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Do outdoor workers know their risk of NMSC? Perceptions, beliefs and preventive behaviour among farmers, roofers and gardeners

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Abstract

Background

Non-melanoma skin cancer (NMSC) was officially recognized in 2015 as an occupational disease for outdoor workers in Germany. Together with the enormous socioeconomic impact of NMSC, this has led to the continuous demand of evidence-based prevention. However, studies assessing the perceptions and beliefs along with risk behavior of outdoor workers as an essential prerequisite for prevention are rare.

Objective

To assess perceptions, beliefs, barriers, risk and preventive behavior towards non-melanoma skin cancer among different outdoor groups as a basis for the development of sustainable prevention programs.

Patients and Methods

Cross-sectional study among outdoor workers of three different occupational groups (farmer, gardener, roofer) using a 20-question online survey on NMSC awareness, risk and preventive behavior.

Results

Between March and April 2016, 353 outdoor workers participated in the study. Of these, 153 (43.4%) reported never to use sunscreen during work. Wearing headgear and long pants were the most common sun protection measures. Poor use of sunscreen was more likely in males and farmers. A low perceived skin cancer risk was significantly associated with poor use of sunscreen, long-sleeved shirts, sunglasses and headgear.

Conclusions

Despite great evidence on NMSC risk in outdoor professions throughout the literature, high risk groups in fact are not yet aware of the topic. Sustainable target group oriented awareness prevention programs are needed to lower the immense burden of NMSC.

Keywords: NMSC, outdoor workers, sun protection, awareness, prevention

Introduction

Non-melanoma skin cancer (NMSC) is the most common skin cancer worldwide [1]. The main risk factor for NMSC is exposure to UV radiation [2,3,4], which automatically suggests that outdoor workers have a higher risk for NMSC compared to indoor professions. In Germany, about 2.5 million people are outdoor workers [5] and within the last few years, numerous studies and several meta-analyses have shown enough evidence that these outdoor workers are at significant risk to develop NMSC and its antecedent forms [6-8]. In 2015, Germany officially recognized NMSC as occupational disease and added "squamous cell carcinoma or multiple actinic keratosis due to natural UV-radiation (UVR)" to the "German List of occupational diseases" [9]. Ever since, prevention campaigns are highly demanded throughout the literature [10] with multiple recommendations typically addressed to the general population [11,12]. However, studies focusing on NMSC related perceptions, beliefs and preventive behavior especially in the high risk group of outdoor professions are rare. Yet, this is essential for the development of evidence-based and sustainable prevention recommendations specifically for outdoor workers. Of the overall somewhat heterogeneous group of outdoor professions, farmers, roofers and gardeners probably belong to the most UV radiation exposed. Typically, these three professions spend most of their working time year-round outdoor. Adequate UV radiation protection seems essential to prevent them from NMSC. Current recommendations on NMSC preventions however are the same as for the general German population: Use of sunscreen, long-sleeved shirts and trousers and UV proved sunglasses [13-15] as primary prevention and a full body skin examination by a dermatologist every two years from the age of 35 or older, as secondary prevention [16]. Independent of recent discussions on efficacy and overall benefit of these recommendations

[15, 17], the aim of this study was to assess individual awareness and barriers, risk and preventive behavior in the high risk group of farmers, roofers and gardeners in Germany as a first approach for the development of sustainable prevention campaigns for outdoor working groups.

Materials and methods

The study was approved by the ethics committee of the Medical Faculty of Technical University of Munich. Farmers, gardeners and roofers were included in this cross-sectional study as typical subgroups of outdoor workers with excessive sun exposure. Farmers were contacted through a local farmer's association (Bayerischer Bauernverband Oberbayern), roofers via the Bavarian Roofer Guild (Landesinnung Bayerisches Dachdeckerhandwerk) and gardeners via the Bavarian Gardening Association (Bayerischer Gärtner-Verband), all located in southern Germany. The agencies of these three organisations were asked to e-mail an online-questionnaire to all of their members including the study information and warm recommendations to participate.

