Letters

The current public health message on UV exposure overlooks many health benefits

The recent review of the current public health message on UV exposure[1] appears to have overemphasized the health risks and undervalued the health benefits of solar ultraviolet-B (UVB) irradiance. For example, the health benefits of solar UVB and vitamin D in reducing the risk of cancer have been well documented. The authors of the review overlooked many recent papers on that topic,[2–7] Although several appeared after the WHO International Workshop on UV Exposure Guidance, in Munich, 17–18 October 2005, in which two of the authors participated. However, some of these papers were reviews and interpretations of papers that were discussed at the workshop.[2,3,6]

What is now in the literature shows vitamin D from UVB or oral sources reduces the risk of about 24 types of cancer,[4–7] that 1000–1500 IU of vitamin D per day is required to reduce cancer rates by 30–50%,[2–4] and that the evidence generally satisfies the criteria for causality in a biological system,[6] i.e. strength of association, nearly linear dose–response relation, consistency in different populations, identification of the mechanisms, and ruling out confounding factors.

So it is unclear what evidence from observational studies the authors would deem to be convincing. None of the adverse effects of UVB that they accept were established in clinical trials of humans, of course. Other authors have called for double-blinded intervention studies for the benefits. However, such trials are extremely time-consuming and would be impractical, as exposure to the sun, the main source of circulating vitamin D metabolites, cannot be randomly allocated.

Humans evolved with solar UVB and vitamin D, and there exist plenty of data to use in testing the UVB/vitamin D/cancer hypothesis, generally using the ecologic approach. When interpreted wisely and with modern multivariate methods to control for confounding, the ecologic approach can provide results that rival the validity of other observational approaches or (usually impossible) intervention studies.

One criticism of the ecologic studies used to make the link between solar UVB doses and cancer risk reduction is that those living in regions with higher UVB doses may not have higher UVB irradiances. However, this line of argument has been invalidated by a recent study that showed that a diagnosis of non-melanoma skin cancer, which is a biomarker of UVR dosage, is associated with reduced risk of a wide range of internal cancers if population average smoking rates are included in the analysis. In addition, it has been noted that non-melanoma skin cancer rates are inversely correlated with rates of many internal cancers in Spain and the United States of America.

It is neither necessary nor advised that people receive excess UV irradiance to obtain adequate vitamin D production. While it is now evident that ordinary dietary sources of vitamin D3 do not supply enough for adequate health (around 250–300 IU/day in the USA; very little fortification with vitamin D3 in Europe), supplements are a safe and reliable source of vitamin D3.[3] However, supplements are not consumed by enough people at high enough doses to have a substantial impact on health status, in part because there is little economic incentive to encourage use of supplements.

As for the rising epidemic of melanoma, there is strong evidence that it can be attributed to the effects of increased travel to sunny locations.[8] Europeans travelling from northern and central Europe to sunny vacation spots generally do not have sufficiently pigmented skin for the amount of time they spend in the sun, and many sunscreens in use historically did not (and still do not) provide adequate protection against UVA, the spectral region most strongly associated with melanoma risk.[9] Chronic UV irradiance such as through occupation is a risk reduction factor for melanoma at higher latitudes.[10] UVB irradiance is actually a risk reduction factor for melanoma, due in part to its role in eliciting the normal human photoprotective response (hypertrophy of the stratum corneum, upregulation of thymine dimer repair enzymes, and increased skin pigmentation) and in part to vitamin D production.[11]

A study in the USA estimated that the economic burden due to excess UV irradiance was US$ 5–6 billion, while that due to insufficient UVB and/or vitamin D was US$ 40–56 billion per year.[12] Similar studies for other non-tropical regions of the world would very likely find similar results.

WHO has a distinguished record of service to humanity. It is hoped that future reviews in the *Bulletin* contrasting the risks and benefits of UVB will provide more balanced coverage of the benefits that incorporates the latest research findings in this rapidly advancing field. ■

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Authors' response

We thank Dr William B Grant for his comments on our paper, "Is the current public health message on UV exposure correct?" Our review reflects the current status of research, which has been heavily weighted towards the adverse effects of UVR exposure but is now beginning to recognize a wide range of possible beneficial effects. The latter evidence is still developing.

At the recent WHO International Workshop on UV Exposure Guidance in Munich on 17–18 October 2005, Kricker and Armstrong reviewed the evidence on vitamin D/UVR exposure and a variety of internal cancers.[1] The conclusion, reiterated in the rapporteur's report,[2] was that there was supportive evidence for an association with colon cancer incidence, but that there were sufficient conflicting results for other cancers that further work was required before a causal association could be considered proven. Also, there is stronger evidence of a protective effect for cancer mortality than for cancer incidence, for a range of cancer types.[3,4]

Much of the work showing a protective effect of vitamin D/UVR on internal cancers comes from ecological studies. This study design is more suited to suggesting possible associations than for causal inference. For the latter, there are two major difficulties: first, in ecological studies it is not clear that those with the outcome had the exposure (or lack of exposure) of interest; second, findings from ecological studies cannot satisfy the only essential criterion for causality — that the exposure preceded the outcome.

