CONSENSUS REPORT: Recognizing non-melanoma skin cancer, including actinic keratosis, as an occupational disease – A Call to Action

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Abstract

1 Non-melanoma skin cancer (NMSC) is by far the most common cancer diagnosed in westernized countries,1–5 and one of the few almost preventable cancers if detected and treated early as up to 90% of NMSC may be attributed to excessive exposure to ultraviolet radiation.6

2 The incidence of NMSC is increasing: 2–3 million people are diagnosed worldwide annually, with an average yearly increase of 3–8% among white populations in Australia, Europe, the US and Canada over the last 30 years.2–5,7

3 The link between solar ultraviolet (UV) radiation and certain forms of NMSC is clearly recognized.8,9 It is estimated that outdoor workers are exposed to an UV radiation dose 2–3 times higher than indoor workers,8 and there is a growing body of research linking UV radiation exposure in outdoor workers to NMSC:

I Occupationally UV-exposed workers are at least at a 43% higher risk of basal cell carcinoma (BCC) and almost doubled risk of squamous cell carcinoma (SCC) compared to the average population, with risk increasing with decreasing latitude10–12.

II The risk for BCC, SCC and actinic keratosis (AK) among workers who have worked outdoors for more than 5 years is 3-fold higher than the risk among those with no years of working outdoors12,13.

4 Primary prevention, early detection, treatment and regular follow-up of skin cancer (NMSC and melanoma) are shown to be beneficial from a health economic perspective.14–17

5 Action is needed at international, European and national level to legislate for recognizing AK and NMSC as an occupational disease, which has the potential to improve access to compensation and drive preventative activities.

6 This report is a Call to Action for:

I The engagement of key stakeholders, including supranational institutions, national governments, trade organizations, employers, workers and patient organizations to drive change in prevention and protection of at-risk groups.

II Employers should be obliged to prevent outdoor worker’s UV exposure from exceeding limit values, and to implement occupational skin cancer screening programmes among the at-risk workforce.

III Educational programmes for the outdoor workforce are needed to improve health literacy and drive behavioural change.

IV Nationally, steps to improve notifications and surveillance of skin cancers through both occupational services and public health programmes are required.

V Future research activities should focus on the precise definition of at-risk groups among outdoor workers through increased data gathering, including UV-dosimetry, and evaluation.

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Introduction
Exposure to solar ultraviolet (UV) radiation is classified by the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) as a recognized group one carcinogen associated with the highest level of causality for skin cancers, both melanoma and non-melanoma skin cancer (NMSC).8,9 NMSC comprises cutaneous squamous cell carcinoma (SCC) and basal cell carcinoma (BCC),18,19 and an estimated 50–70% of SCC and 50–90% of BCC in fair-skinned people are caused by UV radiation.6 Population-based cancer surveys conducted by the National Cancer Institute in the US have shown a north-south gradient for SCC incidence with low rates in northern states and high rates in southern states.20 Actinic keratosis (AK) is an in situ SCC which may develop where skin has been exposed to the sun over time.21 AK is caused by cumulative exposure to the sun and can take years or even decades to appear in the form of noticeable skin changes.22,23 The vast majority of invasive SCCs begin as AKs (see also Table 1).

NMSC is the most common cancer in the world and incidences are increasing.1–5 It is estimated that between 2 and 3 million people are diagnosed worldwide each year, with an average annual increase of 3–8% in fair-skinned populations in Australia, Europe, the US and Canada over the last 30 years.3,4 There is a growing body of research (particularly from Australia and from the European Prevention Initiative for Dermatological Malignancies [EPIDERM] that includes eight European countries) linking exposure to UV radiation in outdoor workers to the rapidly increasing incidence of NMSC and AK. Systematic reviews and meta-analyses have demonstrated that occupationally UV-exposed workers are at least at a 43% higher risk of BCC [pooled odds ratio (OR) 1.43; 95% confidence interval (CI) 1.23–1.66; \( P = 0.0001 \)] and 77% higher risk of SCC (pooled OR 1.77; 95% CI 1.40–2.22) compared to the average population, with risk increasing with decreasing latitude.10,11 According to these recent meta-analyses, the actual risks for outdoor workers are underestimated rather than overestimated, especially for misclassification.

