Objective: To assess when sunburn occurs and who experiences sunburn by personal UV dosimetry and diaries.

Design: Open prospective observational study.

Setting: University hospital.

Participants: A convenience sample of 340 Danish volunteers: children, adolescents, indoor workers, sun worshippers, golfers, and gardeners (age range, 4-68 years).

Main Outcome Measures: Subjects recorded sunburn and sun-exposure behavior in diaries and carried personal, electronic, wristwatch UV radiation (UVR) dosimeters that measured time-stamped UVR doses continuously for a median of 119 days covering 346 sun-years (1 sun-year equals 1 subject participating during 1 summer half-year).

Results: A typical sunburn day was a day off work (91%; odds ratio, 4.1) with risk behavior (sunbathing/exposing shoulders) (79%; odds ratio, 15.9) in May, June, or July (90%) for 6.4 exposure hours (interquartile range, 5-7.7 hours), of which 2.8 hours fell between noon and 3 PM. Subjects had a median of 1 sunburn per sun-year; adolescents, sun worshippers, and indoor workers had more than children, golfers, and gardeners (P<.05). Sunburn peaked at age 20 years, and female subjects had more sunburns than male subjects (P<.01). Skin type IV had fewer sunburns than types I through III (P<.01). Sunburned persons had more risk-behavior days and lower skin type (P<.01) than nonsunburned persons. The median UVR doses received were significantly higher on sunburn days than on nonsunburn days with risk behavior (P<.01). There was a significant correlation between sunburn size and severity; sunburn and sunscreen use; and sunburn and sun-bed use (P<.01 for all 3 comparisons).

Conclusions: Sunburn was highly correlated with risk behavior. Reduction of risk-behavior days and/or exposure hours around noon can reduce sunburn. Sunburn was not found during breaks on normal full-time indoor work or school days.

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Table 1. Distribution of Sunburns per Sun-year

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Sun-years Recruited*</th>
<th>No. of Sun-years Analyzed†</th>
<th>Total No. of Sunburns</th>
<th>No. of Sunburns per Sun-year Mean (Median‡)</th>
<th>Percentage of Sun-years With 0, 1, 2, or ≥3 Sunburns per Sun-year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>96</td>
<td>68 (71)</td>
<td>63</td>
<td>0.9 (0.5) 0-1</td>
<td>50 29 9 12</td>
</tr>
<tr>
<td>Adolescents</td>
<td>31</td>
<td>22 (71)</td>
<td>44</td>
<td>2.0 (2) 0-4</td>
<td>36 9 23 32</td>
</tr>
<tr>
<td>Indoor workers</td>
<td>120</td>
<td>111 (93)</td>
<td>163</td>
<td>1.5 (1) 0-2</td>
<td>34 28 18 20</td>
</tr>
<tr>
<td>Sun worshippers</td>
<td>53</td>
<td>49 (92)</td>
<td>77</td>
<td>1.6 (1) 0-3</td>
<td>29 27 18 27</td>
</tr>
<tr>
<td>Golfers</td>
<td>37</td>
<td>31 (84)</td>
<td>24</td>
<td>0.8 (0) 0-1</td>
<td>55 32 3 10</td>
</tr>
<tr>
<td>Gardeners</td>
<td>70</td>
<td>65 (93)</td>
<td>45</td>
<td>0.7 (1) 0-1</td>
<td>48 38 12 2</td>
</tr>
<tr>
<td>Total</td>
<td>407</td>
<td>346 (85)</td>
<td>416</td>
<td>1.2 (1) 0-2</td>
<td>41 29 14 16</td>
</tr>
</tbody>
</table>

Abbreviations: IQR, interquartile range; UVR, UV radiation.
*Fulfilling the inclusion criteria of Scandinavian ancestry, no history of skin disorders.
†Number (percentage) of sun-years (1 sun-year equals 1 subject participating during 1 summer half-year) with both UVR dosimeter and diary readings for more than 30 days of which 21 or more fell in June, July, or August.
‡Golfers and gardeners had significantly fewer sunburns than all other groups except children (P<.05). Children had significantly fewer sunburns than adolescents and sun worshippers (P<.05).
§IQR, 25% to 75%.

