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Sun exposure and sunburn among Swedish toddlers

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ABSTRACT

Skin cancer is an emerging public health problem in Sweden. Even though the most important preventable risk factor for the development of skin cancer – sun exposure – is known, the incidence of skin cancer is still increasing. Studies have showed an association between increased risk of skin cancer and sunburn early in life. The aim of the present paper was to examine the frequency of sun exposure, sunburn and use of sun protective measures among an urban sample of Swedish toddlers. In March 2003, the parents of 4000 randomly selected children born between September 2001 and August 2002 were contacted by mail, and asked to fill out an enclosed questionnaire. The questionnaire concerned their own and their one-year-old child's sun exposure and sunburn history, and a few questions about knowledge, attitudes and protective activities were also included. One fifth of the children had been severely sunburnt at least once. Thirty-six percent of all children had been abroad on vacation to a sunny resort. More knowledge among parents increased the likelihood that the child was properly protected when in the sun, and parents own time in the sun was positively related to child's time in the sun. Being of the opinion that children look healthier when tanned was also positively associated with child sunburn. Thirty-five percent of all parents spent two hours or more in the sun during peak hours (11 a.m. – 3 p.m.) on a typical work-free day in the summer, and almost 10% of all parents had their children exposed to the sun for two hours or more during peak hours. We conclude that children in Sweden seem to get exposed to extensive sun exposure very early in life. Information and increased knowledge among parents to young children seems to be a potential way of increasing sun protection behaviour and decrease sun exposure among very young children.

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1. Introduction

Skin cancer is an emerging public health problem in Sweden. Even though the most important risk factor for the development of skin cancer – sun exposure – is known, the incidence of skin cancer is still increasing.¹ Cutaneous malignant melanoma (CMM) is the most lethal form of skin cancer. In 2002, 1901 people were diagnosed with CMM in Sweden and about 380 died from it.^{1,2} CMM has been registered in the Swedish

Cancer Registry since 1958 and has had one of the highest increases in incidence among cancer diagnoses.¹ A similar development has been observed in many countries with a high proportion of Caucasian inhabitants.³ The annual incidence of squamous cell carcinoma in Sweden is about 2900 cases.¹ This type of skin cancer has had one of the highest increases in incidence during the last decades.¹ The third form of skin cancer, basal cell carcinoma (BCC), is the most common form of skin cancer. It was not registered in the Swedish

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Cancer Registry until 2004 and the exact incidence is unclear, but estimations indicate that the incidence is about 25 000 cases annually. In the Netherlands, where BCC has been registered since the 1970s, a rapid increase of BCC has been observed.⁴ BCC has very low metastatic potential and is thus considered to be less harmful in terms of mortality,⁵ but the morbidity caused by basal cell carcinoma is however still substantial.

Today it is widely recognised, and there is substantial scientific evidence to support the view, that ultraviolet radiation (UVR) is an important aetiological factor in the induction of all forms of skin cancer.^{6,7} Exposure of the skin to excessive UVR causes sunburn and can result in chromosomal damage.⁶ Therefore, UVR has been suggested to be the most important cause of skin cancer. Other risk factors for skin cancer such as skin pigmentation, light hair colour, blue eye colour, freckles, and hereditary risk are less useful for prevention. There have been several studies investigating which type of radiation contributes to the development of skin cancer and this issue has not yet been resolved. However, in studies of the aetiology of skin cancer, a distinction is often made between intermittent or recreational sun exposure and cumulative or total sun exposure. Intermittent solar exposure is hypothesised to be the major cause of CMM.³ Some studies have showed an increased risk of CMM associated with frequent childhood sunburn.^{3,8}

Studies of young children's sunbathing habits have not been conducted in Sweden, but a European multicentric study led by the European Organization for Research Treatment of Cancer (EORTC) Melanoma Cooperative Group examined prospectively the sun habits of children in the age range 0-6 years in Belgium, Germany, France and Italy. This study found a steady increase of sun exposure with age.⁹ These studies indicate a high frequency of sun exposure early in life. Even though the extent of exposure among infants and young toddlers has so far been unknown in the Swedish population, studies in the US indicate that many very young children are exposed to excessive sun exposure and experience sunburn.¹⁰⁻¹² Already at a very early age, sun protection of children is insufficient.^{10,13} Therefore, preventive efforts targeted at young children seem to be needed.

