

Effectiveness of an Employee Skin Cancer Screening Program for Secondary Prevention

Ugur Uslu, MD; Felix Hees, MD; Eva Winnik, MD; Wolfgang Uter, MD; Michael Sticherling, MD

PRACTICE POINTS

- Employee skin cancer screening programs are an important method of examining high numbers of individuals quickly and efficiently and should be used as an important tool for secondary skin cancer prevention.
- The high rate of suspicious skin lesions diagnosed in this study demonstrates the effectiveness of skin cancer screenings organized in the workplace and provides evidence of the importance of skin cancer screening programs for a wider population.
- Employee skin cancer screening programs should be recommended for all employees, not only those who are at high risk for developing skin cancer due to the nature of their work, such as those who work outdoors.

Incidences of UV-induced skin cancer are continuously increasing. For this reason, early diagnosis is becoming more important. In this study, 783 employees of a technical company participated in an employee skin cancer screening program, which consisted of a physical examination for benign and malignant skin lesions and

pre-malignant conditions. To ensure the quality of the examinations, screening was only performed by 5 trained dermatologists. Participants also were asked to complete a standardized questionnaire prior to examination. A total of 661 skin lesions were diagnosed among 48% of participants; 12.8% of participants exhibited 50 or more melanocytic nevi and the risk for developing skin cancer was categorized as at least moderate for 64.9%. Additionally, 84.4% of participants with at least 1 skin lesion were advised to have a checkup within 1 year. The high rate of suspicious nevi detected in this study suggested that employee skin cancer screening programs are effective and also should be recommended at companies where employees are not at increased risk for developing skin cancer due to the nature of their work (eg, those who work outdoors). Despite the comparatively selective and young study population, these examinations provide evidence of the importance of skin cancer screening for the wider population.

Drs. Uslu, Uter, and Sticherling are from the Friedrich-Alexander-University Erlangen-Nürnberg (FAU), Univeristätsklinikum Erlangen, Germany.

Drs. Uslu and Sticherling are from the Department of Dermatology, and Dr. Uter is from the Department of Medical Informatics, Biometry and Epidemiology. Dr. Hees is from the Department of Otorhinolaryngology, Nürnberg Hospital North, Germany. Dr. Winnik is from Siemens Healthcare GmbH, Erlangen.

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Correspondence: Ugur Uslu, MD, Friedrich-Alexander-University Erlangen-Nürnberg (FAU), Department of Dermatology, Univeristätsklinikum Erlangen, Ulmenweg 18, D-91054 Erlangen, Germany (ugur.uslu@uk-erlangen.de).

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The incidence of skin cancer, along with its effects on patients and the economy, has continued to increase and therefore requires particular attention from dermatologists. UV light has been shown to be of etiopathologic importance in the development of various types of skin cancer.¹⁻³ Studies have shown that there is a direct correlation between the incidence of skin cancer and average annual amounts of UV radiation exposure.³ Accordingly, in 2009 the International Agency for Research on Cancer classified UV light as carcinogenic to humans.⁴ Therefore, the general public must be made aware of the danger of exposure to UV radiation.

In Australia, government initiatives to educate the population on causes of skin cancer development and its relationship to UV radiation have already caused the public to change their way of thinking and to deal with sunlight in a conscious and responsible manner.⁵ A large proportion of the Australian population with light skin is at a particularly high risk for developing skin cancer due to intense exposure to UV radiation. Numerous campaigns in Germany and other countries have attempted to sensitize the public to this issue by emphasizing a reduction in UV exposure (primary prevention) or highlighting the importance of early diagnosis (secondary prevention).^{6,7}