The period of 3 years: June 16 to October 31, 1999; April 5 to September 30, 2000; and April 6 to August 31, 2001. A convenience sample of 340 volunteers from the Copenhagen area were recruited and took part in the study. 14 of whom participated in all 3 seasons and 39 in 2 of the seasons, resulting in 407 sun-years (1 sun-year equals 1 subject participating during 1 summer half-year). All subjects were of Scandinavian ancestry and had no history of skin disorders; 153 were male, 187 female (mean age, 30 years; age range, 4-68 years).

The subjects were chosen to cover a wide age span and included 97 children from kindergarten and primary and secondary school (age range, 4-15 years), 30 adolescents from high school (age range, 16-19 years), and 89 indoor workers, including college students and hospital or computer company employees (age range, 21-64 years). In addition, groups with expected high UVR exposure included 53 sun worshippers recruited through a women’s magazine (age range, 21-63 years), 24 golfers (age range, 27-68 years), and 47 municipal gardeners and rangers (age range, 25-60 years).

The inclusion criteria for a sun-year were more than 30 days with both UVR dosimeter readings and corresponding diary data of which 21 days or more had to be in June, July, or August. This resulted in 346 sun-years for analysis and the exclusion of 61 sun-years from subjects considered nonresponders. However, 43 of the nonresponders had either diary data or UVR data enough for inclusion (10 had both, but not on corresponding days). The 37 nonresponders with diary data did not differ significantly from the responders in sun-exposure behavior such as days off, days abroad, risk behavior, or number of sunburns. Likewise, the 16 nonresponders with UVR data did not differ significantly from responders in mean UVR dose or exposure hours per day. The remaining 18 nonresponders (4%) had neither sufficient diary nor UVR data for inclusion. Thirty-seven (61%) of the nonresponders were younger than 20 years, which may explain the more careless handling of the UVR dosimeters in that group.

The distribution of recruited and analyzed sun-years is outlined in Table 1. The scientific ethics committees for Copenhagen and Frederiksberg approved the study (KF11-007/99).

AMBIENT UVR EXPOSURE

Ambient solar UVR was measured with a UV biometer, model 501 (Solar Light Co Inc, Philadelphia, Pa) on the roof of a 7-floor building at our hospital. The measurements are expressed in standard erythema doses (SEDs), where 1 SED = 10 mJ/cm² normalized to 298 nm, according to the International Commission of Illumination (CIE) erythema action spectrum.14-16

PERSONAL ELECTRONIC UVR DOSIMETER, SUNSAVER

The UVR dosimeter we used was developed and assembled in our department and includes a sensor and a data logger mounted in a housing together with a digital watch. We chose a silicon carbide photodiode (JECF1-1DE, Laser Components, Olching, Germany) sensitive only in the range of 200 to 400 nm. The sensor has a built-in diffuser and cosine response with spectral response similar to the CIE erythema action spectrum.14 The data logger controls the sensor, which was set to measure every eighth second and to store the average of the last 75 measurements every 10 minutes together with the time. The measurement range of the dosimeter is 0.1 SED/h to 23 SED/h.

The SunSaver is battery driven, can run for 143 days without maintenance, and the data can be transferred to a personal computer. In an earlier study, members of our group collected reliable UVR data from wrist measurements and found a significant correlation between wrist and head UVR doses, with the wrist receiving 50% of the UVR dose received by the head.17 The subjects were instructed to replace their normal wrist-watch with the dosimeter, to wear it continuously at least between 7 AM and 7 PM, and not to immerse it in water but rather place it on a towel with the sensor facing upward during swimming (the dosimeter was water resistant but not completely waterproof).13

DIARY

The participants (or the parents of the 22 children younger than 10 years) were carefully instructed how to complete the provided diary. They were to answer Yes or No to the following questions: (1) Did you wear the SunSaver today? (2) Are you off work/school or on holiday today? (3) Are you abroad today? If yes write country code. (4) Did you sunbathe today? (Sitting or lying in the sun with upper body or shoulders exposed to get a tan.) (5) Have you exposed your shoulders or upper body outdoors today? (6) Have you been at the beach or at the sea today? (7) Have you applied a sunscreen today? (If yes, write the factor number.) (8) Did you get sunburned today? If yes: Red? Red and sore? Red, sore, and blistered? On
October, 0%. In July, most of the participants had their holidays and reported significantly more sunburns than in any other month (P<.01). There were clusters of sunburns on a few days with exceptionally high ambient UVR.