The aim of the present paper was to examine the frequency of sun exposure, sunburn and use of sun protection among an urban sample of Swedish toddlers. Further, the predictive value of socio-economic position, knowledge about skin cancer, and sunbathing attitudes on sun exposure and sun protection behaviour was explored.

2. Patients and method

2.1. Participants

In March 2003, the parents of 4000 randomly selected children living in Stockholm County, Sweden (latitude 59-60° N, sea level), born between September 2001 and August 2002, were contacted by mail and asked to fill out an enclosed questionnaire. The questionnaire concerned their own and their one-year-old child's sun exposure and sunburn history. A few questions about knowledge, attitudes and sun protective activities were also included in the questionnaire. Two

reminders were sent to those not responding, the second reminder included a new questionnaire. A total of 3066 questionnaires (77%) were returned. No compensation for participation was given.

2.2. Measures

In addition to background variables, the questionnaires contained about 35 items measuring frequency of sun exposure, sunburn, sun protection behaviour, attitudes towards sunbathing, risk perception with sun exposure and knowledge about sun radiation and the skin. The questionnaire was pilot tested in a group of parents before use in this study. The items used in the present paper were:

Background questions: The respondents were asked to indicate their gender, age and level of education and number of children in their home. The respondents indicated the level of education of both the mother and the father of their child on two questions with seven response-alternatives relevant for Swedish conditions. One open alternative was provided where educational achievements not listed could be recorded. The responses were then coded into three categories according to the parent with the highest level of education, i.e. university degree, high school degree, or elementary school.

Child's skin pigmentation and sun exposure: Skin pigmentation was recorded by assessment of the colour of the child's skin when unaffected by sun exposure. The response alternatives were "light or white"; "light brown or brown", and "dark brown or black". As most respondent indicated "light or white", the variable was dichotomised, collapsing the alternative "light brown or brown" and "dark brown or black". One question was asked about the child's frequency of sun exposure. It concerned the approximate amount of time spent in the sun, a typical work free day during peak hours in the summer. The question had five response categories (<30 minutes, 30 min - 1 h, 1 - 2 h, 2 - 3 h, >3 h).

Child's sunburn: Two questions concerning frequency and severity of sunburns during the past year were asked, and one question about what part of the child's body that got sunburnt.

Vacation to sunny resort: The respondents were asked to indicate how many weeks their child had been abroad on vacation to a sunny resort. The response alternatives were 'More than 4 weeks', '3 - 4 weeks', '1 - 2 weeks' or 'Not at all'.

Use of recommended sun protective measures: Minimising exposure to the sun through: avoiding direct sunlight; using clothing hat and shade as protection; as well as avoiding being in the sun at peak hours, are behaviours recommended in primary preventive campaigns. Respondents indicated on a four-point scale ranging from 1 (Not at all likely) to 4 (Very likely) their likelihood of protecting their child by conducting any of these behaviours. The Cronbach's alpha reliability coefficient for the sun protection variables was 0.70, which motivates using the items as an index.

Parents skin type, sunbathing and sunbed use: The same questions as those used to assess the child's skin pigmentation and sun exposure were used to assess the parent's sun exposure and skin pigmentation.

Attitudes towards sunbathing and having a tan: Fourteen statements about sunbathing, for example, having a tan,

mood benefits of sunbathing, perception of risk with sun exposure, were included in the questionnaire. The respondents were asked to indicate to what degree they agreed with the statements on a four-graded scale.

Information about sun protection: Ten questions were asked about how the respondents have been informed about sun protection and skin cancer.

Knowledge about sun protection and solar radiation: Ten questions concerned knowledge about sun protection and solar radiation. These questions were summed and used as an index of knowledge.

