Summary and conclusion

Summary

UV radiation wavelengths range between 100 nm and 400 nm and are broadly categorised into UVA (>315–400 nm), UVB (>280–315 nm) and UVC (100–280 nm). The portion of solar UV radiation that reaches the earth's surface is composed predominantly of UVA and less than 5% UVB.

The sun is the main source of UV for most individuals. Sources of artificial UV radiation are used during indoor tanning, for medical applications and in some occupations. Indoor tanning facilities in general deliver higher relative intensities and higher proportions of UVA compared with solar UV radiation, but there are wide variations.

Several national and international organisations have presented recommendations regarding the use of indoor tanning facilities, but few countries regulate access and use.

The few studies that have addressed the biological changes in the skin induced by indoor tanning have shown that they are similar to those induced by sunlight.

Many studies have substantiated the carcinogenic effects of UV radiation. Experimental studies in humans have shown that in the basal layers of the epidermis, where melanocytes are located, UVA induces more DNA damage than does UVB.

Both UVA and UVB radiation can affect the immune system: while UVB induces immunosuppression at both the local and systemic levels, UVA does not induce systemic immune suppression. Exposure to tanning appliances has also been shown to induce changes in the skin immune system, including reduced skin test responses, changes in lymphocyte populations, and depression of NK cell activity.

Prevalence of indoor tanning varies greatly between countries; it is widespread in Northern Europe and North America, particularly among women and young people. Indoor tanning has increased considerably since the early 1980s. Several studies show common use by adolescents, and sometimes by children. The most frequent motivations for indoor tanning are the acquisition of a so-called "safe" tan and skin preparation before sun exposure. Limited evidence suggests that compliance with recommendations and regulations by indoor tanning facility operators and customers is poor.

Twenty-three published studies (22 case–control, one cohort) in light-skinned populations investigated the association between indoor tanning and risk for melanoma, and 7 case–control studies for keratinocytic skin cancers. Characterisation of exposure was highly variable across reports.

The summary relative risk for ever versus never use of indoor tanning facilities from the 19 informative studies was 1.15 (1.00–1.31). When the analysis was restricted to the nine population-based case–control studies and the cohort study, the summary relative risk was 1.17 (0.96–1.42). There was no consistent evidence for a dose–response relationship between indoor tanning exposure and risk for melanoma.

All studies that examined age at first exposure found an increased risk for melanoma when exposure started before approximately 30 years of age, with a summary relative risk estimate of 1.75 (1.35–2.26).

Studies on exposure to indoor tanning appliances and squamous cell carcinoma found some evidence for an increased risk for squamous cell carcinoma, especially when age at first use was below 20 years. Studies on basal cell carcinoma did not support an association with use of indoor tanning facilities.

Investigation of the association between indoor tanning and skin cancers poses challenging problems, as the fashion of indoor tanning is still very recent. Associations after long latency periods, such as may be expected for melanoma and basal cell carcinoma, may not yet be detectable.

Artificial UV sources are used to treat a variety of skin conditions, predominantly psoriasis.

Broadband UVB has been used for many years and, more recently, narrow-band UVB, but there are few data on which to base estimates of risk for skin cancer. PUVA therapy increases the risk for squamous cell carcinoma. Data concerning the risk for melanoma as a result of PUVA therapy are conflicting, but to date it seems likely that any increased risk for melanoma is small and that the latency is in excess of 20 years.

Case reports suggest that use of indoor tanning facilities is associated with the development of drug-induced photodermatoses and exacerbation of lupus erythematosus.

UV exposure is related to eye damage, including cataracts, corneal squamous cell carcinoma and ocular melanoma. Several epidemiological studies have shown an association between artificial UV exposure and ocular melanoma, especially if exposure occurred in adolescence or young adulthood.

Sources of vitamin D include photosynthesis in the skin in response to exposure to UVB radiation, oral intake from consumption of food and dietary supplements. In cases of insufficiency, supplementation through oral intake is recommended. Indoor tanning may produce vitamin D photosynthesis in the skin depending on the amount of UVB radiation, if any, in their emission spectrum, although the emission spectrum is generally unknown to consumers and operators.

Conclusion

The use of indoor tanning facilities is widespread in Europe and North America, and this impels consideration of the risk for adverse health consequences, particularly melanoma. Consideration is hampered by the relative recency of widespread use and the limitations of available studies.

Our systematic review of published studies, conducted mainly in North America and Europe, of the association of indoor tanning facility use with melanoma revealed an association of early age at first use (less than approximately 30 years) with melanoma risk. These studies consistently indicated a moderate strength of association, with a summary relative risk of 1.75 (1.35–2.26). The association with ever use of these facilities, or use more than 15 to 20 years prior to diagnosis of melanoma, was weak, and evidence regarding a dose–response relationship was scanty. The evidence is limited by variation in characterization of exposure, potential confounding by sun exposure or other variables, and the low power to detect associations that become evident only following a prolonged lag period after exposure.

The association between indoor tanning facility use and melanoma risk is consistent with the knowledge that melanoma is caused by exposure to solar radiation. Exposure to sunlight in childhood has been established as an important contributing factor for melanoma risk in adults. Although the contexts of exposure to sun and of indoor tanning differ, both deliver UV radiation, and the health effects would therefore be expected to be similar. The limited evidence for an association between indoor tanning and squamous cell carcinoma is consistent with the known association of sun exposure with that cancer. In light of the known effects of UV radiation on the skin, the biological plausibility of a causal association between use of indoor tanning facilities and risk for melanoma and squamous cell carcinoma is strong.

On balance, the evidence pertaining to the strength, consistency, dose–response and temporal sequence of the association of the use of indoor tanning equipment with melanoma risk, and of the coherence and biologic plausibility of the association, leads us to conclude that there is convincing evidence to support a causal relationship, particularly with exposure before the age of 35 years. This evidence is strongly suggestive and further studies could clarify our understanding of this association and allow more definitive conclusions.

We are cognizant of the importance of this issue for the health of light-skinned populations. The strength of the existing evidence suggests that policymakers should consider enacting measures, such as prohibiting minors and discouraging young adults from using indoor tanning facilities, to protect the general population from possible additional risk for melanoma.