

## INVESTIGATIVE REPORT

# Sunbed Use in German Adults: Risk Awareness Does Not Correlate With Behaviour

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**In Europe, little is known about the prevalence of indoor tanning. The aims of this study were therefore to estimate the prevalence of sunbed use and to identify risk groups and motives in a population-based survey. The cross-sectional “SUN-Study 2008” (“Sunbed-Use: Needs for Action-Study 2008”) was conducted in 2008. A total of 500 adults, aged 18–45 years, were randomly selected and asked about their indoor tanning practices, their motivation and risk perception, and the compliance of staff with international sunbed use recommendations. Forty-seven percent of subjects reported having visited an indoor tanning facility at least once in their lives. Prevalence of use was not reduced in risk groups for skin cancer. Risk awareness of users equalled that of non-users. The poor quality of services and advice provided by many solariums was alarming. It can be concluded that appropriate measures to change tanning habits need to be identified. Legal regulations could be one option. Key words: sunburn; melanoma; health behaviour; motivation; prevention; risk factors.**

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Every day millions of people deliberately expose themselves to one of the main established risk factors of skin cancer: artificial ultraviolet radiation (UVR). The aim of this study is to investigate this prevalent, harmful behaviour and establish possibilities for its prevention.

One in every three cancers diagnosed worldwide is skin cancer (1). The incidence rates of skin cancer are rising in developed countries (1, 2); for example, the incidence rate of basal cell carcinoma (BCC) increased from 18.2% in 1976 to 1979, to 29.1% in 2000 to 2003 (3). Of all skin cancers, 80–90% are considered to be caused by UVR (4). Apart from direct exposure to sunlight, indoor tanning facilities (the so-called “sunbeds”, “tanning booths”, “tanning salons”, “tanning parlours”, or “solariums”) are the most important and increasingly

frequent sources of UVR that increase the risk of skin cancer (5, 6).

The commercial indoor tanning business is now promoting sunbeds with extensive advertising campaigns. In the USA alone, artificial tanning is a \$5 billion-a-year industry, with a five-fold increase from 1992 to 2008 (6, 7). The indoor tanning industry is also successful in Europe. In Germany, for example, this sector has consistently achieved an annual turnover of more than 1 billion Euros in recent years (8).

The World Health Organization (WHO) anticipates serious consequences of sunbed use, which include disfigurement, pain, suffering, and early death, as well as substantial costs to national health systems for screening, treating, and monitoring patients with skin cancer (1).

Against this background it is surprising that not a single epidemiological study with current data on the use of sunbeds exists in Central Europe. A recent systematic review showed that a few older epidemiological studies regarding the use of sunbeds exist in other parts of Europe with data samplings date before 2002<sup>1</sup>. It is therefore crucial to collect population-based data about sunbed use to allow for the planning and preparation of future potential public health interventions for skin cancer prevention.

The objective of this study was therefore to:

- determine the prevalence of indoor tanning practices among a randomly selected sample of German adults;
- identify risk groups, their motivations and risk perception; and
- assess the compliance of staff with international recommendations for the use of sunbeds.

## MATERIALS AND METHODS

### Study participants

This paper is based on data from the cross-sectional “SUN-Study 2008” (“Sunbed-Use: Needs for Action-Study 2008”), a collaborative project conducted by the Heidelberg University in

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cooperation with the Association of Dermatological Prevention (ADP) and the European Society of Skin Cancer Prevention EUROSkin. The population-based survey was conducted in Mannheim, a typical major city in southern Germany with 327,000 inhabitants (31 December 2007; 49–50°N latitude, 95 m above sea level).