2.3. Statistical analyses

Analysis of variance was used to analyze differences between groups of respondents and multivariate logistic regression analysis was used to estimate the predictive value of a number of variables measuring child exposure to the sun. The SPSS statistical package was used.¹⁴ Multivariate logistic regression analyses were conducted for four behaviours related to sun exposure i.e. time spent in the sun, sunburn, sun-screen use and use of recommended sun protection. The behavioural variables were dichotomised and level of education, child's skin colour, attitude towards tanning, knowledge, time spent in the sun, number of sunny vacations, and degree of information received were used as independent variables. A forward inclusion method was used in the regression and only the independent variables that significantly contributed to the prediction of the dependent variable were kept in the model.

2.4. Ethical considerations

All participants were informed that participation in the study was voluntary and that they were free to drop out of the study at any time. The study was approved by the Ethics Committee at the Karolinska Institutet (No. 02-068).

3. Results

3.1. Frequency of sun exposure

Thirty-five percent of all parents spent two hours or more in the sun during peak hours (11 a.m.–3 p.m.) on a typical work-free day in the summer. Twenty percent of the parents responded that they often or very often spent time in the sun with the intention to tan. Frequency of time spent in the sun was negatively related to level of education. Those with university education spent significantly less time in the sun ($F = 5.87$, $df = 2$, $P < 0.01$). Almost 10% of all parents had their children exposed to the sun for two hours or more during peak hours (11 a.m.–3 p.m.). The child's exposure for the sun was also negatively related to parental level of education ($F = 11.98$, $df = 2$, $P < 0.001$), with less exposure for higher education.

Thirty-six percent of all children had been abroad on a vacation to a sunny resort. Most of the children had been on vacation to a sunny resort during one or two weeks, but 11% had been on vacation for three or more weeks. Number of children that had been abroad increased with level of edu-

cation. Thirty-eight percent of those with parents who had university education, 33% of those with high school education, and 25% of those with only elementary school had children who had been abroad on a sunny resort. The youngest children had been abroad less often than the older, 30% among those aged 7–9 months had been abroad and 40% among those aged 13–15.

3.2. Frequency of sunburn

One out of every five children had got severely sunburnt at least once. The frequency was even higher for those parents that had only elementary school education (25%). Percentage that had gotten sunburnt increased somewhat with children's age; 15% of those 7–9 months old, 19% of those 10–12 months old, and 21% of those 13–18 months old. Parents could indicate if the child had sunburnt on face/scull, arms/hands, upper body or legs/feet. Of the children who had sunburnt, 37% was burnt on face or scull and 63% were burnt on arms or hands.

3.3. Sun protection behaviours

Almost all parents used several ways to protect their children from the sun. There were however differences between parents of different educational level. Those with higher education protected their children more often than those with less education (Fig. 1). Hat, clothing and staying in the shade were the most common ways to protect the children, and avoiding peak hours was the least used way.

3.4. Knowledge about solar radiation and sun protection

The parents had high scores on the questions meant to measure knowledge about solar radiation and sun protection.

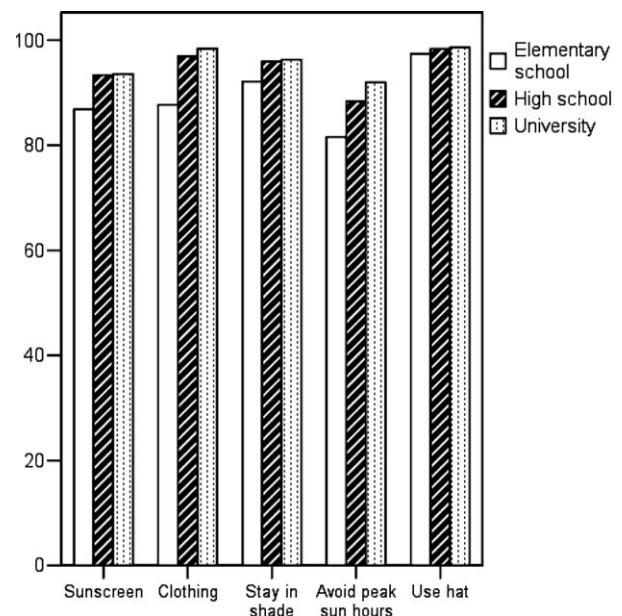


Fig. 1 – Different ways used by parents to protect children from the sun, with different levels of education.

