



## POSITION STATEMENT

# Improved protection of outdoor workers from solar ultraviolet radiation: position statement

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## Abstract

The vast majority of non-melanoma skin cancer (NMSC) is attributable to excessive exposure to ultraviolet radiation (UVR). Outdoor workers are exposed to an UVR dose at least 2 to 3 times higher than indoor workers and often to daily UVR doses 5 times above internationally recommended limits. The risk of UVR workplace exposure is vastly neglected, and the evident future challenges presented in this statement are contrasted with the current situation regarding legal recognition, patient care and compensation. While prevention is crucial to reduce cancer risks for outdoor workers, it is as much of relevance to better protect them through legally binding rules and regulations. Specific actions are outlined in five recommendations based on a Call to Action (table 1). The role of health professionals, including dermatologists, in this context is crucial.

**Keywords:** exposure, non-melanoma skin cancer, occupational disease, outdoor workers, prevention, regulations, ultraviolet radiation.

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## Introduction

Non-melanoma skin cancer (NMSC) is by far the world's most frequently diagnosed cancer<sup>1</sup> with an incidence of 7.7 million cases in 2017.<sup>1</sup> Solar ultraviolet radiation (UVR) is the main cause of NMSC in fair-skinned individuals.<sup>2</sup> An earlier systematic review and meta-analysis found that the risk among outdoor

workers was raised for SCC and actinic keratosis (=intraepidermal SCC) by 77%, and for BCC by 43%, respectively, compared with the general population.<sup>3,4</sup> While UVR is classified as proven human carcinogen (IARC/WHO Group 1), alongside substances such as plutonium and asbestos, by the International Agency for Research on Cancer (IARC),<sup>5,6</sup> it is rarely highlighted as a major

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<sup>1</sup>NMSC encompasses basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and actinic keratosis (AK); more correctly, these tumour entities are being referred to as 'keratinocytic carcinomata'. However, for the purpose of this paper the term NMSC will be applied.

**Table 1** Five fields of action to address the unmet needs of NMSC patients<sup>2</sup> These fields of action are part of the Global Call to Action, launched on 26 April 2019 at the 1st Multi-Stakeholder Summit on Occupational Skin Cancer, held in Paris at the occasion of the 15th EADO Congress (24-27 April 2019).<sup>52</sup>

<p><b>1. Policymakers should improve the legislative framework to protect outdoor workers more effectively and build accessibility for regular screenings and thus earlier treatments. In the European Union, NMSC should be officially recognized as an occupational disease within the next legislative period</b></p>	<ul style="list-style-type: none"> <li>• Update the 2003 Schedule of Occupational Diseases to reflect the fact that NMSC caused by solar UV radiation is directly linked to occupation</li> <li>• Update Directive 2006/25/EC on artificial optical radiation to include solar UV radiation, with specific obligations on health surveillance of outdoor workers, and provide accessibility to early treatment or intervention</li> <li>• Recognize NMSC as occupational diseases in EU member states; adopt or amend national policy instruments to cater for the needs of outdoor workers in terms of targeted prevention measures, compensation and prevention measures</li> <li>• WHO should continue efforts to define and reinforce workplace exposure limits to UVR for member countries</li> <li>• ILO should further update its 2010 List of Occupational Diseases and include more explicit reference to solar UV induced NMSC</li> </ul>
<p><b>2. Doctors, other health professionals and policymakers should work together to ensure standardised EU-wide registration of NMSC</b></p>	<ul style="list-style-type: none"> <li>• Registration of NMSC, including of subsequent tumours and professional activity of patient, in national cancer registries should become compulsory</li> <li>• National, European and international dermatological societies should press for national initiatives to include NMSC in population-based cancer registries</li> <li>• Collecting and analysing cancer registries' data at European level could ensure effective public health measures, early diagnoses and harmonised quality of care for affected workers across the EU</li> <li>• Create incentives to encourage registration of NMSC cases in population-based cancer registries and in occupational disease registries of compensation schemes</li> </ul>
<p><b>3. Employers should use tools to monitor exposure levels to UVR in the workplace. They shall also implement cost-effective techniques for sun-safe behaviour and ensure regular skin cancer screenings for outdoor workers</b></p>	<ul style="list-style-type: none"> <li>• Implement a global measurement programme to evaluate exposure to UVR among outdoor workers during their working hours in comparison with their leisure time</li> <li>• Minimize UVR exposure at the workplace with a variety of technical, organizational and personal strategies</li> <li>• Include in social partner agreements workplace health surveillance and regular skin cancer screening of risk populations</li> <li>• Develop simple but effective tools (e.g. apps, UV-dosimeter cards, UV-index, information platforms through social media) to inform outdoor workers how to protect themselves from the sun, and drive change to sun-smart protection behaviour</li> <li>• Enhance health literacy of outdoor workers, e.g. how to self-examine their skin</li> </ul>
<p><b>4. Doctors and other health professionals should improve reporting of occupational NMSC (including actinic keratosis)</b></p>	<ul style="list-style-type: none"> <li>• Provide primary care physicians with the necessary diagnostic skills and incentives to identify, notify and refer cases of occupational skin cancer to dermatologists</li> <li>• Train occupational physicians on how to recognise, notify and refer occupationally induced skin cancer to dermatologists; train on effective prevention measures to advise employers at workplace visits</li> <li>• Provide physicians with the tools to report cases of occupational skin diseases</li> <li>• Breach gaps between specializations; highlight the need for improved interdisciplinary collaboration, including exchange of data, to improve patient care</li> </ul>
<p><b>5. Patient advocacy groups, doctors and other health professionals as well as employers should collaborate to promote skin cancer prevention and sun-safe working practices and to address the unmet needs of retired outdoor workers with persisting NMSC</b></p>	<ul style="list-style-type: none"> <li>• Improve knowledge and sun protective behaviour by means of social media campaigns and awareness raising activities, with specific attention of children and young populations</li> <li>• Make use of community-based educational organizations</li> <li>• WHO and ILO should establish a good practice databank of sun safety campaigns</li> <li>• Encourage national broadcasters and private media groups to make public service announcements on sun safety for outdoor workers</li> <li>• Enhance a multi-stakeholder dialogue to emphasise the need for preventative measures for outdoor workers, and to educate workers and employers in the importance of applying these measures</li> </ul>

