

**Scientific Committee on Health, Environmental and Emerging Risks
(SCHEER)**

**Opinion on
Biological effects of ultraviolet radiation
relevant to health with particular reference to sunbeds
for cosmetic purposes (November 2016)**

HEALTH EFFECTS – Biology

Dr. Rüdiger Greinert
Head of Dept. Mol. Cellbiology
Skin Cancer Center Buxtehude/Elbeclinics Buxtehude

Secretary General EUROSKIN

Scientific Committee on Health, Environmental and Emerging Risks

SCHEER

**Opinion on
Biological effects of ultraviolet radiation
relevant to health with particular reference to sunbeds
for cosmetic purposes**



The SCHEER approved this Opinion at its plenary on 17 November 2016

Artificial tanning devices (a Webinar)
WHO, Geneva, June 28, 2017



ABSTRACT

Following a request from the European Commission, the Scientific Committee on Health, Environmental and Emerging Risks reviewed recent evidence to update the 2006 Opinion of the Scientific Committee on Consumer Products on the Biological effects of ultraviolet radiation (UVR) relevant to health, with particular reference to sunbeds for cosmetic purposes. The term "sunbed" refers to all types of UV tanning devices used for cosmetic purposes.

UVR, including UVR emitted by sunbeds, is a complete carcinogen, as it acts both as an initiator and a promoter. Based on the available scientific evidence the Committee concludes that there is strong evidence that exposure to UVR, including that emitted by sunbeds, causes cutaneous melanoma and squamous cell carcinoma at all ages and that the risk for cancer is higher when the first exposure takes place in younger ages. There is also moderate evidence that exposure to UVR, including that emitted by sunbeds, also increases the risk of basal cell carcinoma and ocular melanoma.

The beneficial effects of sunbed use, such as generation of vitamin D, are outweighed by the adverse effects. There is no need to use sunbeds to induce vitamin D production because alternative sources of vitamin D are readily available.

There is no threshold level of UV-irradiance and UV-dose for the induction of skin cancer. Therefore, there is no safe limit for exposure to UV radiation from sunbeds.

Keywords: Ultraviolet radiation, UV-tanning devices, Sunbeds, Health effects, Risk assessment, SCHEER

