Sun Exposure Habits and Health Risk-related Behaviours Among Individuals with Previous History of Skin Cancer

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Abstract. *Aim: The aim of the present study was to investigate possible associations between UV exposure and other health risk behaviours in different social environments and in regard to previous history of skin cancer. Patients and Methods: In two closely-located, equally-sized cities in Sweden, representing different social environments (blue collar and white collar), patients aged 55-69 years, diagnosed with skin cancer (study group, n=489) or seborrhoeic keratosis (control group, n=664), were identified through a regional Health Care Register, and were given a questionnaire mapping for sun habits, tobacco smoking, alcohol use, and physical activity. Results: A previous history of skin cancer was associated with reduced UV exposure ($p<0.01$) and increased UV protection ($p<0.001$), higher alcohol consumption ($p<0.05$), and higher level of physical activity ($p<0.05$). Smoking was more common among subjects frequently sunbathing and rarely using sunscreen, but frequent sunbathing was positively associated with physical activity ($p<0.05$). Daily smoking and risky drinking habits were more common in the blue collar social environment, while no differences were seen for sun habits in this respect. Conclusion: A previous history of skin cancer appears to promote increased UV protection. In contrast to alcohol/smoking habits, no association between social environment and sun habits was found.*

Increasing skin cancer incidence in Western societies during recent decades is well-known to be associated with extended sun exposure habits (1, 2). Despite increased awareness of sun exposure risks and strategies to protect from the sun, people tend to continue to seek the sun and to expose themselves to hazardous levels of ultraviolet radiation (UVR). Not least in northern Europe, travel to sunny resorts at latitudes closer to the equator has become increasingly popular, putting the predominantly fair-skinned northern European population at specific risk for UVR damage (3). Health risk behaviours in general are commonly affected by both psychosocial factors as well as socioeconomic and cultural conditions, and there are several factors known to be associated with sun exposure habits. For example, young people (18-25 years of age) tend to sunbathe more frequently, and to undertake sun protective actions to a lower degree, than do people of higher ages (4). In general, women are likely to intentionally sunbathe more frequently than men, while men tend to expose themselves to the sun more often during other outdoor activities (5). Sun protection, in terms of sunscreen use, is more common among women, and also among people of higher, rather than lower, educational levels and socioeconomic status (SES) (6, 7). It is known that higher SES groups are more likely to acquire new information about potential health risks and at a faster rate than lower SES groups (8). In the case of cancer, high income and high educational level are factors shown to be associated with better awareness about causes of major cancer, which allows these people to more accurately protect themselves and minimize their risks (8). For example, low education correlates with greater reluctance to have a skin examination, and in general uncertainty of risks are more common among people of lower education, as well as among ethnic minorities and the elderly (9). Somewhat surprisingly, suboptimal sunscreen use and frequent sunburns are common even among children of mothers with a reported family history of melanoma, and mothers with a previous history of skin cancer (10).

It has also been suggested that having risky habits within one lifestyle area is associated with a tendency of also having risky habits within other lifestyle areas (11).

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Additionally, an accumulation of several risky lifestyle habits appears to lead to impairment of both physical, as well as mental, health (12). Perception of risk plays a pivotal role in health behaviour and an understanding of variations of these perceptions in a given population is essential in order to plan for effective interventions influencing these beliefs (13).

In preventative efforts directed at skin cancer, aiming at reducing UVR exposure, it is of interest and importance to be aware of the underlying factors affecting sun exposure habits, to be able to target intervention towards groups and individuals who are at the highest risk, according to constitutional and behavioural and socio-cultural aspects. Previous studies have suggested primary health care (PHC) to be an important provider in this respect (14-16). In PHC, the physician has to take the full complexity of all the patient's medical conditions and risk profiles into consideration, balancing pros and cons, and with the possibility of relating and adjusting the intervention chosen in regard to the physical findings during examination, an approach that might enhance the effect of intervention. For instance, sun exposure is not solely associated with hazardous, but also positive health consequences which must also be considered, such as the well-known positive effects on psychological well-being and vitamin D regulation. There are also studies indicating a reduced risk for lymphoma and venous thromboembolism (17, 18). Individuals with a previous history of skin cancer have an enhanced risk for future skin malignancies, which is why adequate UVR protection in this group is particularly motivated. However, since due to their previous experience they might already have adopted a more cautious behaviour in the sun, it is not certain that this group constitutes the most important target for sun protection advice.