Table 1  Skin cancer facts, US population statistics

<table>
<thead>
<tr>
<th>Number</th>
<th>US population statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 million</td>
<td>Cases of skin cancer diagnosed in 2.2 million people each year</td>
</tr>
<tr>
<td>5 million</td>
<td>People treated for skin cancer per year</td>
</tr>
<tr>
<td>58 million</td>
<td>People are affected by AK, the most common pre-cancer</td>
</tr>
<tr>
<td>90%</td>
<td>Of NMSCs are associated with UV radiation from the sun</td>
</tr>
<tr>
<td>86%</td>
<td>Of melanomas can be attributed to exposure to UV radiation from the sun</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesions previously treated as AKs</th>
<th>BCC</th>
<th>SCC</th>
<th>Melanoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence, pa</td>
<td>2 800 000</td>
<td>700 000</td>
<td>135 000</td>
</tr>
<tr>
<td>Mortality, pa</td>
<td>3000</td>
<td>3900–8800</td>
<td>9940</td>
</tr>
<tr>
<td>Lesions treated as AKs</td>
<td>36%</td>
<td>65%</td>
<td>–</td>
</tr>
</tbody>
</table>


AK, actinic keratosis; BCC, basal cell carcinoma; NMSC, non-melanoma skin cancer; pa, per annum; SCC, squamous cell carcinoma; UV ultraviolet.
Economic impact of NMSC

Although BCC is not associated with increased mortality, there is evidence for increased mortality after SCC; in particular there is a high-risk subset of cutaneous SCCs that can cause severe morbidity and mortality.28,29 The treatment of all NMSCs poses a considerable burden on the healthcare system. NMSC is ranked among the five most costly cancers to US Medicare.30 The total annual budget for skin cancer in the US has escalated from $3.6 billion in 2002–2006 to $8.1 billion in 2007–2011 of which NMSC treatment accounts for $4.8 billion and melanoma treatment for $3.3 billion.1 The annual number of adults treated for skin cancers in the US increased from 3.4 million to 4.9 million for the same time periods.1 Australia has the highest incidence of NMSC in the world which comprises 75% of all cancers and are the most costly cancer type, accounting for $511 million in 2010.5 The potential for the economic benefits of skin cancer prevention are great and include not only a reduction of costs but also a gain in quality of life, functional ability and health.14

Primary prevention, early detection and follow-up of skin cancer (NMSC and melanoma) are shown to be beneficial from a health economic perspective.14–17 Per year of survival, screening measures can save costs in the range of US$30 000–US$50 000.14 In Australia, a national sun protection campaign was associated with a favourable cost–benefit analysis with the avoidance of around 4300 premature deaths from skin cancer with costs of AUS $1360 per year of lives saved at an overall campaign cost of AUS$5 million.35 In Germany, the decision to introduce skin cancer screening was based upon the results of a population-based skin cancer screening project (SCREEN – Skin Cancer Research to provide Evidence for Effectiveness of Screening in Northern Germany) conducted as a pilot study in Schleswig-Holstein. The savings potential of introducing widespread skin cancer screening in Germany was calculated at over €575 million per annum.14,16 In the SCREEN pilot study, the whole-body inspection by the GP or dermatologist resulted in earlier diagnosis of melanoma, BCC and SCC into prognostically more favourable stages.14,17

Report focus

The authors of this report convened at a working party meeting in Brussels in December 2014, to consider what needs to be done to address the rise of occupationally induced skin cancers (NMSC, incl. AK), and this report is the result of their discussions. This report summarizes what is known regarding the risk of occupational UV exposure, identifies the knowledge gaps and proposes steps that can be undertaken to address the disparity between the evidence base, legislation and common working practices. The authors conclude with a Call to Action for the engagement of key stakeholders, including national governments, trade organizations, employers, workers and patient organizations to drive change in the prevention and protection of at-risk outdoor workers. For an overview on recent systematic measurements see Wittlich et al. in this supplement.31