Wavelengths

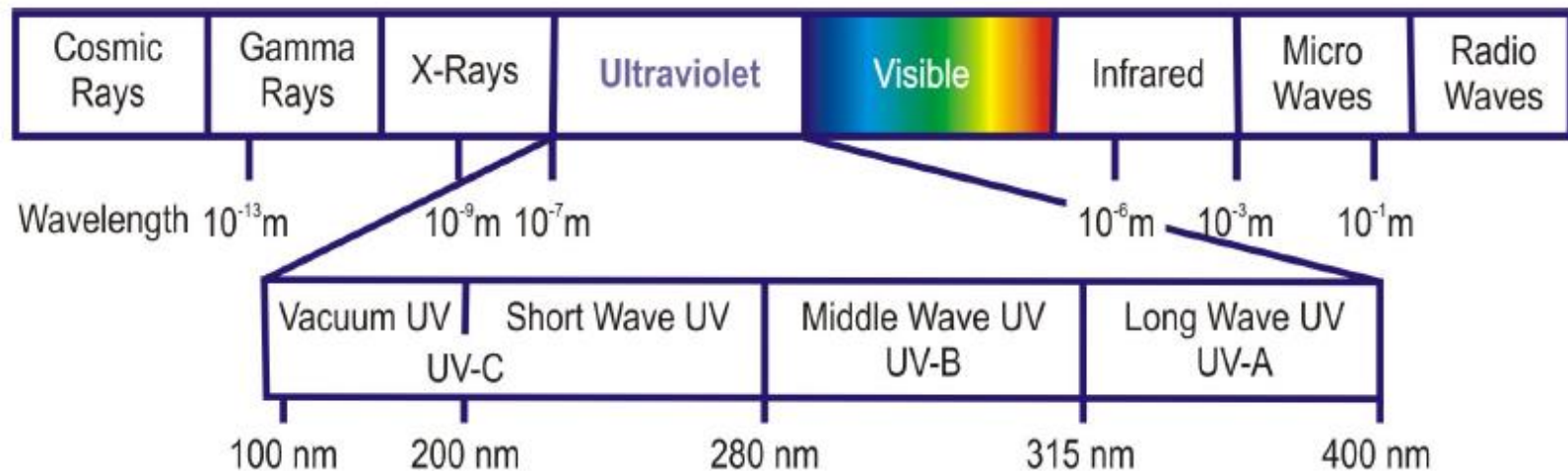
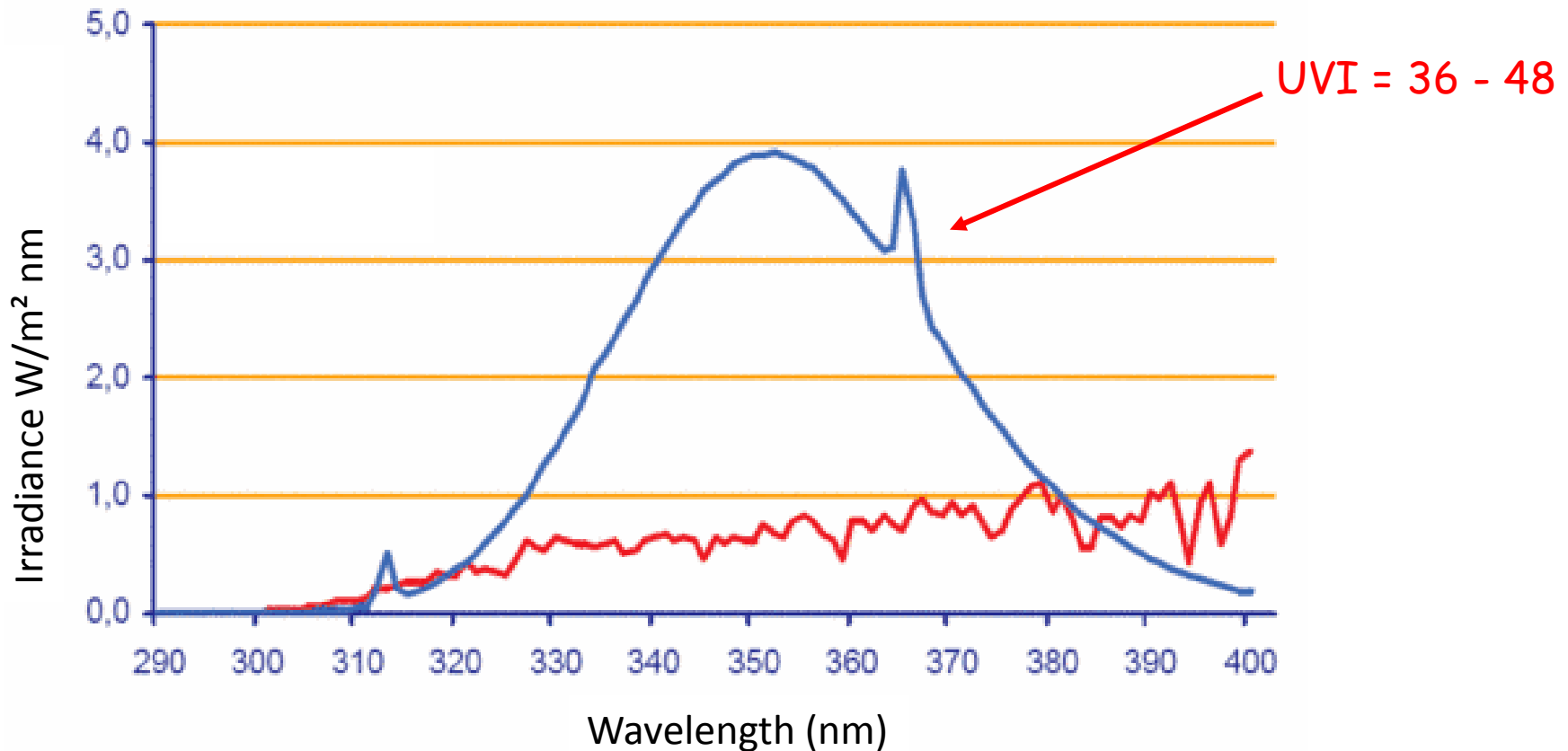


Figure 1. The electromagnetic spectrum and the wavelength bands.