risk factor compared with other work-related carcinogens (e.g. solvents, toxic dust). With a workforce of over 14.5 million in the EU occupied for at least 75% of their working lives outdoors (e.g. in construction, farming, seafaring, and public services), attention to the invisible risk of UVR exposure to develop occupational skin cancer has been vastly neglected. In a recent large case-control study in eight European countries, it is estimated that the risk of developing SCC and BCC triples with five or more years of outdoor work.<sup>7</sup> Correspondingly, in 2018, in another population-based case-control study *occupational* UVR exposure threshold doses could be calculated for both SCC and BCC, above which the risks for these cancers double.<sup>8,9</sup> Thus, within the framework of the UN Sustainable Development Goals (SDG) 2015–2030 the World Health Organization (WHO) and the International Labour Organization (ILO) are giving this topic a high priority and are currently developing a joint methodology to assess the global disease burden of work-related skin cancer by solar UVR.<sup>10</sup>

Non-melanoma skin cancer is on the rise worldwide, and if not detected and prevented at an early stage, NMSC leads to a life-long chronicity with abundant newly forming lesions, entailing an ongoing need for treatment.<sup>11</sup> Often the disease remains 'invisible' as there is a long latency period between exposure and the (chronic) illness, and thus, over 80% of cases occur in people aged 60 and above.<sup>12</sup> As life expectancies increase, so will incidences of NMSC, presenting an increasing burden on healthcare systems globally. However, it is one of the few curable, easily detectable and preventable types of cancer.

### Only what can be measured can be improved

It is frequently argued that insufficient data exist to clearly differentiate between ubiquitous recreational and work UVR exposure to prove which is the root cause of the disease. This has allegedly made it difficult to establish regulations for outdoor workers. Recent exposure assessments (e.g. by means of personal dosimeters) of outdoor workers in different countries and regions reveal unexpectedly high exposures to UVR, as compared with the general population.<sup>13</sup> This exposure regularly vastly exceeds the recommended work exposure limits of 1.3 standard erythemal doses (SED; 1 SED = 100 Jm<sup>-2</sup> of erythemally weighted UV irradiance) for eight hours working outdoors.<sup>14</sup> Overall, yearly occupational UVR exposure in outdoor workers is 3–5 times the yearly average indoor workers' exposure.