Instrument and measures

Based on previous studies [18-20] 20 questions were chosen for the self-completed online questionnaire to assess socio-demographic and work characteristics, the use of sun safety measures, perceived skin cancer risk and the usage of skin cancer screening. Socio-demographic data included age, gender and education level which was categorized into *low* (lower secondary school certificate or no graduation), *medium* (upper secondary school certificate) and *high* (general qualification for university entrance). Skin type was defined by Fitzpatrick scale based on skin, hair and eye color and the tendency to tan [21]. Work

characteristics contained information on the average number of hours per week spent outside in the sun during work. Participants were also asked to score the statement „*If I do not protect my skin from the sun, I feel that my chances of getting skin cancer during lifetime are high*" on a four-point Likert scale from „*strongly agree*" to „*strongly disagree*", which were then classified as „high perceived skin cancer risk" (*strongly agree/agree*) and „low perceived skin cancer risk" (*strongly disagree/disagree*). To determine sun protection behavior, participants had to assess how frequently they use sunscreen, protective clothing, headgear and sunglasses during their work outdoors on a five-point Likert-type scale (*never, rarely, sometimes, often* and *always*). Furthermore, they were asked to state any other measure they might use to protect their skin from the sun. Barriers for respective use of sun protection measurements were assessed with *too expensive, takes too much time, forget to wear,* and/or *inconvenient* as well as the option for an open answer. All participants were further asked if they had ever undergone a skin cancer screening by a medical doctor with a "yes" or "no" answer. If the answer was "no", they further were asked to name one or more of the following reasons "*I do not need it, I am healthy*", "*I did not have the time", "I did not know about the screening*", "*The screening is uncomfortable*" and/or to give an open answer.

Statistical Analysis

All data were analyzed using the software R version 3.2.4. Univariate statistics were used to describe all variables collected in this study and logistic regression models were calculated to identify associations between gender, age, education, occupational group, working hours outdoors, skin type and perceived skin cancer risk in relation to the inadequate use of each of the sun safety measures (sunscreen, long-sleeved shirt, long pants, headgear, sunglasses) as well as having undergone a skin cancer screening. Sun safety measures were divided into *adequate* (always, frequently, sometimes) and *inadequate* (never, rarely). Skin type was classified into the three groups proposed by The International Commission on Non-Ionizing

Radiation Protection: Skin type I and II as "high sun sensitivity", type III as "moderate sun sensitivity" and types III-VI as "moderate sun insensitivity" [13]. Odds ratio (OR) and 95% confidence intervals (CIs) were calculated. Poor sun protection behaviour, gender, age, education level, working time outdoors, skin type and perceived skin cancer risk were compared with the use of sun screen.

Results

Between March and April 2016, 353 outdoor workers participated in the study and completed the online questionnaire. Of these, 82.7% (292 of 353) were male and the median age was 34.5 years (SD 13.9). According to their answers, 60.3% (213 of 353) were farmers, 24.9% (88 of 353) roofers and 14.7% (52 of 353) gardeners. The majority (71.8%, n=254) spent more than 21 hours a week working outdoors (Table 1).

Sun protection and perceived skin cancer risk

Nearly half of the participants (43.4%, n=153) reported that they rarely or never use sunscreen during outdoor work (Figure 1), whereas 27.7% (n=98) use (almost) always sunscreen. Participants reported low levels of use of other sun protection measures, of which headgear and wearing long trousers were the most mentioned. Use of sunscreen und sunglasses varied significantly among the three occupational groups: Use of sunscreen and sunglasses is more frequent in roofers than in gardeners and farmers (Table 2). Overall, from the 353 outdoor workers 75.6% further declared to stay in the shade during breaks, to avoid direct sun exposure at midday (51.8%) and/or to seek sunshade during work (11.3%). Of note, only 3.7% of all outdoor workers acknowledged, that they check the Sun Protection Factor (SPF) of any sun screen before using it. This indicates that more education concerning sunscreen in

general is needed. Asked for their general sun protection, 50.4% (n=178) reported that they „forget about it" and 46.2 % (n=163) think of these as being inconvenient. (Table 3). Interestingly, 51.5% (n=180) said, it is difficult to implement sun protection measures during their everyday work routine. At the same time, 52.9% (n=187) desired more information about sun safety measures for outdoor workers (Table 2).

Of all study participants, 87.5% (n=274) agreed with the statement „If I do not protect my skin from the sun, I feel that my chances of getting skin cancer during lifetime are high", which was classified as general high perceived skin cancer risk (Table 1). Of the three investigated occupational groups, roofers had the highest perceptions (89.7%), farmers the lowest (73.3%).

