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Human exposure to UV radiation and health implications

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There has been much debate on the relative risks (sunburn and skin cancer) and benefits (vitamin D synthesis) of sun exposure, specifically at the ultraviolet (UV) end of the spectrum. Acute excess exposure can be easily identified visually, albeit after the fact, and ample guidance exists on avoiding sunburn. It is less easy to determine a lower limit of exposure that will allow for the benefits of sun exposure, and to then set this within the context of avoiding over exposure. There is no simple indicator that vitamin D has been synthesised in the skin, and the variables that determine adequate vitamin D synthesis are even more numerous than those determining sunburn, and include the definition of adequate vitamin D.
Furthermore, human exposure (and human responses to exposure) differ at the individual level, with ambient UV, defined for example by the UV index, being only the first in a series of determinants of personal exposure. A number of carefully controlled experimental UV exposure studies observing and mimicking real-life (within strictly defined boundaries), have enabled us to quantify the change in vitamin D status at a known dose of UV radiation during a simulated summer, and to explore real-life exposure patterns under measured ambient radiation conditions. These studies have been conducted for a range of skin types, and for both adults and adolescents. Detailed spectral measurements of the experimental radiation regime, and sunlight, combined with seasonal measurements of personal UV exposure and vitamin D status allow us to use radiative transfer modelling to translate the results of our experimental UV exposures into simple real-life situations, validated by our observations. Since the combination of the atmospheric conditions, the local environment and human behaviour are infinitely variable there are caveats attached to our calculations. Nonetheless, they enable us to provide indications of the exposure time required, in sunlight, at various locations, to achieve and maintain selected levels of circulating 25-hydroxyvitamin D, the measure of vitamin D status. These exposures can then be assessed for their potential for skin damage, supported by our observations during the exposure studies.