In the early 2000s, high daily solar UVR exposure of 9.9 SED per day in construction workers was measured in Australia.<sup>15</sup> High SED values of over 5 SED/day for construction and road workers were confirmed for New Zealand<sup>16</sup> and Spain, with a median UV exposure of 6.11 SED per day.<sup>17</sup> In the United States, lifeguards are also exposed to high risk with a range between 1.7 SED and 6.2 SED per day.<sup>18</sup> Nearly 6x the recommended limit, namely 6.1 SED, was also measured as a mean

exposure value in a Canadian study carried out in 2016 in three provinces with over 400 workers from power utilities and municipalities.<sup>19</sup> In 2012, a French study came to a similar conclusion: certain outdoor occupations, such as gardeners, receive high SED doses.<sup>20</sup> Similar results were obtained in Denmark in 2003 where the median estimated yearly UVR was measured as 224 SED for gardeners.<sup>21</sup> In 2017, another Danish study, carried out with 457 Danish workers to measure UVR exposure at work and at leisure, revealed that roofers are exceedingly exposed to UVR with a semi-annual exposure of 361.8 SED.<sup>22</sup> Data obtained from two studies carried out in 2017 in Romania and Croatia with construction workers are not different: they clearly show the high exposure of outdoor workers to UVR during the warm season (April to October), with estimates of up to 6.40 SED per day in Romania and 12 SED/day in Croatia.<sup>23,24</sup>

A 3-year dosimetric measurement project carried out in Germany between 2014 and 2017 with >1000 outdoor workers from 97 different occupations showed that exposures of **up to 5 SED/day** are common. For instance, for dock workers, yearly exposure has been measured at 222 SED, while masons/bricklayers face an average exposure of 435 SED per year, and roofers and quarry workers over 580 SED.<sup>25</sup> To put this into perspective, 1 SED is sufficient to cause sunburn in fair-skinned individuals of Fitzpatrick skin type 1.

Importantly, the German study found that the amount of UV radiation varies significantly, even within the same profession. As a result, contrary to what one would think, arable farming is not among the highest exposure professions in the agricultural sector. New evidence on sun exposure also shows that, among postal service mail carriers, a distinction must be made between those who cover their route on foot (who are likely to seek the shade next to the buildings), and those who cover their route by bike (who are more often directly exposed to the sun when biking).<sup>25</sup>

The above data show that most outdoor workers receive UV erythemal radiation exposure in excess of occupational guidelines. There is no other occupational carcinogen (IARC/WHO group 1) where it is legally accepted for exposed workers to exceed the recommended daily threshold levels regularly by five times or more.

The objective dosimetric measurements have helped to get a more precise understanding of the at-risk populations among outdoor workers: it is not the (industrial) sector as such, but the occupation and tasks linked to the specific occupation within the industrial sector, which is the defining factor in determining the amount of UVR exposure faced at work. As a consequence, in Germany, the introduction of a mathematical model called 'Wittlich's algorithm' to assess individual occupational lifetime UVR exposure (in relation to private exposure) has been derived from the obtained dosimetric data and is now being used by the German statutory social accident insurance to improve prevention measures, healthcare services and compensation for affected

workers.<sup>26</sup> In Germany, with 9905 notified cases in 2018, work-related skin cancer is already the third most frequently reported and the second most frequently acknowledged occupational disease, and by far the most frequent occupational cancer.

In order to obtain improved and objective disease data at global level, an important milestone has been the 11th revision of the WHO International Classification of Diseases (ICD), adopted 25 May 2019: NMSC, incl. actinic keratosis can now be coded for as occupational, and BCC and SCC are now separate entities.<sup>27</sup> Thus, when ICD 11 will come into force by 1 January 2022, it will help reveal the true epidemiological magnitude of work-related skin cancer and may provide pivotal new public health data for cancer prevention in outdoor workers on a global scale. Loney *et al.*<sup>28</sup> have recently demonstrated the current lack of data on skin cancer in occupationally UVR-exposed workers in large parts of the globe.

Given the pressing nature of the growing numbers of NMSC cases linked to occupational UVR exposure, the WHO and ILO are currently assessing – within the UN Sustainable Development Goals 2030 framework – the global disease burden of NMSC. Both UN agencies have classified it among the ten most relevant occupational risk factors and health outcomes that have never been included in previous global estimation strategies but are very likely to account for a considerable disease burden.<sup>10</sup> For the first time, the two UN specialized agencies for health and labour will produce joint estimates on the impact of work on health. This will again help leverage the case of work-related skin cancer at a global level.

