Sunbed Use in Europe: Important Health Benefits and Minimal Health Risks

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Outline

- Health Benefits of UV exposure
  - Vitamin D production
  - Nitric oxide release to lower blood pressure
  - Observed benefits from sunbed use
  - Observed benefits from solar UV exposure
- Minimal risk from sunbed use in Europe
  - Meta-analysis of melanoma with solaria use in Europe
  - Trends of melanoma

Sunbeds as Vitamin D Sources

- We have therefore performed an intervention study in 105 young adults (ages 18-30 years; 91% female) over a mid-winter 8-week period (January-March 2010). The participants were randomised to 3 groups:
- (A) subjected to 3 times a week sub-sunburn sunbed exposure (n = 35), 25(OH)D rose from 62 to 109 nmol/L
- (B) daily vitamin D supplementation, @ 1000 IU (n = 37), 25(OH)D rose from 58 to 93 nmol/L
- (C) a control group without any intervention (n = 33), 25(OH)D dropped from 62 to 55 nmol/L
- Thus, sunbed use was equivalent to about 3000 IU
- De Gruijl and Pavel, Photochem Photobiol Sci. 2012;11(12):1848-54.

Nitric Oxide Liberation by UVA

- In 24 healthy volunteers, irradiation of the skin with two standard erythemal doses of UVA lowered blood pressure (BP), with concomitant decreases in circulating nitrate and rises in nitrite concentrations.
- UVA-induced nitric oxide (NO) release occurs in a dose-dependent manner, with the majority of the light-sensitive NO pool in the upper epidermis.
- Collectively, our data provide mechanistic insights into an important function of the skin in modulating systemic NO bioavailability, which may account for the latitudinal and seasonal variations of BP and CVD.
- Liu et al., J Invest Dermatol. 2014;134(7):1839-46.

Sunbeds Used in Europe Can Be Considered Artificial Sun Sources

- Solaria in Europe are limited to 0.3 W/m^2, which is the same as Mediterranean mid-summer mid-day solar intensity.
- Both sun exposure and sunbed use have many health benefits.
- Both UVA and UVB have health benefits, and man has evolved to take advantage of both.
- Examples to follow.

Active Sun Exposure: Lower Risk of Venous Thrombotic Events (Blood Clots)?

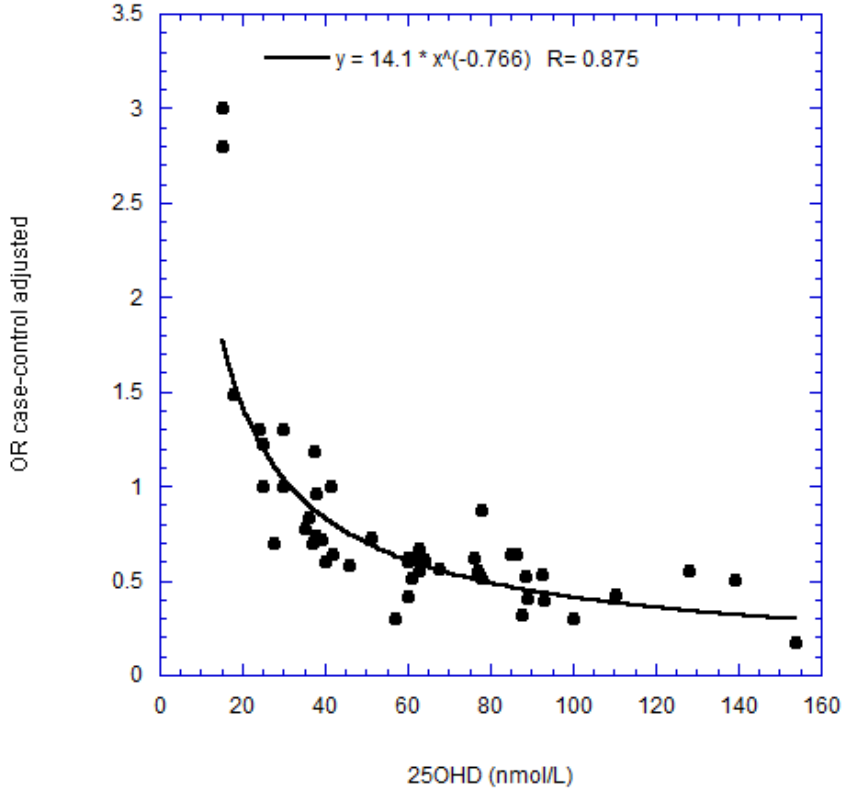
- Swedish women who sunbathed during the summer, on winter vacations, or when abroad, or used a tanning bed, were at 30% lower risk of VTE than those who did not.
- The risk of VTE increased by 50% in winter as compared to the other seasons; the lowest risk was found in the summer.
- Lindqvist et al., J Thromb Haemost. 2009;7(4):605-10.

