UNIL | Université de Lausanne

Faculté de biologie et de médecine

Master's Degree in Medicine

N° 2066

Sun protective behaviour and sunburn prevalence in primary and secondary schoolchildren in Western Switzerland

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Abstract

Background: Switzerland has one of the highest incidence of cutaneous malignant melanoma, a potentially preventable cancer since its main risk factor, exposure to ultraviolet (UV) radiation, is amenable to behavioural changes. Although solar over-exposure during childhood and adolescence increase the risk of melanoma, determinants of sunburn and sun protective behaviours of Swiss children have scarcely been explored.

Objectives: To investigate sunburn occurrence and sun protective behaviours of schoolchildren in western Switzerland.

Methods: Self-reported questionnaires were administered during regular classes to pupils of the 5th (primary school, n=431), 8th and 11th grades (secondary school, n=837) in the 18 public schools of la Chaux-de-Fonds, western Switzerland, regarding their sunburn occurrence and sun-related behaviours. Descriptive statistics and multivariate logistic regression analyses were performed to assess predictors of sunburns and of three sun protective behaviours (sunscreen, shade, wear of covering clothes).

Results: Response rate was 91%. Sunburn prevalence over the preceding year was high (60% at least one sunburn, 30% at least two, 43% at least one painful or blistering sunburn). Younger age, fair skin, regular sunscreen use, higher sun-related knowledge and preference for a tanned skin were predictors of sunburn. Sunscreen was the most used protective measure (69%), followed by seeking shade (33%) and wearing long sleeves shirts (32%). Decline in all protective measures was observed in older and pro-tan attitudes pupils. The wear of covering clothes was significantly associated with sunscreen use and seeking shade. Parental encouragement favoured sunscreen use and wear of protective clothes.

Conclusion: In future sun protection campaigns targeting children and adolescents, sunscreen use as last protective barrier against UV radiation should be better emphasized. Multi-faceted interventions, including role models, parents and peers should help to improve children sun-protective behaviours.

Introduction

Skin cancer is a growing public health and economic burden in fair-skinned populations (1). In Europe, the incidence of cutaneous malignant melanoma (CMM), the most lethal type of skin cancer, has been steadily rising in the last decades (2–4).

Melanoma is potentially preventable since its main risk factor, intermittent intensive exposure to UV radiation, is modifiable (5). Constitutional factors (e.g. skin phototype, eye and hair colour, number and size of nevus, freckles, familial history of CMM and genetic predisposition) also play an important role in the risk of CMM (6,7). Epidemiological evidence indicates that excessive sun exposure early in life, particularly during childhood and adolescence when target cells are still immature and the skin thinner, increases the risk of developing CMM later in life, and that the risk rises with the number of sunburns (5,8).

Sun protection campaigns focussing on young children appear to be more effective as preventive behaviours acquired during childhood are more likely to last than those acquired during adolescence (9,10). In Australia, where campaigns were launched since the 1960s declining CMM incidence rates in children and adolescents have been observed from the mid-1990s, especially for thin (<=1mm) tumours (11). Similar findings were reported about a decade later among US kids (12). Prior studies showed that sun protection knowledge of children and teenagers increased with age whereas sun protective attitudes and behaviours followed the opposite trend (10,13). The explanation is that behaviours of adolescents are mediated by attitudes, usually pro-tan, rather than by knowledge (9,13,14). Sun protective behaviours decline proportionally to the desire of getting tanned (9). Poor sun protective behaviours seem mainly driven by the desire of tan for girls whereas for boys tiresomeness plays an important role (15). Being male, older and having a fair skin seems to be predictors of sunburn (13,16). Whether sunscreen use contributes to sunburn occurrence remains unclear. Sunscreen use was found to reduce the risk of sunburn (17), to increase it among routine users (18) or to have no influence on getting burnt (16,19)

Switzerland has one of the highest CMM incidence rate in Europe (2–4) and CMM is the second most frequent cancer in Swiss under the age of 40. Within Switzerland, incidence rates are higher and the rise has been the largest in the western (French-speaking) part (20). Although prevention campaigns have been conducted for about thirty years (21), knowledge of sun protective

behaviour of Swiss children and their determinants remains limited (19). Our study is the first investigation of sun protective behaviour and sunburn prevalence of children and adolescents in western Switzerland. We also aimed identifying determinants of sunburn and sun protection with a view to providing keys to improve current prevention messages and campaigns.

