

Determinants of sunbed use in a population of Danish adolescents

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In Denmark, melanoma is the most common type of cancer in individuals aged 15–34 years. Ultraviolet radiation from sunbeds is a risk factor for melanoma. Knowledge of the characteristics of sunbed users is important in the development and implementation of prevention strategies of sunbed use. The objective of this study was to examine sunbed use and its association with smoking, parental socioeconomic status (SES), friends' attitudes towards artificial tanning, and school environment among adolescents aged 14–18 years at continuation schools in Denmark. We conducted a survey among adolescents in Danish continuation schools in 2011. We examined sunbed use and its association with age, smoking, friends' attitudes towards artificial tanning, parental SES, and shared environment of the continuation school, using logistic regression. Within the past 12 months, 38% of the pupils had used a sunbed (70% girls and 28% boys). There was no difference in sunbed use according to age. Smoking and friends' positive attitudes towards, and higher use of sunbeds were associated with increased use of sunbeds. High SES of mothers' was associated with lower odds for sunbed use among girls. The association of

school environment with sunbed use was modest compared with the other variables. Adolescents in continuation schools report a higher use of sunbeds than Danish adolescents as such. Educational interventions should be targeted at preteens, as sunbed use is common in 14-year-olds. Special educational tools are tested in the continuation school environment and may prove effective in this population. *European Journal of Cancer Prevention* 22:126–130 © 2013 Wolters Kluwer Health | Lippincott Williams & Wilkins.

European Journal of Cancer Prevention 2013, 22:126–130

Keywords: adolescents, continuation school, melanoma, risk factor, socioeconomic status, sunbed

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Received 6 June 2012 Accepted 2 July 2012

Introduction

The incidence of melanoma (world standardized incidence rate per 100 000) for men and women aged 15–34 years in Denmark increased from 2.6 and 4.5 in 1974–1978 to 8.1 and 18.8 in 2006–2010, respectively (Engholm *et al.*, 2010). Consequently, melanoma has become the most common type of cancer in this age group. Exposure to natural and artificial ultraviolet radiation is an important risk factor for melanoma, and a working group convened by the International Agency for Research on Cancer (IARC) raised the classification of the use of ultraviolet radiation-emitting tanning devices to 'carcinogenic to humans'. The IARC reported recently that first exposure to sunbeds before the age of 35 increases the risk for melanoma by 75% (IARC, 2006), and a study in Australia estimated that 76% of melanomas in individuals who had ever used a sunbed and received their diagnosis between 18 and 29 years of age were attributable to sunbed use (Cust *et al.*, 2010).

Sunbed use is highly prevalent in adolescents in Denmark and other countries, especially among girls (Cokkinides *et al.*, 2002; Lazovich *et al.*, 2005; Koster *et al.*, 2009; Krarup *et al.*, 2011; Mayer *et al.*, 2011). To develop

and implement prevention strategies towards the use of sunbeds in adolescents, it is important to know more about the characteristics of the users. Previous studies have found that sunbed use in adolescents is associated with an unhealthy lifestyle in terms of, for example, smoking and alcohol consumption (Schneider *et al.*, 2010), a lower socioeconomic status (SES) (Demko *et al.*, 2003; Mayer *et al.*, 2011), and peers' attitudes towards artificial tanning (Lazovich *et al.*, 2004; Mayer *et al.*, 2011).

In Denmark, continuation schools are an alternative to the ordinary primary schools. Approximately 15% of the pupils in grades 8, 9, and 10 (aged 14–17 years) attend continuation schools each year in Denmark. Continuation schools offer a unique environment for social interaction as pupils live at the school. However, this school environment has also been shown to lead to a higher risk of smoking among the pupils (Jensen *et al.*, 2010). It can be assumed that the same high-risk behavior exists for sunbed use.

The aim of this study was to examine the prevalence of sunbed use among adolescents at continuation schools in

Denmark and its association with smoking, parental SES, friends' attitudes towards artificial tanning, and school environment.