Individuals unable to speak or understand German were excluded. Because young adults constitute the main user group, age between 18 and 45 years was established as an inclusion criterion. The target subjects were identified on the basis of a two-stage selection process. First, a telephone number was selected from the official telephone register of Mannheim (9) based on a random algorithm, and the household thus selected was contacted by telephone. The target subject, aged 18–45 years, was then defined as the person in the household whose birthday was most recent (last birthday method (10)). Of all the contacted households 1307 had a household member between 18 and 45 years of age. The net sample (i.e. the analytical sample) comprised 500 persons (51.2% men) based on a participation rate of 38% (500/1,307). Approval of the ethics committee of the Medical Faculty of Heidelberg was obtained (ANr2007-269E-MA). The study also complies with the principles laid down in the Declaration of Helsinki. All participants gave informed consent to participate in the study.

#### Procedures

After an interviewer training and a pre-test, all study participants were surveyed from February 2008 to May 2008 by the co-author (SZ), using a standardized questionnaire with computer assistance. At the beginning of the interview, the subjects were informed about the purpose of the survey, the voluntary nature of participation, and the anonymity of the processed data. Data were collected without disclosing the subject's identity, and transferred blinded to the study centre (MIPH). In addition, all presented results were weighted to take into account the age and sex structure of the population: "Adaptation weighting" according to the number of cases was done on the basis of the most recent census data (31 December 2007).

#### Measurements and operationalizations

**Indoor tanning practices.** Subjects were asked whether they ever used a sunbed (*ever users*). Prevalence of use during the last 1, 3, 6 and 12 months was surveyed. In order to conduct more detailed analysis, the subjects who had reported sunbed use were differentiated into *current users* and *past users*.

In accordance with Knight et al. (11) participants were defined as current users when they reported having used a sunbed within the last 12 months, whereas users whose last solarium visit occurred longer ago were defined as past users. In addition, frequency of use, average tanning time and the location of the solarium were also established.

**Risk groups, motivations and risk perception.** In order to identify risk groups, participants also indicated sex, age, educational level and information regarding familial and partnership status, nationality, smoking habits, physical activity during leisure-time, hair and eye colour, self-rated skin type, and answered several questions pertaining to their personal and familial dermatological anamnesis. The questionnaire also contained further closed questions about motives and risk perception.

**Compliance with international recommendations.** All users were asked if they had ever received advice before a tanning session about potential health risks, or information about the role of skin type and the importance of using goggles. Furthermore, details concerning participants' most recent solarium visit were requested (presence of service personnel, availability of goggles).

#### Statistical analyses

A bivariate analysis was first conducted to determine prevalence rates of solarium use in total and for individual risk groups. The  $\chi^2$  test was applied to investigate intergroup differences between: (i) current users and never users; and between (ii) ever users and never users. All tests were two-tailed. The defined level of significance was  $p < 0.05$ . All analyses were performed with SPSS for Windows, Version 16.0 (SPSS Inc., Chicago, IL, 60606, USA).

## RESULTS

### Prevalence of indoor tanning practices

One in two respondents had visited a solarium at least once (46.7% ever users). One in five of the 18–45-year-olds reported having used a sunbed during the last year (21.0% current users). One in eight (12.5%) reported having used sunbeds 1–10 times within the last month prior to the interview (Fig. 1). The average current user reported a mean of 15 visits per year (median = 10). The reports ranged from 1 to 120 times per year. Respondents exposed themselves to the indoor UVR for  $13.6 \pm 4.3$  min each time they used a sunbed. Therefore, the total average UV exposure per current user was around 3.4 h/year (range 0.13 h–36.0 h/year).

In the vast majority of cases, sunbed use occurred in solariums (72.3%), followed by use in fitness studios (15.0%), swimming baths (15.0%) and saunas (7.7%). Many fewer respondents used a sunbed at home (2.4%) or in a hotel (1.3%). Doctors' practices and beauty salons played only a minor role (0.6% and 0.7%, respectively; data for last visit).