For a good prognosis, it is crucial that skin cancer, particularly melanoma, is discovered at an early or precancerous stage.⁸ For this reason, self-examination of the skin and skin cancer screening are important factors that can contribute to ensuring early and curative treatment.⁹⁻¹¹ Since July 1, 2008, skin cancer screenings have been included in the preventative health care program by statutory health insurance providers in Germany. As part of this program, the cost of screening once every 2 years for individuals 35 years and older is covered by statutory health insurance.¹² Several studies have shown a decline in the melanoma mortality rate since the introduction of skin cancer screening programs in Germany.^{11,13,14}

Employee skin cancer screening programs are an important method of examining high numbers of individuals quickly and effectively. These programs have been carried out in Germany and other countries.^{15,16} Studies have shown that skin cancer screening carried out selectively on defined groups can be an effective form of secondary prevention, particularly for those who work outdoors.¹⁷

An employee skin cancer screening program was carried out as part of this study. The findings are interpreted and discussed in relation to other employee screening programs that have been

reported as well as those introduced by statutory health insurance providers in Germany. The aim of this study was to determine the importance and effectiveness of employee skin cancer screening programs and the role they play in secondary prevention of skin cancer.

Methods

Study Population—Employees of a technical company in Bavaria, Germany, were offered a skin cancer screening program by the employer's occupational health service and health insurance provider in collaboration with the Department of Dermatology at the University Hospital Erlangen (Erlangen, Germany). Skin examinations were performed exclusively by 5 trained dermatologists. Only direct employees of the company at 3 of its locations in the Erlangen area were eligible to participate. The total number of employees varied by location (1072–5126 employees). The majority of employees had a university education or had completed technical training. Family members and other individuals who were not members of the company were excluded. There were no further inclusion or exclusion criteria. Over a period of 13 days, 783 of 7823 total employees (10.0%) were examined and included in the study. The study was approved by the Responsible Ethics Commission of the Faculty of Medicine at Friedrich-Alexander-University Erlangen-Nürnberg, Germany.

Study Design—Employees signed a consent form for participation in the study and completed a standardized questionnaire. The questionnaire was based on surveys used in a prior study¹⁸ and collected information on current and prior skin lesions, prior dermatological screening, personal and family history of skin tumors, frequency of UV exposure, and type of UV protection used. For the question on measures taken for protection from UV radiation, possible answers included with sunscreen cream, with suitable sun-protective clothing, and by staying in the shade, or no measures were taken. In contrast to the other questions, multiple answers were accepted for this question. Answering no automatically excluded other possible answers. Participants also were asked to assess their own Fitzpatrick skin type¹⁹; the questionnaire included explanations of each skin type (I–IV).

The participants were then called in for examination by the dermatologist at 15-minute intervals. All clothing was removed and the skin was examined. Dermatoscopes were used for closer examination of suspicious skin lesions. The clinical results of the examinations were recorded on a standardized form.

An estimation of the number of melanocytic nevi— ≤ 20 , 21–49, or ≥ 50 —was recorded for each patient. Suspicious skin lesions were assigned to one of the following categories: nevus requiring future checkup (Nc), nevus requiring excision (Ne), suspected malignant melanoma (MM), suspected squamous cell carcinoma, suspected basal cell carcinoma (BCC), suspected other skin tumor, and precancerous lesion. Fitzpatrick skin type also was assessed for all participants and recorded by the dermatologist carrying out the examination. Each participant was assigned to a risk group—low, moderate, or high risk—based on their individual risk for developing a skin tumor. Factors that were considered when determining participants' risk for developing skin cancer included Fitzpatrick skin type, number of melanocytic nevi, personal and family history, leisure activities, UV protection used, and current clinical diagnosis of skin lesions.

After the skin examination, participants were informed of recommended treatment but were not given any additional dermatologic advice. Participants could arrange an appointment at the Department of Dermatology, University Hospital Erlangen, for the excision and histological analysis of the skin lesions. All recorded data were collected in a computerized spreadsheet program. When evaluating the questionnaires, questions that were not answered or were answered incorrectly (participant chose more than 1 answer) were ignored.

