Risk factors for malignant melanoma in an Icelandic population sample

Vilhjalmur Rafnsson, a,* Jon Hrafnskelsson, b Hrafn Tulinius, a,c Bardur Sigurgeirsson, d and Jon H. Olafsson d

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Abstract

Objectives. To describe the constitutional risk factors for malignant melanoma and exposure to sunlight in a population sample in Iceland.

Methods. Information on various risk factors for malignant melanoma was collected through mailed questionnaires sent to a random sample of the Icelandic population. The information collected was the first phase of a prospective study on malignant melanoma among aircrew members as compared to a population sample.

Results. The overall participation rate was about 50%. Seven percent of women and six percent of men had red hair color. Blue or green eye color was reported among 89% of women and 87% of men. Sixteen percent of women aged 20 to 39 had used sun beds more than 100 times during their lifetime, while the corresponding figure was 12% for men of the same age. Younger age groups had more sunny vacations than the older age groups. The frequency of sunburn differed in the groups with reported different skin types according to Fitzpatrick classification.

Conclusion. The high prevalence of sun bed usage among young women is concurrent with the increased incidence of malignant melanoma among young women registered in the nationwide cancer registry. Young people have more often used sun beds and taken sunny vacation than the older, indicating a changed behavior in the population.

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Keywords: Malignant melanoma; Sun beds; Fitzpatrick classification

Introduction

According to the Icelandic Cancer Registry, the age-standardized incidence of malignant melanoma per 100,000 people has increased rapidly in Iceland during the last decades, from 5 to 14 in women and 3 to 8 in men when the period 1985–1989 is compared to the period 1995–1999 [1]. There was a substantial variation in the incidence of cutaneous melanoma between the Nordic countries. In the earlier period, the lowest incidence was observed among males in Iceland [2], but the rates for cutaneous melanoma in Iceland have recently increased to the same level as in the other Nordic countries. Reykjavik, the capital of Iceland, where the majority of the population lives, is located at a latitude of 64°04’ and a longitude of 21°51’. The altitude is 18 m above sea level. The average temperature is 5.0°C, average humidity of 82%, rainfall amounts to 805 mm/year, and solar radiation of 203 cal/cm².

Little is known about constitutional and behavioral risk factors and exposure to UV radiation in the Icelandic population. The aim of this study was to describe the prevalence of constitutional risk factors and recreational exposure to sunlight among a randomly selected population sample.

Methods

Information on various risk factors for malignant melanoma was collected by questionnaires sent by mail to home addresses according to the national registry. The population sample was selected from the national registry randomly to reflect the same age range and gender proportion as the cohort of aircrews, which have been the subjects of previous studies [3,4]. The answers were returned with a personal
identifier to enable follow-up of individuals later by record linkage to the Cancer Registry. Altogether, 3768 individuals were in the sample, 2624 women and 1144 men. One reminder was mailed 1 month after the questionnaire was first sent. Nonrespondents tended to be younger and were more often residents of the capital area than those who responded to the mail questionnaire.

When designing the questionnaire, we considered what risk factors have been studied in previous case control studies [5] and descriptive cohort studies [6].

Table 1
Number and percentage of women according to responses to seven selected questions divided on five age groups

<table>
<thead>
<tr>
<th>Questions</th>
<th>Age, years</th>
<th>20–29</th>
<th>30–39</th>
<th>40–49</th>
<th>50–59</th>
<th>60+</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have ever had freckles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>Skin reaction when sunbathing</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>15</td>
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<td>63</td>
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<tr>
<td>Occasionally burn, always tan (skin type III)</td>
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<td>32</td>
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<td>Use of sun beds</td>
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<td>68</td>
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<td>70</td>
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<td>51</td>
<td>55</td>
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</tr>
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Table 2
Number and percentage of men according to responses to seven selected questions divided on five age groups