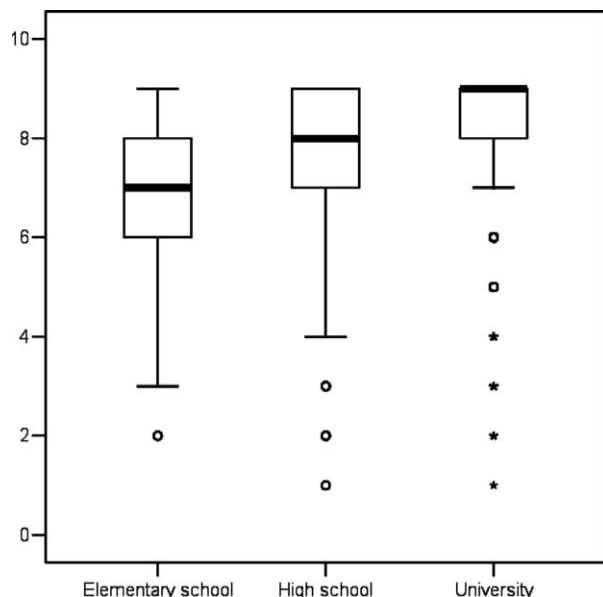


Fig. 2 – Median and quartiles of scores on parent's knowledge (min = 0, max = 9) about solar radiation and sun protection, by level of education. Boxes contain 50% of the values. Whiskers extending from boxes show highest and lowest values, excluding outliers. A line across a box indicates the median, circles are outliers (between 1.5 and 3 box lengths from upper or lower edge of box), and an asterisk is an extreme value (cases with values of more than 3 box lengths from upper or lower edge of box).

Almost 46% had correct answers to all questions. However, those with higher education had significantly higher scores on the knowledge index ($F = 78.00$, $df = 2$, $P < 0.001$) (Fig. 2).

3.5. Predictors of sun exposure, sunburn and use of sun protection

The respondent's answers on attitudes, risk perception and questions about information are presented in Table 1. The results from the regression analyses are presented in Table 2. Children with parents, whose attitudes towards tanning and sunbathing were positive, spent more time in the sun. Especially the attitude that children look healthier when tanned increased time spent in the sun. Children with parents, whose attitudes towards tanning and sunbathing were negative, spent less time in the sun. A very strong association was found for the time the parents themselves spent in the sun and the child's time in the sun, with those spending a lot of time in the sun themselves having their children exposed as well.

Children with light or white skin colour and parents who have the opinion that they knew enough about how to behave in the sun were more often sunburnt. Having an attitude that children look healthier when tanned and perceiving sunbathing as a health risk were both positively associated with child sunburn. Further, the more time the child spent in the sun the more likely the child became sunburnt.

Table 1 – Responses in percentages and numbers on questions about sun exposure, sun protection, attitudes, and information about sun and sun protection

	% (n)	% (n)	Total N
<i>UV exposure and sun protection</i>			
Child spending more than one hour in the sun at peak hours	38 (1162)	62 (1880)	3042
Child ever been sunburnt	19 (578)	81 (2472)	3050
Using sunscreen on child	93 (2829)	7 (209)	3038
Using recommended sun protection on child	87 (2624)	13 (386)	3010
<i>Attitudes</i>			
	<i>Agree</i>	<i>Disagree</i>	
Even small children look healthier when tanned	18 (542)	82 (2472)	3014
I look better when tanned	83 (2491)	17 (513)	3004
I feel more healthy when tanned	62 (1865)	38 (1143)	3008
I like sunbathing	57 (1724)	43 (1290)	3014
Sunbathing is harmful for my child	73 (2206)	27 (815)	3021
<i>Information</i>			
	<i>Yes</i>	<i>No</i>	
Have received information about sun and sun protection	76 (2322)	24 (721)	3043
Have received information from the pharmacy	63 (1530)	37 (912)	2442
Have enough knowledge about how to behave in the sun	82 (2487)	18 (562)	3066

Children with parents who thought that sunbathing was harmful to their child and who had received information about sun and sun protection or information from pharmacies were more often protected with sunscreen.