Statistical Analysis—Statistical analysis was carried out using SPSS software version 16.0. The majority of the data were nominal or ordinal. Metric data were checked for normal distribution using the Shapiro-Wilk test before carrying out parametric tests. Statistical tests were carried out using the χ^2 test and the *t* test for independent samples. Non-nominal distributed data were checked using the Mann-Whitney *U* test. $P < .05$ was considered statistically significant in the exploratory data analysis.

Results

Of 783 employees included in the study, 288 (36.8%) were female and 495 (63.2%) were male (Table 1). In comparison with the total workforce, a significantly higher proportion of women than men took part in the cross-sectional study ($P < .01$). The average age (SD) was 42.3 (9.5) years (range, 18–64 years). Female participants (average age [SD], 39.8 [10.2] years) were significantly younger than male participants (average age [SD], 43.8 [8.8] years; $P < .01$). Forty-one percent of participants had a prior skin cancer screening. One percent of participants had a personal history of skin cancer, with 1 participant reporting a history of MM;

Table 1.

Participant Characteristics (N=783)

Characteristic	No. of Participants (%)
Sex	
Female	288 (36.8)
Male	495 (63.2)
Age, y	
≤ 20	5 (0.6)
21–30	107 (13.7)
31–40	178 (22.7)
41–50	322 (41.1)
51–60	168 (21.5)
>60	3 (0.4)
Total no. of melanocytic nevi	
≤ 20	343 (43.8)
21–49	340 (43.4)
≥ 50	100 (12.8)
Personal history of skin cancer	
Yes	8 (1.0)
No	775 (99.0)
Family history of skin cancer	
Yes	51 (6.5)
No	732 (93.5)
Prior skin cancer screening	
Yes	321 (41.0)
No	462 (59.0)
History of sunburns	
Never	11 (1.4)
Rarely	373 (47.6)
Once per year	289 (36.9)
Several times per year	110 (14.0)

6.5% had a family history of skin cancer, of which 39.2% had a family history of MM.

The results of the clinical examinations showed that 43.8% of participants had 20 or fewer melanocytic nevi, 43.4% had 21 to 49 melanocytic nevi, and 12.8% had 50 or more melanocytic nevi. Significantly more women than men had 20 or fewer melanocytic nevi ($P<.05$).

Approximately 92% of participants assessed themselves as having Fitzpatrick skin types II (35.2%) or III (56.7%), while only approximately 3.6% and 4.5% assessed themselves as having skin types I and IV, respectively. The results of the Fitzpatrick skin type assessments made by dermatologists were similar: 96.9% of participants were assessed as having Fitzpatrick skin types II (43.0%) and III (53.8%); approximately 1.9% and 1.3% were assessed as having Fitzpatrick skin types I and IV, respectively. Results showed that 80.2% of all participants assessed their skin type in the same way as the dermatologist; 13.5% assessed their skin type as darker and 6.3% (49/783) assessed it as lighter. A quantitative analysis of Fitzpatrick skin type and sex showed that significantly more male participants than female participants assessed their Fitzpatrick skin type darker than their actual skin type ($P<.01$).

Overall, 47.6% of participants reported having had sunburn rarely in the past, while 36.9% and 14.0% had experienced sunburn once per year and several times per year, respectively. Approximately

1.4% of participants reported never having a sunburn. More of the male participants made use of comprehensive sun protection using all methods listed (34.5%; $P<.05$) or a combination of sunscreen and sun-protective clothing (14.9%; $P<.01$) than the female participants who relied more frequently on sunscreen alone (29.5%; $P<.01$) or a combination of sunscreen and staying in the shade (29.5%; $P<.01$).

In general it was clear that sunscreen, either alone or in combination with other sun-protection methods, was used most frequently (88.0%); 58.0% protected themselves by staying in the shade, while 48.0% used suitable sun-protective clothing. Only 3.6% of participants did not protect themselves using any of the suggested methods.