Skin cancer screening

The majority of participants (67.4%; 238 of 353) revealed that they had never attended a skin cancer screening before (Figure 1) and 31.4 % (n=111) of all participants had never even heard about this screening. 20.9% (n=74) thought they were „healthy" and „do not need" a skin cancer screening. Statistically significant differences were seen between the three occupational groups but not between different age groups. In the group of farmers only 26.3% (n=56) had a skin cancer screening before (Figure 1).

Determinants of low individual sun protection behavior

Significantly associated with inadequate sunscreen use compared to the other groups was being a farmer (OR 2.31; 95% CI, 1.14-4.85) and being male (OR 2.51; 95% CI, 1.26-5.24). A low perceived skin cancer risk was significantly associated with poor use of sunscreen (OR, 3.16; 95% CI, 1.75-5.84), poor use of long-sleeved shirts (OR, 2.20; 95% CI, 1.09-4.75), sunglasses (OR, 2.15; 95% CI, 1.22-3.85) and headgear (OR, 1.87; 95% CI, 1.07-3.27). Skin

type III and higher were positively associated with low levels of sunscreen use (OR, 2.07; 95% CI, 1.15-3.79) and long-sleeved shirt (OR, 1.90; 95% CI, 1.05-3.43). Never attending skin cancer screening was associated with working outdoors more than 40 hours a week (OR, 2.42; 95% CI, 1.91-5.82) and younger age (OR, 0.94; 95% CI, 0.92-0.96).

Discussion

This study is the first to investigate sun protective behavior among farmers, roofers and gardeners in Germany after NMSC was officially recognized as occupational disease in 2015. We demonstrated an overall poor sun protection behavior and a low participation rate for skin cancer screening, which is consistent with previous studies with other outdoor workers [18,19,22-24]. Sunscreen appears as an easy to use and simple UV protection tool, but only a minority of the study population really do regularly use sunscreen. Regular sunscreen use in the general population is described as high as 78% in some studies [25]. Outdoor workers typically are males and tend to have a lower education which could be a possible explanation for these divergent findings, although this was not seen in our study. As evidence-based prevention is not yet available for NMSC, it is intensively discussed, if sunscreen really is the "ideal" sun protection or for example if shade and protective clothing are more effective [15]. In our study, worn headgear, long pants and staying in the shade during the midday sun and during breaks were the most common sun protection measures besides the use of sunscreen, which is consistent with previous studies [19, 22]. Naturally, outdoor workers can have difficulties seeking for shade during work due to the character of their working place. A roofer on a building for example will not find shade if constructing the roof of a ten story building. This could explain, why only one third of the roofers reported that they avoid direct sun exposure at midday. Concerning possible barriers for sun protection, the most frequent

answers were "*I forget*", "*Inconvenient*" and "*Too hot to wear during work*", which is similiar to the answers in a study among Mississippi state park workers [26].

In this study, two out of three outdoor workers had never attended a skin cancer screening before. Although the average age of the study population with about 35 years and the German skin cancer screening regulations could bias the answers concerning the usage skin cancer screening, similar percentages are reported in other studies: Hault et al. found out in a mixed group of outdoor workers that „a majority (52.5%) do not go to a general practitioner or a dermatologist for skin cancer screening" [23]. In studies with mountain guides (mean age 52.9 years) and glider pilots (mean age 51 years), 48.4% and 46%, respectively, had never undergone a skin examination before [18,19]. Independently of recent discussions, if population based skin cancer screenings introduced in Germany in 2008 have a benefit for the general population [17], these screenings are highly accepted and about one third of the eligible population with an age of 35 years or older were screened at least once [27, 28]. With a percentage of 32.6%, the rate of farmers, roofers and gardeners in this study who have undergone a skin examination before basically reflects the above mentioned number of the general population [28]. Consistent with the literature, that outdoor workers have a higher risk for NMSC, an increased rate for regular skin examinations by dermatologists has to be promoted for these professions. This shall be emphasized even more when acknowledging that nearly one third of the participants in our study have never heard about their possibility to undergo a skin examination.