The aims of the present study were to investigate, in a PHC population: i) possible associations between sun exposure habits and other health risk-related behaviours; ii) possible differences in sun exposure habits in relation to different social environments; and iii) whether a previous history of skin cancer affects the behaviour in terms of sun exposure and protection.

Patients and Methods

The study was performed as a part of the Twincities Research Project, comparing health and morbidity between two closely-located and equally-sized cities in the south east of Sweden, each with a population of around 135,000 inhabitants, however representing two different social environments which could be designated a white-collar and a blue-collar city (19): the white-collar city being Linköping, with a typically academic social history and structure, and the blue-collar city being Norrköping, with a more pronounced industrial, working-class-based social history. Although the extrinsic differences between the two cities today are small, major differences in terms of public health, lifestyle, morbidity and life expectancy, among others, have been stated (19-21). Additionally, a third but small city with a blue-collar profile, Motala, with a population of around 40,000 inhabitants, located in the same county, was also included in the study. The study population was recruited among the patients of four PHC centres in Linköping and Norrköping, respectively, and two centres in Motala. The PHC centres represent different socioeconomic and rural/suburban populations and represent one third of the total population in this Swedish county.

The study group was designated to consist of patients with a recent history of skin cancer. Patients between 55-69 years of age who had been diagnosed with either of the three skin cancer forms, malignant melanoma (MM), squamous cell carcinoma (SCC) or basal cell carcinoma (BCC) during the period of January 2007 to December 2009 were identified through a regional administrative Health Care Register (HCR). This HCR covers all patient diagnosis from PHC as well as from out-patient and in-patient hospital care, and has been found to be suitable for population-based epidemiological studies with high validation (22). From the same HCR register and PHC centres, a control group was selected consisting of patients within the same age interval, having a fully-benign, non-UVR-related skin tumour. For this purpose, the diagnosis of seborrhoeic keratosis (or senile warts) was chosen. Seborrhoic keratosis is common in the specified age interval, and is also a common reason for patients to consult the doctor, since its appearance may raise a concern that it might be malignant.

A questionnaire was sent to all participants in both groups. It consisted of questions concerning sun habits, tobacco smoking, alcohol use and level of physical activity. Additionally, co-morbidity in terms of ischaemic heart disease, type-2 diabetes, stroke, diabetes and depression were asked for. For sun habits, the included measures were based on five-grade Likert scales covering the items "intentional tanning", "sunscreen use", "staying in the shade", "number of occasions with sunburn" and "sunbed use", all of which have been used in previous studies (14, 15). For tobacco smoking, the respondents were asked to respond to whether they were non-smokers, smokers, or passive smokers, and in the case of being smokers, also if they smoked daily. For mapping of alcohol use, the first three questions of the Alcohol Use Disorders Identification Test (AUDIT) were extracted, investigating frequency of alcohol intake, typical quantity of alcohol intake, and frequency of heavy drinking (AUDIT-C) (23). For physical activity, two questions from the national Swedish public health survey were utilised, mapping for typical physical activity on a yearly basis and on a weekly basis, respectively (24).

The questionnaire was identical for the groups, except for that in the study group, the participants were also asked whether they had changed sun habits after being diagnosed with skin cancer (Figure 1). An additional section, investigating perception of a set of different health risk behaviours, were also part of the questionnaire, but will be presented separately, and was not interpreted in the present study. One questionnaire reminder was sent to those participants who did not respond to the first request.

Statistical analysis. During data analysis, the responses were graded according to increasing risk behaviour, so that a low value represented less risky health behaviour than a high value. In the statistical analyses, the scores for each question were dichotomised to represent a high or low health risk behaviour within each behaviour field. Pearson's χ^2-test was used to analyse for possible differences in risk behaviour between cases and controls, and according to gender. Multiple binary logistic regression analysis was