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<th>Age, years</th>
<th>20–29</th>
<th>30–39</th>
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<th>50–59</th>
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<td>1144</td>
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<td>73</td>
<td>68</td>
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<td>10</td>
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<td>7</td>
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<td>2</td>
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<tr>
<td>Skin reaction when sunbathing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>16</td>
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<td>6</td>
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<td>n = 141</td>
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<td>68</td>
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<td>76</td>
<td>64</td>
<td>69</td>
</tr>
<tr>
<td>Never burn, always tan (skin type IV)</td>
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<td>9</td>
<td>12</td>
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<td>12</td>
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<tr>
<td>Use of sun beds</td>
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</tr>
<tr>
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<tr>
<td>More than 100</td>
<td>n = 503</td>
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<td>10</td>
<td>17</td>
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</tr>
<tr>
<td>Sunny vacation</td>
<td></td>
<td></td>
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<tr>
<td>Never</td>
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<td>1–10 times</td>
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<td>72</td>
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<td>68</td>
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<td>8</td>
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<td>11–20 times</td>
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</table>
examined self-assessed sun sensitivity and tanning ability in attempt to make a skin-type classification based on a modification of the Fitzpatrick classification [7]. There is no general agreement on a standardized questionnaire to evaluate risk of malignant melanoma, definitely not as far as prospective studies are concerned. The questionnaire included 13 items, among them are questions about hair color, eye color, freckles, number of nevi, family history of skin cancer and nevi, skin type, history of sunburn, sun bed and sunscreen use, and number of sunny vacations and travel abroad.

The responses to the questionnaires from males and females were analyzed separately. Differences in distribution between groups were compared using the chi-square test. All tests were two-tailed with the significance level set at \( P < 0.05 \).

The National Bioethics Committee and the Data Protection Authority approved the study.

**Results**

The participation rate was 53.1%, 57.2% among women and 43.9% among men. Seven percent of women and six percent of men reported having red hair color. Blue or green eye color was reported among 89% of women and 87% of men. Women had more freckles and a higher number of nevi than men (Tables 1 and 2). The numbers and percentages of sample participants having the different risk factors for malignant melanoma among females and males are shown in Tables 1 and 2. The prevalence of risk factors was higher among females than males; women had more often used sun beds and had more often protected themselves by using sunscreen.

When divided into 10-year age groups, substantial differences appear between the groups. Among females, there is a greater difference than among males (Tables 1 and 2). The number of persons reporting 100 or more nevi decreased with age in both genders. Similarly, the number of lifetime users of sun beds or sunlamps decreased with age in both women and men. Sixteen percent of women aged 20 to 39 reported having used sun beds more than 100 times during their lifetime, while the corresponding figure was 12% for men. The younger age groups reported more sunny vacations than the older. Most frequently, people reported having taken 1 to 10 sunny vacations, with the frequency decreasing with increasing age.

Table 3 shows the frequency of a history of severe sunburn (sunburn which had caused erythema and pain for several days) both before and after the age of 19, according to the four skin types. Those with skin type I (who tan with difficulty) more often had a history of sunburn than those with other skin types.

Table 4 shows the frequency of sunny vacations taken after the age of 19 among females and males in the population sample.
with skin type IV. This was true of both genders and of periods before and after the age of 19. While this is not unexpected, it is interesting that 1.4% to 4.4% of those maintaining that they never burn but always tan (skin type IV) still reported a history of more than five episodes of severe sunburn.

Table 4 shows the connection between taking a sunny vacation or not and the frequency of history of severe sunburn. Females and males who had taken at least one sunny vacation had more often experienced severe sunburn after the age of 19 than had those persons never taking sunny vacation. Seventeen to twenty percent of those who had never taken a sunny vacation had a history of severe sunburn more than five times.

Table 5 shows the frequency of severe sunburn after the age of 19 among females and males who had never taken a sunny vacation and never used sun beds. This was compared to those who had taken at least one sunny vacation and used sun beds at any time. Females and males who had taken a sunny vacation and used sun beds more often had experienced severe sunburn after the age of 19 than the others. However, 14% to 23% of those who had never taken sunny vacations and never used sun beds had a history of severe sunburn more than five times.

Tables 6 and 7 show the use of sun beds and number of sunny vacations among females and males who had reported to have relatives with skin cancer. The use of sun beds and the number of sunny vacations seem to be equally distributed among those who have reported relatives to have skin cancer and those who have no skin cancer reported among relatives.