Primary prevention

At work – Safety first

While some data on the risk of skin cancers from UV exposure of outdoor workers exist, there is an identified need for a clear definition of outdoor work and high-risk activities, with consensus from all professions, and compilation of a compendium of all theoretical and known risks using shared examples from relevant countries. Nonetheless, it is recognized that outdoor workers, such as agricultural workers, construction workers, gardeners, police officers, physical education teachers, ski instructors, lifeguards and fishermen have an increased risk of skin cancer.18,32 It has been estimated by the IARC that outdoor workers are exposed to an UV radiation dose 2–3 times higher than indoor workers.8 In a Danish UVR dosimetry study, for example, the median estimated yearly UVR was measured as 132 standard erythema doses (SED) for indoor workers, but 224 SED for gardeners.33 More detailed and perennial UVA/B exposure data on >100 outdoor professions is currently obtained in Germany and will be available within the GENESIS-UV project.31
EPIDERM aims to acquire and disseminate knowledge on skin cancers relating to occurrence, risk factors, treatment and costs, to develop prevention and risk reduction strategies. The EPIDERM outdoor worker project has examined solar UV exposure among outdoor workers compared with indoor workers. The study concluded that outdoor workers had similar constitutional risk factors for skin cancer, but have higher risk behaviour, with more UV exposure (during both occupational and leisure time) and less sunscreen use. This combined with lower health literacy results in higher exposure, and therefore more photo-damage and higher risks of AK, BCC and SCC. The risk for BCC, SCC and AK among workers who have worked outdoors for more than 5 years is 3-fold higher than the risk among those with no years of working outdoors. The UV radiation exposure of outdoor workers may be measured using personal UVR dose-meters.

Data collected in this way can contribute to development of a job-exposure matrix and activity-exposure matrix.

What is needed now is an international database on factual UV exposure in outdoor workplaces obtained with comparable, advanced technology devices. This will help define the needs for improved health and safety and workers’ education. The aforementioned pilot study of >600 outdoor workers in Germany has already revealed unexpectedly high exposures. A study of construction workers in Spain using personal dose-meters found median UV exposure was 6.11 (SED) per day. Comparison with the occupational UV radiation exposure limit showed that the subjects had received UV erythemal radiation exposure in excess of occupational guidelines, indicating that protective measures against this risk are highly advisable. It seems therefore warranted to install regulation to protect outdoor workers from UV radiation in the workplace.

Regulation: legislation and non-legislative documentation

Primary and secondary prevention of occupational skin cancer (OSC) is easy and cost-effective, and can be successfully driven by legislation at the supra-national and national level. In 2014, the European Commission adopted a new Strategic Framework on Occupational Health and Safety at Work. The prevention of work-related and occupational diseases is among the three major challenges outlined for 2014–2020. In 2015, the European Commission started to review all EU existing legislation on health and safety at work. The 2006 EU Directive on Optical Radiation (2006/25/EC) will be included in this review. This directive defines limit values for exposure of workers to artificial optical radiation to eyes and skin, but does not currently cover exposure to natural optical radiation (sunlight).

The International Labour Organization (ILO) maintains a list of occupational diseases, which acts as a worldwide benchmark for the establishment, review and revision of national lists. The 2010 ILO list makes a general recommendation to include diseases caused by optical (ultraviolet, visible light, infrared) radiation in national lists, but does not specify diseases (Table 1). Another policy instrument of potential relevance is the European Schedule of Occupational Diseases, a list of occupational diseases that the European Commission recommends EU member states introduce into their national legislation. Arguably, the ILO list can be considered to have more influence on national legislation. The ILO list is regarded as a criterion for reimbursable diseases in the US, the UK and other European countries. Nearly all EU/EEA countries have national occupational disease lists, which specify the diseases entitled to compensation, and include a presumption of work-related origin.

New legislation came into force on 1 January 2015 to include ‘SCC or multiple AK of the skin by natural radiation’ into the German Ordinance on Occupational Diseases (BKV, Berufskrankheitsverordnung). This now means full recognition as an occupational disease, and medical care and compensation for all workers who have had long-time solar exposure (usually more than 15 years) and suffer from more than five AK or SCC. According to German law, cases can be notified and recognized after retirement, and very frequently are.