Methods

Study population and questionnaire

The study population consisted of all 5th, 8th and 11th grade students (n=1268) from the 18 public schools in La Chaux-de-Fonds, the third biggest city in western (French-speaking) Switzerland. This survey, based on anonymous self-reported questionnaires, was approved by the health promotion service of La Chaux-de-Fonds and by the cantonal ethics commission. Teachers and parents were separately informed by letter about the survey objectives. In May 2014, the questionnaires were completed during class hours under the supervision of teachers. Altogether, 1154 pupils (91%) of an average age of 9, 12 and 15 years participated in the study.

Due to the age span of students, two versions of the questionnaires were addressed to primary (5th grade) and secondary (8th and 11th grades) school classes, respectively. These questionnaires were adapted and validated in French from a previous study (19). The questionnaires mostly consisted of multiple choices questions focusing on (1) the pupils' knowledge of the harmful effects of UV radiation and sun protective measures, (2) their attitude towards suntan, (3) their sun exposure and sunburn history, (4) their sun protective behaviour, and (5) parents' influence on their behaviour.

Definitions and classifications

Skin type was assessed from a table of six coloured photographs of faces representing each category of Fitzpatrick photo type with a corresponding description (skin, hair, eye colour and ability to tan). These images were selected by Swiss dermatologists and used in previous skin cancer prevention campaigns of the Swiss league against cancer. For analysis, skin types were grouped into fair (phototype I & II), intermediately pigmented (phototype III & IV) and dark (phototype V & VI).

The socioprofessional status (SPS) of each parent was retrieved from their reported occupation in the questionnaires and independently coded by two trained investigators (FL and JLB). The SPS of each child was defined as the highest SPS of either parent. Parental education was sought but deemed too unreliable to derive an educational status (over 40% of children did not know the highest qualification attained by their parents). Sunburn was defined as a reddening of the skin after sun exposure and considered as severe if reported as painful or involved blistering. Sunscreen use was defined as "routine" when reported to be applied always, nearly always or often and as "sporadic" when used sometimes, rarely or never. Any means of sun protection (sunscreen, shade or clothes) actively encouraged to be used or directly applied by the parents was considered as parental encouragement. A child was classified as informed by his/her parents when they explained to him/her the dangers of UV or mentioned sun protection as a topic at home.

Statistical analyses

One questionnaire with no gender information was discarded from all analyses. Association between categorical variables were examined using the Chi-square statistic. Differences between means were tested by the t-test for dichotomic variables and by an analysis of variance (ANOVA) when more than two means were compared. A multivariate logistic regression analysis was performed separately for each outcome. The outcomes considered were the prevalence of at least two sunburns the preceding year, and, for sun protection behaviours, the sporadic use of sunscreen, the intentional search of shade and wear of a long sleeve top. For predictors of sunburn, a sensitivity analysis was performed using the occurrence of at least one severe sunburn as an alternative outcome. Goodness-of-fit of models were assessed with standard summary measures (22). All statistical analyses were carried out with Stata 12 (StataCorp LP, College Station, Texas, USA).

Results

Sunburn

Overall, 60.2% of children reported at least one episode of sunburn, 30.1% at least two, 11.2% at least three and 43.2 % at least one occurrence of severe sunburn over the preceding year (2013). Of those sunburnt, 66.3% described their worst sunburn as painful without blister, 6.9% as painful and blisters and 26.8% as painless. Activities related to sunburn occurrence were swimming or

water sports (50.3%), other sports activities (23.8%) and non-physical activities (25.9%). Fifty percent of children reported using sunscreen and 5% to be in the shade when experiencing their worst sunburn whereas 26% had no protection and 18% could not remember (data not shown).

The prevalence of at least two sunburns over the last year did not differ significantly by school grade (Table 1) and was significantly associated with the skin type, sunscreen use, tanning preference and perception of sufficient self-protection. Most of these significant associations were also observed for each school grade. The highest sunburn prevalence was found in children of skin type I-II (42.8%), routine sunscreen users (33.6%) and those who preferred a tanned skin (38.3%).

The multivariate analysis (Table 2) identified younger age, fair skin, routine sunscreen use, preference for a tanned skin and a higher sun-related knowledge as predictors of sunburns. When the analysis was repeated with severe sunburn as the outcome (see supplementary Table S1), significant effects of comparable magnitude were found for skin type, routine sunscreen use, and tanning preference. However, the risk of severe sunburn increased with age, whereas it decreased with age for the occurrence of sunburn (Table 2). Parental encouragement was also a potential predictor of the occurrence of a severe episode of sunburn (p=0.07, Table S1).