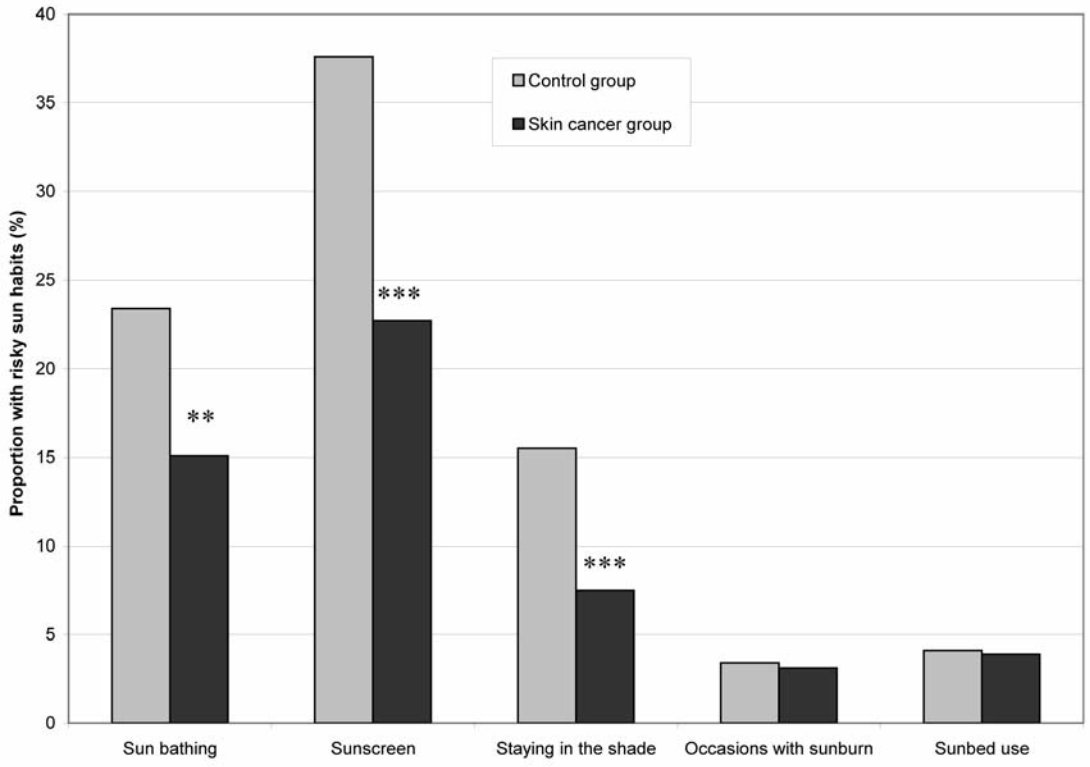

Figure 1. *Distribution of individuals with risky sun habits in the skin cancer group and in the control group. For all items, a risky sun habit is either a high level of UV exposure (e.g. sun bathing) or a low level of UV protection (e.g. sunscreen use). **p<0.01, ***p<0.001 (Pearson's χ^2-test).*

used to investigate the impact of risky sun habits on other health risk behaviours, with group (skin cancer group and control group) and gender and indicator of social environments as covariates.

Ethics approval. The study was approved by the Regional Ethics Review Board in Linköping, Dnr 2010/180-31.

Results

A total of 489 cases, 224 (46%) males and 265 (54%) females, with either one of the three skin cancer diagnoses MM, SCC or BCC were identified in the registers and included in the skin cancer group. Correspondingly, 664 controls, 287 (44%) males and 377 (56%) females, with a diagnosis of seborrhoeic keratosis were identified to comprise the control group. After one questionnaire reminder, the response rate in the skin cancer group was 82%, and that in the control group was 81% (overall 81%). Twelve participants in the skin cancer group were excluded since they were shown to have a false skin cancer diagnosis (suspected skin cancer that after histological analysis was proven to be benign), leaving 388 eligible participants (179 males and 209 females) in the skin cancer group and 535 participants (230 males and 305 females) in the control group.

Differences in sun habits between groups. In Figure 1, the different proportions of individuals with risky sun habits, in the skin cancer group compared to the control group are shown. Those with a previous history of skin cancer, less frequently reported sunbathing ($p<0.01$), and to a greater extent reported protecting themselves from the sun, either by seeking shade ($p<0.001$) or by applying sunscreens ($p<0.001$). A total of 77.9% of those in the skin cancer group reported that they had become more precautious in the sun after they had received their skin cancer diagnoses, while 20.5% reported not to have changed their behaviour, and 1.6% reported having become less precautious.

