

Commentary

Prevention of Health Risks Related to Occupational Solar Ultraviolet Radiation Exposure in Times of Climate Change and COVID-19 Pandemic

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Abstract: Occupational exposure to solar ultraviolet (UV) radiation is a recognized work-related risk, as is associated with the induction of long-term adverse health effects such as Non-Melanoma Skin Cancers and cataracts. Recent research provided new data suggesting an increased risk of specific forms of malignant melanoma, i.e., Lentigo Maligna Melanoma, for outdoor workers, while the relation of cumulative exposure to solar radiation with ocular diseases, such as uveal melanoma and macular degeneration, is still debated. Nowadays, one of the main focuses of prevention activities is the organization of multicomponent sun safety initiatives, which are proved to be effective, particularly when including technologies that are able to directly interact with individuals, such as phone apps, such as the recently released SunSmart Global UV App. Nevertheless, we should not forget that we are living in an era of profound changes, and phenomena such as climate change and the COVID-19 pandemic have an impact on all aspects of our lives, including how and when we perform, as well as the perception of, outdoor activities. In the future, this may result in possible changes in the scenario of occupational and leisure-time solar radiation exposure-related health risks.



Citation: Modenese, A. Prevention of Health Risks Related to Occupational Solar Ultraviolet Radiation Exposure in Times of Climate Change and COVID-19 Pandemic. *Atmosphere* **2022**, *13*, 1147. <https://doi.org/10.3390/atmos13071147>

Academic Editor: Slavica Malinović-Miličević

Received: 28 June 2022

Accepted: 15 July 2022

Published: 20 July 2022

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Keywords: solar ultraviolet radiation; occupational exposure; sun safety; skin cancers; cataract; prevention; outdoor activities; climate change; COVID-19

1. Introduction

Exposure to solar ultraviolet radiation (SUVR) is considered a recognized occupational risk, and it is ranked first for the number of exposed workers among all carcinogenic agents at work, even if occupational skin cancers are still largely underreported to compensation authorities [1–3]. A comprehensive review published in 2021 highlighted the high number of studies reporting the individual data of occupational SUVR exposure, measured with various dosimetry-based methods, often with a wide inter- and intra-variability of the results obtained and possible issues in comparing the data [3]. Nevertheless, a recent report demonstrated that it is possible to meaningfully compare data from studies using different dosimeters, as long as their spectral response is sufficiently similar [4]. Despite the quite relevant amounts of data on occupational SUVR exposure levels collected, there are still no official occupational SUVR exposure limits for outdoor workers in Europe [5]. Certainly, an important limitation of the research in this field is related to the lack of available data on cumulative individual SUVR exposure at work, with a few exceptions [6]: The availability of long-term exposure data would facilitate the study of SUVR-related chronic adverse eye and skin effects, better differentiating the risk by occupation, geography, and individual characteristics, and therefore providing an important input to the advancement in both research and prevention. Considering these latter two points, some recent publications and initiatives revealed interesting issues and provided important confirmations, providing new data and stimulating scientific discussions in the field of the prevention of occupational SUVR exposure risk. Moreover, recent facts perturbing the world as we know it, i.e., climate

change and the SARS-CoV-2 pandemic, may also pose additional questions on the way we interpret SUVR work-related risks.

2. Recent Research on Occupational SUVR Risk and Its Prevention

Consolidated evidence for cumulative SUVR exposure and health effects recognizes non-melanoma skin cancers (NMSCs), including basal cell carcinomas (BCC) and squamous cell carcinomas (SCC), and cortical cataract as the most frequent diseases occurring in chronically SUVR-exposed populations, such as outdoor workers (OW) [7]. Recently, new evidence of association with SUVR came out also for nuclear cataracts [8], while the relation with SUVR of other ocular diseases, such as uveal melanoma and macular degeneration, is still debated [7,9].

Considering the skin, NMSCs, also called keratinocytes cancers, occurring in OW have been evaluated in a recent systematic review aimed at finding “global evidence”. The review included nineteen studies from twelve countries, in which the majority of the population is fair-skinned: Eleven studies found a significantly increased risk of NMSC. However, no consistently elevated risks across comparable sub-regions and latitudes have been found [10]. In April 2022, a joint World Health Organization–International Labour Organization (WHO-ILO) systematic review judged the body of evidence on the association between SUVR exposure at work and NMSC incidence as sufficient for assessing the harmfulness of the exposure. Twenty case–control studies are included in the WHO-ILO meta-analysis, indicating a moderately increased Relative Risk (RR) with any (or high) occupational SUVR exposure of 1.60 (95% CI 1.21–2.11), compared with no (or low) exposure, with some concerns raised on the risk of bias of the studies included [11]. Even if it can be important to study BCC and SCC together, as they are currently grouped in the International Classification of Diseases 10th revision (ICD-10) with the C44 code, this may have influenced the results of recent systematic reviews. BCC and SCC have, in fact, significantly different relations with cumulative SUVR exposure, as SCC is highly associated with the accumulated UVR dose in the skin over years, particularly in photo-exposed body regions, while repeated intense exposures over time for BCC, with intermittent patterns, seem more important [12]. The new 11th ICD revision (ICD-11) will finally include SCC and BCC in two separate categories, respectively, with codes 2C31 and 2C32, and will provide the possibility to use additional codes when identifying occupation as the primary factor for the disease, or as a cofactor, or coding the tumor as not occupation-related [13].

