

Indoor Tanning and Risk of Melanoma: a Case-Control Study in a Highly Exposed Population – Response

Grant and colleagues state that our observed multivariate-adjusted odds ratio of 1.74 (95% confidence intervals, 1.42-2.14; ref. 1) for past versus never use of indoor tanning is “puzzling(ly)” high compared with some of the studies summarized in the IARC meta-analysis (2), primarily because we included individuals at high risk for melanoma. To back this claim, Grant and colleagues cite his re-analysis (3) of the IARC meta-analysis and use our

published data to estimate how much of the melanoma risk associated with indoor tanning could be explained by these risk factors.

The weakly positive association for indoor tanning in relation to melanoma reported in the IARC meta-analysis, in contrast with our results, is not surprising when we consider major differences between past research on this topic and our study. To give just a few examples, we note the less detailed exposure assessment in the studies reviewed by IARC, the fact that prior studies did not restrict their analyses to cases with melanomas occurring by the age of 59 years, and they typically had smaller numbers of participants with

Table 1. Comparison of past to never users of indoor tanning among cases and controls stratified by established melanoma risk factors

	Cases		Controls		Adjusted OR* (past vs. never use)	95% confidence intervals	P for interaction
	N	% Exposed	N	% Exposed			
Eye color							
Gray/blue	529	61.0	445	47.6	2.28	(1.64-3.16)	0.50
Green	175	72.6	142	57.7	1.48	(0.74-2.97)	
Hazel	237	64.6	236	55.0	1.60	(1.02-2.51)	
Brown	226	58.0	278	50.0	1.36	(0.88-2.10)	
Hair color							
Red	120	56.7	46	47.8	1.64	(0.64-4.19)	0.63
Blonde	362	68.5	226	57.1	2.00	(1.27-3.13)	
Light brown	396	64.6	438	53.2	1.95	(1.39-2.74)	
Dark brown	289	56.1	391	45.8	1.61	(1.10-2.36)	
Skin color							
Very fair	215	56.2	128	46.1	1.77	(0.98-3.20)	0.31
Fair	827	63.6	746	52.1	1.80	(1.40-2.31)	
All other	125	61.6	227	50.6	1.88	(1.07-3.31)	
Moles							
Some/many	321	71.7	104	60.6	1.98	(1.08-3.63)	0.56
Few	644	61.5	545	52.5	1.83	(1.39-2.40)	
None	191	52.9	446	46.9	1.91	(1.25-2.92)	
Number of painful sunburns							
0-2	201	65.7	289	48.4	2.28	(1.39-3.76)	0.18
3+	963	62.2	810	52.1	1.68	(1.33-2.13)	
Skin sensitivity to sun [†]							
Painful sunburn, then peeling	423	64.3	318	50.6	2.03	(1.39-2.97)	0.94
Mild burn, then tan	579	63.6	551	55.9	1.64	(1.21-2.20)	
Tan without sunburn	116	55.2	181	42.0	2.32	(1.24-4.34)	
Family history of melanoma							
Yes	216	70.0	224	51.8	2.75	(1.62-4.68)	0.04
No	939	61.6	850	50.7	1.61	(1.28-2.02)	

*All odds ratios were adjusted for age, gender, freckles, income, education, routine sun exposure, outdoor activity sun exposure, outdoor job exposure, and mean sunscreen use; depending on the analysis, odds ratios were additionally adjusted for eye color, natural hair color, skin color, moles, number of lifetime painful sunburns, and family history of melanoma, unless stratified on that characteristic.

[†]Unable to estimate an odds ratio among cases and controls who severely burn or who do not experience sun-related changes due to small numbers [severely burned: 27 cases (55.6% exposed), 30 controls (43.3% exposed); no sun-related changes: 9 cases (44.4% exposed), 17 controls (17.7% exposed)].

substantial exposure. Although we did not publish the distribution of indoor tanning use across the various risk factors that would allow the reader to fully assess their potential for confounding, the crude odds ratio of 1.62 (see Table 5 of our report) was, in fact, stronger after adjustment for the very risk factors that Grant and colleagues suggest would "...explain nearly all the risk found" with exposure to indoor tanning.

To unequivocally address the concerns raised by Grant and colleagues, we present a stratified analysis according to the characteristics known to increase the risk of melanoma (see Table 1). Regardless of the characteristic used to stratify, the risk of melanoma in relation to indoor tanning use is elevated at about the same magnitude or greater as in our published report, the confidence intervals exclude the null value in almost all comparisons, and the *P* values for interaction are nonsignificant, except for family history. Although not reported here, we also consistently found a dose-response for melanoma risk in relation to the total number of indoor tanning sessions stratified by these same risk factors. Comparing persons in the highest category of use (e.g., 100+ sessions) to never users, the risk of melanoma was increased 2.2 to 4.9 times across all categories of risk defined in Table 1. Confidence intervals excluded the null value, and the *P* values for trend were highly significant in all but one instance (among red-haired persons).

In their letter, Grant and colleagues conclude that "those with preexisting high-risk factors... should be careful in using indoor tanning...". Our data clearly indicate that both persons with and persons without these factors should expect that use of indoor tanning, especially frequent use, will increase their risk of developing malignant melanoma.

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