Active Sun Exposure Habits: Risk of Type 2 Diabetes Mellitus in Women

- Our findings indicated that women with active sun exposure habits (including use of sunbeds) were at a 30% lower risk of having DM, as compared to those with non-active habits.

- Lindqvist et al. Diabetes Res Clin Pract. 2010;90(1):109-14.

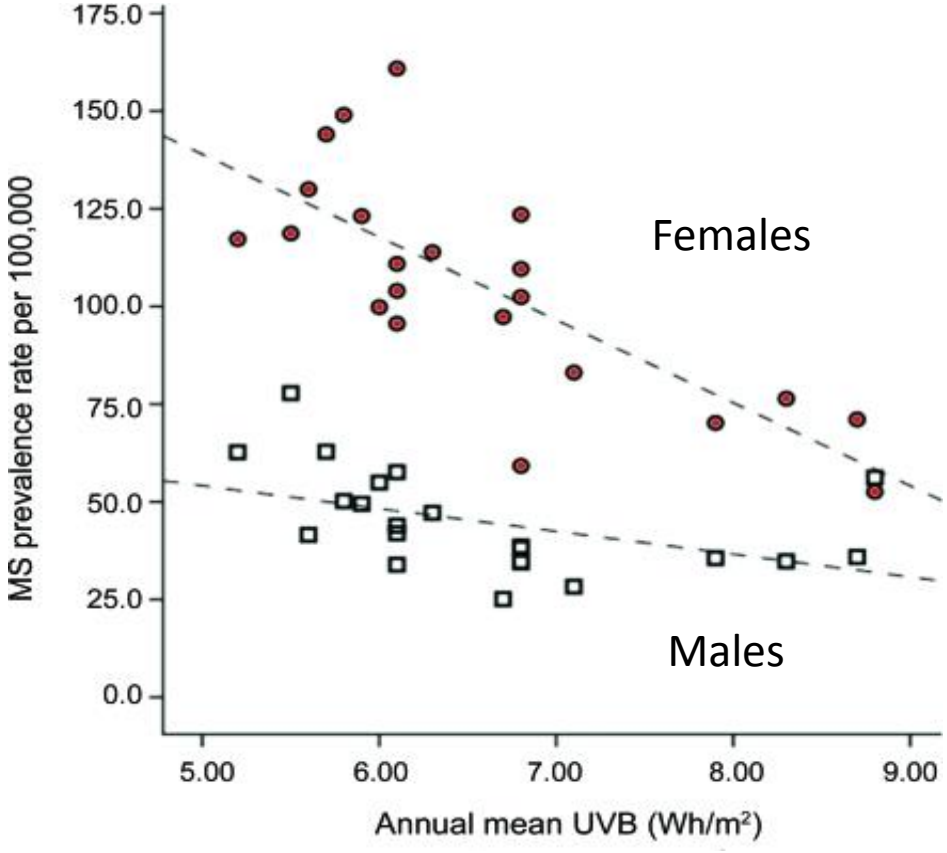
Relation Between 25(OH)D Concentration and Breast Cancer Risk



Based on 11 case-control studies from seven countries.