Solaria UV

Comparison of **solar**- and **sunbed**-irradiance

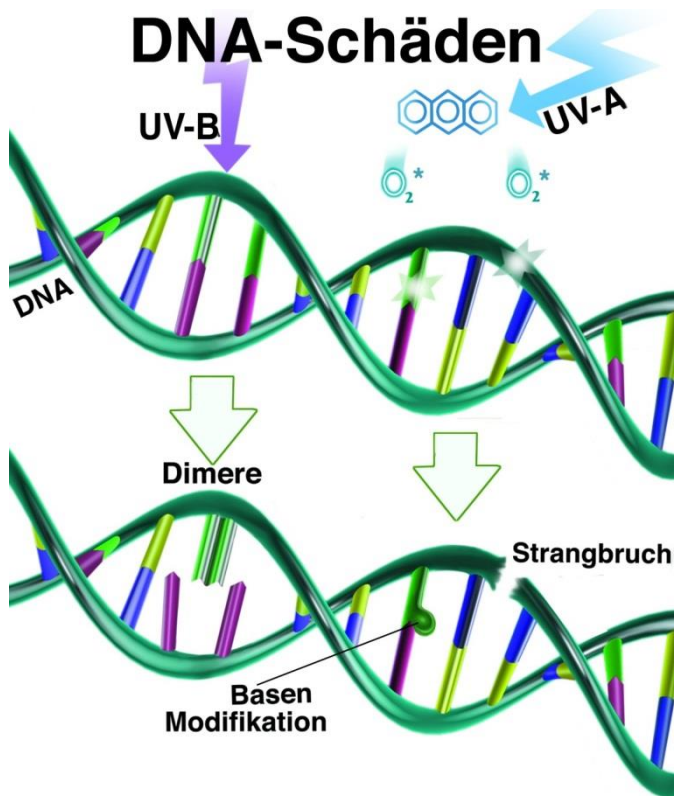


Quelle: Photomed Bundesfachverband Solarien und Besonnung e.V.

UV-radiation, including UVR emitted by sunbeds, is a complete carcinogen, group 1 carcinogen (IARC 2009), as it acts as an initiator and a promoter.

