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JNCI-14-0602 FINAL REVISED VERSION FOR COPYEDITING**Re: Exposure to indoor tanning without burning and melanoma risk by sunburn history**

Vogel et al¹ provide another demonstration that the risk from sunbed use is not limited to skin-sensitive populations and shows increased risk even in those not having experienced sunburns in their lifetimes. It counters the argument frequently put forward by the indoor tanning industry that indoor tanning prevents sunburn and adds further evidence of the carcinogenicity of indoor tanning.

We are, however, concerned that those who consider vitamin D as a protective agent for cancer and thus defend sunbed use, might misinterpret the decline in odds ratio (OR) for increasing burns and consider that the increasing burns diminished the effect of sunbed use, hence providing “protection”.

Our interpretation is that the declining trend of OR from sunbed use by increasing number of burns is a marker of an additive effect of sunbed use. Indeed, the modeling approach used in most publications on this subject, including that of Vogel et al.(1), relied on an implicit multiplicative effect of risk factors. The declining trend of association with sunbed use in the stratified analysis indicates a failure in the multiplicative effect assumption. In Table 1, we derive a crude calculation of ORs for sunburns (using 0 as reference), assuming a background risk of 10 per 100,000 person years, and model incidence in sunbed users and in non-users (Table 1). We also computed the difference in incidence between the two groups and apart from the first category based on small numbers, the risk difference remained constant.

This suggests that sunbed use has an effect on melanoma risk independently from the effect of sunburns. This hypothesis is in line with a study in Iceland showing rapid decrease in incidence of melanoma after strong regulation of sunbeds, since a change in sunbed use would result in change in incidence independently of other factors.²

Thus the additive effect of sunbed use could have been hidden by the multiplicative assumption used in past research. Consequently, the overall population impact of sunbed use could be even greater than anticipated.

Sunbed exposure is by far the most easily preventable skin cancer risk factor. This is an important public health issue since the risk is high, especially in youth. The prevalence of sunbed use is very high in adolescents and young adults.³ A growing number of countries have introduced regulations to reduce the public’s exposure. Such public health actions may result in a decrease in risk, as shown by the example in Iceland.^{2,4}

Considering that it is not possible to define a safety limit, Brazil chose in 2009 to ban the use of tanning beds for cosmetic purposes. Brazil's ban has been followed by New South Wales, and now every Australian state has either banned or plans to outlaw commercial sunbeds.

In view of the rapid expansion in marketing and use for cosmetic purposes of tanning devices emitting carcinogenic UV rays, without any beneficial health effect, and in view of the limited efficiency of control measures, we recommend the cessation of the marketing and commercial use of UV-emitting tanning beds.

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Table 1. Computation of incidence of melanoma in sunbed users and non-sunbed users with risks from Table 1 of Vogel et al 2014 and assuming a background melanoma rate of 10 per 100,000 person-years

No. of sunburns	OR for sunbed use	OR for sunburns	Incidence* for sunbed users	Incidence* for non-sunbed users	Difference in incidence*
0	3.87	1 (ref)	38.7	10	28.7
1-2	1.78	1.49	26.6	14.9	11.7
3-5	1.49	1.92	28.5	19.2	9.4
>5	1.42	2.38	33.8	23.8	10

* Per 100,000 person years, assuming a background risk of 10 per 100,000 person-years. OR = odds ratio.