Differences in other health risk behaviours between groups. In Figure 2, the proportions of those with risky health behaviours, by means of tobacco smoking, alcohol intake and physical inactivity, in the skin cancer group, compared to the control group are shown. For alcohol use and for physical activity, the outcomes for each question, as well as a summarised score of all ingoing questions in each field, are shown. Those in the skin cancer group significantly more often reported higher alcohol consumption ($p<0.05$), but were less likely to have a low level of physical activity

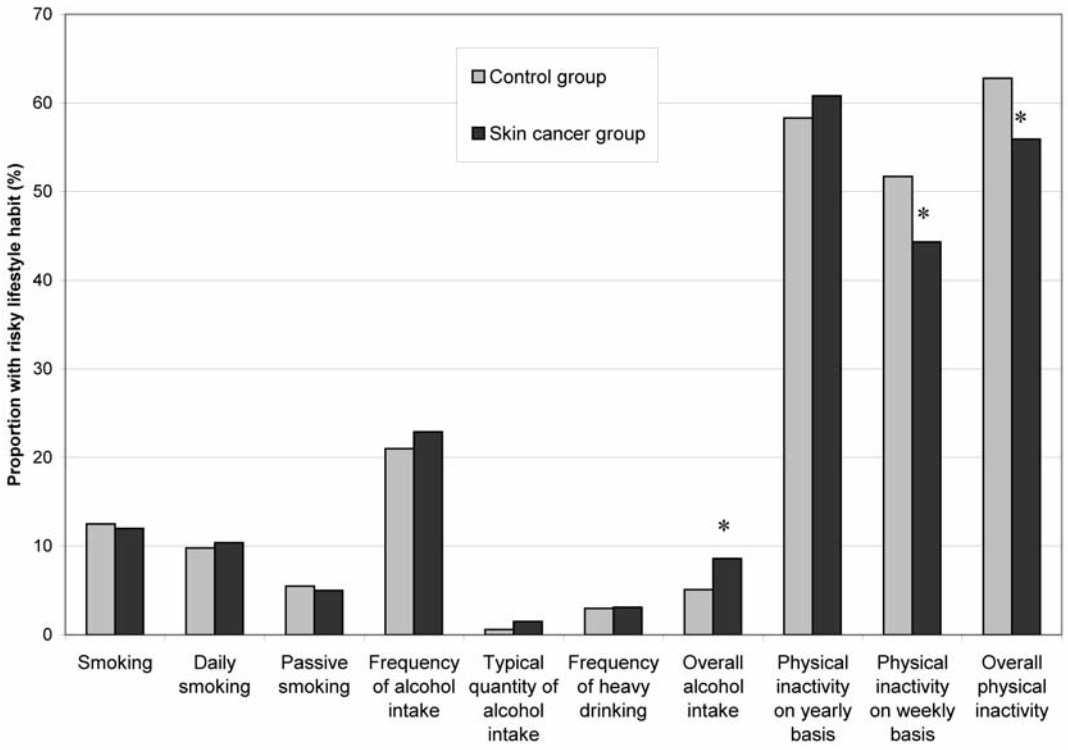

Figure 2. *Distribution of individuals with risky health behaviours, by means of tobacco smoking, alcohol intake and physical inactivity in the skin cancer group and in the control group. *p<0.05 (Pearson's χ^2-test).*

($p<0.05$). No significant difference was seen for tobacco smoking.

Differences in sun habits according to gender. In Figure 3, proportions of individuals reporting risky sun habits, according to gender, are presented. Frequent sunbathing was more common among females ($p<0.05$), as was protection by application of sunscreens ($p<0.001$). Additionally, females more frequently reported seeking shade as sun protection than did males ($p<0.001$). Sunbed use was more common among females.

Correlation between risky sun habits and other health risk behaviours. In Table I, the distribution of those reporting daily smoking, high alcohol intake and low level of physical activity, according to whether or not they had risky sun habits, are displayed. In the Table I, the odds ratios (OR) for having other risky lifestyle habits, if having risky sun habits, are also displayed, along with their 95% confidence interval (CI), based on logistic regression analysis. The OR for gender and group (skin cancer group and controls), used as covariates in the analysis, are also shown. Only the summarised alcohol intake and level of physical activity are included in the presentation, but significantly higher ORs were seen for having a low level of physical activity on a yearly basis (OR=1.64, $p<0.01$), as well as a high frequency of heavy drinking (OR=2.4, $p<0.05$), if having a low frequency of sunscreen use.