The Figure shows the ambient UVR and UVR dose received on June 10, 2000, when the most subjects (14) were sunburned. Sunburn occurred most often on days off work, ie, 378 (91%) of 416 sunburn days (OR, 4.1 adjusted for risk behavior; P<.01), and on days with risk behavior (79% overall [range: adolescents, 91% to gardeners, 60%;]; OR, 15.9 adjusted for days off work; P<.01).

### SUNBURN DAYS VS NONSUNBURN DAYS WITH RISK BEHAVIOR

In all subgroups, the UVR doses and number of exposure hours were significantly higher on sunburn days than on nonsunburn days with risk behavior (P<.01) (Table 2). In Denmark, we found that ambient UVR was also significantly higher on sunburn days than on nonsunburn days with risk behavior (25.6 vs 22.7 SEDs) (P<.01), as was the percentage of ambient UVR received (median, 21.0%; IQR, 13.8%-32.8% vs median, 9.6%; IQR, 3.8%-19.0%) (P<.01). On nonsunburn days without risk behavior, the median UVR dose received was only 0.1 SED (IQR, 0-0.7 SED) in 1 exposure hour (IQR, 0.2-2.8 hours).

### SUNBURNS PER SUN-YEAR

Adolescents had the most sunburns, significantly more than children, golfers, and gardeners (P<.05). Thirty-two percent of the adolescents had 3 or more sunburns, significantly more than any other subgroup (P<.01). Subjects with 3 or more sunburns per sun-year also had significantly more risk-behavior days than subjects having fewer sunburns or none (P<.05) (Table 1).

### SKIN TYPE AND SUNBURN

Subjects with skin type IV had significantly fewer sunburns, more days with risk behavior, higher annual UVR doses, and higher mean daily UVR doses than subjects with skin types I through III (P<.01). However, we found no significant differences in UVR doses on sunburn days among the skin types. Across all skin types, significantly higher UVR doses were found on risk-behavior days with sunburn than without (P<.01) (Table 3).

### SUN-YEARS WITH RISK BEHAVIOR WITH AND WITHOUT SUNBURN

Persons who experienced sunburn had significantly more days with risk behavior, a higher UVR dose on risk-behavior days, more days with sunscreen use, and lower skin type than persons without sunburn (P<.01). There were no significant differences between the sunburned and nonsunburned participants in age, annual UVR doses, mean UVR doses, exposure hours per day or between noon and 3 PM, or number of days spent in southern Europe (Table 4).
In both northern and southern locations, we found, as expected, a significantly higher UVR dose per sunburn day than per nonsunburn day (northern latitudes, 93% higher; southern latitudes, 62% higher) (Table 5). The subgroups having the most days with risk behavior also had the most sunburns. Even in southern Europe, where the number of risk-behavior days was limited by the length of the holidays, sun worshippers still had significantly more risk behavior and sunburns than children, golfers, and gardeners ($P<.05$).

### AGE, SEX, AND SUNBURN

In adults older than 20 years, there was a significant negative correlation between age and number of sunburns per sun-year ($r=-.29$; $P<.01$). In subjects younger than 20 years, there was a significant positive correlation between age and number of sunburns ($r=0.41$; $P<.01$). Female participants had a median of 1 sunburn (IQR, 0-2 sunburns), which was significantly more than male participants. 