### The disease burden of NMSC

The economic impact of work-related UVR-induced skin cancer is quite burdensome. It increasingly places governments and healthcare systems under significant economic pressure. The annual direct healthcare costs in Europe are estimated to range from EUR 341 to EUR 853 million per year.<sup>29</sup> For Canada, the direct and indirect costs of occupational NMSC cases are CA\$ 28.9 million, while compensation claims for occupational skin cancer in Australia between 2000 and 2012 amounted to AU\$ 63 million demonstrating an upward trend.<sup>30,31</sup> In the United States, the average annual costs for NMSC treatment between 2007 and 2011, regardless of its causation, amounted to US\$ 4.8 billion.<sup>32</sup>

NMSC patients also inevitably endure a considerable reduction in quality of life due to the chronicity of this highly recalcitrant disease. Given that NMSC patients often undergo repeatedly surgery, and given that the disease occurs on highly visible areas (such as on the head, ears, neck and hands), patients may suffer significant consequences for their appearance, self-esteem and well-being. The intangible costs for NMSC are therefore estimated to be even higher than original estimates, namely EUR 1,040 to EUR 2,040 million per year in Europe and CA\$ 5.7 million in Canada.<sup>29,30</sup>

This expenditure could be largely avoided if targeted prevention measures were put in place. Primary prevention, early detection, treatment and regular follow-up (NMSC and melanoma) are shown to be beneficial from a health economic perspective.<sup>33–36</sup> The positive impact of primary skin cancer prevention on health costs has recently been assessed in Denmark by calculating the return on investment (ROI) resulting from the 2007–2015 national campaign. For each Euro invested, EUR 2.18 were saved in health expenses.<sup>37</sup> The potential for the economic benefits of skin cancer prevention is thus great and includes not only a reduction of costs, but also increased quality of life, functional ability and health.<sup>33</sup>

In this context, health surveillance and skin cancer screening are important tools to detect any adverse changes to the skin at an early stage. This includes not only regular skin inspections by a responsible person (health professional), but it also means informing the worker about the risks – and about when and where to seek assistance if a skin lesion is suspected. However, studies have indicated that outdoor workers with higher UVR exposure are indeed less likely to have received a skin examination than the average (indoor) worker. For instance, several studies from the United States revealed that farmers never had skin examinations and that they did not know how to conduct skin self-examinations.<sup>38,39</sup> The same situation was found among fishermen in Brazil, who regularly face over 12 h of UVR exposure every day.<sup>40</sup>

In Germany, the decision to introduce skin cancer screening was based on 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 were calculated at over EUR 575 million annually.<sup>29,30</sup> In the SCREEN pilot study, it is claimed that the inspection of the complete body by the GP or dermatologist resulted in earlier diagnosis of melanoma, BCC and SCC in predictable more favourable stages.<sup>33,35</sup>

However, cancer screening of the general population as described above has been debated in the scientific community; screening of high-risk populations like outdoor workers, however, is not controversial but a stringent postulate by physicians throughout the world.

### Legislation covering occupational NMSC

To date, not many countries cover compensation for occupational skin cancer (NMSC) *inter alia* due to the fact that the relationship between the disease and the occupation is still not being made, despite growing evidence. However, in Australia, legislation for NMSC as an occupational disease comes from state legislation. In Canada, it is organized by provinces and territories. In Europe, only seven countries recognize UVR-inflicted occupational skin cancer as an occupational disease.<sup>41</sup>

Yet, even in these countries, patients with work-related NMSC mostly do not benefit from recognition, because, despite disposing of the legal grounds for notifying and treating cases, under-reporting is massive: the responsible physician or dermatologist does not notify, as the correlation between the disease and the occupation is not yet routinely made.

In Denmark, only 36 cases of skin cancer have been recognized since its inclusion in the list of occupational diseases in 2000.<sup>42</sup> In Italy, where NMSC is on the occupational diseases list, the situation is no different: on average only 34 cases were reported annually between 2002 and 2017<sup>43</sup>; a similarly dramatic underreporting applies to other countries.<sup>41</sup>

The picture changed in Germany in 2015, when some forms of NMSC (SCC, multiple AK) were officially included in the list of occupational diseases. Within the first 12 months of official recognition, more than 7700 occupational NMSC cases were notified. In 2018, the number of notifications amounted to 9905. Notifications are expected to continue increasing in the years to come. However, it is worth noting that a financial incentive has been instituted which encourages physicians to report – which undoubtedly has been instrumental to the high numbers of notifications. Also, patients with acknowledged occupational skin cancer are provided with priority medical care and, in severe cases, substantial compensation. Furthermore, as of July 2019, employers are specifically required to conduct UVR exposure risk assessment, provide personal protective equipment and offer UVR-exposed employees a consultation by an occupational physician every three years.<sup>44</sup>

Regarding the situation of population-based cancer registries, NMSC is not reported in the majority of cases and can therefore only be measured in an inconsistent manner. When recorded, only primary tumours are registered, while consecutive tumours are not. This is a relevant problem because the risk of acquiring further NMSC after the first lesion has been diagnosed, is about 30% in the first year after diagnosis in the average population; and in outdoor workers, it is expected to be even higher due to the substantial actinic damage that so many of them suffer from.<sup>28</sup>

