play any role in knowledge levels, but seemed to be involved regarding attitude change. Students who lived in semi-urban areas showed poorer attitudes regarding sun protection compared to their classmates who lived in urban areas. Yet, the use of sunscreen with SPF 30 or higher increased after the intervention for students living in urban areas (29%% *vs* 55.7%, p<0.001), and for those from semi-urban areas as well (31.3% *vs* 52.5%, p<0.001).

Correlation of knowledge after the intervention and attitudes

In order to correlate the students' knowledge with

their overall attitudes, it was found that the higher the knowledge scores, the better the attitudes. Before the intervention there was low and negative correlation (r=0.05, p=0.016) among knowledge and attitude, which means that poor knowledge leads to poor attitudes. After the intervention, we found a low and positive correlation

Table 4. Correlation of Knowledge before and after the Intervention

		Values				P Pearson's x^2 test
		Before		After		
		N	%	N	%	
Sun exposure may be more dangerous…	Wrong answer	348	16.1	139	7.1	<0.001
	Correct answer	1814	83.9	1831	92.9	
Sunscreen…	Wrong answer	129	6	95	4.8	0.105
	Correct answer	2033	94	1875	95.2	
A Sun Protection Factor appropriate for children should be…	Wrong answer	1577	72.9	855	43.4	<0.001
	Correct answer	585	27.1	1115	56.6	
Frequent sun exposure may cause…	Wrong answer	502	23.2	285	14.5	<0.001
	Correct answer	1660	76.8	1685	85.5	
Knowledge score		2.8±0.9		3.3±0.9		<0.001*

*mean value±SD

Table 5. Correlation of Attitudes and Knowledge before and after the Intervention

Attitudes	Before			After		
	Knowledge score		P Anova	Knowledge score		P Anova
	mean	SD		mean	SD	
Do you wear a hat when you are outside under the sun?						
Always	2.87	0.84	0.011	3.47	0.80	<0.001
Sometimes	2.79	0.87		3.30	0.88	
Never	2.66	1.03		2.61	1.03	
Do you wear long trousers and long-sleeve shirts when you are outside under the sun?						
Always	2.95	0.89	0.002	3.21	1.06	<0.001
Sometimes	2.79	0.82		3.41	0.83	
Never	2.79	0.91		3.19	0.92	
Do you stay in the shade at the beach?						
Always	2.86	0.82	0.017*	3.47	0.80	<0.001*
sometimes/never	2.78	0.91		3.16	0.94	
Do you wear sun-glasses?						
Always	2.83	0.88	0.698	3.41	0.86	<0.001
sometimes	2.80	0.86		3.28	0.92	
Never	2.83	0.87		3.18	0.85	
Do you use sunscreens?						
Always	2.86	0.85	<0.001	3.43	0.83	<0.001
Sometimes	2.71	0.87		3.11	0.94	
Never	2.51	1.18		2.75	0.96	
What SPF did your sunscreen have?						
I didn't use any sunscreens/15 or lower	2.69	0.79	<0.001	2.62	0.97	<0.001
Over 15	2.71	0.80		2.97	0.69	
Over 30	3.39	0.75		3.78	0.52	
I don't know	2.51	0.79		2.62	0.98	
Do you re-apply your sunscreen at the beach?						
Every 2 hours	2.98	0.81	<0.001	3.38	0.91	<0.001
Every time I get out of the sea	2.85	0.77		3.53	0.68	
Rarely	2.71	0.90		3.19	0.92	
Never	2.69	0.98		2.99	0.98	
Do you keep using a sunscreen even after you have got a tan?						
Always	2.92	0.82	<0.001	3.53	0.75	<0.001
Sometimes	2.67	0.90		3.16	0.93	
Never	2.67	0.94		2.85	0.96	
Do you like being tan?						
No	2.66	0.86	<0.001	3.22	0.87	0.006
Yes	3.03	0.84		3.32	0.93	
I don't care	3.02	0.85		3.39	0.81	
Did some part of your face or body get reddish or a sunburn last summer?						
No	2.83	0.87	<0.001	3.32	0.89	0.199
Yes	2.87	0.82		3.31	0.90	
I don't remember	2.52	1.00		3.18	0.80	

(r=0.08, p=0.001), which means that more knowledge results in improved attitudes. The students' attitude score before (mean ±SD21.60 ±3.48) and after the intervention (mean± SD 19.71 ±3.40, p student's t-test <0.001), suggest that higher scores point towards better attitudes.