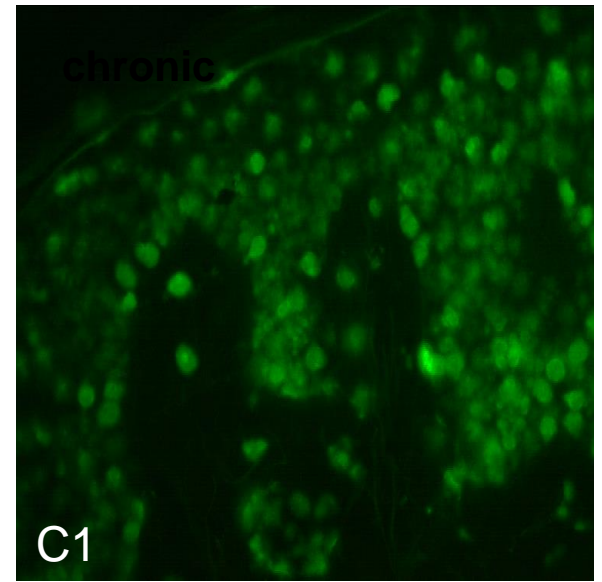
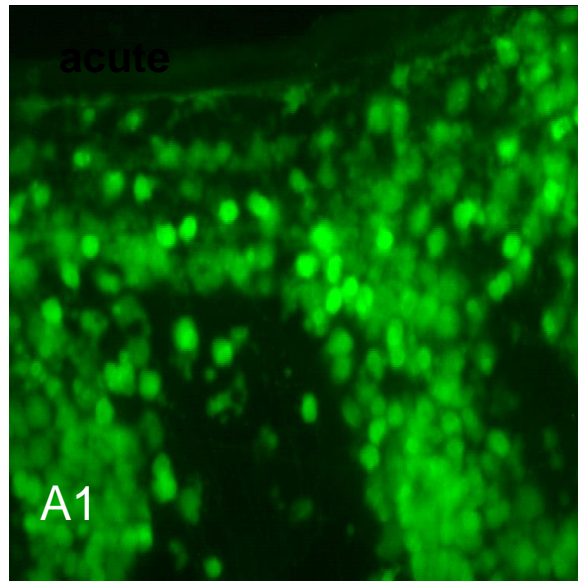
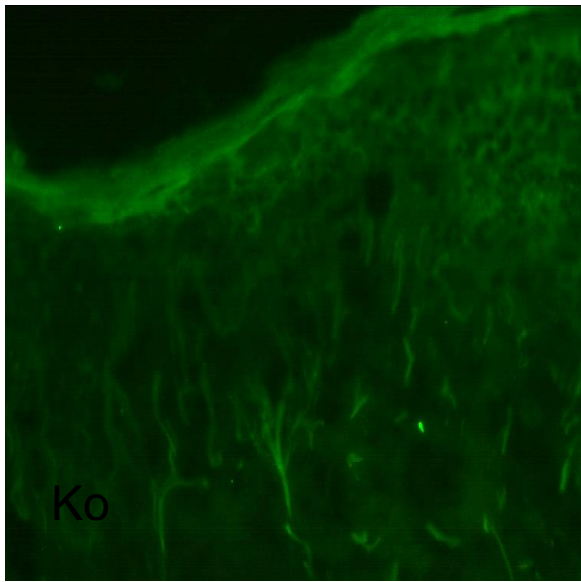
Initiation:

Promotion:

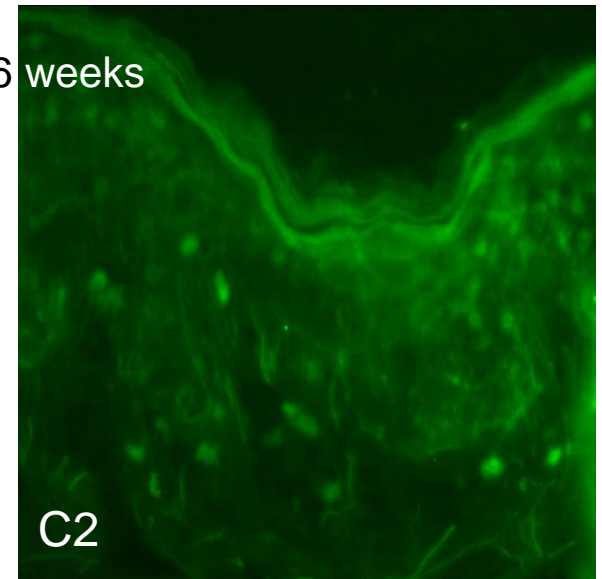
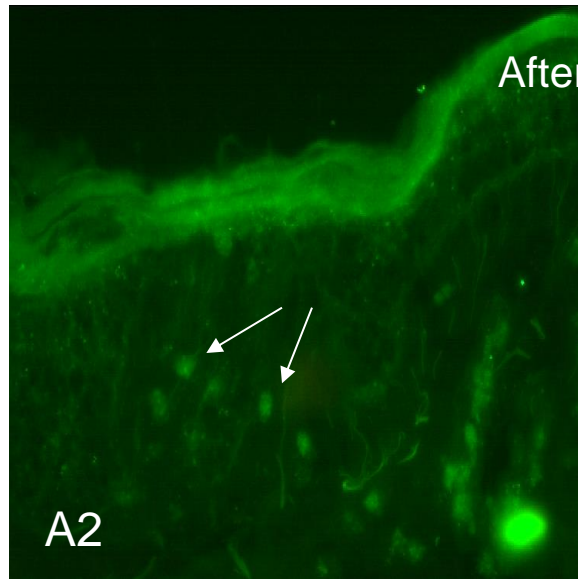


UVA and UVB cause immunosuppression, which promotes the development of skin cancer because the immune system can not fight early stages of cancer cells.