A total of 661 categorized skin lesions were found in 377 participants. Of these lesions, 491 were Nc and 121 were Ne. Twenty-four of the skin lesions were suspected precancerous lesions, 13 were suspected BCC, 2 were suspected MM, and 10 were suspected other skin tumor (Table 2). Overall, male participants who were diagnosed with at least 1 skin lesion (average age, 44.0 years) were significantly older than the women (average age, 39.3 years) ($P<.01$). Similar findings were observed in participants with at least 1 Nc (men, 43.3 years; women, 38.7 years; $P<.01$) and at least 1 Ne (men, 44.2 years; women, 38.0 years; $P<.05$). With regard to the individual risk for developing skin

Table 2.

Clinically Diagnosed Categorized Skin Lesions Identified

Category ^a	Female, n (%)	Male, n (%)	Total, N (%)
Nevus requiring future checkup	146 (77.2)	345 (73.1)	491 (74.3)
Nevus requiring excision	34 (18.0)	87 (18.4)	121 (18.3)
Precancerous lesion	2 (1.1)	22 (4.7)	24 (3.6)
Suspected SCC	0 (0)	0 (0)	0 (0)
Suspected BCC	3 (1.6)	10 (2.1)	13 (2.0)
Suspected MM	0 (0)	2 (0.4)	2 (0.3)
Suspected other skin tumor	4 (2.1)	6 (1.3)	10 (1.5)
Total no. of skin lesions detected	189 (100)	472 (100)	661 (100)

Abbreviations: SCC, squamous cell carcinoma; BCC, basal cell carcinoma; MM, malignant melanoma.

^aSkin lesions identified in 377 of 783 participants. Several skin lesions per participant possible.

cancer, 32.6% of participants were considered to be at low risk, 64.9% were at moderate risk, and 2.6% were at high risk.

Approximately 61.5% of 377 participants who were diagnosed with at least 1 categorized skin lesion were advised to have a specific skin lesion checked by a dermatologist or to have a full examination for skin cancer once every 12 months. Furthermore, 22.5% were advised to follow-up biannually and 11.7% were advised to follow-up once every 2 years. Of the remaining participants who were advised to have follow-ups, 0.3% were advised to have a skin examination once every 3 months after having had MM, and 4.0% were advised to have follow-up once every 18 months. Overall, follow-up was recommended within 1 year in 84.4% of cases and within 1 to 2 years in 15.6% (Table 3).

Subsequent histological analysis of the excised tissue resulted in a diagnosis of only 21 clinically significant skin conditions. One case of Bowen disease and 1 case of BCC was confirmed. Histological analysis identified the remaining 19 excised skin lesions, which included the 2 suspected MMs, as dysplastic nevi.

Comment

The aim of this cross-sectional study was to examine the importance and effectiveness of employee skin cancer screening programs. In comparison with the total workforce, significantly more women took part than men. Female participants were significantly younger than male participants, which mirrors the findings of prior studies showing that screening programs reach women more frequently than men and that women who participate in screenings are also younger on average in comparison to men.⁷⁻¹³ Men and older individuals usually are underrepresented.^{7,13} The average age of participants in our study was 42.3 years, which is lower than in the SCREEN (Skin Cancer Research to Provide Evidence for Effectiveness of Screening in Northern Germany) study (average age, 49.7 years).¹³ The average age in our study also is likely to be lower than patients who undergo skin cancer screenings offered by statutory health insurance providers in Germany, which has a minimum age restriction of 35 years; however, it is comparable to the average age of participants in other employee screening programs and therefore represents the average age of individuals employed in Germany.^{15,16}

The employee skin cancer screening program in this study generated a high level of interest, indicated by the fact that all available appointments had been booked just 36 hours after the screening was announced. Furthermore, there was a waiting

Table 3.