Methods

Sample and questionnaire

A postal survey was conducted among 6059 pupils aged 14–18 years attending 56 continuation schools in Denmark in September 2010 (the beginning of the new school year). The survey was distributed to the schools, where the pupils used a school lesson to complete the questionnaire, which was then collected and returned by the school. Ninety-one percent of the pupils ($n = 5509$) completed the survey. The 56 schools were chosen randomly among schools, where smoking was either prohibited for both employees and pupils ($n = 26$) or allowed indoors and/or outdoors for both employees and pupils ($n = 30$). The schools were thus a representative sample of all Danish continuation schools with strong or weak smoking policies, but the pupils were not necessarily representative of all Danish adolescents. The sample size was based on power calculations on smoking progression in schools with different smoking policies.

The survey covered the subjects of smoking habits, sunbed use, friends' use and attitudes towards sunbeds, and parents' SES, divided into nine categories according to the definitions prepared by R. Krølner and B.E. Hostein (2006, personal communication) (see Table 1 for categories).

The number of times the respondent had used a sunbed in the past 12 months was dichotomized into sunbed use in the past 12 months (number > 1) or no use in the past 12 months (number = 0). The dichotomous variable was treated as an outcome variable.

Smokers were defined as those who smoked at least once a week. Age was coded as 14, 15, 16, 17 or 18 years or older. Pupils rated whether they 'Strongly agree', 'Agree', 'Disagree', 'Strongly disagree' or 'Do not know' to the questions 'Most people I know use a sunbed', and 'My friends think that a sunbed tan is most attractive'. The categories 'Strongly agree' and 'Agree' were combined into a 'Yes' category and the categories 'Strongly disagree' and 'Disagree' were combined into a 'No' category. Smoking status, age, mothers' and fathers' SES, and school were used as independent variables.

The study was approved by the Danish Data Protection Agency (registration number 2010-41-4450).

Statistical analyses

The statistical package SAS ver. 9.2 (SAS Institute Inc., Cary, North Carolina, USA) was used for all statistical analyses. The χ^2 -test was used to determine differences in sunbed use between girls and boys. Unconditional logistic regression analysis was carried out to establish

Table 1 Characteristics of the study population

	N (%)
Sex	
Girl	2718 (49.6%)
Boy	2674 (48.8%)
Missing	93 (1.7%)
Age (years)	
14	600 (10.9%)
15	2206 (40.2%)
16	2365 (43.1%)
17	193 (3.5%)
18	15 (0.27%)
> 18	6 (0.11%)
Missing	100 (1.8%)
Sunbed use at least once the last 12 months	
Yes	2086 (38.0%)
No	3157 (57.6%)
Missing	242 (4.4%)
Mother's SES	
Academic occupation, managers and owners of large corporations	197 (3.6%)
Highly skilled occupation, team leaders, business owners	1519 (27.7%)
Occupation requiring specialist knowledge, small business owners	508 (9.3%)
Skilled manual occupation, low-level white collar worker	1103 (20.1%)
Unskilled occupation	591 (10.8%)
Economically active, but unclassifiable into codes 1–5	670 (12.2%)
Economically inactive	724 (13.2%)
Unclassifiable	122 (2.2%)
Missing	51 (0.93%)
Father's SES	
Academic occupation, managers and owners of large corporations	230 (4.2%)
Highly skilled occupation, team leaders, business owners	823 (15.0%)
Occupation requiring specialist knowledge, small business owners	811 (14.6%)
Skilled manual occupation, low-level white collar worker	1373 (25.0%)
Unskilled occupation	838 (15.3%)
Economically active, but unclassifiable into codes 1–5	572 (10.4%)
Economically inactive	402 (7.3%)
Unclassifiable	373 (6.8%)
Missing	63 (1.2%)
Smoking at least once a week	
Yes	900 (16.4%)
No	4344 (79.2%)
Missing	241 (4.4%)

odds ratios (OR) for sunbed use according to smoking status, age, friends' attitudes and use of sunbeds, and parental SES. These analyses were stratified by sex. Effect of school environment on sunbed use was analyzed with school as a random effect and by calculating the mean odds ratio (MOR) according to Larsen and Merlo (2005). OR and 95% confidence intervals were calculated using the procedure GLIMMIX.