Logistic regression

The logistic regression analysis had as its dependent variable whether the scores were befoe (=0) or after (=1) the intervention; the independent variables were age, gender, nationality, distance from the beach, participation to previous studies, if they belonged to a high-risk group, knowledge score and attitude score. Taking all those factors into account, it was found that after the intervention knowledge scores had increased. Also, attitude scores were lower after the intervention. More specifically, knowledge score was (OR (95% Confidence Interval (CI)), 4.36 (3.17-5.99) and attitude score was (OR (95% CI), 0.72 (0.66-0.78), p<0.001. Table 4 illustrates knowledge scores before and after the intervention with regards to the students' sun protection attitudes. It follows that the higher the students' knowledge scores, the better their attitudes towards sun protection measures.

It was also found that children who used to take sun protection measures had had significantly higher knowledge scores both before and after the intervention. Also, after the intervention, those students who took no protection measures had had lower knowledge scores compared to those who protected themselves. Table 5 illustrates knowledge scores before and after the intervention depending on sun protection measures (if any).

Discussion

Since sun protection has become a priority in many countries, several intervention programs and campaigns have been designed in order to be implemented mainly in schools. So far, it ha been established that proper and timely education, especially if it starts from pre-school years and continues up to adolescence, can contribute substantially to the adoption of healthier attitudes and the avoidance of the adverse effects caused by prologue or excessive sun exposure (Gilaberte et al., 2008; EPA, 2013). Schools can be an effective place for such programs to be implemented, but in Greece such a health education program has yet to be implemented.

The present study aimed at improving the students' knowledge and at encouraging them to adjust their attitudes regarding sun protection. The creation of a targeted intervention program was the tool by which the research team tried to accomplish those goals, and the completion of an anonymous questionnaire was the means to assess the success of that program.

The program draws from Bandura's social-cognitive theory, according to which the enhancement of learning can contribute to behaviour changes (Bandura, 1997). In our program, the enhancement of learning was mainly focused on knowledge improvement and attitude change by adopting sun protection measures. Our main guide had been the Sun Smart program which has been successfully implemented in Australia and New Zealand (; Livingston et al., 2007Gilaberte et al., 2008).

The specific age group that participated (8-12 years old) has generally a better response to health education programs compared to older children and teenagers, because in these ages children absorb information more easily and shape their attitudes and behaviours (Bandura, 1997). Family and school environment, teachers, the Media and the Internet also influence greatly children of this age. The results of the present study came from a self-reference tool (questionnaire) and may be influenced or biased by the children's family, social or cultural stereotypes, nevertheless they reflect the participants' overall knowledge and attitudes.

The total sample of the study consisted of 4133 elementary school students, and can yield reliable results. A factor that has contributed to this fact, is the location of the area where the study took place, which includes coastal, mountainous, urban and semi-urban areas, and also the fact that the sample included both Greek and non-Greek pupils. Other relevant studies have focused mainly on coastal area populations that are more prone to prolonged sun exposure (Buller et al., 2006). Other studies that assess sun protection intervention programs have been carried out by individual researchers or government agencies and it has been found that the programs that targeted more population groups and had more duration, were the most successful ones (Eakin et al., 2004; Buller et al., 2006; Roberts et al., 2009; Ergul et al.,2011).

Regarding the participants' gender, no significant differences emerged, because males and females participated equally. The students' nationality was also taken into account, since Greece has become a multi-cultural society. Most students were Greek (84.2%), as expected, but students who were of non-Greek nationality (15.8%) were many enough to provide us with significant input regarding their knowledge and attitudes, as influenced (perhaps) by their cultural characteristics. Several studies have found that nationality may affect knowledge levels and attitudes because of different cultural values (Bandura,1997; Horsley et al., 2002; Saraiya et al., 2003; Feher et al., 2010). Naturally, geographical and cultural/religious characteristics are important factors in their own right, but modern societies include immigrants and in general people from other national/religious backgrounds, e.g. the way Muslim females, or several Jewish persons usually dress by covering most of their body, is a sun protection measure by itself (Tamir et al., 2002; de Vries et al., 2005).