Protective behaviours

Some 69.2% of children reported applying sunscreen routinely in summer and 39.5% also used it regularly in winter for sports, 32.8% of the pupils sought shade whenever possible and 31.5% of secondary school pupils wore deliberately long sleeves shirts as a sun protective measure. Among routine sunscreen users, two thirds applied sunscreen several times during sun exposure and 55% reapplied it specifically after swimming. Nearly 9 out of 10 secondary school students used a sun protection factor (SPF) of 20 or higher, however, a third did not remember the SPF (data not shown).

As shown in Table 3, the three studied protective behaviours (using sunscreen routinely, seeking shade, wearing purposely long sleeves) were most frequent at younger ages, among those who preferred an untanned skin and among fair skinned children except for seeking shade which was most common among those of skin type V or VI. In addition, users of one sun protective measure reported more frequently use of other sun protective behaviours, expect for those seeking shade which did not apply significantly more often sunscreen.

61% of the scholars were encouraged by their parents to protect against UV radiation and 55.6% of the secondary school students were informed by their parents about the dangers of the UV radiation (data not shown). Those encouraged by their parents reported more frequently protective behaviours (Table 3). Some 61.5% felt to protect themselves enough against the sun. The reasons mentioned for not protecting themselves better were to forget (34.4%), preferring a tanned skin (25.3%), having a naturally dark skin (18%), finding sunscreen to be an unpleasant sensation on their skin (11%) or finding sun protection altogether to be too demanding (6.9%) (data not shown).

The multivariate analyses (Tables 4, 5 and supplementary Table S2) revealed that preference for a tanned skin and the perception of being insufficiently protected were associated with lesser use of any sun protection measure. On the contrary, being younger was predictive of protective behaviours except for seeking shade. Fair skin was a predictor of applying routinely sunscreen and seeking shade. Parental encouragement was significantly associated with routine sunscreen use and possibly wearing long sleeves. On the contrary, secondary pupils sensitized by their parents were less likely to wear protective clothes deliberately. Wearing long sleeves shirt was also positively associated with use of other sun protective means (Table S2). Children who did not seek shade or used sporadically sunscreen were more likely not to protect themselves with clothes. Gender showed no association with use of sun protection measures except for sunscreen, with male being 1.5 times less likely to apply it routinely. Furthermore, being of a low familial SPS and having a lower sun-related knowledge were predictors of sporadic sunscreen use.

Discussion

This first broad investigation of sun protective behaviours of children and adolescents in one of the European region with the highest incidence of CMM showed an alarming high annual prevalence of all types of sunburn. Younger age, fair skin (phototype I or II) and a high sun-related knowledge were predictive of sunburn occurrence while a desire for a tan and sunscreen use were the main potentially modifiable determinants of sunburn found. Along with the observed decline in behaviours and attitudes supportive of sun protection with increasing age, and the predominant reliance on sunscreen as a protective measure, our results largely but not entirely concurred with those reported from other high melanoma incidence countries (10,13–16,19).

The increased likelihood of getting sunburnt for routine sunscreen users disagreed with previous studies, including from other Swiss populations (16-17,19). This suggests an inadequate sunscreen use, such as applying an insufficient quantity (23,24) or an insufficient renewal, or some intentionally prolonged sun exposure (25), with sunscreen being used as a tanning aid. Our observation that sunscreen was used in 51.7% of the time when pupils got their worst sunburn supports the hypothesis of an inappropriate use. Moreover, the main reliance on sunscreen as means of sun protection could also result from misleading campaigns of the industry which advertised sunscreen as safe when used alone. A frequent and predominant use of sunscreen has also been reported in northwestern Switzerland and in other countries with high incidence of melanoma (10,13,15,19). In addition, in those same countries, other protective means such as clothes and shade were as sparsely used as observed in our survey.

The greater propensity of younger than older children to get sunburnt was at variance with several prior studies (13,16,17). The lower risk of sunburn in older schoolchildren should be put in balance with our finding that older age was associated with more severe sunburns. Getting sunburnt at younger age can be considered as resulting from inadequate protection, possibly from insufficient parental assistance, whereas getting sunburnt at older age is more likely to reflect a riskier behaviour and deliberate poor sun protection, for instance due to tanning preference, social norms and fashion's influence (26).