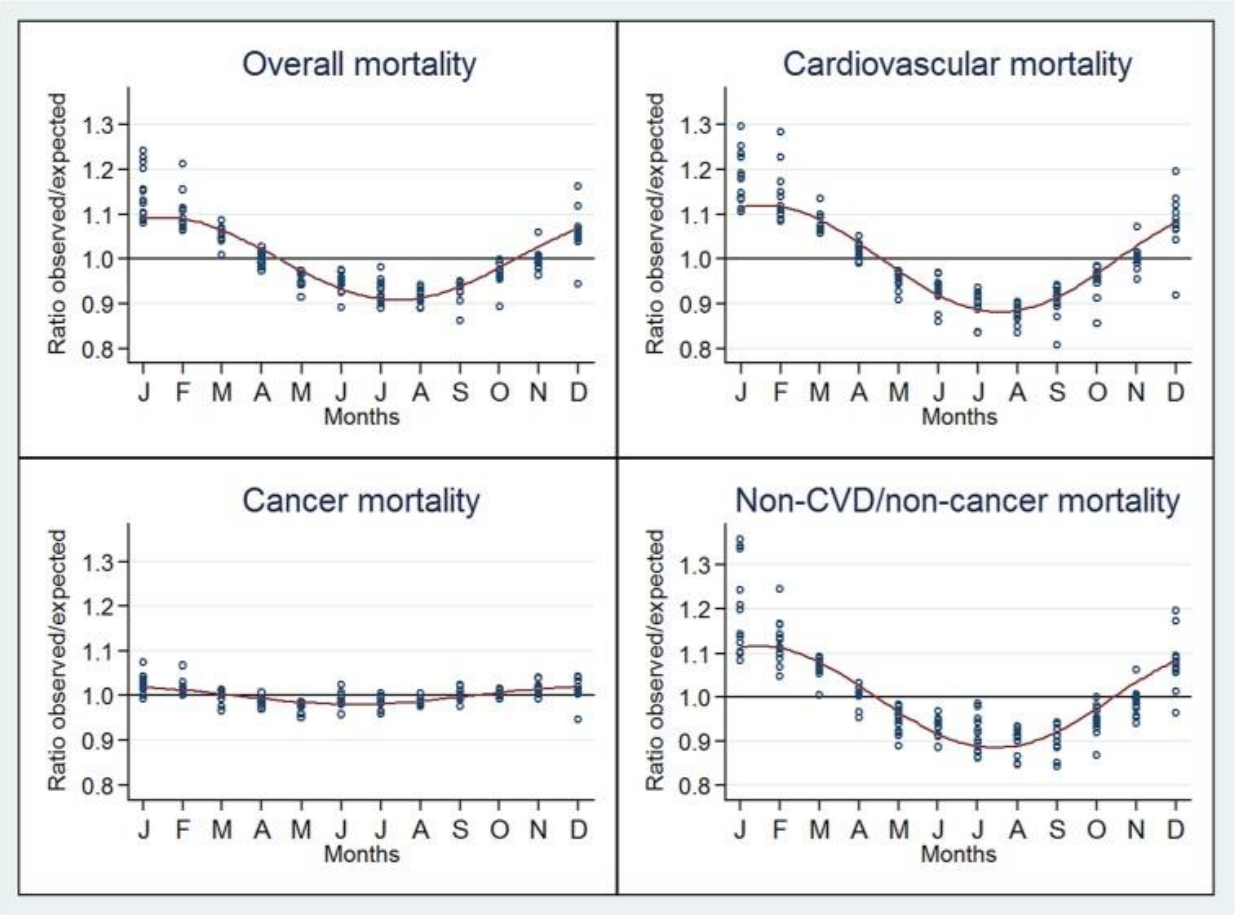
Grant WB. 25-Hydroxyvitamin D and breast cancer, colorectal cancer, and colorectal adenomas: case–control versus nested case–control studies, Anticancer Res. 2015;35(2):1153-60.

