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Sun-related knowledge and attitude of primary and secondary schoolchildren in western Switzerland

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Abstract

Background: Switzerland experiences the highest incidence of cutaneous malignant melanoma in Europe and rates are highest in the western (French-speaking) part of Switzerland. However, despite prevention campaigns for about 30 years and the increased risk of melanoma with sun overexposure during childhood, little is known about sun-related knowledge and attitudes of Swiss children.

Objectives: To investigate schoolchildren knowledge and sources of information about the adverse health effects of ultraviolet (UV) radiation, attitude towards a suntan and parental influence in a western canton of Switzerland (Neuchâtel).

Methods: All pupils from 5th, 8th and 11th grades (average ages of 9, 12 and 15, respectively) in the 18 primary (5th grade, n=431) and secondary (8th and 11th grades, n=837) public schools of La Chaux-de-Fonds were surveyed during regular school classes. Response rate was 91% (1154/1268). Descriptive statistics and multivariate logistic regression analyses were performed to assess predictors of suntan preferences.

Results: Swiss children had an overall high sun-related knowledge. Eight out of 10 knew about the risk of skin cancer and could recognize the most susceptible skin phototype. The level of knowledge increased significantly with age. Girls, older children (11th grade), fair-skinned subjects and those who reported preferring a tanned skin obtained the highest knowledge score. The main channel of information about UV radiation and sun protection was parents (76%), followed by school (11%) and media (9%). Seeking a suntan was associated with children of skin type III-IV, of higher sun-related knowledge and coming from families of lower socio-professional status (SPS). Parental sensitization (56%) and encouragement (61%) towards sun protective behaviours was more common among fair-

skinned children and children coming from higher SPS.

Conclusions: The high awareness of skin cancer risk among Swiss schoolchildren does not systematically translate into appropriate attitude. Changing the current pro-tan attitude remains a crucial challenge in order to improve children's sun behaviour. Community wide intervention programs involving parents, teachers, peers and primary care clinicians could be considered for Swiss skin cancer prevention campaigns.

Introduction

Skin cancer is an important public health issue, causing a significant and increasing economic burden (1). The incidence rate of cutaneous malignant melanoma (CMM), the most aggressive form of skin cancer, has been steadily rising in Caucasian populations over the past decades and around 100'000 cases of CMM are diagnosed each year in Europe (2,3). However, mortality rates from CMM in fair-skinned populations have been levelling off or have stabilised, and even started to decline in subjects younger than 50 years, possibly due to the efforts of secondary prevention (4).

Solar ultraviolet (UV) exposure yields positive and negative effects on the body. In the short term, UV exposure can prevent diseases of vitamin D insufficiency and increases the risk of sunburn. In the long term, it can cause CMM and epithelial skin cancers, accelerated skin aging and cataract (5). Melanoma results from the interplay between host and environmental factors and exposure to UV radiation is the most preventable cause of this cancer. As the risk of melanoma increases with intense sun exposure during childhood, when skin vulnerability to UV radiation damage is highest, and preventive habits acquired early in life are more likely to be maintained than those established during adolescence (6)(7), some prevention programmes have targeted young people to raise awareness and to adopt appropriate sun protective behaviours from early life on (8)(9). Although educational campaigns have raised sun-related knowledge and awareness of school students in Europe, sun protective behaviours have remained not appropriate (10,11). A challenge of skin cancer prevention is to combat the tanning desire of today's teenagers, strengthened by fashion, as favourable sun protective behaviours decreased with increased desire of a tan (12)(13).

Switzerland experiences the highest incidence of CMM in Europe, rising 3% per year (14), and within Switzerland, rates are higher in the western (French-speaking) part (15). In 2012, CMM was the fourth

most frequent cancer in Switzerland and ranked second among people aged 19-25 years old (15). However, despite primary and secondary prevention campaigns since the late 1980's (16), knowledge and attitudes of Swiss children regarding UV exposure and sun protection measures has scarcely been investigated (17).

This study aims at assessing the level of knowledge about the harmful effects of UV radiation and at examining the influence of tan preferences on sun protective behaviours of primary and secondary schoolchildren in western Switzerland.

