Sunbed Use, User Characteristics, and Motivations for Tanning

Results From the German Population-Based SUN-Study 2012

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**Objectives:** To calculate sunbed use prevalence rates, to investigate the motivations for tanning, and to identify typical target groups for interventions to prevent skin cancer.

**Design:** Cross-sectional, representative, population-based study, primary analysis of the SUN-Study 2012 (Sunbed-Use: Needs for Action-Study).

**Setting:** Nationwide telephone survey of the general population in Germany.

**Participants:** Study participants (n=4851) aged 14 to 45 years.

**Main Outcome Measures:** Frequency of sunbed use and, if applicable, motivational reasons for use, the location of the most recent use, and the available advisory service. Characteristics of typical sunbed users were identified using logistic regression analysis.

**Results:** The overall prevalence of sunbed use was 39.2% (ever users); 14.6% had used a sunbed within the last 12 months (current users). Among minors and persons with skin types I or II, this proportion was 5.2% and 8.9%, respectively. Positive determinants of current sunbed use (quantified as odds ratios [95% CIs]) were female sex (1.97 [1.64-2.37]), immigrant background (1.46 [1.21-1.77]), and full-time (1.93 [1.53-2.43]) or part-time employment (1.44 [1.11-1.85]). The main motivations for tanning were relaxation and increased attractiveness. Sunbeds were mainly used in tanning studios (74.9%), and many users had never been advised about potential health risks (72.8%).

**Conclusions:** The results of this study emphasize the need for more frequent and higher-quality educational interventions to change tanning behavior, particularly among women, people with darker skin, and those with an immigrant background. Owing to their elevated vulnerability, minors and people with pale skin should also be the focus of such interventions.

ciodemographic and skin-related factors into account. Furthermore, we analyzed the location of sunbed use (eg, place of last use) and motivational factors for using sunbeds to obtain a more comprehensive overview of the current state of sunbed use in Germany. Germany represents a suitable case for study because, with 81 million inhabitants, it is the largest country in the European Union.

METHODS

This representative population-based study was conducted by the Mannheim Institute of Public Health (Heidelberg University, Germany) in cooperation with the Association of Dermatological Prevention (Hamburg, Germany). Approval was obtained from the ethics committee of the Medical Faculty in Mannheim (ANr2007-269E-MA), and all participants consented to participate in the study. Data were collected by means of computer-assisted personal telephone interviews and transferred in anonymized form to the authors.

STUDY PARTICIPANTS

The study included German residents aged 14 to 45 years. A multistage sampling process was used to randomly select study participants in accordance with the highest national survey standards. Based on the well-established Gabler-Häder method, a pool of telephone numbers was generated; a telephone number was selected using a random algorithm, and the corresponding household was contacted by phone. If there was more than 1 person from the target population in that household, the person with the next birthday was chosen to participate. To eliminate potential seasonal effects, the data collection process was divided into 2 phases: The first half of the sample was interviewed during the summer (July to September 2011), and the second half during the winter (November 2011 to January 2012). Finally, data were weighted by age, sex, educational level, and federal state using official national data from the German Microcensus 2010. This standard procedure ensures the national representativeness of the sample.

INSTRUMENTATION AND MEASUREMENTS

The authors were supported by an expert group in developing the questionnaire, which was then evaluated and tested several times before the field research was conducted. First, the core questionnaire was piloted in a regional sample of 500 individuals from Mannheim, Germany. Second, the reliability of the questionnaire items was tested using another sample of 96 individuals who were interviewed twice by telephone at intervals of 2 to 3 weeks. This pretest showed a very high reliability rate for the questions assessing past and current sunbed use (correlation coefficients between 0.83 and 1.00). Third, 15 cognitive interviews were carried out in cooperation with the GESIS Leibniz Institute for the Social Sciences in Mannheim, Germany, an independent public institution, to ensure that items were interpreted as intended. (Sections of the final questionnaire are available in the eAppendix; http://www.jamaderm.com).

During the telephone interviews, the participants were asked if they had ever used a sunbed. If they had, detailed information was collected about their sunbed use over the last 12, 6, and 3 months and 4 weeks. In the analysis, current sunbed use was defined as having used a sunbed at least once during the last 12 months (current user). The comparison group consisted of participants who reported having never used a sunbed (never user) or those who had used one more than 12 months ago (past user). Past and current users of sunbeds (ever user) were additionally asked about where they had last used a sunbed (eg, tanning studio, fitness center), the advisory service they had been provided with before using the sunbed, and the factors that motivated their sunbed use.