Results

Table 1 shows the distribution of the participants by sex, age, sunbed use, parents' SES, and smoking. Data were missing for less than 5% of the respondents and these cases were excluded from the data set. Missing values were often present for more than one variable and were otherwise evenly distributed. The sex distribution was almost equal. Most pupils were 15 or 16 years old and very few were aged 17, 18, or older. Therefore, we combined these age groups into one in further analyses. Of the 6059 respondents, 38% had used a sunbed within

the past year. Sunbed use was more common among girls (70%) than boys (28%) (data not shown). Hence, further analyses are stratified on sex.

Table 2 shows the unadjusted and adjusted OR for sunbed use according to age, smoking, friends' attitudes towards sunbed use, and parents' SES stratified on sex. Smokers had a three- to four-fold risk of being sunbed users compared with nonsmokers. The risk of being a sunbed user for girl smokers was slightly higher than that for boys. Friends' views on having a sunbed tan and having peers who use sunbeds were associated with a two- to three-fold risk of using a sunbed. However, among girls, the association between having peers who use sunbeds and sunbed use was not significant after adjustment.

The associations between mothers' and fathers' SES and sunbed use were different in boys and girls. Sunbed use was not associated with parents' SES after adjusting for other explanatory variables in boys. In girls, sunbed use was significantly associated with their mothers' SES, whereas fathers' SES was not associated with sunbed use after adjustment. Age was not associated with sunbed use.

The MOR for the random effect of schools on sunbed use was 1.44 for boys and 1.49 for girls.

Discussion

In our study of pupils aged 14–18 years in continuation schools in Denmark, we found that 38% had used a sunbed at least once in the past year (70% girls and 28% boys). This number is in agreement with two previous Danish studies from 2008, where 43–44% in the age groups 15–18 and 15–19 years had used a sunbed in the previous year (Koster *et al.*, 2011; Krarup *et al.*, 2011), with a much higher prevalence among girls than boys. However, sunbed use has decreased in this age group since 2008 in Denmark. In 2009, 33% of 15–19 year olds had used a sunbed in the previous year (Koster *et al.*, 2011) and in 2010 this number decreased to 21% (Darsø *et al.*, 2011, summary in English). Apparently, this marked decrease in sunbed use has not occurred among adolescents in continuation schools. This indicates that pupils at continuation schools may have a special and unhealthy lifestyle compared with the rest of the youth population in Denmark. Continuation schools have been considered a high-risk environment for smoking and smoking initiation (Jensen *et al.*, 2010), and this high-risk environment may even include sunbed use.

In contrast to other studies, we did not find that older age was associated with a higher prevalence of sunbed use in