### Table 2. UV Radiation Doses and Exposure Hours Per Sunburn Day and Nonsunburn Day With Risk Behavior*

<table>
<thead>
<tr>
<th>Subject Group</th>
<th>No. of SEDs per Sunburn Day</th>
<th>No. of SEDs per Nonsunburn Day With Risk</th>
<th>No. of Exposure Hours per Sunburn Day</th>
<th>No. of Exposure Hours per Nonsunburn Day With Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>5.7 (2.8-15.9)</td>
<td>1.5 (0.5-4.4)</td>
<td>5.8 (4.3-7.2)</td>
<td>3.8 (2.0-5.7)</td>
</tr>
<tr>
<td>Adolescents</td>
<td>7.4 (4.6-9.9)</td>
<td>2.6 (0.9-7.3)</td>
<td>6.2 (4.1-7.1)</td>
<td>4.2 (2.3-6.2)</td>
</tr>
<tr>
<td>Indoor workers</td>
<td>5.1 (2.7-8.2)</td>
<td>2.1 (1.0-4.4)</td>
<td>6.5 (5.0-7.7)</td>
<td>4.3 (2.7-6.2)</td>
</tr>
<tr>
<td>Sun worshippers</td>
<td>6.0 (3.0-11.1)</td>
<td>2.4 (1.0-5.1)</td>
<td>5.8 (4.6-7.2)</td>
<td>4.3 (2.7-6.2)</td>
</tr>
<tr>
<td>Golfers</td>
<td>5.8 (3.3-7.7)</td>
<td>2.9 (1.3-5.3)</td>
<td>7.0 (6.3-8.4)</td>
<td>5.5 (3.7-7.2)</td>
</tr>
<tr>
<td>Gardeners</td>
<td>4.8 (2.9-9.2)</td>
<td>2.7 (1.2-4.9)</td>
<td>6.8 (6.4-8.2)</td>
<td>6.0 (4.7-7.7)</td>
</tr>
<tr>
<td>Total</td>
<td>5.6 (3.0-10.0)</td>
<td>2.2 (0.9-4.9)</td>
<td>6.4 (5.0-7.7)</td>
<td>4.5 (2.7-6.3)</td>
</tr>
</tbody>
</table>

| 12 Noon to 3 PM     |                             |                                          |                                      |                                                  |
| Children            | 3.2 (0.9-10.3)              | 0.6 (1.0-2.2)                            | 2.7 (1.7-3.0)                        | 1.7 (0.7-2.5)                                    |
| Adolescents         | 4.4 (2.6-6.1)               | 1.1 (0.3-4.2)                            | 2.8 (2.2-3.0)                        | 1.8 (1.0-2.7)                                    |
| Indoor workers      | 2.8 (1.3-5.1)               | 0.8 (0.1-2.2)                            | 2.7 (2.0-3.0)                        | 1.8 (0.7-2.7)                                    |
| Sun worshippers     | 3.6 (1.5-6.1)               | 1.0 (0.2-2.7)                            | 2.8 (2.2-3.0)                        | 1.8 (0.8-2.7)                                    |
| Golfers             | 3.2 (1.6-3.8)               | 1.2 (0.4-2.5)                            | 3.0 (2.0-3.0)                        | 2.2 (1.3-2.8)                                    |
| Gardeners           | 2.7 (1.3-4.2)               | 1.1 (0.4-2.4)                            | 2.8 (2.0-3.0)                        | 2.3 (1.5-2.8)                                    |
| Total               | 3.1 (1.4-5.8)               | 0.9 (0.2-2.4)                            | 2.8 (2.0-3.0)                        | 1.8 (0.8-2.7)                                    |

12 Noon to 3 PM

### Table 3. UV Radiation Doses per Risk Behavior Day With and Without Sunburn by Skin Type

<table>
<thead>
<tr>
<th>Fitzpatrick Skin Type</th>
<th>No. of Sun-years</th>
<th>Sun-years With &lt;1 Sunburn, %</th>
<th>UVR Dose per Risk-Behavior Day With Sunburn*</th>
<th>UVR Dose per Risk-Behavior Day Without Sunburn*</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>26</td>
<td>77</td>
<td>5.5 (4.3-8.2)</td>
<td>2.2 (1.2-3.5)</td>
</tr>
<tr>
<td>II</td>
<td>83</td>
<td>63</td>
<td>6.8 (2.9-10.6)</td>
<td>3.0 (1.8-4.3)</td>
</tr>
<tr>
<td>III</td>
<td>180</td>
<td>58</td>
<td>6.4 (3.5-9.2)</td>
<td>3.0 (2.0-4.8)</td>
</tr>
<tr>
<td>IV</td>
<td>56</td>
<td>48</td>
<td>7.7 (4.5-17.7)</td>
<td>3.5 (2.1-5.2)</td>
</tr>
</tbody>
</table>