Parents with higher knowledge and those having received information about sun and sun protection were more likely to use recommended ways to protect the child from the sun. Number of hours that the child spent in the sun and the attitude that children look healthier when tanned were negatively associated with use of recommended ways of sun protection. However, having the perception that sunbathing is harmful for the child increased the likelihood that the parent used recommended ways of sun protection.

4. Discussion

This is, to our knowledge, the first Swedish study of very young children's exposure to solar radiation. Knowing more about UV exposure in early years is essential in the prevention of skin cancers. In this study, the parents of very young children exposed themselves to a lot of solar radiation during work-free days in the summer, often with the intention to acquire a tan. This comes as no surprise as earlier studies have shown a high degree of sun exposure among young adults in Sweden.¹⁵ What is more alarming is that the exposure of these parents was accompanied with sun exposure of their children. The more the parent sunbathed the more likely their child was to be exposed to the sun also. Both parent's and child's sun exposure were related to parent's level of education, indicating that the need for preventive activities and information is greater among groups with lower levels of education. Parents that are more educated might be more knowl-

Table 2 – Adjusted odds ratios given from multivariate logistic regression models for four different behaviours related to sun exposure with 95% confidence interval

	OR for child spending more than one hour in the sun at peak hours	OR for child ever been sunburnt	OR for using sunscreen on child	OR for using recommended sun protection on child
Background				
Child skin colour (reference = light or white)	–	0.66 (0.51–0.85)	–	–
Knowledge (OR for each point increase)	–	–	–	1.33 (1.22–1.45)
Attitudes (OR for agreeing to statement)				
Even small children look healthier when tanned	1.53 (1.22–1.92)	1.50 (1.19–1.89)	–	0.61 (0.46–0.81)
It is important to have a tan after the summer	0.78 (0.65–0.94)	–	–	–
Sunbathing is harmful for my child	0.53 (0.44–0.65)	1.33 (1.06–1.67)	2.33 (1.63–3.34)	2.19 (1.69–2.82)
Parent's time in the sun at peak hours	P < 0.001	–	–	–
less than 30 minutes (reference)	1	–	–	–
30 minutes to 1 hour	0.72 (0.38–1.35)	–	–	–
1 to 2 hours	6.05 (3.47–10.53)	–	–	–
2 to 3 hours	18.08 (10.29–31.75)	–	–	–
more than 3 hours	26.14 (14.27–47.88)	–	–	–
Child's time in the sun at peak hours	–	P < 0.001	–	P < 0.001
less than 30 minutes (reference)	–	1	–	1
30 minutes to 1 hour	–	1.21 (0.94–1.57)	–	0.79 (0.53–1.18)
1 to 2 hours	–	1.66 (1.28–2.16)	–	0.36 (0.25–0.53)
2 to 3 hours	–	1.86 (1.29–2.68)	–	0.18 (0.12–0.29)
more than 3 hours	–	1.86 (0.97–3.54)	–	0.31 (0.15–0.67)
Information				
Have received information about sun and sun protection	–	–	2.90 (1.74–4.82)	1.83 (1.39–2.41)
Have received information from the pharmacy	–	–	1.53 (1.04–2.25)	–
Perceive themselves to have enough knowledge on how to behave in the sun	1.58 (1.26–1.97)	1.51 (1.20–1.90)	–	–

Note 1 – significant odds ratios are typed in bold.

Note 2 – parent's and children's age, parent's education, gender of parent or child, and whether or not the child had been abroad or had any siblings, were included in the analysis but is not presented in the table as they were not significantly associated with any of the dependent variables.