To standardise comparisons of incidence trends between regions, the European Network of Cancer Registries and the International Agency for Research on Cancer recommend reporting only the first BCC or SCC per person.<sup>45,46</sup> This leads to incomplete data – another reason why NMSC is often not included in the analyses of comparative cancer data. Some additional barriers to recording NMSC cases include the high costs associated with the labour-intensive aspect of the registration process, the lack of digitalization, the often-limited sharing of data (even more so in view of the current EU data protection regulation) and the low usage of notification forms in a given country. Furthermore, the practice of skin cancer registration varies between countries, which adds to the fact that the crisis remains in the shadow.<sup>46,47</sup> As a result, outdoor workers still lack

legislative protection to ensure adequate prevention measures, diagnosis and effective treatments for this occupational disease. Interestingly, numerous elimination and control protocols to protect workers from exposure to the IARC/WHO group 1 carcinogens have been put in place over the years, regulations have been adopted and amended to better protect workers' health, but not for UVR. Multi-purpose reporting forms for occupational skin cancer cases, which can also be used to inform respective authorities in countries where this is not yet a recognized occupational disease, have recently been published open access.<sup>48</sup>

Almost thirty years ago, the European Union adopted its first global directive for improving the workplace prevention of work-related cancer. And since 2015, the European Commission has been reviewing all EU existing legislation on health and safety at work. Still, the damage to workers' health caused by UVR continues to be underestimated throughout the EU. While EU-OSHA states that UVR is one of the most common sources of carcinogenic exposure in the EU member states, the EU occupational safety and health directives have so far failed to protect outdoor workers from skin cancer – as the continuous exposure of workers to UVR is excluded. For instance, the 2006 EU Directive on Optical Radiation (2006/25/EC), which defines limit values for workers' exposure to artificial optical radiation to eyes and skin, does not cover exposure to natural optical radiation (sunlight). This could however be amended accordingly. Also, the European Commission has proposed to amend Directive 2004/37/EC by expanding its scope and by including and/or revising occupational exposure limit values for a number of occupational mutagens and carcinogens. Unfortunately, UVR – as the most frequent occupational carcinogen – is also not included, although the initiative is proceeding in steps and a third proposal is currently being negotiated in EU trilogue deliberations.

As welcome as safer workplace legislation is, there remain missed opportunities to increase cancer protection and prevention for the approximately 15 million outdoor workers in the EU who are put at extremely high risk due to UVR. Indeed, risks with postponed effects should not lead to postponed prevention. Actions to increase protection against work-related skin cancer have clearly stagnated.

In November 2017, the European Parliament, the Council and the Commission committed themselves to abiding by the European Pillar of Social Rights, which features 20 key principles aimed at delivering new and more effective rights for citizens. Principle 10 is particularly noteworthy, as it states that 'a) *Workers have the right to a high level of protection of their health and safety at work. b) Workers have the right to a working environment adapted to their professional needs and which enables them to prolong their participation in the labour market*'.<sup>49</sup> This principle should set the groundwork for introducing targeted measures to better protect outdoor workers exposed to high levels of UVR.

It is against this background that a Global Call to Action was launched on 26 April 2019 by key stakeholders including patient advocacy groups, medical associations and an international organization focused on occupational health to call on policymakers, health professionals, doctors, employers, workers and patient advocacy groups to take five specific actions to address the unmet needs of NMSC patients (Table 1), and thus make outdoor workplaces safer.

In addition, Europe's Beating Cancer Plan launched 4 February 2020 and currently undergoing a large EU-wide public consultation to help shape the plan, determine priorities and future actions offers a tremendous window of opportunity to bring occupational skin cancer more to the attention of policymakers. The Plan explicitly points to the need to reduce exposure to environmental risks including natural UVR as (occupational) carcinogen, and to envisage 'legislative and soft measures' to reduce UVR exposure in the workplace and to the general public.<sup>50</sup> Interestingly, at international level, article 1.2.5 of the 2010 *ILO List of Occupational Diseases*, which represents the latest worldwide consensus on diseases caused by work, includes UVR-induced NMSC as an occupational disease.<sup>51</sup>

It is now time to adapt policies and legislation to new scientific evidence. Prevention of UVR exposure for outdoor workers should therefore be part of the European agenda. It is cheap and simple, but action is needed. If several EU and non-EU countries have overcome the complex issue of exposure and causation, what is stopping others from following suit and recognising NMSC as an occupational disease?

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