A ‘Call to Action’ was presented to the EU Commission in April 2014 by the European Academy of Dermatology and Venereology (EADV) calling for legislative change (Box 1). This was answered by the former DG EMPL Mr L. Andor and Commission President J.M. Baroso, both expressing the high importance they were attributing the issue of sun protection of workers. It is now up to the current Commission to take action.

The EU Horizon 2020 COST Action TD 1206 ‘StanDerm’, comprising more than 140 experts from 31 European countries, aims to coordinate activities relevant for prevention of occupational skin diseases, including collecting data on aetiology, individual susceptibility, and epidemiological surveillance, and to develop and implement European standards on their prevention, including OSC. StanDerm has provided an “Interpretative Document” to the EU Strategic Framework Health and Safety at Work.
work 2014–2020 aimed at DG EMPL and EU OSHA. The document summarizes the current scientific basis for improved health and safety for outdoor workers.

**Employer and worker joint responsibility**

Employer responsibilities include the responsibility to decrease risk factors, develop internal policies, and raise education and awareness among workers. UV exposure can be minimized in the workplace with a variety of technical, organizational and personal strategies, combined with adequate training. Examples of technical measures include: the use of awnings, planning of work schedules to reduce work during high midday sun, optimal use of personal protective measures (clothing, brimmed hats with neck protection, sunglasses), and the use of sunscreens on uncovered skin surfaces. A change in health awareness regarding exposure to UV radiation, knowledge of preventative measures and observing and regularly applying them (including clothing protection and sunscreens), are important for workers with high natural UV exposure.18

The efficacy of personal protective equipment strongly depends on workers’ compliance, which is currently quite low in the workplace. It is recommended that occupational screenings should include regular interventions aimed at enhancing a clear understanding of risk factors for individuals and improving the acceptance and maintenance of UV-protective means at the workplace.41

**Raising awareness among at-risk populations**

Both bottom up and top down approaches may be employed to raise awareness, to include the general public, healthcare professionals, vocational trainers, employers, single workers, schools, policymakers, social partnership organizations, prevention institutions, accident insurance companies and occupational bodies. Programmes to educate the outdoor workforce are being developed. For example, the Sun Safe Workplaces programme in the UK aims to provide employers and workers with educational materials on suitable sun safe policies. Similarly, the Sun at Work programme in Canada and the SunPass project, which was implemented in 55 kindergartens in Germany in 2010, are alternative examples of programmes aiming to inform and protect outdoor workers.

Generation and dissemination of educational materials that raise awareness and improve knowledge, along with development of benchmark tools, are essential to drive change in health behaviour. It is also important that these materials are accessible through multiple formats and platforms including social media to engage the public’s interest and increase the accessibility of health education to the outdoor worker.

**Secondary prevention**

**Surveillance essential to understand the true scale of the problem**

Currently, there is considerable underreporting of OSC, and there is an identified need to improve the notification of skin cancers. BCC and SCC are not reported to cancer registries in most countries, thus precise statistics of NMSC are generally not available. OSCs are not notified even in those countries where they would be recognizable as an occupational disease. The updated WHO ICD 11, which is planned for 2017, will include separate codes for BCC and SCC (included as a single code in ICD 10) and will also with the 4-digit code allow for coding of occupational aetiology of NMSC. Steps to drive screening for early identification of skin cancers are recommended, particularly in defined high-risk populations, such as outdoor workers with more than 5 years’ exposure.

Euromelanoma is a dermatologist-led skin cancer prevention programme concerned with conducting annual screening and public education campaigns in over 30 European countries. Within its 10 year history, Euromelanoma has screened over 260 000 individuals across Europe, detecting a significant number of NMSC and melanomas, identifying high-risk individuals for further surveillance and promoting awareness on the hazardous effects of excessive UV exposure.18 The effectiveness of skin cancer screening programmes in Germany has been studied and the importance of these programmes and collaboration with GPs is well established. In one screening study of workers at five large German companies, rates of suspected melanoma and NMSC were low in this relatively young population (mean age 40 years). However, around one-third of those screened who had an increased risk for developing skin cancer (with at least one risk factor) will benefit from the screening. A major endogenous risk factor for NMSC in outdoor workers are Fitzpatrick skin types 1 and 2.

There is an identified need for a clear definition of screening activity: who to screen, when (number of years of exposure), how, how often (frequency) and why. Notification and surveillance can be driven through both occupational services and public health programmes.