Table 2 Odds for sunbed use stratified according to sex

	Girls		Boys	
	Unadjusted OR [95% CI]	Adjusted OR [95% CI]	Unadjusted OR [95% CI]	Adjusted OR [95% CI]
Age				
14	1.2 [0.9–1.5]	1.1 [0.9–1.6]	1.1 [0.8–1.6]	1.2 [0.7–1.8]
15	Reference	Reference	Reference	Reference
16	1.0 [0.9–1.2]	1.1 [0.9–1.4]	1.0 [0.8–1.2]	1.1 [0.8–1.4]
17+	0.6 [0.4–1.0]	0.6 [0.3–1.2]	0.9 [0.6–1.5]	1.1 [0.6–2.0]
Smoking at least once a week				
No	Reference	Reference	Reference	Reference
Yes	3.9 [3.0–4.9]	4.5 [3.2–6.1]	2.8 [2.2–3.5]	2.9 [2.2–4.0]
My friends think a sunbed tan is most attractive				
No	Reference	Reference	Reference	Reference
Yes	2.5 [2.0–3.0]	1.9 [1.5–2.5]	3.2 [2.4–4.3]	2.5 [1.8–3.6]
Most people I know use a sunbed				
No	Reference	Reference	Reference	Reference
Yes	2.0 [1.6–2.3]	1.2 [1.0–1.5]	2.8 [2.3–3.5]	1.8 [1.4–2.4]
Mother's SES				
Academic occupation, managers and owners of large corporations	Reference	Reference	Reference	Reference
Highly skilled occupation, team leaders, business owners	2.6 [1.5–4.4]	2.2 [1.2–4.4]	1.2 [0.7–2.0]	0.9 [0.5–1.7]
Occupation requiring specialist knowledge, small business owners	3.1 [1.8–5.4]	2.3 [1.1–4.6]	0.9 [0.5–1.7]	0.8 [0.4–1.8]
Skilled manual occupation, low level white collar worker	3.8 [2.2–6.5]	2.8 [1.4–5.5]	1.7 [1.0–2.9]	1.1 [0.5–2.1]
Unskilled occupation	3.2 [1.8–5.7]	2.7 [1.3–5.4]	1.5 [0.8–2.6]	1.0 [0.5–2.1]
Economically active, but unclassifiable into codes 1–5	3.0 [1.7–5.2]	2.3 [1.1–4.7]	1.6 [0.9–2.7]	1.3 [0.6–2.6]
Economically inactive	3.4 [1.9–5.8]	2.5 [1.3–5.0]	1.3 [0.8–2.4]	0.9 [0.4–1.9]
Unclassifiable	2.9 [1.3–6.1]	2.7 [1.0–6.9]	1.8 [0.9–3.8]	1.1 [0.4–3.1]
Father's SES				
Academic occupation, managers and owners of large corporations	Reference	Reference	Reference	Reference
Highly skilled occupation, team leaders, business owners	1.6 [1.0–2.5]	1.2 [0.7–2.0]	2.1 [1.1–4.0]	1.4 [0.7–2.9]
Occupation requiring specialist knowledge, small business owners	2.2 [1.4–3.4]	1.5 [0.8–2.5]	2.2 [1.2–4.3]	1.3 [0.6–2.7]
Skilled manual occupation, low-level white collar worker	2.5 [1.6–3.8]	1.6 [0.9–2.7]	2.9 [1.5–5.3]	1.7 [0.8–3.4]
Unskilled occupation	1.9 [1.2–3.0]	1.3 [0.7–2.2]	2.1 [1.1–4.0]	1.4 [0.7–2.9]
Economically active, but unclassifiable into codes 1–5	2.4 [1.5–3.8]	1.5 [0.8–2.7]	2.1 [1.1–4.1]	1.2 [0.6–2.6]
Economically inactive	1.8 [1.1–3.0]	1.0 [0.5–1.8]	2.5 [1.2–4.9]	1.4 [0.6–3.2]
Unclassifiable	2.5 [1.5–4.0]	1.3 [0.7–2.4]	3.2 [1.6–6.5]	1.5 [0.7–3.5]

CI, confidence interval; OR, odds ratio; SES, socioeconomic status.

the adolescents (Boldeman *et al.*, 2003; Demko *et al.*, 2003; Krarup *et al.*, 2011; Mayer *et al.*, 2011). This indicates that youths at continuation schools behave differently from their peers outside the continuation school system and that the transition from nonusers to sunbed users may occur earlier in adolescents attracted by continuation schools. This could be a consequence or a premise of the increased demand for independence that going to a continuation schools requires, that is, being away from parents and the home environment for a prolonged period of time.

The differences in sunbed use between adolescents at continuation schools and other adolescents could also be ascribed to differences in the mode of data collection and questions used. In this study, data were collected using traditional surveys distributed and collected at the respondents' schools and we had a very high response rate (91%). Data on sunbed use from adolescents in Denmark have mainly been collected using either web surveys or postal questionnaires, with lower response rates (around 30%). Data on sunbed use in these surveys were collected using a question where the respondents should indicate their use of a sunbed in the previous 12 months by choosing one of seven different answers ('Have used a sunbed several times a week/once a week/several times a month/once a month/four times or less in the previous year/Not in the previous year, but have used a sunbed earlier/Have never used a sunbed'), whereas in this study in the continuation school, pupils had to write the number of times they had used a sunbed in the previous year. It is possible that this study, with its higher response rate, has gathered responses from adolescents not reached by our web and postal surveys, and that this study in continuation schools therefore monitors sunbed use among adolescents more precisely than the population-based surveys. However, the previous population-based surveys were representative of the Danish population for the age group 15 + in terms of sex and geographical region of residence, which this continuation-based survey is not. Also, it is possible that the differences in how questions on sunbed use are phrased may have influenced the data collection.