Finally, all participants were asked about their skin type (using a pretested closed-item format based on the definition by Fitzpatrick). As the skin types V and VI are very rare in Germany, types III through VI were grouped so that case numbers did not violate the requirements of the statistical models. Educational level was defined based on the number of years of schooling completed by the participants using the following categories: low (9 or fewer years of school completed, including students), medium (10 years of school completed), or high (11 or more years of school completed). We used a binary variable to define immigration status based on established German key indicators. According to these indicators, a participant was defined as being an immigrant if his or her mother and father was born outside of Germany, if the participant and 1 parent were born outside of Germany, or if the participant’s mother tongue was not German. Data about the residential area of each participant (geographical region within Germany) was included as a control variable in the analyses.

STATISTICAL ANALYSIS

To determine the prevalence of sunbed use, the proportions of ever, current, and past users in the total sample were calculated with 95% CIs. Differences in prevalence estimates in association with sociodemographic and skin-related factors were investigated using chi-square tests. We conducted multivariable logistic regression analyses to identify factors associated with ever and current sunbed use and report odds ratios (ORs) with adjusted 95% CIs.

On July 29, 2009, the German Bundestag passed the “Law on Nonionizing Radiation Protection” (Gesetz zum Schutz vor nichtionisierender Strahlung), which prohibited those younger than 18 years from using commercial solariums. The law came into force on the August 4, 2009. However, minors are still allowed to use spray-tanning facilities. Therefore, in the analyses conducted in this study, the age group that includes 14- through 17-year-olds is compared with the reference group of 18- through 25-year-olds. Reference categories for other independent variables were those with the corresponding lowest level (eg, low level of education, pale skin type). In the subgroup of ever users, the location of the last sunbed use as well as the advisory service provided before sunbed use were analyzed. Finally, differences in motivational factors between current and past sunbed users were analyzed using chi-square statistics. The predefined level of significance was P<.05. All analyses were conducted with IBM SPSS 20 Statistics (IBM Corporation).

RESULTS

DESCRIPTION OF STUDY PARTICIPANTS

A total of 4851 persons participated in the study (response rate, 28.1%, according to American Association for Public Opinion Research Standard Definition). The sample consisted of 50.9% men and 49.1% women, mean (SD) age, 30.6 (9.5) years. Two-thirds of the participants had a partner, and 22.0% were classified as having an immigrant background. One-third of participants had a medium level of education; another third had a high level of education. There were 11.7% students in the
sample. Most participants reported having either skin type III (35.2%) or skin type IV (27.9%) (Table 1).

### Prevalence of Sunbed Use

The overall prevalence (95% CI) of sunbed use was 39.2% (37.8%-40.6%) (ever users). Of the ever users, 4 of 10 were current users; the others had used a sunbed more than 12 months ago (past users) (Figure 1). Within the total sample, 14.6% (13.6%-15.6%) reported current and past users.

Stratified analysis showed several differences in ever and current sunbed use in association with sociodemographic and skin-related factors (Table 2). Current sunbed use, for example, was more prevalent in persons aged 18 to 25 years (21.4%) compared with the mean of other age groups (12.6%) (P < .001). Compared with men, women were more likely to have ever used a sunbed (49.0% vs 29.8%) or to be currently using sunbeds (17.7% vs 11.7%) (P < .001 for both comparisons). Ever and current sunbed use was also more prevalent in persons with skin type III to VI than in those with paler skin (40.7% vs 36.5% and 17.4% vs 8.9% respectively) (P < .001 for both comparisons). Those with an immigrant background were significantly more likely to be currently using a sunbed (19.7% vs 13.2%) (P < .001). For partnership status and educational level, significant differences appeared for the prevalence of ever use (Table 2).

### Factors Associated with Sunbed Use

Multivariable logistic regression analyses affirmed the bivariate results on associations between sociodemographic and skin-related factors and sunbed use (Table 3). They demonstrated that, compared with the age group of the 18- to 25-year-olds, current sunbed use was significantly less common among minors (OR = 0.24 [95% CI, 0.16-0.38]) and among older persons (OR = 0.70 for 26- to 35-year-olds and OR = 0.44 for 36- to 45-year-olds) (P < .01 for both comparisons). Positive determinants of current sunbed use were female sex (OR = 1.97 [95% CI, 1.64-2.37]), skin type III through VI (OR = 2.47 [95% CI, 2.00-3.04]), immigrant background (OR = 1.46 [95% CI, 1.21-1.77]), and full-time (OR = 1.93 [95% CI, 1.53-2.43]) or part-time employment (OR = 1.44 [95% CI, 1.11-1.85]) (Table 3).