Overall, the absence of a gender difference in sunburn prevalence and of gender as a predictor of sunburn does not support the hypothesis that sun-related behaviours and attitudes are gender-specific. The only notable gender difference in sun-related behaviour was the greater propensity of girls than boys to apply sunscreen. As neither the pro-tan attitude nor the type of activity related to the worst sunburn differed between girls and boys, this gender difference in sunscreen use did not appear to be of sufficient magnitude to impact sun exposure. Along with a few studies (10,19), our results support that the observed gender difference in sunburn among adults may be less or even non-existent among primary schoolchildren.

Our survey highlighted some encouraging facts about the impact of sun protection campaigns. The deliberate wear of covering clothes was significantly associated with other protective means, suggesting that pupils start to use more than one protection measure, as recommended (27). To

our knowledge, determinant of covering clothes as a sun protection measure in children has not been reported before. Furthermore, parental encouragement had a positive impact on children protective behaviours as both routine sunscreen use and wear of long sleeves top were associated with parental encouragement. Parents also seemed to be well aware of the different sun sensitivity of skin phototypes as fair-skinned children were more often encouraged to protect themselves from UV rays. The decline in parental encouragement with older children, as previously reported (10), is probably due to the greater self-responsibility of older pupils, for which parents might ease up on advices, and the lesser influence of parents as peer pressure becomes the major influential factor on behaviours of teenagers (26).

Our results corroborated that a pro-tan attitude remains one of the most consistent predictors of sunburns and of unhealthy sun-related behaviours among children and teenagers in high melanoma incidence countries such as Switzerland (19). Such attitude is largely driven by fashion representing a suntan as healthy and attractive (26). Pro-tan attitudes may probably also explained the association between fair skin and routine sunscreen use. Fair-skinned children are the most vulnerable to the pro-tan attitude since despite being found to be more likely to apply routinely sunscreen than darker-skinned children, they were about twice as likely to experience sunburns.

The high participation rate (91 %), the inclusion of all public schools in a delineated region and the use of a previously validated questionnaire are among the main strengths of this study. Further, the study design did not permit any parental guidance or teacher's influence on the children filling the questionnaires. The main limitations of this study are the reliance on information self-reported by children and a potential social desirability bias in answering. However, children appear to be accurate at reporting on their own health (28), and self-reports about sun protection practices are generally valid (29). As questionnaires were distributed in May and most questions were about last summer, some recall bias cannot be excluded. Finally, our sensitivity analysis on the definition of the outcome (at least: one sunburn, two sunburns, a severe sunburn) indicated some minor variation across results from multivariate models. Our *a priori* selection of the outcome (at least two sunburns) considered that one sunburn could occur accidentally without truly reflecting one's sun protection behaviour and that occurrence of severe sunburn, while more likely to be accurately recalled, encompassed more subjectivity (pain, etc.).

Our survey assisted in identifying several ways to improve current sun protection messages. Sunscreen use as the last protective barrier against UV radiation when other means of protection cannot be applied (e.g. for water activities) or as an adjunct to other sun protection measures need to be better emphasized. Educational messages about sufficient application and frequency of reapplication of sunscreen (at least every 2 hours when perspiring or swimming) should help to limit the inappropriate use of sunscreen to intentionally extend one's sun exposure (30). Multi-faceted interventions appear to be more effective to change behaviours and attitudes toward sun exposure (31). School environmental changes, e.g. provision of shaded outdoor areas, and reversing fashion norms, e.g. making covering clothes more attractive are some examples. Sun protection campaigns targeting children and teenagers should involve role models such as athletes, artists or models, peers as peer pressure is paramount in the initiation of habit during adolescence (26), and include parents. Sun protection behaviours of young children depend to a large extent on their parents (32) stressing the importance to include parents in sun educational messages as early as possible in child's life.

Acknowledgements

This study was supported by la Ligue neuchâteloise contre le cancer (Neuchâtel Cancer League). The authors gratefully acknowledge Dr. S. Latrèche, School Health Promotion Service of la Chaux-de-Fonds, Switzerland, for supporting this work and for his contribution in informing the teachers and parents about the study, and in organising the survey delivery across schools. Teachers and children of the participating schools are thanked for their assistance with data collection.