### Risk groups

Among respondents who had used tanning beds during the last year, a significantly higher proportion were

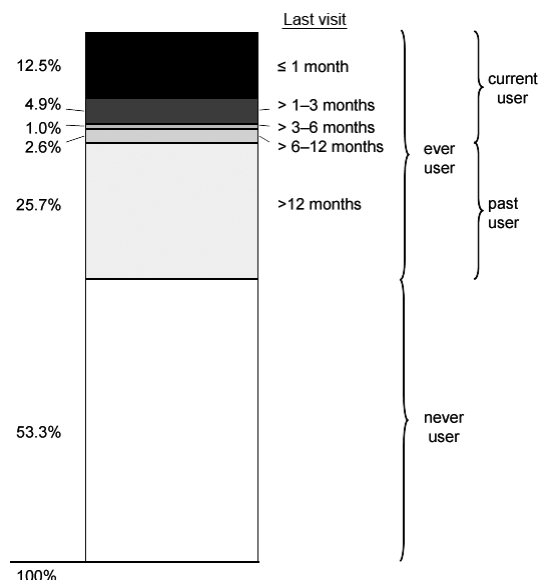


Fig. 1. Prevalence of sunbed use among 18–45-year-old persons.

female, individuals with medium education, and current smokers (Table I). Prevalence of use was also typically higher among employed participants than among their unemployed counterparts. Marital and partnership status, nationality, and age were not associated with the likelihood of using indoor tanning facilities. Similar patterns could be observed in the comparison between never users and current users. In addition, a correlation existed between the type of sport activity and sunbed use: in comparison to non-sportsmen and to participants in team and combatant sports, respondents who do individual sports (e.g. aerobics, gymnastics and fitness training) reported significantly more frequent solarium use in their lifetime (Table I).

Individuals with paler skin types, a history of sunburn, a large number of pigmentation marks (naevus/mole) and cases of malignant melanoma in their familial history belong to the skin cancer risk groups (especially for malignant melanoma (4, 5)). However, our data show that the usage pattern of these risk groups did not differ significantly from that of the rest of the population (exception: current user with pale skin type). Within these known risk groups, sunbed use was not less frequent (Table II).

### Motivations

Appearance (i.e. the wish to look better) and well-being were the most popular reasons given by the respondents for using sunbeds, followed by “relaxation”, the plea-

Table I. Sunbed use (%) by socioeconomic and lifestyle characteristics among 18–45-year-old persons

	Never user	Current user		Ever user	
Gender					
Male	65.2	16.0	$p < 0.001$	34.8	$p < 0.001$
Female	41.0	26.6		59.0	
Age (years)					
18–25	58.5	26.2	$p = 0.266$	41.5	$p = 0.390$
26–35	51.4	15.1		48.6	
36–45	51.6	22.9		48.4	
Nationality					
German	53.1	20.6	$p = 0.594$	46.9	$p = 0.844$
Non-German	54.5	25.5		45.5	
Marital status					
Married	52.9	17.8	$p = 0.302$	47.1	$p = 0.936$
Single/divorced	53.2	23.1		46.8	
Occupation					
No	56.2	13.1	$p = 0.024$	43.8	$p = 0.447$
Yes	52.3	23.7		47.7	
Vocational education					
None / low	65.5	16.2	$p = 0.001$	34.5	$p < 0.001$
Medium	43.0	27.5		57.0	
High	55.3	16.0		44.7	
Smoking					
No	55.5	18.6	$p = 0.037$	44.5	$p = 0.124$
Yes	47.9	26.7		52.1	
Sport activity					
None	50.0	17.3	$p = 0.110$	50.0	$p = 0.004$
Team or combatant sport	74.5	16.4		25.5	
Individual sport	51.2	24.4		48.8	

Table II. Sunbed use (%) by risk groups among 18–45-year-old persons

	Never user	Current user		Ever user	
Skin type I and II					
Yes	56.8	13.5	$p = 0.005$	43.2	$p = 0.234$
No	51.3	25.3		48.7	
Often sunburn as a child					
Yes	51.7	17.6	$p = 0.471$	48.3	$p = 0.623$
No	54.1	22.4		45.9	
Malignant melanoma					
Yes	35.7	28.6	$p = 0.274$	64.3	$p = 0.181$
No	53.8	20.7		46.2	
More than 50 pigment marks					
Yes	49.2	17.4	$p = 0.618$	50.8	$p = 0.277$
No	54.7	22.2		45.3	

sant feeling of light and warmth, and the intention to get a “pre-holiday tan” (Fig. 2). In comparison with these dominating motives, only a small minority of the users reported using tanning beds for the treatment of skin disease (neurodermatitis, acne, or photosensitivity) or other health-motivated reasons. When contrasting past and current users, it became apparent that the latter’s reasons for use were considerably more often associated with aesthetic and pleasant sensations.