Differences in health risk behaviours according to social environments. In Table II, the proportions of individuals with risky lifestyle habits in the three cities, representing different social environments, are shown. No significant difference in sun habits between the cities was detected. However, tobacco use appeared to be significantly more common in Norrköping and Motala (the two blue collar cities) than in Linköping (white collar city) ($p<0.05$), while the frequency of alcohol intake was significantly higher in Linköping ($p<0.01$).

In Table III, participants have been divided into subgroups according to the predominant SES status of the PHC population, and differences in health risk behaviours are displayed. Again, no significant differences in regard to sun habits were seen, while tobacco smoking, heavy drinking and a low level of physical activity appeared to be significantly more common among those with low SES.

Skin cancer and co-morbidity. Out of the investigated diseases (stroke, ischaemic heart disease, type-2 diabetes and depression), stroke was the only condition which was

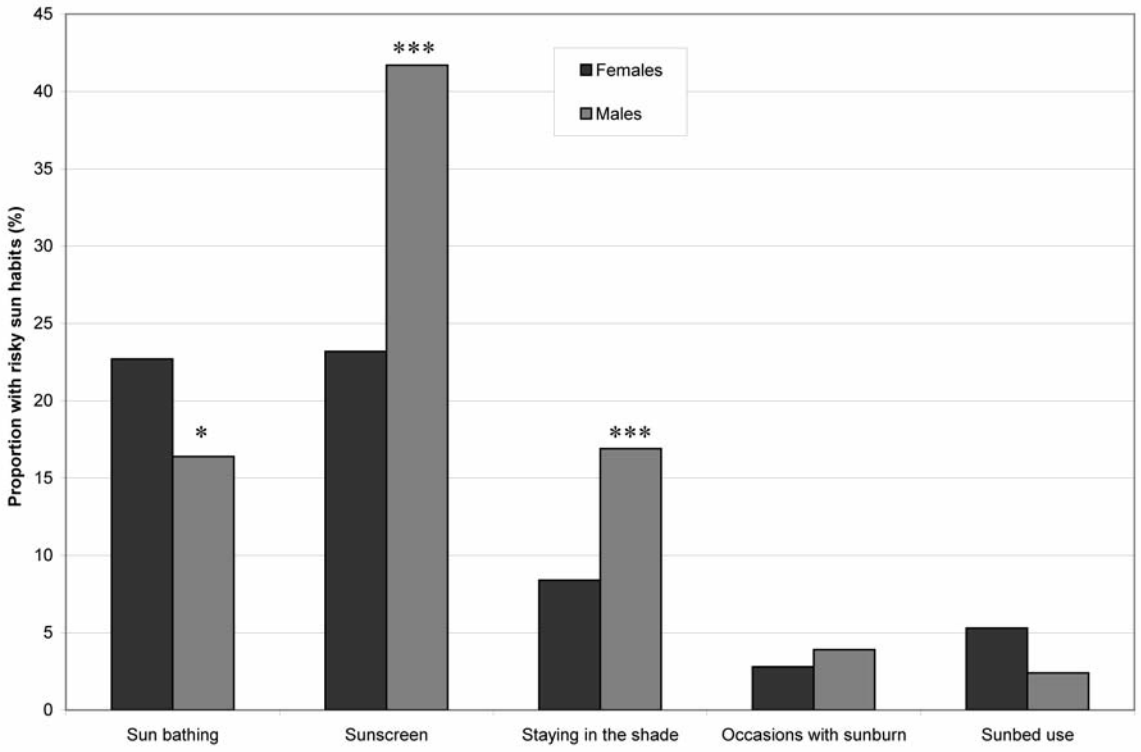

Figure 3. *Gender distribution of individuals with risky sun habits. For all items, a risky sun habit is either a high level of UV exposure (e.g. sun bathing) or a low level of UV protection (e.g. sunscreen use). *p<0.05, ***p<0.001 (Pearson's χ^2-test).*

significantly more common in the skin cancer group in this cohort: 5.2% compared to 2.6% in the control group ($p<0.05$, Pearson's χ^2-test; OR=2.02, $p<0.05$). However, when adjusted for gender, the observed difference was no longer significant ($p=0.06$).