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Tables

Table 1: Prevalence (in %) of at least two sunburns by school grade

	Total % (N)	**5th grade % (N)**	**8th grade % (N)**	**11th grade % (N)**
	30.1(1153)	29.8(366)	31.9(414)	28.4(373)
Socio-demographic characteristics				
Gender				
Male	31.1(573)	32.6(187)	33(209)	27.1(177)
Female	29.1(580)	26.8(179)	30.7(205)	29.6(196)
Skin type	**	**	**	**
I-II	42.8(355)	40(110)	50(116)	38.8(129)
III-IV	29.6(604)	30.2(182)	31.2(231)	27.2(191)
V-VI	6.6(182)	11.6(69)	1.56(64)	6.1(49)
SPS				
Low	27.6(185)	21.6(51)	23.8(63)	35.2(71)
Intermediate	30.4(603)	32.3(198)	33.5(212)	24.9(193)
High	28.2(262)	24.7(81)	30.9(94)	28.7(87)
Unknown	39	14	17	8
Protective behaviours				
Use of sunscreen (in summer)	**		*	*
Routine	33.6(789)	31.1(289)	35.7(286)	34.1(214)
Sporadic	22.7(352)	25.7(74)	24.4(123)	20(155)
Seek shade				
Yes	27.4(372)	30.9(136)	27(137)	23.2(99)
No	31.6(761)	30(220)	34.2(272)	30.1(269)
Wear long sleeves t-shirt				
Yes	28.5(246)	#NA	30(160)	25.6(86)
No	31.3(534)	#NA	33.6(250)	29.2(284)
Attitudes				
Tanning preference	**	**	**	*
No preference	27.9(340)	23.7(135)	29.8(114)	31.9(91)
Tanned skin	38.3(540)	43(107)	42(212)	32.6(221)
Untanned skin	34.3(70)	41.7(36)	40(20)	7.1(14)
Naturally dark skin	7.8(154)	16.7(42)	1.54(65)	8.5(47)
Perception of self-protection	**	**		*
Sufficient	26(697)	25.3(261)	30(257)	21.2(179)
No sufficient	37.2(436)	43.6(94)	35.8(151)	35.1(191)
Parental encouragement				*
Yes	31.6(708)	29.9(278)	32.8(232)	32.8(198)
No	27.6(445)	29.6(88)	30.8(182)	23.4(175)
Parental sensitization				*
Yes	30.9(641)	#NA	31.5(321)	30.3(320)
No	29.1(512)	#NA	33.3(93)	17(53)

* p<0.05** p≤0.001 # No asked to 5th graders NA not applicable

Table 2: Multivariate logistic regression analysis for the occurrence of at least two sunburns

Factor	**Adjusted OR***	**95 % CI**
8th vs 5th	0.80	0.56-1.14
11th vs 5th	0.51	0.33-0.78
Skin type (III-IV vs I-II)	0.56	0.42-0.75
Skin type (V-VI vs I-II)	0.15	0.07-0.30
SPS (low vs high)	1.11	0.70-1.76
SPS (intermediate vs high)	1.27	0.89-1.79
Sporadic sunscreen use (yes vs no)	0.64	0.46-0.90
Preference for a tanned skin (yes vs no)	1.64	1.21-2.24
Perceived self-protection (not enough vs enough)	2.16	1.60-2.91
Knowledge**	1.12	1.00-1.26

CI: Confidence interval

* Each variable was adjusted for all other factors in the model. **per score points