Multiple Sclerosis Prevalence vs. UVB Doses in France



Orton et al., Association of UV radiation with multiple sclerosis prevalence and sex ratio in France**.**
Neurology. 2011;76(5):425-31.

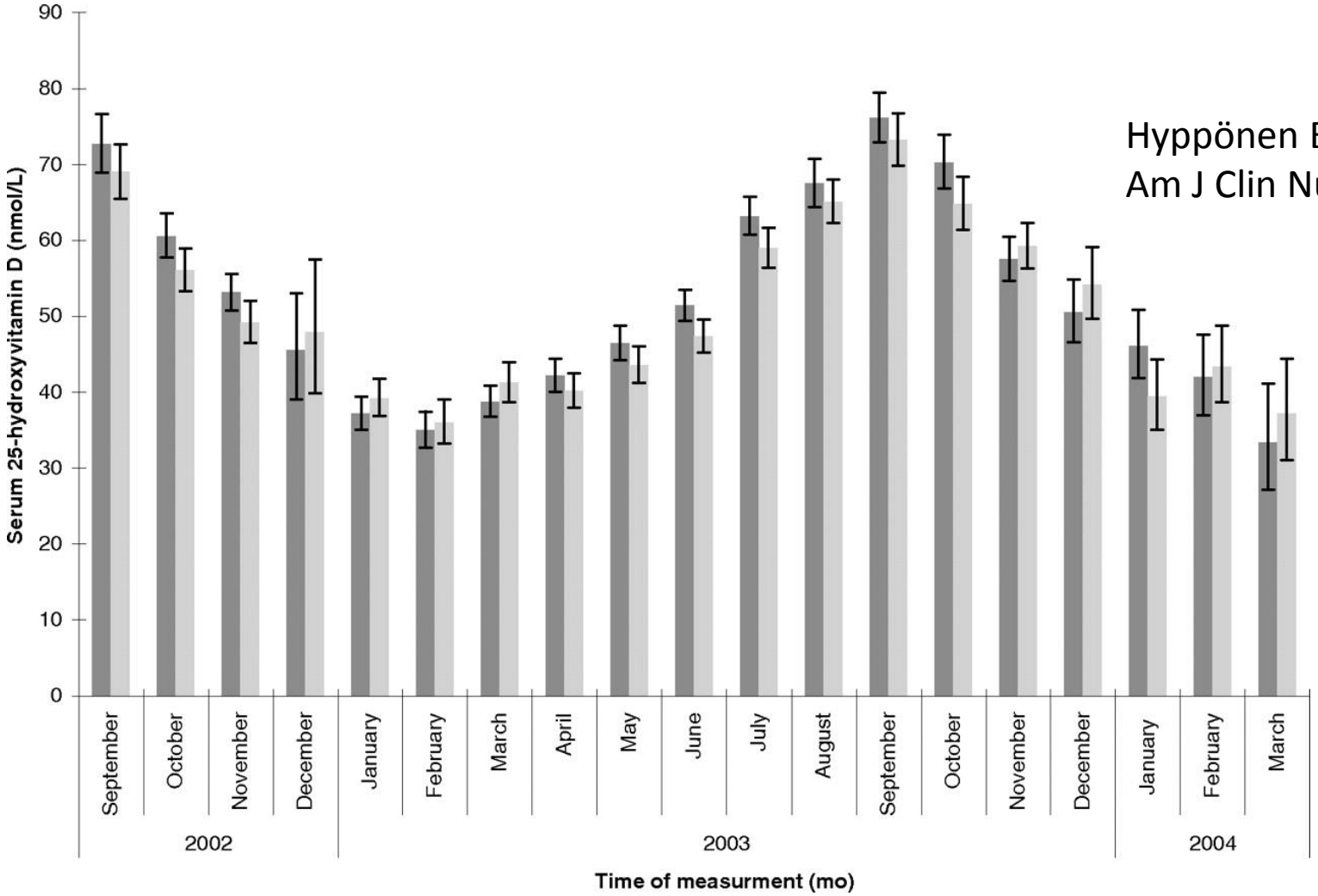
Death Rates Are Highest in Winter, Lowest in Summer



Three primary reasons: Temperature, 25(OH)D concentrations, and infections.