Discussion

The continuously increasing skin cancer incidence worldwide and its relation to sun exposure habits highlights the necessity for intensified preventative measures. In the present study, an attempt to broaden the knowledge and understanding of factors that might be associated with at-risk behaviour in the sun, and its relation to other health risk behaviours, are presented.

Having a previous history of skin cancer is a concrete risk factor for developing a new skin cancer lesion. For that reason, extra attention on reducing sun exposure in this category of individuals must be considered crucial. The finding that those in the skin cancer group reported a consistently higher level of sun avoidance, compared to the control group, is thus to be viewed as highly appropriate. A fear of the disease, and of relapse, is likely to be one major explanation for this phenomenon, but it is also probable that the individuals in this group have been subject to enhanced sun protection advice from healthcare providers during assessment of their malignancies. In this particular case, sun protective advice is an important element of secondary skin cancer prevention, along with efforts to promote early detection, while sun protection advice in the general population, or directed at specified target groups of people without previous history of skin cancer, refers to primary prevention. Undoubtedly both these groups exhibit a need for increased efforts.

In concordance with previous studies, females reported more frequently sunbathing than males, both in the sun and by use of artificial lighting. At the same time, somewhat in contrast to this, they also reported a higher level of sun protection, by means of sunscreen use and seeking shade. This might suggest that females have a tendency to more actively seek the sun, but that they simultaneously also choose to undertake protection to enable this. This is in line with previous studies indicating that males expose themselves to the sun to a greater extent during outdoor activities in general (without any actual intention to tan), while females tend to sunbathe more often (5).

Tobacco smoking appeared to be associated with having a less precautious behaviour in the sun, as was partly the case for excessive alcohol intake as well. The negative association between sunbathing and a low level of physical activity is

Table I. *Distribution of individuals reporting daily smoking, high alcohol intake and low level of physical activity according to the presence or absence of risky sun habit. The odds ratios (OR) for having other risky habits, along with their 95% confidence interval (CI), based on binary logistic regression analysis, if having a risky sun habit, are presented, as well as the ORs for gender and group (skin cancer group and controls), used as covariates in the analysis. For p-values, ns=non-significant, referring to a p-value≥0.05.*

	Daily smoker (n=91)				Risky drinking habit (n=52)				Physical inactivity (n=542)			
	(%)	OR	95% CI	*p*-Value	(%)	OR	95% CI	*p*-Value	(%)	OR	95% CI	*p*-Value
Intentional tanning												
High risk	12.2	1.96	1.11-3.47	$p<0.05$	3.7	0.55	0.21-1.50	ns	51.7	0.68	0.48-0.99	$p<0.05$
Low risk	9.5				7.2				62.1			
Sunscreen use												
High risk	13.7	2.12	1.32-3.44	$p<0.01$	10.2	1.53	0.82-2.85	ns	63.4	1.17	0.86-1.60	ns
Low risk	8.4				15.1				58.4			
Staying in the shade												
High risk	6.3	0.39	0.16-0.92	$p<0.05$	9.7	1.48	0.62-3.54	ns	53.2	0.76	0.49-1.20	ns
Low risk	10.6				6.1				60.8			
Occasions with sunburn												
High risk	10.4	0.24	0.03-1.83	ns	4.3	0.66	0.08-5.18	ns	63.3	1.27	0.59-2.76	ns
Low risk	3.3				6.7				59.7			
Sunbed use												
High risk	11.8	1.07	0.35-3.27	ns	6.1	1.48	0.30-2.73	ns	51.4	0.81	0.41-1.63	ns
Low risk	10.0				6.9				60.3			
Gender												
Male	11.1	0.78	0.49-1.24	ns	11.4	4.65	2.25-9.66	$p<0.001$	62.3	1.17	0.88-1.55	ns
Female	8.8				2.3				57.9			
Group												
Skin cancer	10.4	1.22	0.77-1.94	ns	8.6	1.70	0.93-3.10	ns	55.9	0.75	0.56-0.99	$p<0.05$
Controls	9.8				5.1				62.8			
Social environment												
Blue collar city	13.1	2.19	1.36-3.52	$p<0.001$	8.2	1.86	1.01-3.44	$p<0.05$	57.4	0.83	0.63-1.09	ns
White collar city	6.5				4.6				62.8			

probably related to being outdoors; it is believed that people who have outdoor sporting habits and similar also tend to expose themselves to sunlight to a greated extent than others. In the skin cancer group, on the other hand, the lower level of physical activity observed, compared to the control group, probably reflects an avoidance of outdoor physical activities, in order to be protected from the sun.