Our study results have shown that poor sun protection was associated with being male. Prior research indicated, that women in general are more likely to use sunscreen at work [23,29, 30]. Interestingly however, the use of headgear was more frequently by men. An association of educational level and sun protection behavior was not seen in our study, although there is evidence from other studies, that persons with higher education level engage more likely in

sun protection measures [20]. Nonetheless, it has been shown, that sun-safety education programmes can significantly improve the risk behaviour of outdoor workers [22]. A low perceived skin cancer risk was significantly associated with poor use of several protection measures, but not with the skin cancer screening. This is consistent with previous studies, in which outdoor workers with higher levels of perceived skin cancer risk were more likely to engage in sun protection practice [29,31,32].

Several limitations have to be discussed for this study. The questionnaire design as an online survey which was promoted by e-mail might have attracted younger and technology-oriented groups rather than for example older age groups not too familiar with online tools. The average age of all study participants strengthens these aspects, thus selection bias has to be taken into account. Furthermore, especially outdoor workers very interested or very concerned about NMSC and sun protection might have rather participated in the online study. As always for self-completed questionnaires, recall or social desirability bias and overestimation of the use of sun protection methods can as well not be fully excluded in our study. However, a study among postal workers which measured the validity of self-report for occupational sun protection behavior stated a high level of concordance between self-report and observation [33]. Due to these limitations, the rather small number of 353 participants and the inclusion only of farmers, roofers and gardeners in Bavaria, our findings cannot easily be transferred in general to all outdoor workers in Germany.

The scientific community as well as dermatologists worldwide are well aware of the NMSC risk for outdoor workers. But the study results show, that affected outdoor workers are not yet aware. Outdoor occupational associations as well as employers have to be addressed in future activities to promote adequate preventive measures for their members. With the high interest shown by the majority of farmers, roofers and gardeners in NMSC and preventive behavior in

this limited study, prevention campaigns specifically designed for the needs of different outdoor workers should be developed ideally together with representatives of these professions. This could substantially increase primary and secondary prevention of NMSC and finally lower the disease burden.

Conclusion

Despite the intensive discussion on NMSC in outdoor workers throughout the literature, this study has shown, that high NMSC risk groups of farmers, roofers and gardeners in Germany are not yet aware of their continuously anticipated high risk. Understandably, their overall sun protection currently is rather poor. But at the same time, they display a rather high interest in the topic. This makes obvious: Effective and sustainable target group oriented awareness and prevention programs are desperately needed for outdoor workers. Unfortunately, these are at first expensive and time consuming but compulsory for a substantial long term public health achievement and substantial savings.

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Conflict of interest

All other authors: None declared

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Figures

Figure 1: Sunscreen use and undergone skin check in farmers, roofers and gardeners

Tables

Table 1: Baseline data of the included farmers, roofers and gardeners.

Table 2: Sun protection behavior among different occupational groups [n (%)]

Table 3: Barriers of sun protection behavior among different occupational groups [n (%)]

Table 1: Baseline data of the included farmers, roofers and gardeners.

	Total N=353 n (%)	**Farmer** n=213 n (%)	**Roofers** n=88 n (%)	**Gardeners** n=52 n (%)	**p-value**
Sex					**<0.05**
- Female	61 (17.3)	44 (20,7)	5 (5.7%)	12 (32.1)	
- Male	292 (82.7)	169 (79.3)	83 (94.3)	40 (76.9)	
Age (mean in years)	**34.5**	**32.5**	**36.0**	**40.1**	
Education level					**0.27**
- High	120 (34.0)	81 (38.0)	25 (28.4)	14 (26.9)	
- Medium	158 (44.8)	92 (43.2)	39 (44.3)	27 (51.9)	
- Low	75 (21.1)	40 (18.8)	24 (27.3)	11 (21.2)	
Working hours spent outdoors per week					**<0.05**
- 0-10	39 (11.0)	20 (9.4)	14 (15.9)	5 (9.6)	
- 11-20	60 (17.0)	33 (20.7)	8 (9.1)	8 (15.4)	
- 21-40	122 (34.6)	87 (40.8)	16 (18.2)	19 (36.5)	
- More than 40	132 (37.4)	62 (29.1)	50 (56.8)	20 (38.5)	
Perceived skin cancer risk					**<0.05**
- High	274 (78.5)	154 (73.3)	78 (89.7)	42 (80.8)	
- Low	75 (21.5)	56 (27.7)	9 (10.3)	10 (19.2)	