Marti-Soler et al., PLoS One. 2014;9(11): e113500

Hypovitaminosis D in British Adults at Age 45 Years



Hyppönen E, Power C.
Am J Clin Nutr, 2007

An estimate of the global reduction in mortality rates through doubling vitamin D levels - 1

- The goal of this work is to estimate the reduction in mortality rates for six geopolitical regions of the world under the assumption that serum 25-hydroxyvitamin D (25(OH)D) levels increase from 54 to 110 nmol/L.
- The vitamin D-sensitive diseases that account for more than half of global mortality rates are CVD, cancer, respiratory infections, respiratory diseases, tuberculosis and diabetes mellitus.
- Additional vitamin D-sensitive diseases and conditions that account for 2 to 3% of global mortality rates are Alzheimer's disease, falls, meningitis, Parkinson's disease, maternal sepsis, maternal hypertension (pre-eclampsia) and multiple sclerosis.
- Increasing serum 25(OH)D levels from 54 to 110 nmol/L would reduce the vitamin D-sensitive disease mortality rate by an estimated 20%.

An estimate of the global reduction in mortality rates through doubling vitamin D levels - 2

- The reduction in all-cause mortality rates range from 7.6% for African females to 17.3% for European females. The estimated increase in life expectancy is 2 years for all six regions.
- Increasing serum 25(OH)D levels is the most cost-effective way to reduce global mortality rates, as the cost of vitamin D is very low and there are few adverse effects from oral intake and/or frequent moderate UVB irradiance with sufficient body surface area exposed.

- Grant WB. Eur J Clin Nutr. 2011;65(9):1016-26.

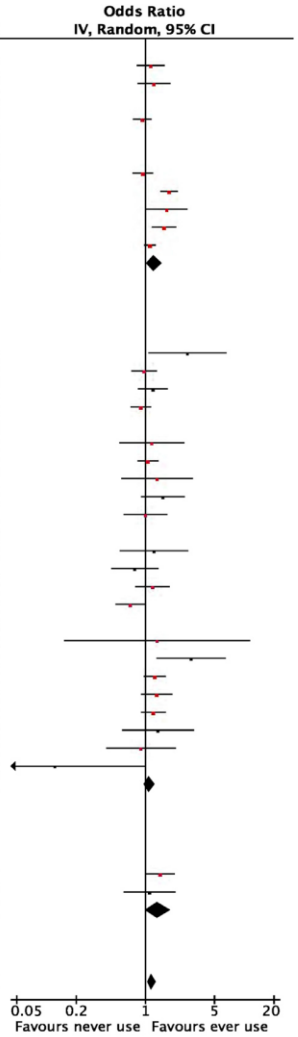
Cancer Incidence and Mortality Patterns in Europe in 2012

- Vitamin D-sensitive cancers (oesophagus, stomach, colorectal, liver, gallbladder, pancreas, larynx, lung, breast, ovarian, kidney, bladder, lymphoma)
  - Incidence: 1.38 million cases/yr
  - Mortality: 0.59 million deaths/yr
- Melanoma
  - Incidence: 82 thousand cases/yr
  - Mortality: 16 thousand deaths/yr
- Ratio melanoma to vitamin D-sensitive cancers
  - Incidence: 0.06
  - Mortality: 0.03

- Ferlay et al. Cancer incidence and mortality patterns in Europe: estimates for 40 countries in 2012. Eur J Cancer. 2013;49(6):1374-403.