Methods

Target population

The study target population consisted of primary and secondary schoolchildren from the area of La Chaux-de-Fonds, the third biggest city in western Switzerland. La Chaux-de-Fonds experienced annually 1734 hours of sunshine, in line with the swiss average (1769 hours between 2000 and 2014, data courtesy of Meteoswiss). We targeted 5th, 8th and 11th grade classes (Swiss Harmos grading system) of all public schools of the city (n=18), corresponding to 1268 students with an average age of 9, 12 and 15 years, respectively. Fifteen schools took part, amounting to 1154 pupils (response rate: 91%).

The 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 handed out and completed during class hours under the supervision of teachers. Therefore only attending schoolchildren participated in this study.

Questionnaires

Due to the age span of students, two versions of the questionnaire were addressed to the primary (5th grade) and secondary (8th and 11th grades) school classes. These questionnaires were adapted and tested in French from a previous study (17). The questionnaires mostly consisted of multiple choice 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 the children behaviour.

Definitions and classifications

Skin type was self-assessed based on a table of six coloured photographs of faces representing each category of Fitzpatrick skin 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 socio-professional 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).

A sun-related knowledge score was constructed from the number of correctly answered knowledge questions. A pro-tan attitude was defined as a preference for having a tanned skin or be ready to get sunburnt in order to get a tan.

Statistical analyses

One questionnaire with no gender information was discarded from all analyses. Missing and invalid

answers were considered as “unknown”. 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 several means were compared. A multivariate logistic regression analysis was performed to evaluate the strength of associations between a positive attitude towards a suntan and potential predictor variables. Goodness-of-fit of the model was assessed with standard summary measures (18). All statistical analyses were carried out with Stata 12 (StataCorp LP, College Station, Texas, USA).

Results

Of the 1153 responding pupils, 573 (50%) were boys (Table 1). Pupils were evenly distributed across school grades. The distribution of skin type and socio-professional status (SPS) did not differ between genders. However, a significant difference was observed in SPS across sectors of La Chaux-de-Fonds ($p=0.001$, data not shown) which corroborated known socioeconomic differences within the city (Dr. S. Latrèche, School Health Promotion Service of la Chaux-de-Fonds, personal communication)

Table 2 presents the proportion of correct answers to each question about the sun-related knowledge by sex and school grade. Overall, the level of knowledge concerning the risk of skin cancer due to intensive sun exposure was high (79%), reaching 95% among 11th grade students. In contrast, two thirds of the participants were not aware of the premature skin photoaging effect caused by UV. Although two thirds of the pupils knew that sunburn could also occur during winter sports, less than half knew that cloudy weather does not prevent from getting sunburnt. Sun-related knowledge increased markedly with higher school grades and the oldest students (11th grade) provided the highest percentage of correct answers for all sun-related knowledge items. A significant gender difference ($p<0.05$) was only observed for 8th grade classes, where girls were more aware than boys that sunburn can occur during

winter sports (71% vs 64%), that the sun protection factor (SPF) does not correspond to the number of hours of protection (77 vs 68%) and to better recognize the most susceptible skin phototype from coloured photographs (83% vs 75%).

The main reported source of information about UV and sun protection differed significantly according to sex, age, skin type and SPS (Table 3). Among the 91% of pupils who had heard about UV radiation, 76% reported their parents as their main source of information, 11% school and 9% the media. Girls mentioned more often their parents as their main source of information, whereas boys reported school more frequently as their main channel of information. Media and schools were increasingly reported as the main source of information with increasing age (school grade). Fair-skinned children and children coming from a higher SPS tended to have their parents more frequently as their primary source of information.

Parental sensitization (56%) and encouragement (61%) about sun protective behaviours were provided to approximately half of the respondents (data not shown). Boys, dark-skinned subjects and children with unknown SPS were less likely to report any parental sensitization or encouragement. As they get older, children tended to report more parental sensitization than parental encouragement.

The sun-related knowledge score was significantly higher among girls than boys (3.8 vs 3.5, $p=0.0003$, Figure 1). Knowledge increased with school grade (2.7, 3.6 and 4.5 for 5th, 8th and 11th grade, respectively, $p<0.0001$), and with skin photosusceptibility (3.1, 3.7, 3.9 for phototypes V-VI, III-IV and I-II, respectively $p<0.0001$). Although sun-related knowledge differed across SPS, no clear gradient with SPS was observed (3.9 for high SPS vs 3.7 for low SPS). Pupils for which media was the primary source of information obtained the highest knowledge score (4.0), followed by those who had their parents as their main source of information (3.8). Children who reported to have never heard of UV radiation or

sun protection had the lowest knowledge score (2.5). Pupils with a preference for a tanned skin had a higher sun-related knowledge than pupils who did not report a pro-tan attitude (4.0 vs 3.3, $p < 0.0001$).