Considering the other important skin neoplasm, i.e., malignant melanoma, there are new data from recent research to be mentioned here. Currently, melanoma is still acknowledged as non-specifically related to outdoor work, as it is associated with repeated intense-SUVR exposures during childhood and reiterated sunburns at young age. Nevertheless, it has been reported that the specific form Lentigo Maligna Melanoma (LMM) may be associated with cumulative SUVR exposure [14]. The recent WHO-ILO systematic review judged the body of evidence on the association between occupational SUVR exposure and melanoma incidence as “limited” for the assessment of the harmfulness of the exposure. The meta-analysis performed indicated an increased RR of 1.16 (CI 95% 0.91–1.49), but it was not significantly elevated according to the confidence intervals. Nevertheless, when performing a sensitivity analysis of the studies specifically including LMM, a significantly increased RR of 1.45 (CI 95% 1.08–1.94) was calculated for SUVR-exposed workers. Another factor that should be mentioned here, possibly important when interpreting the recent WHO-ILO results, is that the systematic review criteria included also informal economy and very young OW, ≥ 15 years-old [11].

Speaking of melanoma, after years of repeated increases in its incidence, for the first time in Australia, a change of this trend was detected: A decreased incidence in age groups under 55 years has been observed [15]. This indicates an extremely important achievement of sun-safety initiatives and skin-cancer prevention. Certainly, parts of these results can be explained by the improvements in therapies and skin screening, but the data also suggest the effectiveness of the educational interventions performed. Australia is a pioneer in

skin cancer prevention since the early 1980s, including specific campaigns for OW [16]. Recent research particularly focused on the identification of the most effective ways to foster occupational SUVR-related health-risk prevention: Multi-component educational interventions including the provision of specific individual protections and of targeted information, which are improved with direct interactive communication systems, have been recognized as the most effective interventions [17]. Moreover, for this reason, WHO and the ILO, together with the World Meteorological Organization and the United Nations Environment Programme (UNEP), recently launched the SunSmart Global UV App in June 2022 [18].

3. Future Changes in Occupational SUVR Exposure Risk and Outdoor Activities Definitions?

Various research in the past considered malignant melanoma as a disease possibly affecting indoor workers, especially those from northern countries, with fair photo-types and repeated sunburns during their leisure time and vacations and often at lower latitudes [19]. More recently, this pattern has been hypothesized also for NMSC and, in particular, for BCC [20]. Climate change, with an increase not only in the temperature but also in the number of sunshine hours at least in some regions [21], may be one of the factors possibly responsible of these recent literature findings. Today, not only OW should be considered at risk for SUVR-related adverse effects but also mixed indoor–outdoor workers, and even indoor workers have to be advised on the negative consequences of their excessive leisure exposures. Currently, one of the latest available definitions of workers at risk for SUVR exposure adverse skin effects, applied in Germany as criteria for the recognition of occupational skin cancers, is that of considering spending more than 1 h outdoor between 11 a.m. and 4 p.m. at risk on more than 50 days in the period from April to September in the northern hemisphere [5].

In addition to climate change, the COVID-19 pandemic and, in particular, the cultural and behavioral changes induced by the pandemic and the preventive measures taken to prevent the spread of the virus have relevantly modified the way we perceive outdoor activities. Furthermore, the pandemic has determined profound changes in work organization, e.g., highly increasing telework [22,23], even if it should be noted that this does not necessarily indicate a reduction in SUVR exposure [24]. On the one hand, the lock-down measures and the restrictions of various job activities may have somewhat reduced the risk of excessive SUVR exposure for classic outdoor professions, such as gardeners or masons, at least for some months. Nevertheless, it has also to be noted that OW cannot perform any telework; thus, it is fundamental to persist in retaining strict preventive measures to reduce SUVR-related risks that they are exposed to. At the same time, for many workers that spend too much time indoor, there is also a risk of insufficient SUVR exposure, which is possibly related to a deficiency in vitamin D production, and this has to be carefully taken into account [25,26]. For example, it has been reported that night-shift work is associated with lower active vitamin D serological levels [27]. Considering this, an important challenge of future research is the identification of recommended ranges for the levels of SUVR doses we should absorb for an optimal balance between beneficial and adverse health effects. Currently available indications for the prevention of vitamin D deficiency and, in particular, for the prevention of osteoporosis and rickets recommend a SUVR exposure of 20–30 min of the face and the forearms for fair-skinned individuals at intermediate latitudes during midday and a repetition of this habit for 2–3 times per week [28,29].

Finally, it has to be mentioned that there is also a possible paradoxical effect of lock-down measures and telework, even increasing SUVR exposure for some categories of subjects, as recently reported [24]. In fact, many subjects felt confined to their homes/offices, and some of them possibly reacted by increasing their time outside whenever possible. This increase in outdoor activities can also be encouraged by the fear of being infected inside close environments with insufficient air circulation, particular in the case of crowded

places, as well as by the lab data demonstrating that SARS-CoV-2 is deactivated by UV rays and that it seems to have a lower spread in warmer months [30].

4. Conclusions

SUVR exposure is a recognized and relevant occupational hazard: Alongside the consolidated risk of developing NMSC and cataract, recent research has provided new evidence for an increased risk in incidence of specific forms of malignant melanoma, i.e., LMM, in outdoor workers. One of the main focuses of prevention activities is the organization of multicomponent sun-safety initiatives, which are proved to be effective by recent scientific publications, particularly when including technologies that are able to directly interact with individuals, such as phone' apps. Nevertheless, we should not forget that we are living in an era of profound changes, and phenomena such as climate change and the COVID-19 pandemic have an impact on all the aspects of our lives, including how and when we perform, as well as the perception of outdoor activities. In the future, this may result in possible changes in the scenario of occupational and leisure-time SUVR-exposure-related health risks.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

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