### Location of Last Sunbed Use and Advisory Service

Sunbed use took place predominately in tanning studios (74.9%), followed by fitness centers (10.1%) and swimming pools/saunas (7.9%). In contrast, sunbeds at home (3.8%), in hotels (1.5%), beauty studios (0.7%), and medical facilities (0.6%) were less frequently used. Of the current users, 68.2% stated that advisory personnel were present during their last solarium visit (Table 4). Two-thirds of the current users (67.4%) were provided with goggles during their last visit; however, 4.0% had to request them. Overall, 41.0% of the current users wore goggles during their last visit, while 40.0% were never advised to wear goggles. Several further deficiencies were identified in the advisory services at tanning studios: 40.1% of the current users had never received advice on skin type, and almost three-quarters were not informed about the potential health risks of sunbed use (72.8%). Among the majority of the current users (70.3%), information regarding skin-related medication, skincare products, or skin disorders was not requested by the advisory personnel, and 77.6% of users did not receive...
an individual tanning plan specifically tailored to their skin type (Table 4).

**MOTIVATION FOR TANNING**

Although the order of reasons for using sunbeds was the same for current and past users, we found significant differences in the rate of agreement with certain types of motivations (Figure 2). The most important motivations reported were relaxation, increased attractiveness, pretanning for holidays, and the desire for a feeling of warmth. Overall, a significantly higher proportion of current users agreed with these motivations. Significant differences between current and past users were also found for health care and vitamin D supplementation as reasons for using sunbeds, with a higher number of current users agreeing with these motivations. No significant differences were found for the motivations “skin diseases” and “following a physician’s recommendation.” However, more past than current users agreed to the physician’s recommendation motivation (Figure 2).

The prevalence of ever use of sunbeds among the 14- to 45-year-olds in Germany was 39.2%, and every seventh person in this age group had used a sunbed during the last 12 months. A particularly large percentage of women, adolescents, immigrants, and the employed reported using solari-ums. The representative data also show that the advisory services provided in German solariums are often inadequate.

The highest prevalence of current sunbed use was observed in persons aged 18 to 25 years, a finding that is consistent with those from other smaller, non–population-based studies. The present study thus supports and refines the findings of earlier studies by showing that particularly women and persons with skin type III and higher are more likely to use sunbeds. In addition, the results show that more than one-third of persons with skin type I and II had used a sunbed at least once. The analysis also demonstrated that among part- and full-time employed persons, the prevalence of sunbed use was higher than among unemployed persons. One finding of this study that had not previously been shown in studies from other countries is that immigrants were significantly more likely to be current sunbed users. This association might be explained by beauty ideals of users with a Turkish heritage: Turks represent the largest group of immigrants in Germany.

The findings in relation to the quality of advisory services in solariums represent an additional unique contribution to the field of research: The user reports indicate an urgent need for better advisory services at tanning studios. Such improved services should include adequate advice on the health risks associated with sunbed use (the risk of skin cancer, skin and eye damage) as well as the provision of goggles and the advice to wear them. In addition, the findings revealed that only a mi-
nority of sunbed users received an individual tanning plan to avoid skin damage. Moreover, in many cases the advisory personnel disregarded the ban on minors’ use of sunbeds. In addition, the results revealed that persons with paler skin (skin types I and II) were not advised against using a sunbed, as suggested by a recently passed federal recommendation.38

These findings emphasize the urgent need for standardized education of sunbed personnel by independent (not sunbed industry–associated) institutions. The results presented here show that advisory personnel fail to inform users that many motivations for using sunbeds (for example Vitamin D supplementation, holiday pre-tanning, and self-treatment of skin diseases) are not medically sound.

### Table 3. Results From Logistic Regression Analyses on Factors Associated With Ever and Current Use of Sunbeds

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Ever Use</th>
<th>Current Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-17</td>
<td>0.28 (0.19-0.39)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>18-25</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>26-35</td>
<td>1.66 (1.39-1.98)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>36-45</td>
<td>1.45 (1.22-1.73)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1 [Reference]</td>
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</tr>
<tr>
<td>Female</td>
<td>2.66 (2.31-3.05)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Immigration status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonimmigrant</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Immigrant</td>
<td>0.91 (0.78-1.06)</td>
<td>.22</td>
</tr>
<tr>
<td>Partnership status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without partner</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>With partner</td>
<td>1.05 (0.91-1.22)</td>
<td>.50</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>1.41 (1.19-1.66)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>High</td>
<td>1.43 (1.21-1.69)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Full-time</td>
<td>1.68 (1.41-1.99)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Part-time</td>
<td>1.37 (1.14-1.65)</td>
<td>.001</td>
</tr>
<tr>
<td>Skin type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I or II</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>III-VI</td>
<td>1.44 (1.25-1.65)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Total participants, No.</td>
<td>4639 NA</td>
<td></td>
</tr>
<tr>
<td>Nagelkerre $^2$</td>
<td>0.169 NA</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: NA, not applicable; OR, odds ratio.

$^a$Coding of the dependent variables: model for ever use (1 = ever use; 0 = never use); model for current use (1 = current use; 0 = past or never use). All covariates were entered into the model simultaneously. Model is adjusted for geographic region. Current use is defined as sunbed use within the last 12 months.