### Risk perception

Sunbed users were in no case less informed about the risk of solarium use than non-users: sunbed use was not correlated with the proportion of correct answers about the risks of UVR for the formation of lasting skin damage and other health risks (Fig. 3). Sunbed users even reported more often than non-users knowing that UVR led to premature ageing of the skin.

### Compliance of staff with international recommendations

Nearly half of the respondents (44.2% of all ever users) reported that their last visit was to a solarium without service or advisory personnel (a so-called “coin sola-

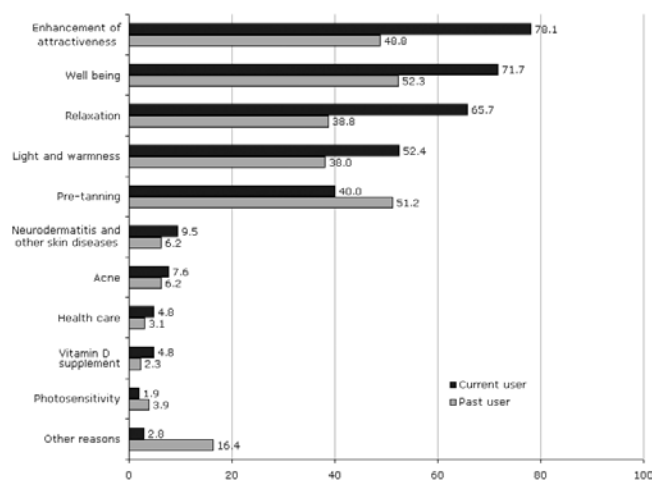


Fig. 2. Motivations for sunbed use among current and past users.

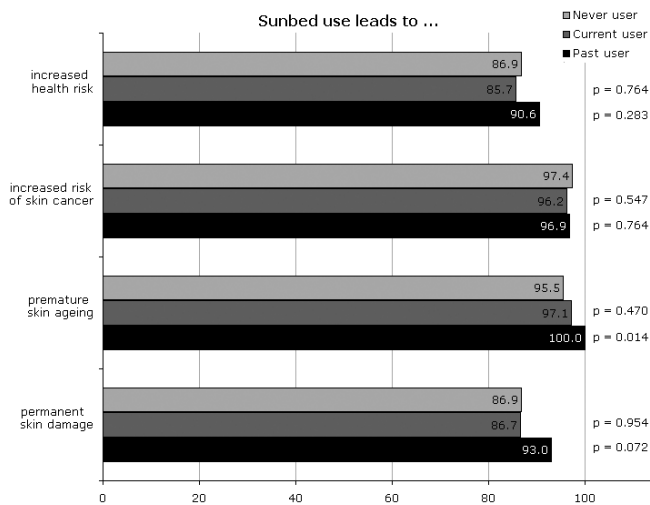


Fig. 3. Risk perception by user groups among 18–45-year-old persons.

rium”). In tanning studios with staff, the compliance of staff showed several deficits in relation to international recommendations: 70.5% of the ever users reported that they had never received warning about the health risks of indoor tanning. 45.3% had never undertaken a consultation regarding skin type. Against this background it is not surprising that nearly half of the respondents (45.5%) experienced sunburn at least once when using indoor tanning facilities. More than half (53.4%) of the ever users interviewed had never been told to wear goggles. Accordingly, only 52.8% of the customers were given a pair of goggles during their last solarium visit. Only 33.3% of those who received goggles proceeded to wear them (Fig. 4).