Note 3 – The odds ratios are adjusted for all other independent variables entered in the model.

edgeable about sun and sun protection, and thus, protect their children to a higher extent. From our findings, it seems as knowledge, information and attitudes has a stronger influence on sun related behaviour than level of education, and thus, should be a target for prevention. Knowledge, however, was measured as self perceived knowledge about sun and sun protection, and it seems as though this measure do not predict actual protective behaviour as sufficient knowledge was associated with child sunburn. The lack of association between knowledge and actual behaviour has previously been documented.¹⁶ Another explanation between the positive

association between sunburn and knowledge could be that even though some parents think that they have sufficient knowledge they actually do not. A challenge for prevention is to make people who know enough to behave in accordance with their knowledge, and to further inform those who consider themselves to be sufficiently knowledgeable.

Another surprising result from this study is that many parents consider a tanned complexion to be a sign of health in their child. The preference for a tan on adolescents and adults is well documented in studies from many countries with a high proportion of Caucasian inhabitants, and has its

historical roots.¹⁷⁻²⁰ However, the application of the same attitude on very small children is somewhat more surprising and may be an important target for preventive activities. However, the most important contributor to very young children's sun exposure was the parents own sun exposure, probably because parent and child spend a lot of their time together during the first year of life. This corresponds to findings from a French study where mother's sun protective habits were predictive of children's sun exposure.²¹ This also informs us about the importance of targeting parents of young children in the prevention of skin cancer. Not only do these parents contribute to their own risk of getting skin cancer but they might also increase their child's risk of getting skin cancer in adulthood. The importance of including parents in interventions targeted at children sun exposure, both as role models and as provider of sun safe practice, has also been emphasised in other studies.²²

A somewhat strange finding was that parent's health risk perception concerning sunbathing was positively related to child sunburn. It is important to consider the causation. Most likely, parents whose children were severely sunburnt are more concerned with the risk of sunbathing and not the other way around.

Another finding that needs to be taken into account concerns the use of sunscreens on very young children. Those receiving information from pharmacies were more likely to use sunscreens on their children. This is problematic as it is under debate whether sunscreens are damaging or not, and it is often not recommended for children younger than one year.²³ Further, studies have found associations between use of sunscreen among children and number of nevi in 6 to 7-year-old children, indicating a higher amount of sun related skin damage among sunscreen users.^{24,25} It seems important to make a stronger emphasis on using other ways of sun protection than sunscreen in information from pharmacies. The large proportion of children that travel on vacations to sunny resorts gives an opportunity to target people in need for information about sun and sun protection. Spreading information in connection with vacations that includes a lot of sun exposure might be an effective way of increasing knowledge and decreasing children's exposure.

The most hopeful finding was that knowledge and information about sun and sun protection seemed to be important to decrease sun exposure, in particular to increase the use of recommended ways to be safe in the sun. Many studies have had difficulty in showing differences in behavioural outcome measures resulting from interventions based on information and increased knowledge.²⁶ Nevertheless, information and increased knowledge among parents of young children seems to be a potential way of increasing sun protection behaviour and decrease sun exposure.

4.1. Limitations of the study

Although the present study has extended previous work by examining the degree of sun exposure and sunburn among very young children, it has several limitations. Even though we used a random sample from the population, we have no data comparing respondents versus non-respondents. The response rate in this study was, however, exceptionally high as

compared to similar questionnaire studies. Further, our measurement of sun exposure is not exact. We have to rely on parental reports of both exposure and sunburn, making it likely to bias reports.

4.2. Future directions

This study shows that young children in Sweden are extensively exposed to solar radiation and many children receive severe sunburns during their first year of life. The extent of sun exposure early in life calls for increased skin cancer prevention efforts. This study also indicates that efforts to increase knowledge about sun and sun protection among parents to young children might be an effective strategy for prevention. Information and health educational efforts in the past have had difficulty in showing sufficient positive results. Parents of young children might be an important target group for preventive interventions. However, as parents with lower level of education are less informed, and expose their children to more solar radiation, other preventive strategies might be needed. Less educated people are often more difficult to reach with health information and, thus, an environmental prevention approach should be considered e.g. increase shaded areas at beaches and parks, sun protective clothing for toddlers. Well-designed intervention programs to decrease young children's sun exposure are highly warranted.

Conflict of interest statement

None declared.

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