### Table 4. Comparison of Sun-years With Risk Behavior With and Without Sunburn*

<table>
<thead>
<tr>
<th>Days per Sun-year With:</th>
<th>No. of Sun-years</th>
<th>Risk</th>
<th>Sunburn</th>
<th>Sunscreen</th>
<th>UVR Dose per Risk Day</th>
<th>UVR Dose per Day</th>
<th>Annual† UVR Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>With sunburn</td>
<td>173</td>
<td>16 (10-27)</td>
<td>2 (1-3)</td>
<td>7 (2-14)</td>
<td>3.6 (2.6-5.5)</td>
<td>1.0 (0.7-1.5)</td>
<td>179 (133-250)</td>
</tr>
<tr>
<td>Without sunburn</td>
<td>127</td>
<td>13 (5-22)</td>
<td>NA</td>
<td>2 (0-11)</td>
<td>2.8 (1.8-4.4)</td>
<td>0.9 (0.6-1.4)</td>
<td>160 (110-247)</td>
</tr>
<tr>
<td>P value</td>
<td>NA</td>
<td>&lt;.01</td>
<td>NA</td>
<td>&lt;.01</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: IQR, interquartile range (25%-75%); SED, standard erythema dose.

*Data are reported as medians (IQRs); risk behavior is defined as sunbathing or exposing upper body or shoulders.

†Significantly lower than on days with sunburn ($P<.01$).

*Unless otherwise indicated, data are reported as medians (IQRs). A sun-year equals 1 subject participating during 1 summer half-year.

**The annual dose was calculated based on the individual measured daily doses and for missing days as the same part of ambient UVR, as in Thieden et al.13
participants (0 sunburns; IQR, 0–1 sunburn), and significantly more days with risk behavior (17 days; IQR, 9–29 days vs 9 days; IQR, 3–19 days). Female subjects applied sunscreen on more days than did male subjects but also had more risk-behavior days without sunscreen (8 days; IQR, 3–16 days vs 5 days; IQR, 2–12 days) (P < .05). Female subjects applied sunscreen on more days than did male subjects but also had more risk-behavior days without sunscreen (8 days; IQR, 3–16 days vs 5 days; IQR, 2–12 days) (P < .05). Female subjects did not receive a significantly higher annual UVR dose than male subjects.

**SUN-YEARS WITH SUNBURN AND SUNSCREEN**

Among sun-years, there was a significant correlation between number of sunburns and number of days with sunscreen applied (r = 0.3; P < .01) but no significant difference in sun protection factor number used on sunburn vs nonsunburn days.

**SEVERITY OF SUNBURN**

Forty-one percent of the sunburns were characterized by redness of the skin over a small area, 39% over a moderate area, and 6% over an extensive area. Thirty-seven (9%) of the sunburns were reported as red and sore, and 7 sunburns (2%) were red, sore, and blistered. There was a significant association between severity and area affected (P < .01). There was no significant difference in the severity of sunburn in northern vs southern Europe.

**SUN BED USE PER SUN-YEAR**

In 44 of the sun-years, sun bed use was reported for a median of 3 days (range, 1–23 days). The sun bed users had significantly more risk-behavior days, more sunburn days, and higher UVR doses per sunburn day with risk behavior (P < .05).

It is difficult to compare our results with the findings of other groups because the definitions of sunburn are different, and other groups used retrospective interviews or self-reported surveys. One group used time-stamped UVR dosimeters placed near volunteers on the ground to obtain data on UVR doses and sunburns, but only on sunbathing days. We chose continuous, time-stamped, personal UVR measurements of UVR doses during all kinds of subject activities and supplemented these with diary information. This approach offers the possibility to identify the time and area during which sunburn occurs. The UVR dosimeters were wristwatch devices in which the UVR data were invisible and inaccessible to the participants so as to avoid their influencing sun exposure behavior; changes were noted in behavior in a pilot study where UVR data were open to the users. In our convenience sample, the proportion of subjects younger than 20 years equaled that in the Danish population overall, while adults engaging in outdoor work, outdoor sport, and sun worship were overrepresented. We thus selected an adult population sample that might have a higher UVR exposure than the average Danish population.

A typical day when sunburn occurred in Denmark was a day off work in May through July (90%) with risk behavior (79%) and a median of 6.4 hours’ exposure, of which 2.8 hours fell between noon and 3 PM. During this time, there was high level of ambient UVR (>25 SEDs) of which the participant received a median of 21%. This indicates that persons in our latitude without outdoor work get sunburned on working days only if they take part in outdoor activities for several hours mainly around noon.