Overall, 55% of children reported a pro-tan attitude (Figure 2). Tan-seeking attitude was significantly age-related (29%, 65% and 70% for 5th, 8th and 11th grade, respectively, $p < 0.0001$) and also depended on skin type (56%, 65% and 20% for phototypes I-II, III-IV and V-VI, respectively, $p < 0.0001$). A pro-tan attitude increased slightly with decreasing familial SPS.

Results from the multivariate analysis showed overall that sun-related knowledge and skin type (III-IV vs I-II) were significant predictors of a tan-seeking attitude, with slight differences according to school grade (Table 4). The pro-tan attitude of the oldest pupils also depended on the SPS of their family but was not associated with their knowledge. Among 11th grade children, those with unknown SPS were 4.3 times more likely to prefer being tanned than those in the highest SPS category and twice as likely to desire a tan if their phototype was III or IV as compared to I or II (OR = 2.04). Interestingly, gender did not appear to be a significant predictor of suntan preference in any of the three school grades.

Discussion

This study, carried out in a European region of very high incidence of CMM, showed that knowledge of adverse effects of sun exposure was high overall among Swiss schoolchildren, especially for skin cancer risk and for recognizing the most susceptible skin phototype. However, less than half the children knew about the premature skin aging effect and risk of sunburn under cloudy sky. Knowledge was positively related to a desire of a tan among younger children only and skin type was the predictor the most consistently associated with tan-seeking attitude.

The high participation rate (91%), the inclusion of all public schools in a delineated region, the use of a previously validated questionnaire and a study setting which did not permit any parental or teachers'

influence on the children self-reported information are the main strengths of this study. The main limitations are the reliance on self-reports by children, although can accurately report on their own health (40) and potential social desirability and recall biases since questionnaires were distributed in May and most questions pertained to previous summer.

Our results on sun-related knowledge of schoolchildren in western Switzerland concurred with prior studies in countries of high incidence of melanoma (17,19) and suggest that key sun prevention messages have been anchored by most children. An increase in knowledge of the danger of sun exposure and of adequate sun protective measures with age has also been reported in other European populations (10,17,20). The insufficient awareness of children about the non-negligible risk of sunburn on a cloudy day and the premature skin aging effect of UV radiation corroborated results from a previous survey in northern Switzerland (17). Increasing this knowledge by introducing season-dependent or activity-specific prevention messages (winter sports, indoor tanning, holidays abroad), as performed in Denmark, or the recent shift to seasonal sun protection recommendations by the Swiss cancer league could address this shortcoming (21,22). Viewing with a specific device one's own early facial skin damage caused by UV radiation under filtered UV light has been an effective intervention to heighten American schoolchildren's perception of adverse sun effects and to bring favorable sun behaviour changes (23)(24).

Parents as the primary source of information about UV radiation and sun protection measures of children confirmed results from a Greek survey (11) and stressed their key role in the consciousness-raising of children. Parents can send personalized and effective prevention messages to their children and initiate early in life sun protective habits when outdoors. According to our results, parental sensitization and encouragement was more common among fair-skinned pupils and children from

higher socio-professional families, possibly reflecting more systematic or sustained sun educational messages in familial environment with more sun-susceptible children.

As they get older, school and media appear to take over or at least complement the parental role as channels of information, as has also been observed among Italian teenagers (10). School can play a significant role in increasing children sun awareness and knowledge. Specific class lessons or brief interventions incorporated in the annual school schedule, such as during science, geography or physical education lessons and repeated routinely every year have been performed (25). Albeit these educational interventions have increased children's knowledge, long-term positive changes in children's sun protective behaviour have yet to be observed (25-27). Providing schools, kindergartens, swimming pools and other outdoor leisure centres with regularly updated sun protection policy including sun prevention recommendations has been effective in some countries (28–31)

Introducing community wide intervention programs could be a challenging opportunity for countries with high incidence of melanoma, such as Switzerland. This American concept of adding to ordinary sun education school lessons the involvement of adults and teenagers (parents, clinicians, school nurses, teachers, sport coaches), who tend to actively promote sun protective practice and act as influent role models, has efficiently raised young people's awareness and increased their sun protection practices (23). The inclusion of trained teenagers seems to favourably influence tanning preferences among their peers, possibly the hardest attitude to modify (12,32). Moreover, medical staff (dermatologists, paediatricians, general practitioners and school nurses) could be more involved in recognizing high-risk children population and delivering tailored prevention messages. In Italy, children who reported dermatologists or general practitioners as information source tended to have better sun protective behaviours (10).