**Discussion**

The prevalence of risk factors for malignant melanoma was high in the population sample, particularly among the youngest age groups and higher among females than males. This corresponds to the malignant melanoma incidence in Iceland, where the incidence is higher among women than men in contrast to what was found, for example, in England and Wales [8]. Recently, the incidence of malignant melanoma among young women (age < 45) in Iceland has increased dramatically. Between 1986 and 1990, 10–20% of the women diagnosed with melanoma were younger than 45 years. The corresponding figures for the period between 1996 and 2000 are 50–65% [1].

The distribution of skin types in the present study is similar to what was found among Swedish adolescents, with reservation for the presentation of the questions [6]. The difference between age groups was considerable; skin type IV was reported more often among the oldest participants, both females and males. It is impossible to deduce whether the tendency to burn and tan changes with age from the results of this cross-sectional study, although this can be expected. When asking about burning tendency and tanning ability in separate questions, Rampen et al. [9] have shown that the classification of people into skin type categories is
unreliable and this widely used classification was not originally proposed with the purpose of evaluating melanoma risk [7]. In our questionnaire, we addressed this issue by asking for self-assessment of burning tendency and tanning ability in one question. It may be overly complicated to ask about these two items simultaneously. Burning is the negative effect of exposure to UV radiation, but there is a great desire to have a tan, which is reflected in the widespread use of sun beds and the high frequency of sunny vacations.

Our question about sun bed use was directed at the frequency of life-long use of sun beds, and no attempt was made to quantify the duration of the sun bed sessions or the type of sunlamps. As no standardized recommendation or classification of frequency of sun bed use exists, comparison with the results of other studies is difficult. Sun bed use among the youngest age groups in the present study seems to be more frequent than among Swedish adolescents, where more than half had used sun beds during the last 12 months [10]. A similar study from the United States showed that 34% of high school students had used sun beds during the last 12 months [11]. Studies from Canada and United Kingdom have shown similar results [12,13]. Usage of sun beds seems to be high in our study, as only 2.5% of women 20–24 years of age and 12.3% of men 25–29 years of age had never used sun beds, although the results are not directly comparable to other studies.

Sunny vacations seem to be quite common among both females and males in the population sample, and this frequency is somewhat higher than found among cases and controls in a Swedish study [14], with reservation for the different approaches. Our questions on life-long use of sun beds and number of sunny vacations are of course age-dependent. Older subjects have had the opportunity to use sun beds over a longer period of time or to take more sunny vacations. Nevertheless, the frequency of sun bed use and the frequency of 1 to 10 sunny vacations was highest among the youngest age groups. Sunbathing vacations abroad and vacations spent in the Mediterranean and in sunny vacation areas, measured with different questions in retrospective studies, are independent risk factors for malignant melanoma [14–17].

In our study, the questions on sunburn were followed immediately by the question on skin type, and as expected, those with skin type IV reported the lowest frequency of sunburn. However, 4.4% to 4.5% of the females in this category said they had burned more than five times both before and after the age of 19. The corresponding figures were 1.4 and 2.9 for males. The results in Tables 4 and 5 indicate that those taking sunny vacations and those using sun beds burn more frequently than those who had never taken a sunny vacation or used sun beds. However, sunny vacations or use of sun beds are by no means necessary to get severe sunburn, as 14% to 23% of those without such exposure have a history of severe sunburn more than five times. This may be considered as an indication of the strong desire to tan among the Icelandic population. According to the figures in Tables 6 and 7, knowledge of skin cancer among relatives does not seem to modify the use of sun beds or the number of sunny vacation taken.

The extensive use of sun beds and tanning lamps among the youngest age categories revealed in the present study is of great concern. It is not yet possible to conclusively answer the question of whether artificial tanning causes melanoma [18]. Prospective studies are, therefore, needed. Such a study may be feasible in a population with a high rate of sun bed usage as in the present study. It may even be possible that a shorter follow-up would be required than in other settings. The high prevalence of sun bed usage among young women is concurrent with the increased incidence of malignant melanoma among young women registered in the nationwide cancer registry [1], as this is mainly the result of increased incidence among women younger than 45 years. Young people have more often used sun beds and taken sunny vacation than the older, indicating a changed behavior in the population.

References