Melanoma and Sunbed Use in Europe

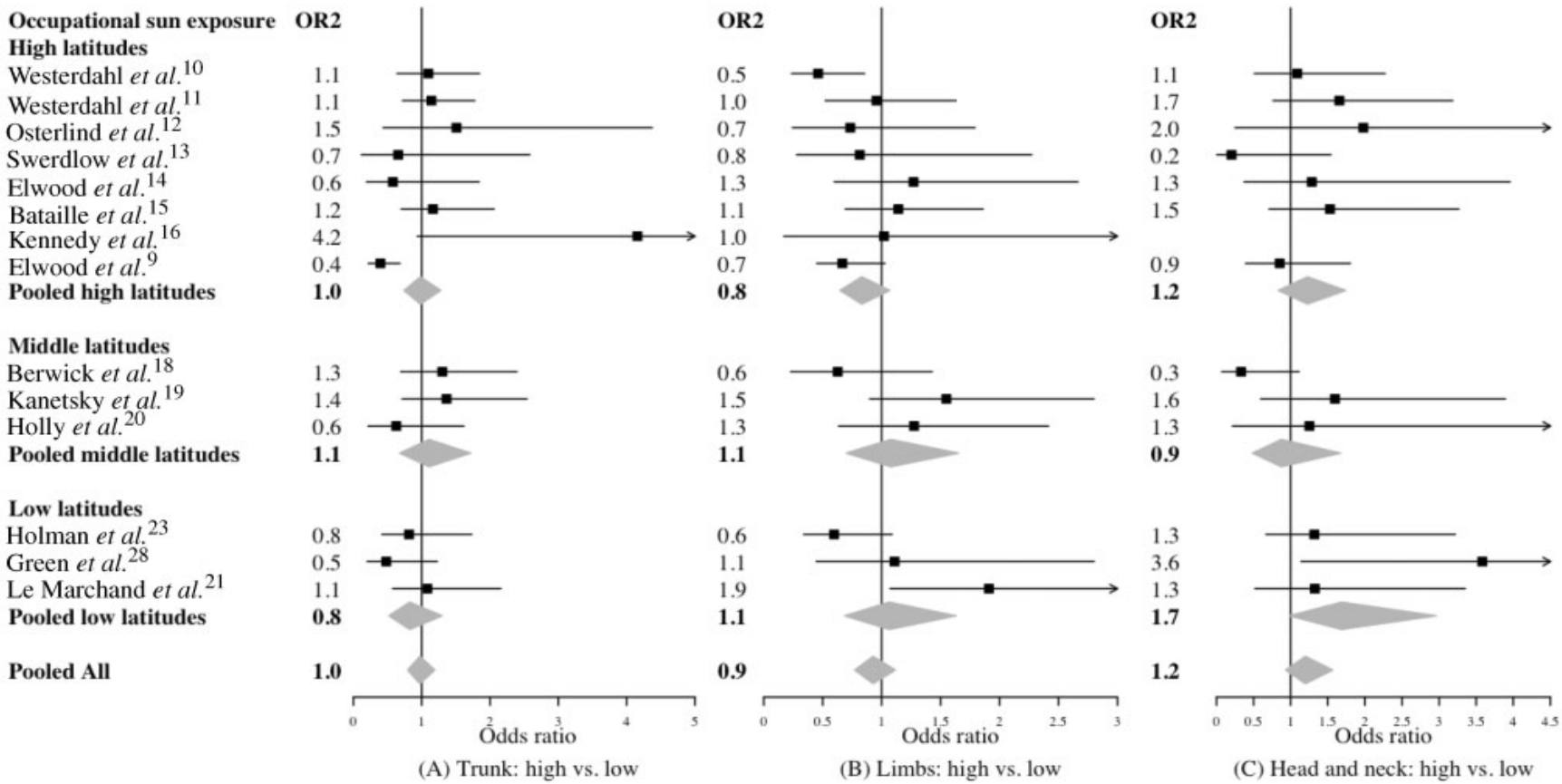
Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
1.1.1 North America				
Chen et al. 1998[42]	0.1222	0.1636	4.2%	1.13 [0.82, 1.56]
Clough-Gorr et al. 2008[43]	0.1989	0.1965	3.5%	1.22 [0.83, 1.79]
Dubin et al. 1989[22]	0	0		Not estimable
Fears et al. 2011[44]	-0.0726	0.1098	5.6%	0.93 [0.75, 1.15]
Gallagher et al. 1986[23]	0	0		Not estimable
Holly et al. 1987[24]	0	0		Not estimable
Holly et al. 1995[45]	-0.0619	0.1221	5.3%	0.94 [0.74, 1.19]
Lazovich et al. 2010[46]	0.5539	0.1037	5.8%	1.74 [1.42, 2.13]
Ting et al. 2007[41]	0.4947	0.2473	2.6%	1.64 [1.01, 2.66]
Walter et al. 1999[47]	0.4318	0.1446	4.7%	1.54 [1.16, 2.04]
Zhang et al. 2012[48]	0.1044	0.0688	6.8%	1.11 [0.97, 1.27]
Subtotal (95% CI)			**38.6%**	**1.23 [1.03, 1.47]**
Heterogeneity: Tau² = 0.05; Chi² = 28.20, df = 7 (P = 0.0002); I² = 75%				
Test for overall effect: Z = 2.25 (P = 0.02)				
1.1.2 Europe				
Adam et al. 1981[39]	0.9783	0.4646	1.0%	2.66 [1.07, 6.61]
Autier et al. 1994[49]	-0.0305	0.1521	4.5%	0.97 [0.72, 1.31]
Bataille et al. 2004[50]	0.174	0.1777	3.9%	1.19 [0.84, 1.69]
Bataille et al. 2005[51]	-0.1054	0.121	5.3%	0.90 [0.71, 1.14]
Beitner et al. 1990[21]	0	0		Not estimable
Dunn-Lane et al. 1993[52]	0.149	0.3864	1.4%	1.16 [0.54, 2.48]
Elliott et al. 2012[53]	0.0583	0.1248	5.2%	1.06 [0.83, 1.35]
Elwood et al. 1986[54]	0.27	0.4246	1.2%	1.31 [0.57, 3.01]
Garbe et al. 1993[40]	0.4055	0.2606	2.5%	1.50 [0.90, 2.50]
Kaskel et al. 2001[55]	0	0.2606	2.5%	1.00 [0.60, 1.67]