Educational campaigns conveyed by the media can have an immediate beneficial impact on adolescents' behaviours, such as improved sunscreen use, decreased tanning preferences and, most importantly, reduced sun exposure (28). Prevention messages targeting children and adolescents should use multiple communication channels, such television, the internet, magazines and posters, and be regularly updated to maximize their outreach. Further, considering that most of today's teenagers own a mobile phone and are registered on social networks, technologies and social media are being assessed as information channels to attract more attention of young people on sun protective behaviors by creating Facebook pages and designing new apps on smartphones (34). Use of personal dosimeters and collection of self-evaluated UV exposure data by means of daily dairies on smartphones appear to have high compliance (35). Significant positive changes about sun-related knowledge and behaviours have been observed in young Americans after a brief sun safety education program followed by short message service (SMS) reminders during 12 weeks (36).

The high level of sun-related knowledge of Swiss schoolchildren was not systematically associated with suitable sun protective behaviours and attitudes, an observation reported in other countries (10)(37). Young people seem to explain their sun protective carelessness because of cosmetics and convenience reasons (38) and do not perceive death and illness the same as older people, so are less frightened by long-term detrimental health effects of sun exposure (13).

Other studies have investigated predictors of insufficient sun protective behaviour in young people. A Turkish survey reported that older students tended to get more often sunburnt even if they applied more sunscreen, which could be explained by longer hours spent at the beach (20). Less compliance with sun protective measures was also observed for Australian children with a desire for a darker skin (32). However, the tan-seeking attitude did not differ between boys and girls in our survey, contrary to what was reported in northwestern Switzerland and Scotland (17)(12).

Introducing multi-component intervention programs is paramount as peers and family appear to bear the most influence on tanning attitude (12). As the desire for a tan is associated with feeling better and more attractive, future sun prevention campaigns should not only focus on increasing sun-related knowledge but also on reducing the association between tanning, health and beauty, which seems confusing among young people (37). This is one of the biggest challenges of sun prevention, especially since modern fashion exposes all year round tanned skin models revealing far too much skin.

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Table 1: Socio-demographic characteristics of schoolchildren by sex

	Boys Numbers (col %)	Girls Numbers (col %)	Total Numbers (col %)
Grade			
5th	187 (33)	179 (31)	366 (32)
8th	209 (36)	205(35)	414 (36)
11th	177 (31)	196 (34)	373 (32)
Skin type			
I-II	165 (29)	190 (33)	355 (31)
III-IV	314 (55)	290 (50)	604 (52)
V-VI	89 (16)	93 (16)	182 (16)
Unknown	5 (1)	7 (1)	12 (1)
SPS*			
High	130 (23)	132 (23)	262 (23)
Medium	294 (51)	309 (53)	603 (52)
Low	95 (17)	90 (16)	185 (16)
Unknown	54 (9)	49 (8)	103 (9)

* SPS: Socio-professional status

Table 2: Knowledge of various adverse effects of UV radiation on the skin and of adequate sun protective measures by sex and school grade

	Overall (% correct answers)	Sex (% correct answers)		p-value	Grade (% correct answers)			p-value
		Boys	Girls		5 th	8 th	11 th	
Causes skin cancer	79	77	81		61	81	95	**
Causes premature skin aging	31	30	33		25	26	43	**
Sunburn in winter	68	64	71	*	34	76	91	**
Sunburn with clouds	42	40	45		34	39	53	**
Recognition of most susceptible skin type	79	75	83	**	61	81	94	**
Duration of sunscreen protection ¹	58	60	56		58	N/A	N/A	
The higher the SPF, the better the protection ²	66	63	68		N/A	57	75	**
A SPF of 10 means 10 hours of sun exposure without getting burn ²	73	68	77	*	N/A	67	80	**

*: χ^2 , $p < 0.05$ **: χ^2 , $p < 0.0001$ N/A: not applicable

¹ Question asked only to 5th grade classes

² Question asked only to 8th and 11th grade classes

Table 3: Main source of information about UV radiation and sun protection of schoolchildren by sex, school grade, skin type and socio-professional status