Fifty-nine percent of the subjects had at least 1 sunburn, which is significantly higher than was found in a Danish population study where only 28% recalled having been sunburned. However, a Swedish study reported that people underestimate the number of sunburns when recalling. Our results are in agreement with studies reporting that 53% of Canadians older than 15 years and 39% of a representative sample of the British population older than 16 years recalled having been sunburned within the last year. Among our subgroups, golfers and gardeners had the lowest number of sunburns and the lowest number of days with risk behavior. Adolescents had the highest number of sunburns: 64% experienced sunburn, and 32% had 3 or more per season as a consequence of a high number of days with risk behavior. Sunburn and UVR dose per sunburn day peaked at age 20 years and decreased with age in adults, which is in agreement with other studies. Even among children, 50% reported sunburn, while in the Danish population study, parents only recalled that 16% of their children had sunburn. An explanation for this discrepancy could be that sunburn in children is a sign of parental negligence and therefore is unconsciously underestimated.
Persons engaging in risk behavior without getting sunburned spent significantly fewer days with risk behavior, received lower UVR doses during the risk behavior, especially between noon and 3 PM, and had higher skin type than persons getting sunburned during risk behavior. However, no significant differences in annual UVR doses or exposure hours were found.13

In contrast to the Danish retrospective interview study,20 our results based on daily diary reports showed more sunburns in female subjects than in male (P<.01), both in the total group and in the age-related groups of children, adolescents, and indoor workers. Since 79% of the sunburns occurred during risk behavior, this finding suggests women and girls engage in more risk behavior than men and boys. Also, even though they applied sunscreen more often, female subjects still had significantly more risk-behavior days without sunscreen applied than did men. There were no differences in total UVR exposure per season between female and male participants, indicating that women and girls received their UVR exposure in peaks on days with risk behavior when a great part of their body was exposed, while men and boys had a more even exposure pattern. That might explain the higher incidence of malignant melanoma in women.23

The subjects more often applied sunscreen on sunburn days. This indicates that sunburn occurs when persons know they will engage in risk behavior and expect extended UVR exposure, but (1) the sun protection factor of the sunscreen they used was too low, (2) the sunscreen layer was too thin, or (3) the sunscreen was applied only after they went out in the sun rather than before.24-27

We found a significantly higher UVR dose per sunburn day than per nonsunburn day: in northern Europe, north of Paris (latitude, 49° north), it was 93% higher, and in southern Europe (south of Paris), it was 62% higher. The UVR dose necessary to cause sunburn during risk behavior was significantly higher in southern Europe (62%). An explanation might be that subjects in southern Europe use screens more frequently. In addition, people generally travel to southern Europe later in the season, when their skin might already be darkened by exposure to the summer sun and thus able to tolerate a higher UVR dose before reaching the sunburn threshold.28,29 We found a median increase of 70% in UVR dose per sunburn day in Denmark from April/May to August. A similar percentage increase in UVR sensitivity after UVR exposure has been found after irradiation with artificial UVR sources.30 This might explain most of the higher dose tolerated in southern Europe. We found no significant difference in sunburn severity between north and south.

In spite of moderate sun bed use, we found that sun bed users experienced more sunburns than non–sun-bed users, probably because they had more risk-behavior days and were also more often outdoor sunbathers (P<.01). The pattern might be different among heavy sun bed users.31

In conclusion, persons had the highest UVR dose on sunburn days with risk behavior. Adolescents and younger adults had the most sunburn days, the most risk-behavior days, and the most exposure hours between noon and 3 PM and thus accumulated the highest UVR dose. Golfers and gardeners received a high UVR dose per season but had fewer days with sunburn and risk behavior and therefore a smaller skin surface area exposed. Sunburn during breaks from normal full-time indoor work or school days was not found in Denmark (latitude, 56° north). Campaigns to prevent sunburn should aim at reducing the number of days with risk behavior and be directed at adolescents, young adults, and sun worshippers. Sun protection campaigns for golfers and gardeners should emphasize the importance of protecting the face, neck, and arms during extended sun exposure.

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