Klepp & Magnus 1979[25]	0	0		Not estimable
MacKie et al. 1989[38]	0.1989	0.4065	1.2%	1.22 [0.55, 2.71]
Naldi et al. 2000[56]	-0.2485	0.2806	2.2%	0.78 [0.45, 1.35]
Nielsen et al. 2012[57]	0.1655	0.2047	3.3%	1.18 [0.79, 1.76]
Osterlind et al. 1988[58]	-0.3567	0.1717	4.0%	0.70 [0.50, 0.98]
Rodenas et al. 1996[26]	0	0		Not estimable
Schmitt et al. 2011[59]	0.27	1.1057	0.2%	1.31 [0.15, 11.44]
Swerdlow et al. 1988[60]	1.0647	0.4094	1.2%	2.90 [1.30, 6.47]
Veierod et al. 2010[61]	0.2151	0.1306	5.1%	1.24 [0.96, 1.60]
Westerdahl et al. 1994[62]	0.2624	0.1876	3.7%	1.30 [0.90, 1.88]
Westerdahl et al. 2000[63]	0.1823	0.1468	4.6%	1.20 [0.90, 1.60]
Wolf et al. 1998[64]	0.2927	0.4273	1.1%	1.34 [0.58, 3.10]
Zanetti et al. 1988[65]	-0.1054	0.4137	1.2%	0.90 [0.40, 2.02]
Zivkovic et al. 2012[66]	-2.1115	1.0707	0.2%	0.12 [0.01, 0.99]
Subtotal (95% CI)			**55.5%**	**1.10 [0.98, 1.24]**
Heterogeneity: Tau² = 0.02; Chi² = 29.86, df = 20 (P = 0.07); I² = 33%				
Test for overall effect: Z = 1.56 (P = 0.12)				
1.1.3 Oceania				
Cust et al. 2011[67]	0.3436	0.1702	4.1%	1.41 [1.01, 1.97]
Holman et al. 1986[68]	0.0953	0.3093	1.9%	1.10 [0.60, 2.02]
Subtotal (95% CI)			**6.0%**	**1.33 [0.99, 1.78]**
Heterogeneity: Tau² = 0.00; Chi² = 0.49, df = 1 (P = 0.48); I² = 0%				
Test for overall effect: Z = 1.92 (P = 0.06)				
Total (95% CI)			**100.0%**	**1.16 [1.05, 1.28]**
Heterogeneity: Tau² = 0.03; Chi² = 62.05, df = 30 (P = 0.0005); I² = 52%				
Test for overall effect: Z = 3.02 (P = 0.003)				
Test for subgroup differences: Chi² = 1.93, df = 2 (P = 0.38), I² = 0%				