	Parents	School	Media ¹	Other
Sex*				
Boys	73%	13%	10%	4%
Girls	79%	8%	9%	4%
Grade**				
5 th	85%	7%	4%	4%
8 th	78%	10%	9%	3%
11 th	66%	15%	16%	4%
Skin type**				
I-II	80%	7%	9%	4%
III-IV	77%	11%	9%	4%
V-VI	66%	18%	12%	5%
SPS**				
High	85%	6%	5%	4%
Medium	76%	11%	10%	3%
Low	70%	13%	13%	4%
Unknown	62%	18%	13%	8%

*: χ^2 , p<0.05 **: χ^2 , p<0.0001

SPS: Socio-professional status

Media¹: Internet, TV, magazines, prevention campaigns/messages (such as Cancer League)

Table 4: Multivariate logistic analysis of predictors for a preference of a suntan skin according to school grade*

Factor	5th grade (250 cases)	8th grade (325 cases)	11th grade (308 cases)
	OR** (95% CI)	OR** (95% CI)	OR** (95% CI)
Knowledge score ***	1.18 (0.98-1.43)	1.33 (1.10-1.62)	NS
Skin type (III-IV vs I-II)	1.7 (0.99-2.91)	2.66 (1.64-4.32)	2.04 (1.24-3.36)
SPS			
High	NS	NS	Ref.
Medium	NS	NS	2.06 (1.15-3.67)
Low	NS	NS	2.37 (1.10-5.10)
Unknown	NS	NS	4.29 (0.86-21.30)

CI: Confidence interval

NS: not significant

* Analysis restricted to the 833 children who reported not having a naturally tanned skin or a phototype V or VI.

** OR adjusted for all other factors in the model.

*** per knowledge score points (0-6)

Figure 1: Mean sun-related knowledge score of schoolchildren by sex, school grade, skin type, socio-professional status, main source of UV information and tanning preference