## DISCUSSION

### Main message

Every second 18–45-year-old has visited a solarium at least once, and every fifth is a current user. Although the service and advice quality in tanning studios is inadequate, users are surprisingly well informed about the health risks involved. The fact that the known risk groups, namely individuals with a history of sunburn, pigmentation marks and familial melanoma risk, do not use solariums significantly less often is alarming.

### Relation to other studies

In comparison with other nations, the high level of sunbed use by 36–45-year-olds appears to be a particular German characteristic. Some of our results are consistent with those of other international studies: previous studies show that women (12–14), smokers (12, 14, 17) and persons with skin type III or IV are more likely to use sunbeds than the reference groups (14, 17) and that there is an association with physical activity (6). Other parts of our results add several new insights: although a

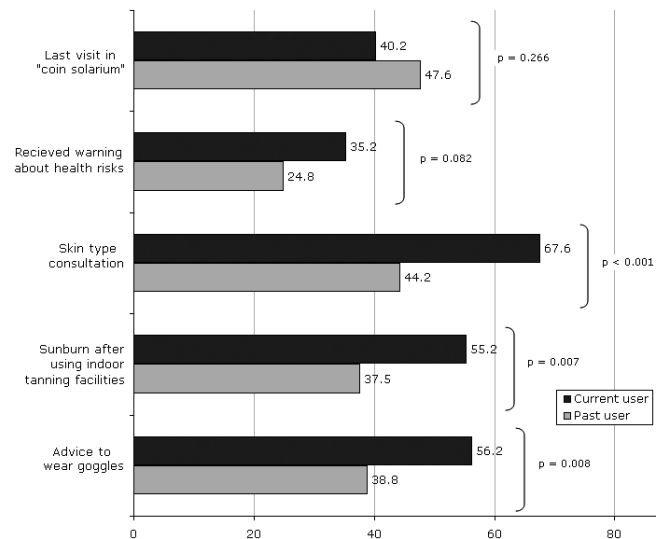


Fig. 4. Service and advice provided in indoor tanning facilities by user groups.

negative correlation between education and the use of sunbeds has been reported (14), we found the highest use of indoor tanning facilities among persons with a medium level of education. Furthermore, we identified a correlation between employment status and sunbed use, which has not been reported previously.

Our study also confirms the discovery that several quantitative and some qualitative studies from the USA and Europe report: sunbed users know the associated risks as well as non-users (18–20). This also applies to young adults and adolescents (21, 22).

Banks et al. (21) presume that body image and self-esteem are stronger forces in the face of social pressure than knowledge of long-term harmful effects of UVR. In some cases, dependence may play a significant role: in qualitative interviews, some users experienced their tanning behaviour as addictive (so called “tannorexia” (20, 23)). This finding is supported by the free-text entries of some of the participants of our study, who entered “I am addicted to solariums” or “addiction” as their reason for tanning.

Even though the indoor tanning industry claims the opposite (24), molecular and animal studies have shown the danger of tanning beds (7) (for an overview see (25)). Recent reviews comment on evidence of the causal association between the use of sunbeds, squamous cell carcinoma (SCC) and cutaneous malignant melanoma (CMM), even after adjusting for sunburns, sunbathing, and sun exposure (5, 7, 26). The causal effect on BCC has not yet been clarified (6, 28).

Furthermore, exposure to UVR via sunbeds has other acute health consequences, including skin burns, eye burns and ocular disorders, and suppression of immune functioning. This demonstrates the danger caused by sunbeds. However, use of sunbeds is a risk factor that is modifiable, even completely avoidable.

Taking into account that, by mandate of the European Commission, sunbeds should not produce higher irradiances than  $0.3 \text{ W/m}^2$  and that a minimal erythemal dose (MED) for skin type II corresponds to  $210 \text{ J/m}^2$  (28), the mean indoor exposure time given above (13.6 min) at an irradiance of  $0.3 \text{ W/m}^2$  will yield an irradiation dose of approximately  $245 \text{ J/m}^2$ . This value is already approximately 17% higher than 1 MED ( $210 \text{ J/m}^2$ ), which, according to international recommendations (1), should never be exceeded in any "UV-session".