Odds ratios:
Europe: 1.10 (0.98-1.24)
North America: 1.23 (1.03-1.47)
Oceania: 1.33 (0.99-1.78)

Colantonio S, Bracken MB, Beecker J. The association of indoor tanning and melanoma in adults: systematic review and meta-analysis. J Am Acad Dermatol. 2014;70(5): 847-57.e1-18.

Occupational Sun Exposure and Risk of Melanoma



Chang YM, et al. Sun exposure and melanoma risk at different latitudes: a pooled analysis of 5700 cases and 7216 controls. Int J Epidemiol. 2009;38(3):814-30.

Melanoma Trends Are Affected by “Overdiagnosis”

- **RESULTS:** Between 1994 and 2010, 34,156 persons were diagnosed with an in situ or thin melanoma. The European standardised rates (ESR) of in situ melanomas doubled for males and females with a recent steeper rise in incidence (EAPC 12% (95% confidence interval [CI]: 8.1-16) and 13% (95% CI: 5.9-20), respectively). ESR for thin melanomas amongst males approximately doubled with a steep, but non-significant acceleration compared to other thickness categories since 2006 for <0.25 mm melanomas (EAPC 26% (95% CI: 2.1-35)). For female patients with thin melanomas the ESRs increased almost two-fold, except for <0.25 mm melanomas.
- **CONCLUSIONS:** The incidence rates of in situ, thin and thick melanomas increased similarly between 1994 and 2010. Recently steep increases were found for in situ melanomas and thin melanomas in men. Explanations are 'overdiagnosis' in conjunction with increased ultraviolet exposure (natural and artificial) and therefore a 'true' increase, increased awareness, early detection, diagnostic drift and changed market forces in the Dutch health care system.

- Van der Leest et al., Increasing time trends of thin melanomas in The Netherlands: What are the explanations of recent accelerations? Eur J Cancer. 2015;51(18):2833-41.

How Does The Body Protect Against Melanoma?

- The mechanisms related to UV exposure that are protective against melanoma include:
  - Tanning (reduces penetration of UVA and melanin repairs DNA damage)
  - Thickening of the stratum corneum (outer layer)
  - Vitamin D production, which includes both 25(OH)D and 1,25$(OH)_2$D in the skin. 1,25$(OH)_2$D reduces risk of cancer incidence, progression and metastasis.

Hill's Criteria for Causality in a Biological System: Melanoma Risk from Sunbed Use

- Strength of association: very weak
- Consistency: no
- Temporality: ? Many factors affect melanoma trends
- Biological gradient: weak since occupational UV exposure is not a risk factor
- Plausibility: yes
- Coherence: yes
- Experiment: no
- Accounting for confounding factors: weak – hard to separate indoor tanning from outdoor tanning
- **Conclusion: Hill's criteria are not well-enough satisfied to guide public policy regarding sunbed use in Europe**
- Hill AB. The environment and disease: Association or causation? Proc R Soc Med. 1965;58:295-300.

Conclusion

- There are many health benefits from UV exposure whether from the sun or sunbeds.
- Demonstrated health risks associated with sunbed use in Europe are minimal.
- Sunscreen abuse is a much more important problem since sunscreen blocks vitamin D production and permits greater UVA exposure.