The high-risk group was created according to the pupils' individual characteristics, and 14.8% of the children were included in that group, which is hardly surprising given the country's geographical location and its climate conditions. Several international studies take into account the participants' phototype since protection measures vary according to one's phototype (Ergul et al., 2011; Saridi et al., 2012). Countries with similar climatic conditions, such as Italy, Malta, Turkey, Spain, Brazil and Israel present similar racial characteristics to the ones featured in our sample (; ; ; Aquilina et al., 2004; Benvenuto-Andrade et al., 2005; El Sayed et al., 2006;

Aguilera et al., 2009; Ergul et al., 2011; Ramazzotti et al., 2011).

Another important finding of our study was that 69.2% reported having moles on their face or body. Another study in teenagers from the same area recorded a similarly high percentage (80%). Only few studies, e.g. the 'Euromelanoma' study (Nikolaou et al., 2009), and other recent studies from Italy(Ramazzotti et al., 2011), USA (Aalborg et al., 2009; Scope et al., 2011), Australia (Harrison et al., 2008), Brazil (Vallarelli et al., 2010), Spain (Aguilera et al., 2009), Turkey (Akyol et al., 2008), Malaysia (Al Naggar, 2013) and Austria (Richtig et al., 2009), have mapped moles of students. Yet no studies have counted moles on children or adolescents or the way they are distributed on the body, although it's an established fact that number of moles and their distribution can be a risk factor for melanoma. It is an encouraging fact that modern studies routinely map the participants' moles and focus on regular monitoring (Fitzpatrick et al., 2003; Aguilera et al., 2009; Saridi et al., 2013).

Assessment of knowledge and attitudes before and after the intervention

Knowledge levels showed a significant difference before and after the intervention. More specifically, after the intervention most students knew what time of the day the sun was at its peak and sun exposure may be dangerous (92.9% *vs* 83.9%). Most recent studies also take this point into account. The protective effects of sunscreen became more widespread among the participants after the intervention, and also after the intervention more students became aware that excessive sun exposure may cause skin or eye damage. Also after the program, many more students knew what the correct SPF for them was (56.6% *vs* 27.1%). Several international studies have also confirmed that knowledge about the correct sunscreen increases greatly especially in combination with an education program(Geller et al., 2005; Buller et al., 2006; Cokkinides et al., 2006; Livingston et al., 2007; Murray, 2013).

As far as attitudes were concerned, our findings after the intervention did not show any improvements, which was expected since children's attitudes change gradually and mainly under the influence of their family environment. But there was a positive change in some crucial points. More specifically, before the intervention only 29.7% of the participants said they used sunscreen with SPF 30 or higher, while after the program that figure rose to 54.8%. Also, after the intervention it was found that re-applying the sunscreen had become more widespread among the students. There have been reported some issues regarding the correct use of the right sunscreen, but that could be attributed to the studies' usually small samples. Several studies have also shown that continuous education programs can improve knowledge and encourage attitude change, especially when addressed to parents and teachers too (Horsley et al., 2002; Piperakis et al., 2003; Geller et al., 2005; Livingston et al., 2007).

The correlation between knowledge and demographics showed a relation between knowledge levels and place of residence. Students who lived away from the beach had usually lower knowledge levels. On the other hand, pupils who lived in urban coastal areas scored higher in sun protection measures compared to their classmates who lived in semi-urban areas. International studies confirm our findings, although place of residence has not been studied well enough yet as a factor that could effect sun protection attitudes. It should be noted that sun protection should not be important only in coastal areas, but rural areas as well, since children there tend to stay outdoors for long duration (Hewitt et al., 2001; Kirsner et al., 2005; Wright et al., 2008).

There was also a statistically significant correlation between knowledge levels and the students' participation in previous similar programs. Students who had attended similar programs in the past had had higher knowledge levels and better attitudes. According to several studies, systematic and recurring education programs encourage students to adopt healthier attitudes (Mahe et al., 2001; Kirsner et al., 2005; LaBat et al., 2005).