Social environment affected smoking and drinking habits to some extent, but did not seem to affect the level of sun exposure. Previous studies have suggested sunscreen use to be more common among individuals with higher, rather than lower educational levels and SES (6, 7), while outcomes of studies concerning intentional tanning are inconsistent (25-29). In the present study, SES was not investigated individually for the included participants, but as a marker of their social environment on a community level. This might be seen as a limitation, but was, however, one of the fundamental elements of the study, since major differences in several health indicators have previously been stated between the three investigated cities representing the white collar and blue collar social environments (19-21). One must remember that the participants in this study are not the general population from two different social environments, but rather selective groups with defined skin diagnoses. For these groups of patients, their backgrounds in different social environments did not seem to influence their behaviour. If the main aim were to actually investigate possible differences according to individual SES, a considerably different study design would thus have to be chosen.

Another limitation of the study is that it does not reveal any information about the level of sun exposure in the skin cancer group prior to their skin cancer diagnoses. A considerable majority, 77.9%, reported to have become more precautious in the sun, but it would, indeed, have been interesting to know what their sun habits were before the onset of their skin malignancies, and the possible differences compared to those in the control group. This would, however, demand a long-term cohort study design, and this was not possible within the limitation of the present project.

In conclusion, the social environment appeared to be associated with some differences in smoking, alcohol intake and level of physical activity, but not with sun exposure

Table II. *Proportions of individuals with risky lifestyle habits in the three cities representing different social environments (Linköping, white collar city; Norrköping and Motala, blue collar cities). Significance values refer to Pearson's χ^2-test (ns=non-significant, referring to a p-value≥0.05).*

	Linköping (%) (n=424)	Norrköping (%) (n=334)	Motala (%) (n=165)	*p*-Value
Intentional tanning	19.7	19.9	20.6	ns
Sunscreen use	30.2	30.8	35.4	ns
Staying in the shade	10.9	13.2	13.3	ns
Occasions with sunburn	2.9	3.9	3.1	ns
Sunbed use	3.5	4.2	4.9	ns
Daily smoking	6.5	13.6	12.1	$p<0.01$
Passive smoking	2.1	7.3	9.1	$p<0.001$
Frequent alcohol intake	23.0	24.4	13.6	$p<0.05$
Typical quantity of alcohol	0.8	1.3	0.7	ns
Frequent heavy drinking	2.3	2.5	6.1	ns
Physical inactivity on weekly basis	50.6	47.7	45.1	ns
Physical inactivity on yearly basis	56.2	60.5	65.0	ns

habit. A previous history of skin cancer was associated with an increase of sun avoidance/protection, and female gender with a higher frequency of outdoor tanning and sunbed use, but also with more frequent protection by sunscreens and by seeking shade. Those in the skin cancer group were less likely to have a low level of physical activity, but reported a higher level of alcohol consumption. The results indicate a previous history of skin cancer to be a major factor affecting sun protection behaviour, but whether this is mainly an effect of a natural fear of relapse of the disease, or a result of secondary preventative measures conducted by healthcare providers during cancer management, remains uncertain.

Table III. *Distribution of individuals with risky lifestyle habits according to the dominating socioeconomic status (SES) of the primary health care (PHC) population to which each individual was connected. Significance values refer to Pearson's χ^2-test (ns=non-significant, referring to a p-value≥0.05).*

	Low SES (%) (n=297)	High SES (%) (n=626)	*p*-Value
Intentional tanning	18.4	20.7	ns
Sunscreen use	32.0	31.0	ns
Staying in the shade	12.2	12.1	ns
Occasions with sunburn	4.1	2.9	ns
Sunbed use	4.7	3.7	ns
Daily smoking	16.4	7.1	$p<0.001$
Passive smoking	9.2	3.4	$p<0.001$
Frequency of alcohol intake	22.2	21.6	ns
Typical quantity of alcohol	1.5	0.7	ns
Frequency of heavy drinking	5.0	2.1	$p<0.05$
Physical inactivity on weekly basis	4.92	48.3	ns
Physical inactivity on yearly basis	64.5	56.9	$p<0.05$

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