Table 3: Prevalence (in %) of various sun protective behaviours

	Routine use of sunscreen (in summer) % (N)	**Seeking shade** % (N)	**Wearing long sleeves shirts #** % (N)
Socio-demographic characteristics			
Gender	*		
Male	65(568)	32.4(565)	33.1(384)
Female	73.3(573)	33.3(568)	30.1(396)
School year	**	*	**
5th	79.6(363)	38.2(356)	#NA
8th	69.3(409)	33.5(409)	39(410)
11th	58(369)	26.9(368)	23.2(370)
Skin type	**	**	*
I-II	80.4(352)	36.7(349)	36.5(244)
III-IV	69.6(599)	27.8(597)	30.2(420)
V-VI	44.4(180)	41.6(178)	22.9(109)
SPS	**		
low	61.6(185)	33.2(184)	28.6(133)
intermediate	68.2(597)	32.2(593)	30.6(402)
high	81(258)	32.7(257)	35.6(180)
Unknown	59	36	21
Protective behaviours			
Use of sunscreen (in summer)			**
Routine use		34.3(778)	38.2(498)
Sporadic use		29.2(349)	20(275)
Use of sunscreen (in winter)	**		*
Routine use	82.4(442)	34.8(440)	36.8(337)
Sporadic use	60.8(676)	31.4(672)	27.6(432)
Seeking shade			**
Yes	72.4(369)		40.9(235)
No	67.4(758)		27.5(538)
Wearing long-sleeves shirts	**	**	
Yes	77.6(245)	39.3(244)	
No	58.3(528)	26.3(529)	
Attitudes			
Tanning preference	*	**	**
No preference	77.5(338)	41(334)	41.7(204)
Tanned skin	69.2(535)	22.4(535)	27.8(431)
Untanned skin	79.7(69)	55.9(68)	42.4(33)
Naturally dark skin + Unknown	72	64	26
Perception of self-protection	**	**	**
Sufficient	79.4(693)	36.6(689)	37.3(434)
Not sufficient	53.5(432)	27.2(430)	24.1(341)
Parental encouragement	**		*

Yes	82.2(703)	35(698)	36(428)
No	48.2(438)	29.4(435)	26.1(352)
Parental sensitization		*	
Yes	69(636)	29.5(637)	31.2(638)
No	69.3(505)	37.1(496)	33.1(142)

* p< 0.05 ** p≤0.001 # Not asked to 5th graders NA not applicable

Table 4: Multivariate logistic regression analysis for sporadic use of sunscreen

Factor	**Adjusted OR***	**95 % CI**
Male vs female	1.49	1.10-2.01
8th vs 5th	1.43	0.95-2.16
11th vs 5th	2.81	1.78-4.44
Skin type (III-IV vs I-II)	1.67	1.17-2.40
Skin type (V-VI vs I-II)	3.64	2.11-6.27
SPS (low vs high)	1.75	1.07-2.85
SPS (intermediate vs high)	1.49	0.99-2.24
Preference for a tanned skin (yes vs no)	1.22	0.85-1.73
Perceived self-protection (not enough vs enough)	2.82	2.09-3.80
Parental encouragement (no vs yes)	3.61	2.67-4.88
Knowledge**	0.89	0.78-1.01

CI: Confidence interval

* Each variable was adjusted for all other factors in the model. **per score points

Table 5: Multivariate logistic regression analysis for seeking shade

Factor	**Adjusted OR***	**95 % CI**
Skin type (III-IV vs I-II)	0.73	0.55-98
Skin type (V-VI vs I-II)	1.10	0.69-1.75
Preference for a tanned skin (yes vs no)	0.41	0.31-0.55
Perceived self-protection (not enough vs enough)	0.66	0.50-0.87

CI: Confidence interval

* Each variable was adjusted for all other factors in the model

Supplementary tables

Table S1: Multivariate logistic regression analysis for severe sunburns

Factor	Adjusted OR*	95 % CI
8th vs 5th	2.18	1.56-3.04
11th vs 5th	2.34	1.65-3.32
Skin type (III-IV vs I-II)	0.53	0.40-0.71
Skin type (V-VI vs I-II)	0.22	0.13-0.39
Sporadic sunscreen use (yes vs no)	0.73	0.53-1.01
Preference for a tanned skin (yes vs no)	1.31	0.98-1.74
Perceived self-protection (not enough vs enough)	1.78	1.34–2.37
Parental encouragement (no vs yes)	0.77	0.57-1.02

CI: Confidence interval

*** Each variable was adjusted for all other factors in the model.**

Table S2: Multivariate logistic regression analysis for not wearing long sleeves shirt as a protection #

Factor	**Adjusted OR***	**95 % CI**
11th vs 8th	1.82	1.31-2.54
Sporadic sunscreen use (yes vs no)	1.87	1.26-2.76
Seeking shade (yes vs no)	0.68	0.48-0.97
Preference for a tanned skin (yes vs no)	1.55	1.08-2.22
Perceived self-protection (not enough vs enough)	1.41	1.00-1.99
Parental encouragement (no vs yes)	1.45	0.96-2.18
Parental sensitization (no vs yes)	0.59	0.35-0.98

CI: Confidence interval
* Each variable was adjusted for all other factors in the model.
# only asked to the 8^{th} and 11^{th} graders