Distribution of Recommended Follow-up: Participants With at Least 1 Clinically Diagnosed Categorized Skin Lesion (n=377)

Recommended Follow-up	No. of Participants (%)
Once every 3 mo, after excision of MM	1 (0.3)
Once every 6 mo	85 (22.5)
Once every 12 mo	232 (61.5)
Once every 18 mo	15 (4.0)
Once every 24 mo	44 (11.7)

Abbreviation: MM, malignant melanoma.

list of approximately 300 employees who were not able to undergo a skin examination. For logistical reasons, the number of participants was limited to 10% of the workforce. The high level of interest is an indication of increased awareness of the importance of recognizing skin tumors early and the associated need for information as well as the need to undergo screening for skin cancer as a precaution. This observation also can be made with regard to the skin cancer screening introduced by statutory health insurance providers in Germany. Studies published by Augustin et al²⁰ and Kornek et al^{21,22} confirm that skin cancer screenings have gained wide acceptance in Germany because they were introduced by statutory health insurance providers in 2008. The number of skin cancer screenings carried out by dermatologists in Germany also is increasing.²⁰⁻²² Although approximately 19% of those eligible to participate took part in the SCREEN pilot project,¹³ approximately 31% of individuals who were eligible to participate took part in skin cancer screenings offered by statutory health insurance providers in Germany in 2012, and the percentage is rising.²³ Two important factors affecting the high level of interest in the employee screening program used in our study were undoubtedly the advantages of the examination taking place during working hours and being held on the occupational health services' premises in the workplace, which helped participants avoid the cost

of travel and wait times associated with visiting a medical practice.

Of 783 participants included in this study, 377 displayed at least 1 categorized skin lesion; the majority were suspicious melanocytic nevi. This high incidence rate suggested that regular skin cancer screenings are useful, as it has been shown that there is a correlation between higher numbers of melanocytic nevi and increased risk for developing melanoma.²⁴

In a study by Winkler et al,²⁵ a skin cancer screening of 1658 bank and insurance employees found that 33.8% of those examined displayed at least 1 atypical melanocytic nevus and 27.2% displayed more than 50 melanocytic nevi (compared to 12.8% with ≥ 50 melanocytic nevi in the current study). The risk for developing skin cancer was classified as intermediate or high in 54.5% (compared to 67.5% at moderate or high risk in the current study).²⁵ Therefore, the rate of suspicious skin lesions was lower in the population of the study by Winkler et al²⁵ in comparison to the population of the current study. As the overall number of melanocytic nevi and the individual risk for skin cancer, however, was underestimated by the majority of the bank and insurance employees,²⁵ employee skin cancer screening programs can be used as a potentially effective tool to make employees aware of the issue and sensitizing them to it. Employee screening in addition to a final diagnosis can contribute to ensuring suitable treatment is started. For example, in the large-scale employee screening published by Schaefer et al¹⁵ and Augustin et al,¹⁶ 48,665 and 90,880 employees, respectively, were screened for inflammatory and noninflammatory skin diseases, and 19% and 27% of participants, respectively, were diagnosed with skin lesions that required treatment.

Participants in the current study were given no further treatment or advice. Recommendations were made that participants monitor suspicious skin lesions or have them removed. With regard to future screening, 84.4% of participants with at least 1 categorized skin lesion were advised to have a regular follow-up within 1 year, while 15.6% were advised to follow-up within 1 to 2 years. Therefore, a period of 2 years before the next checkup, the period between screenings offered by statutory health insurance providers in Germany,¹² was considered too long for the majority of participants, according to the dermatologists involved with our study.

Conclusion

The high rate of suspicious skin lesions diagnosed demonstrated the effectiveness of skin cancer screenings organized in the workplace, which should

be recommended for all employees, not only those who are at high risk for developing skin cancer due to the nature of their work, such as those who work outdoors. It should be noted that the study group examined in the current study was a homogeneous group of employees of a technical company only and is therefore relatively selective. Nevertheless, despite the comparatively selective and young participant group, these examinations provide evidence of the importance of skin cancer screening programs for a wider population.

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