Regarding knowledge and gender, no significant differences were found, but female students showed more cautious behaviours than their male classmates. Similar studies have also concluded that females have pore positive attitudes against sun protection measures that may result from cultural reasons, since females are urged to look after their appearance much more compared to males (Lowe et al., 2000; Geller et al., 2005; Cokkinides et al., 2006; Livingston et al., 2007).

Our study also showed a significant difference among the students according to their age. The highest knowledge increase was among students aged 9 or less. Numerous international studies have established that interventions that take place during childhood are usually the most fruitful ones. All age groups after the intervention showed slightly higher rates of not using some protection measure, but those percentages were not statistically significant (p=0.088). Students aged 10 or older used sunscreen with the right SPF, something which has been confirmed by other studies too; the fact that older children tend to adopt more easily protection measures may be attributed to lifestyle trends regarding hats or sun-glasses and not so much on prevention causes, but this is not important. So in this case commercial interests benefit health as well (Horsley et al., 2002; Saraiya et al., 2003; Aquilina et al., 2004; Ramazzotti et al., 2011).

Regarding nationality and knowledge, Greek students scored higher compared to their non-Greek classmates. After the intervention no significant differences among the two groups were found. Similar findings from other studies have been attributed to the students not being totally familiar with the new education/social system, perhaps because many of them come from countries with lower education level, or just because of cultural differences. Regarding attitudes, Greek students also reported better attitudes regarding sun protection measures compared to their non-Greek classmates (Saraiya et al., 2003; Benvenuto-Andrade et al., 2005; Ergul et al., 2011; Saridi et al., 2013).

Students in the high-risk group after the intervention had higher knowledge scores but there was no improvement in their attitudes. Findings in other studies regarding this

group vary considerably, which once again shows why continuous education programs about sun protection are so important. In general, fair-skinned people tend to be much more aware of sun-related risks and protect themselves systematically (Lowe et al., 2000; Stankeviciute et al., 2004; Cokkinides et al., 2006; Richtig et al., 2009).

In general, it was found that increasing knowledge does not necessarily improve attitude or behaviour. But it was quite obvious that in what concerned the right use of sunscreens, a point of importance for the present study, there was a change in attitudes, regardless of the fact that the intervention was an isolated, one-off effort.

The logistic regression also confirmed that higher knowledge usually goes along with better attitude, albeit marginally. Similar findings have been reported by other international studies (Geller et al., 2005; Livingston et al., 2007).

It has been noted that after the implementation of education programs sun protection measures are more widely adopted, something that did not happen in our study, mainly because the intervention was an isolated one-off effort that was not continued in order to increase knowledge and have an impact on the students' attitudes (Hewitt et al., 2001; Kirsner et al., 2005; Milne et al., 2006; Roberts et al., 2009; Saridi et al., 2014).

Study limitations

An initial limitation had been the fact that access to the study sample was not always easy, since the schools were located in several different areas. The financial burden was on the researcher, with no public financing, something that restricted this study to only one province in Greece .

Also, during phase 1 of this study (completion of questionnaires and intervention, October 2009 to May 2010) the H1N1 pandemic was on the rise. According to the Ministry of Health and the Greek CDC guidelines, students should not be gathered together in large numbers, thus the intervention took place in every classroom and the researchers had to stay longer in every school.

At last the fact that several of the participants were non-Greek posed another difficulty since the researcher had to help those students to fully understand the questions.

In conclusions, the assessment of the intervention showed that it lead to a knowledge increase and a minor attitude improvement regarding sun protection. Behaviour modification theories insist that systematically increasing and updating knowledge is a basic factor for attitude change or improvement. Consequently, one should not expect an immediate attitude change, but the changes will come in the long term and according to the effects of one's age and family/social environment.

Designing and implementing similar programs in children has shown encouraging results. But in order for those programs to be effective, they have to be systematic and integrated in the child's daily routine (school, family and social environment). Hence, all relevant individuals and agencies should combine forces and implement continuous, updated education programs in order to provide children and teenagers with healthier behaviour patterns.

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