**Developing a universal NMSC patient pathway**

There is an identified need to increase the profile of the ILO list of occupational diseases, and drive adherence and implementation. Research from the EPIDERM project has identified variations across Europe in the journey a skin cancer patient will follow from diagnosis to treatment. Significant disparities, both in the accessibility of specialists and in the provision and costs of adequate and new treatment were detected.12,25 Guidance on an optimal patient pathway through development of a common patient management algorithm may help address health disparities, and efforts to address health inequalities should lead to
improvements in European healthcare quality and reduction in morbidity from skin cancer. Further educational materials targeted at people showing the early signs of skin cancer are warranted to halt the progression of further skin damage.

**Need for improved access to compensation**

The authors have identified a need to improve access to compensation, although the exact approaches undertaken will differ between the involved countries. For example in Germany, every dermatologist who suspects that skin cancer is due to occupational UV exposure has to report this with an Occupational Disease Notification Form (F6000) to the responsible statutory social accident insurance institution. To date, already more than 6000 cases have thus been notified since this new occupational disease has been introduced on 1 January 2015.

There is a global need for consistent, better reporting of occupational NMSC and AK so that the true dimension of prevalence can be revealed and better treatment and compensation ensured.

**Conclusions**

- Primary prevention, early detection, treatment and regular follow-up of AK and NMSC are demonstrated to be beneficial from a patient outcomes and health economic perspective.

- Urgent action is needed at international, European and national level to legislate for recognizing AK and NMSC as an occupational disease, which has the potential to drive preventative activities.

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**Call out Box 2**

Future research needs:
- Understanding and precise definition of at-risk groups
- Evaluation and outcome of true UV exposure data for outdoor workers
- Epidemiology, including improved notification of OSC to reduce under-reporting
- Health economic impact modelling of OSC disease burden.

**Call out Box 3**

Achieving change – A Call to Action

**Legislation**

1. Immediate action at international, European and national level is needed to:
   - Update the EU directive on optical radiation to include solar UV radiation
   - Legislate for recognizing AK as an occupational disease which is entitled to compensation; UV-induced AKs and NMSC should be included under the EU schedule of occupational diseases
   - Implement recommendations from the ILO list of occupational diseases in all ILO member countries, while an update of the ILO list to include a more explicit reference to occupationally induced AK and NMSC is warranted

**Implementation**

1. At national level, employers with workers exposed to outdoor work should be obliged to:
   - Measure the levels of workers’ exposure to UV and to implement plans to prevent exposure exceeding the limit values
   - Implement OSC screening programmes among the at-risk workforce
   - Encourage and assist patients to seek medical help to receive appropriate treatment, if they have developed AK or any form of skin cancer

**Education**

- Take steps to increase knowledge about the risk of AK and NMSC among occupational workers to empower and change behaviour among these groups, and ensure proper follow-up to detect and treat appropriately with the latest efficacious medicines available
- The development of smart, simple and accessible information platforms is warranted beyond leaflets and information campaigns, e.g. through social media, to improve health literacy among outdoor workers and the general population to drive change in behaviour

**Surveillance**

- Steps may be taken nationally to improve notifications and surveillance of skin cancers through both occupational services and public health programmes

**Research**

- Future research activities may focus on the precise definition of at-risk groups among outdoor workers, through increased data gathering and evaluation
• Employers should be obliged to prevent outdoor worker’s UV exposure from exceeding the limit values, and to implement OSC screening programmes among the at-risk workforce.
• Educational programmes for the outdoor workforce are needed to improve health literacy and drive behavioural change.
• Nationally, steps to improve notifications and surveillance of skin cancers through both occupational services and public health programmes are required.
• Future research is urgently needed and these activities should focus on the precise definition of at-risk groups among outdoor workers through increased data gathering, including UV dosimetry and evaluation (see Box 2).

The ‘Call to Action’ (see Box 3) focuses on the most critical areas that need to be addressed to drive change in prevention and protection of at-risk groups. We believe with collective and concerted effort on the part of all stakeholders, namely national governments, trade organizations, employers, workers and patient organizations, we can achieve more for those at greatest risk of AK and NMSC.

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