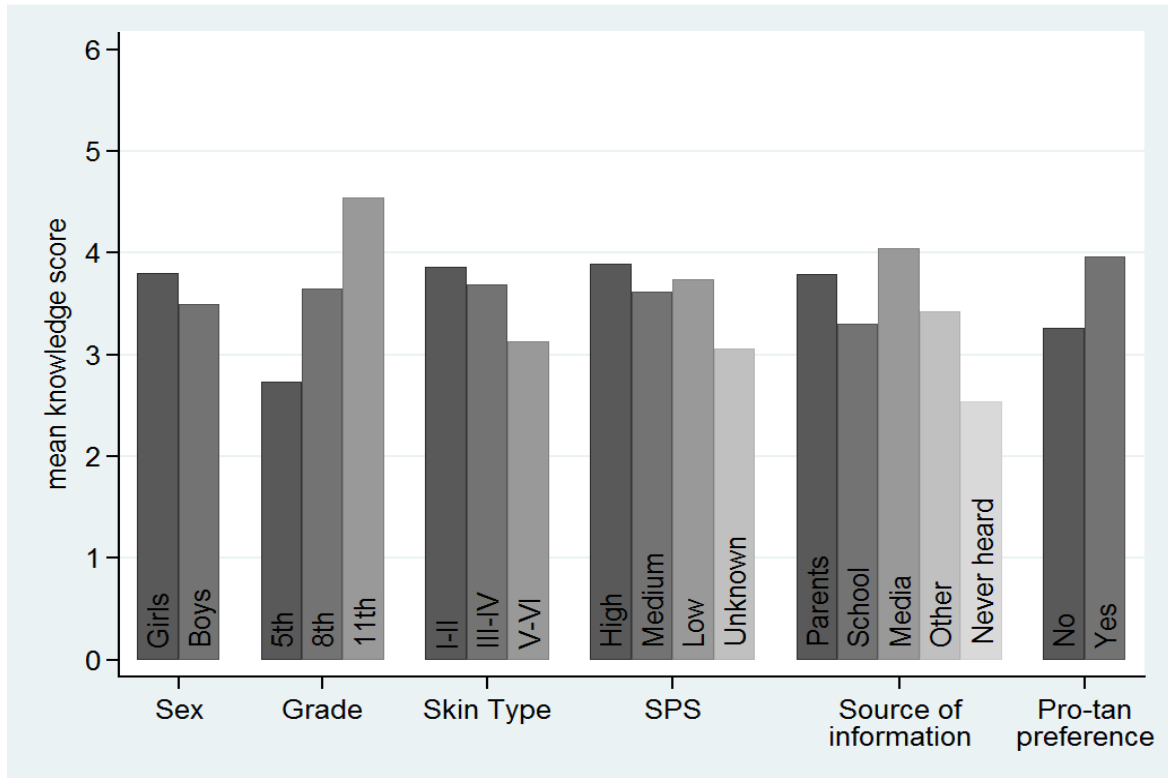
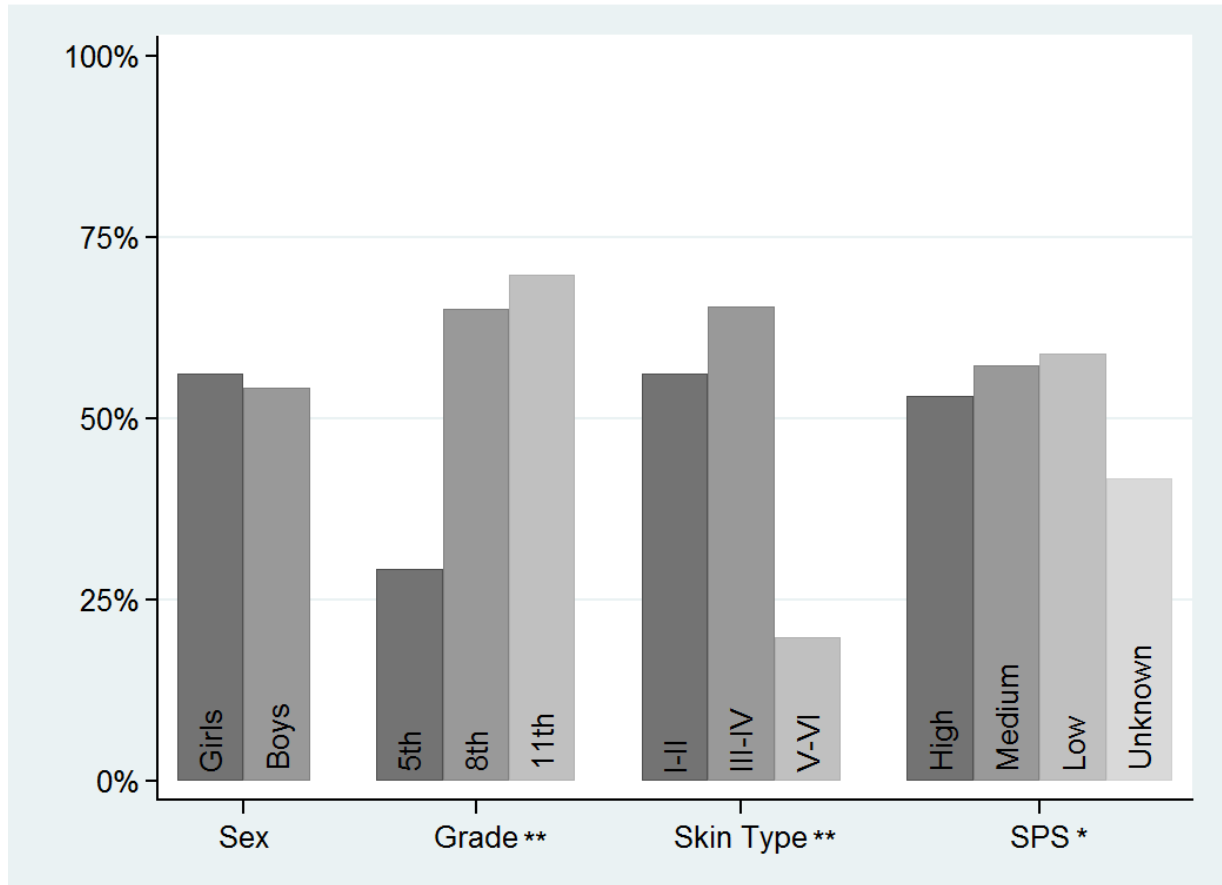


Figure 2: Attitude towards a suntan of schoolchildren by sex, school grade, skin type and socio-professional status



*: χ^2 , $p < 0.05$ **: χ^2 , $p < 0.0001$

SPS: Socio-professional status