While modern multivariate methods can include possible confounders, this adjustment can only be for averaged levels of those confounders for which there are population-level data. Thus, while average smoking levels can be included in multivariate analyses (although the rationale for considering smoking as a confounder of the UVR/cancer association is not clear), other possibly important confounders may not be able to be considered, for example physical activity levels. The same difficulties of not being sure which individuals had the exposure, outcome or confounder remain.

Ecological studies have examined cancer incidence and mortality in relation to latitude, ambient UVR or particular UVR wavelengths.[5,6] These results do not directly extrapolate to a protective effect of vitamin D adequacy. Indeed, Diffey et al. have shown that there is no relation between latitude and vitamin D levels in adult populations.[7] There are several ways in which UVR exposure may be beneficial to health that do not involve the vitamin D pathway.[8,9] Individual-level studies will clarify whether it is vitamin D, personal UVR dose (a function of ambient UVR and time in the sun), or some other correlate of latitude/ambient UVR that is important to cancer incidence.

Furthermore, there is some evidence that higher levels of vitamin D increase risk of prostate cancer[10] and pancreatic cancer.[11] We believe this is a time for caution — sun safety messages were developed under fear of ozone depletion and rapidly increasing skin cancer incidence. We are now recognizing that perhaps those messages require some moderation and that modest sun exposure is beneficial to health. It would be imprudent to leap into promotion of widespread vitamin D supplementation before we have clear evidence on the prevalence of insufficiency, risk factors for insufficiency and health outcomes associated with various blood vitamin D levels.

Dr Grant does not provide a reference for his statement about the association of non-melanoma skin cancers with internal cancers, if average smoking rates are included in the analysis. However, this is in direct contrast to a recent individual level study that found an *increased* risk of a wide range of internal cancers following a diagnosis of SCC — the best biomarker of chronic sun exposure.[12] Clearly, further work is required to clarify these contradictory results.

We agree with Dr Grant that the economic and disease burden due to insufficient UVR exposure may be greater than that associated with excessive UVR exposure — this is clear from the recent global burden of disease due to UVR exposure report, released by WHO July 2006.[13] This is a rapidly advancing field and it is extremely important that the evidence be assessed critically. This assessment must take account of study design and issues of possible bias and confounding to ensure that a safe and appropriate public health message regarding sun exposure and vitamin D intake is formulated and promoted. ■

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Studies on health and electromagnetic fields

Here are some comments on the review by Robyn M Lucas, Michael H Repacholi & Anthony J McMichael in the June 2006 issue of the *Bulletin*.

This is a very good review. I will comment on some statements from the text. I will also refer to two WHO projects regarding studies on health and electromagnetic fields (EMFs) in which I am currently involved.[1,2]

"Skin cancer (is) caused by excessive exposure to UVR." This is not necessarily true; another hypothesis is that the increase is caused by reduced efficiency of the skin-damage repair process.[3]

"There is evidence that the incidence of skin cancer is beginning to plateau in some countries." It is important to note that for cutaneous malignant melanoma (CMM) it is the incidence among younger age cohorts that has levelled off; this is yet not so for older cohorts. This indicates an environmental change some 50 years ago, and that we will have to wait until 2025 before all age cohorts flatten out, thus giving a stable age-standardized level.[3–5]

"The age-standardized incidence of CMM in southern and eastern Europe are now increasing sharply in all age groups." The change from the 70 to 87–108 MHz band for FM radio in eastern countries around 1990 onwards is expected to give increasing rates of CMM, as we noticed in Nordic countries from around 1955–1960 onwards. In the Nordic countries, the body-resonant FM radio was introduced starting in 1955. ■

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Authors' response

We thank Dr Hallberg for his comments on our paper "Is the current public health message on UV exposure correct?" We are aware of the research on EMF and melanoma; however, the weight of evidence supports a primary role for excessive UVR exposure in the causation of skin cancers.[1] Clearly other factors are important, including skin pigmentation and genetic susceptibility, for example defects in DNA repair seen in people with xeroderma pigmentosa.[2] Ecological studies support an hypothesis of a role for EMF in melanoma with hypothesized biological plausibility for a causative association via impaired cell repair and apoptosis — if individual-level studies support that hypothesis, UVR exposure remains of primary importance as the cause of the cell damage that requires repair.

We agree that the finding that some skin cancer incidence rates are beginning to plateau in younger age cohorts correlates with an environmental change some years ago. Since most evidence supports the importance of episodic excessive sun exposure in childhood for the later development of melanoma[3] (commonly diagnosed at 40–50 years), then an environmental change occurring not 50 years ago, but more like 30 years ago, could be driving the incidence rate plateau. This would be consistent with the initial concerns about ozone depletion and a resulting increased risk of skin cancers starting in the early 1970s.[4] Sun awareness and protection messages developed soon after this, particularly in those same countries in which plateauing melanoma incidence rates are now being observed.

Further evidence for sun exposure playing a role in melanoma comes from the consideration of changing incidence rates for cutaneous malignant melanoma, on sun-exposed compared to non-sun-exposed sites.[5] Individual-level work on the role of EMF will be required to clarify its role in the causation of skin cancers, particularly cutaneous malignant melanoma. ■

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