In our study, smoking was heavily associated with sunbed use in both girls and boys, which is in agreement with earlier observations that have linked adverse health behavior in other areas to problematic UV exposure (Boldeman *et al.*, 1997; Demko *et al.*, 2003; O'Riordan *et al.*, 2006; Miyamoto *et al.*, 2012). Sunbed use was also associated with friends' attitudes towards sunbed and their perceived behavior. Similar results have been reported in other studies (Lazovich *et al.*, 2004).

This study uses detailed information about the SES of both mothers and fathers. We found differences in the association between SES and sunbed use between girls and boys. Having a mother with a lower social class than the top (i.e. with academic occupation, managers, and

owners of large corporations) was associated with a two-fold risk of sunbed use among the adolescent girls. We observed no gradient in this risk; the OR for sunbed use in other social classes were all slightly above 2 and uniform among all seven groups. Fathers' SES was not statistically significantly associated with girls' or boys' sunbed use after adjustment for other explanatory variables. In addition, mothers' SES was not associated with sunbed use among boys either before or after adjustment.

Previous studies have also found parents' social status to be associated with sunbed use in children (Demko *et al.*, 2003; Stryker *et al.*, 2004). For example, Mayer *et al.* (2011) found that children whose parents had a college degree had a 25% less risk of having used a sunbed in the past 12 months compared with children of parents with lower education. Mayer *et al.* (2011) did not report on sex differences among parents or children. That girls' sunbed use is more strongly associated with their mothers' SES compared with their fathers may not be surprising, as girls most likely see their mother as the primary role model in the family. What may seem more surprising is the lack of a gradient in the association of sunbed use and SES. One could expect that the lowest SES (e.g. women outside the labor market) would be more strongly associated with adolescent sunbed use as is seen in, for example, smoking, but this was not the case. This may indicate that sunbed use is not considered as an unhealthy behavior that is avoided by the higher social classes as is the case with smoking (Hiscock *et al.*, 2012). There was no difference in the OR for girls' sunbed use between women with, for example, highly skilled occupation, manual occupation, and no occupation. Only having a mother in the highest social class was associated with decreased sunbed use among the girls. This may be because mothers with this SES has a low level of sunbed use themselves and this reflects their daughters' sunbed use [sunbed use by parents has been associated with sunbed use in their children in previous studies (Cokkinides *et al.*, 2002)]. The association may also be explained by families in this high social class going on vacations to sunny destinations more often than others and that the girls therefore have a 'natural' tan and thus have no need for using sunbeds to get a tan. However, this does not explain why we did not observe the same effect for boys.

School-level effect as measured by the MOR was modest compared with the individual ORs for the explanatory variables, which makes sense, as the data were collected at the beginning of the school year, where the common environmental factors associated with the school may not yet have been overtly present.

Strengths and limitations of study

Our study is characterized by a high response rate, a detailed description of parents' SES, and the use of statistical methods which allow us to estimate the effect of the common (school) environment. It would have been

interesting to include, for example, parents' use of sunbeds in the analyses, but this question was not a part of the distributed questionnaire. The population of adolescents in continuation schools may not be representative of the Danish adolescent population as such and the results from this study may therefore not reflect the determinants of sunbed use in other populations.

Conclusion and implications

We observed a high use of sunbeds in this population of adolescents in continuation schools in Denmark. The use of sunbeds was apparent already in 14 year olds, which implies that educational interventions to discourage sunbed use should preferably take place before this age. An educational effort aimed at continuation schools should also be considered and tested. The ultimate initiative that could abolish teenagers' use of sunbeds would be legislation (banning use of sunbeds for minors), but this has not (yet) been accomplished in Denmark.

Acknowledgements

The authors gratefully acknowledge Niels Christensen and Anne Mette Tranberg Kejs from the Danish Cancer Society for data management (NC) and aid in the randomization of continuation schools (AMTK).

The Danish SunSmart Campaign is financially supported by the philanthropic foundation TrygFonden. This study was financially supported by the Danish Cancer Society and The National Board of Health (Denmark).

Conflicts of interest

There are no conflicts of interest.

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