Education level: High = general qualification for university, Medium = upper secondary school certificate, low = no graduation or lower secondary school certificate.
p-Value of Chi square test for the comparison of the three different occupational groups farmers, roofers and gardeners

Table 2: Sun protection behavior among different occupational groups [n (%)]

	All N=353 n (%)	Farmer N=213 n (%)	Roofer N=88 n (%)	Gardener N=52 n (%)	p-Value[1]
Sunscreen					**0.001**
Always	22 (6.2)	10 (4.7)	6 (6.8)	6 (11.5)	
Often	76 (21.5)	30 (14.1)	28 (31.8)	18 (34.6)	
Sometimes	94 (26.6)	56 (26.3)	27 (30.7)	11 (21.2)	
Rarely	79 (22.4)	57 (26.8)	15 (17.0)	7 (13.5)	
Never	74 (21.0)	52 (24.4)	12 (13.6)	10 (19.2)	
Missing data	8	8			
Hat					0.182
Always	65 (18.4)	45 (21.1)	15 (17.0)	5 (9.6)	
Often	93 (26.3)	56 (26.3)	24 (27.3)	13 (25.0)	
Sometimes	58 (16.4)	27 (12.7)	18 (20.5)	13 (25.0)	
Rarely	60 (17.0)	35 (16.4)	12 (13.6)	13 (25.0)	
Never	71 (21.0)	45 (21.1)	18 (20.5)	8 (15.4)	
Missing data	5	5			
Long sleeved shirt					0.283
Always	8 (2.3)	5 (2.3)	1 (1.1)	2 (3.8)	
Often	24 (6.8)	16 (7.5)	3 (3.4)	5 (9.6)	
Sometimes	63 (17.8)	38 (17.8)	11 (12.5)	14 (26.9)	
Rarely	121 (34.3)	72 (33.8)	33 (37.5)	16 (30.8)	
Never	130 (36.8)	76 (35.7)	39 (44.3)	15 (28.8)	
Missing data	7	6		1	
Long pants					0.307
Always	66 (18.7)	44 (20.7)	12 (13.6)	10 (19.2)	
Often	90 (25.5)	51 (23.9)	21 (23.9)	18 (34.6)	
Sometimes	55 (15.6)	31 (14.6)	18 (20.5)	6 (11.5)	
Rarely	77 (21.8)	43 (20.2)	20 (22.7)	14 (26.9)	
Never	59 (16.7)	39 (18.3)	16 (18.2)	4 (7.7)	
Missing data	5	5			
Sunglasses					**0.017**
Always	25 (7.1)	13 (6.1)	9 (10.2)	3 (5.8)	
Often	90 (25.5)	51 (23.9)	30 (34.1)	9 (17.3)	
Sometimes	80 (22.7)	47 (22.1)	24 (27.3(	9 (17.3)	
Rarely	77 (21.8)	45 (21.1)	12 (13.6)	20 (38.5)	
Never	71 (20.1)	48 (22.5)	12 (13.6)	11 (21.2)	
Missing data	10	9		1	

[1] P-Value of Chi square test for the comparison of the different occupational groups. Statistically significant ($p<0.05$) determinants printed in bold.

Table 3: Barriers of correct sun protection behavior among different occupational groups [n (%)]

	All N=353 n (%)	Farmer N=213 n (%)	Roofer N=88 n (%)	Gardener N=52 n (%)	p-Value[1]
Barriers					
Not necessary for me	37 (10.4)	23 (10.8)	8 (9.1)	6 (11.5)	0.888
I am not at risk	42 (11.9)	30 (14.1)	10 (11.4)	2 (3.8)	0.123
Forget to wear	178 (50.4)	109 (51.2)	36 (40.9)	33 (63.5)	**0.040**
Inconvenient	163 (46.2)	107 (50.2)	35 (39.8)	21 (40.4)	0.187
Too expensive	9 (2.5)	5 (2.3)	1 (1.1)	3 (5.8)	0.236
Too hot to wear	96 (27.2)	53 (24.9)	23 (26.1)	20 (38.5)	0.140
I want to get a tan	62 (17.6)	38 (17.8)	18 (20.5)	6 (11.5)	0.387

[1] P-value of Chi square test for the comparison of the different occupational groups. Statistically significant ($p<0.05$) determinants printed in bold.