The use of sunbeds in Germany is noticeably more frequent than in most other nations (3, 4, 18, 23, 30). However, it is also typical for other studies that in particular women and smokers belong to the most frequent sunbed users (3, 7, 11, 12, 18, 28–30).

### *Limitations and strengths*

Methodological limitations of this study mainly concern the selection of the investigated region, the selection procedure, the response rate, the cross-sectional design and the validity of self-reports.

*Selection of the investigated region.* Mannheim is a typical German city with an urban centre and surrounding, partly rural suburbs, as well as a comparatively average German-wide population structure. The collection of samples in a defined study region normally reduces the generalization capability of our data. Because no current studies with that analytical approach exist (either for Germany or for other European countries), this study can provide the first indications of typical user groups, advice deficiency and prevention approaches.

*Selection procedure.* Another source of selection bias could be the choice to use landline telephone numbers from the official telephone registry (9). First, there are persons that have unlisted numbers, which were excluded from selection. Furthermore, there are households in Germany that only have cellular mobile telephones (in 2003: 5.5%) or have no telephone connection at all (in 2003: 1.6%) (32). Hence, only 93% of all households are covered by the sampling procedure (from the register of landline telephone numbers).

*Response rate.* The response rate of 38% is lower than national health surveys, with multiple letters of invitation (4), but higher than the response rate of commercial market research studies. Comparable studies about this theme are based on similar rates (12, 27).

*Cross-sectional design.* Another limitation arises out of the cross-sectional nature of the study, which does not allow for causal conclusions. The fact that firstly, principally descriptive percentage values are referred to, and secondly, no attempts are made to explain illness cases (e.g. cancer incidences), should put this fundamental objection into perspective.

*Validity of self-reports.* Social desirability may be an important issue here. On the one hand, sunbed users are more likely to complete the questionnaire (12). On the other hand, the respondents could have provided socially desirable answers. The first phenomenon would lead to over-reporting, the latter to under-reporting. To what extent these two bias sources influence the results and possibly neutralize each other, cannot be quantified.

This study's strength lies in the population-based sample selection. In other studies in the German language area, solarium visitors were surveyed as they left the salon (31). This procedure leads to an over-representation of frequent users and therefore to non-representative prevalence values. In addition, numerous studies do not contain information regarding a control group of non-users (11, 33). Our approach was considerably more expensive and time-consuming, but leads to more representative data. Finally, seasonal effects on use practices were compensated by the 4-month data attainment period as well as by the retrospective survey of the 12-month prevalence rates.

### *Implications*

Cancer scientists and epidemiologists may be as surprised about the results of our investigation concerning the prevalence of indoor tanning overall and particularly among certain risk groups. It turns out that despite people's awareness of the risks associated with sunbed, they still decide to use them. This seems to indicate that classical education campaigns are definitely not the optimal strategy for skin cancer protection (34). Therefore, two further strategies appear to be particularly promising: short-term condition-oriented prevention and long-term influence of socially accepted beauty ideals (behaviour-oriented prevention).

*Condition-oriented prevention.* The WHO has recommended that sunbeds should not be used by anybody worldwide, especially not by persons under 18 years of age (1, 2). Additionally, EUROSkin has recently called for the abolition of coin-operated tanning devices, a time limitation for tanning sessions, the requirement to use UV-protective eyewear, and that the operator staff has to receive an approved training (1, 34).

*Behaviour-oriented prevention.* In order to affect a long-term and, above all, sustainable decrease in the rate of artificial tanning, public opinion will have to change regarding what is aesthetically admirable. It will take a concentrated joint effort on behalf of scientists, public health officials, healthcare organizations, industry and politicians to bring about a change in the belief that natural or artificial tans are attractive and healthy.

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