### Table 4. Advisory Service at Indoor Tanning Facilities

<table>
<thead>
<tr>
<th>Advisory Service</th>
<th>Participants, %$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agreement</td>
</tr>
<tr>
<td>Advisory service during last use</td>
<td></td>
</tr>
<tr>
<td>Advisory personnel available</td>
<td>68.2</td>
</tr>
<tr>
<td>Provision of goggles</td>
<td>67.4$^b$</td>
</tr>
<tr>
<td>Use of goggles</td>
<td>41.0</td>
</tr>
<tr>
<td>Ever counseling in the past</td>
<td></td>
</tr>
<tr>
<td>Advice to wear goggles</td>
<td>59.2</td>
</tr>
<tr>
<td>Advice on skin type</td>
<td>58.3</td>
</tr>
<tr>
<td>Assessment of skin-related medication/products/diseases</td>
<td>27.8</td>
</tr>
<tr>
<td>Counseling on health risks</td>
<td>26.5</td>
</tr>
<tr>
<td>Preparation of an individual tanning plan</td>
<td>21.5</td>
</tr>
</tbody>
</table>

$^a$All reported data obtained from valid cases; due to minor rounding errors, each line might not sum to 100%.

$^b$Four percentage points of 67.4% were provided with goggles only on request.

with paler skin (skin types I and II) were not advised against using a sunbed, as suggested by a recently passed federal recommendation.38

These findings emphasize the urgent need for standardized education of sunbed personnel by independent (not sunbed industry–associated) institutions. The results presented here show that advisory personnel fail to inform users that many motivations for using sunbeds (for example Vitamin D supplementation, holiday pre-tanning, and self-treatment of skin diseases) are not medically sound.

### Figure 2. Reasons for sunbed use.

- Relaxation
- Enhancement of attractiveness
- Pretanning for holiday
- Light and warmth
- Health care
- Vitamin D supplementation
- Skin diseases
- Physician’s recommendation

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The present article is the first report of the SUN-Study 2012, the largest representative study on sunbed use to be carried out worldwide. It also provides unique population-based data on the deficiencies of advisory services provided in solariums and presents suggestions for the improvement of such services. Further strengths of the study include the fact that it included minors (14- to 17-year-olds) and that the response rate was high for a study of its kind.39,40 Furthermore, the highest survey standards were followed based on the results of a pilot study, an extensive reliability study, and cognitive interviews. Additional strengths are that the sample also included unlisted telephone numbers; the study involved a high number of contact attempts; and interviewers were provided with extensive training and supervision.

Nevertheless, the interpretation of the findings has to be tempered by some limitations. It cannot be excluded that some participants did not correctly recall if and when they used a sunbed for the last time. However, the pretests (reliability test and cognitive probing) showed that recall bias was negligible with regard to the prevalence estimates. In addition, despite the high response rate,39,40 a nonparticipation bias in the results cannot be ruled out (eg, sunbed users might have been more willing to take part in the study). To reduce this potential shortcoming, the real aim of the study was not disclosed to the participants at the beginning of the telephone interview, which started with several innocuous questions (about lifestyle aspects) to avoid never users of sunbeds declining to participate. Furthermore, care was taken that every interviewer was well instructed and supervised and that interviews were conducted in a standardized manner. In addition, data were weighted by age, sex, educational level, and federal state to reduce these sources of bias as much as possible. The social structure of the sample therefore reflects the distributions of the representative German Microcensus data.

The present study presents target groups for future interventions: For example, such interventions could target occupations in which predominantly younger women work because the group of working women are particularly likely to use sunbeds. Furthermore, the relationship between current sunbed use and immigrant background indicates a specific need for the education of this population subgroup. Owing to their high vulnerability levels, minors and persons with skin types I and II should refrain from the use of sunbeds, according to World Health Organization recommendations.1 The fact that both of these high-risk groups continue to use sunbeds indicates that further intervention measures should not be restricted to the education of users but should also include the appropriate education of advisory personnel and corresponding regulation by relevant noncommercial authorities.

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Author Contributions: Dr Schneider had full access to all of the data used in the study and takes responsibility for the integrity of the data and the accuracy of the analysis. Study concept and design: Schneider, Diehl, Bock, Breitbart, Volkmer, and Greinert. Acquisition of data: Schneider, Diehl, Bock, and Schlüter. Analysis and interpretation of data: Schneider, Diehl, Bock, Breitbart, Volkmer, and Greinert. Drafting of the manuscript: Schneider, Diehl, Bock, and Schlüter. Critical revision of the manuscript for important intellectual content: Schneider, Diehl, Bock, Breitbart, Volkmer, and Greinert. Statistical analysis: Diehl and Bock. Obtained funding: Schneider and Bock. Administrative, technical, and material support: Schneider, Diehl, Bock, Schlüter. Study supervision: Schneider, Diehl, and Bock.

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