If DNA-lesions are mis-repaired they will lead to mutations, „UV-signature mutations“, causing skin cancer



Proband 3_03
Skin-type I-II
IMED = 350 J/m²

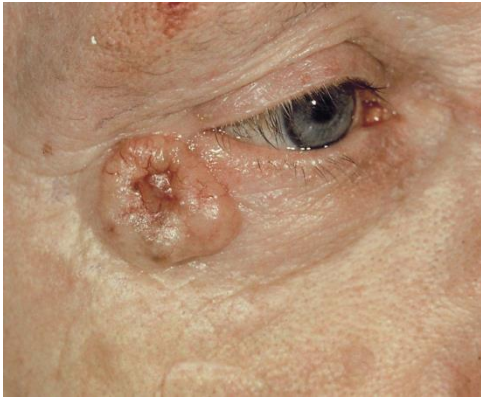


Sunbed-UV is a very potent inducer of mutations

A 15 min. sunbed session, reaching 1 minimal erythema dose (MED), equivalent to a dose of $300\text{J}/\text{m}^2$ for a skin type II, produces **10,000- 100,000** pre-mutagenic DNA-lesions in every exposed skin cell!

UVA and UVB from sunbeds cause the induction and promotion of all types of skin cancer

Basal Cell Carcinoma(BCC)



Sunbed-UV induction not as evident as for SCC and MM.
Most frequent skin cancer worldwide.
Mortality: 1-2 %

Squamous Cell Carcinoma (SCC)



Second most frequent skin cancer worldwide.
Induced by sunbed-UV
Mortality: 1-5 %
Depending on location as high as 30%

Malignant Melanoma (MM)



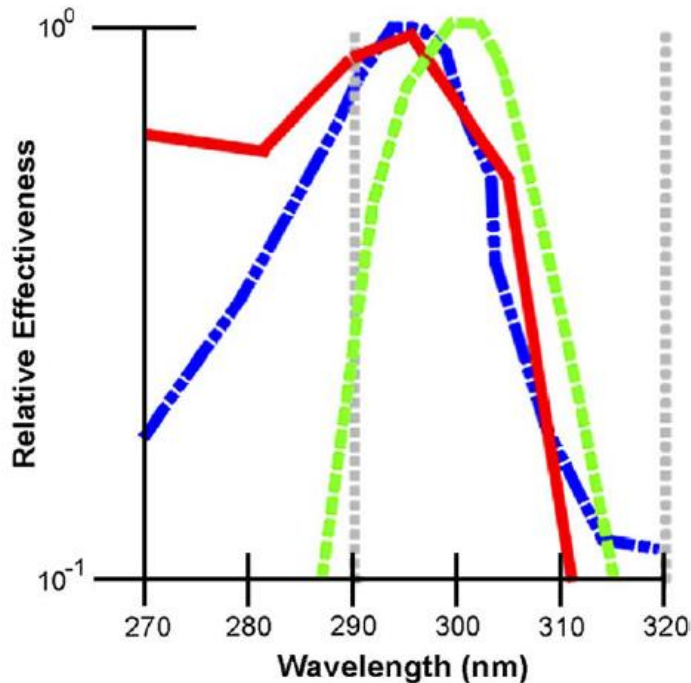
Skin cancer with highest mortality (20-25 % of diagnosed cases).
Induced by sunbed-UV

Hochrechnungen Hautkrebserkrankungen Deutschland 2014

Art	Gesamt	Männer	Frauen
Malignes Melanom, invasiv	25.106	12.581	12.525
Malignes Melanom, in situ	11.335	5.316	6.020
Malignes Melanom, gesamt	36.441	17.896	18.545
Basalzellkarzinom	156.260	79.260	77.000
Spinozelluläres Karzinom, invasiv	51.770	30.550	21.220
Spinozelluläres Karzinom, in situ	46.220	20.980	25.240
Spinozelluläres Karzinom, gesamt	97.990	51.530	46.460
Hautkrebs gesamt	290.691	148.686	142.005

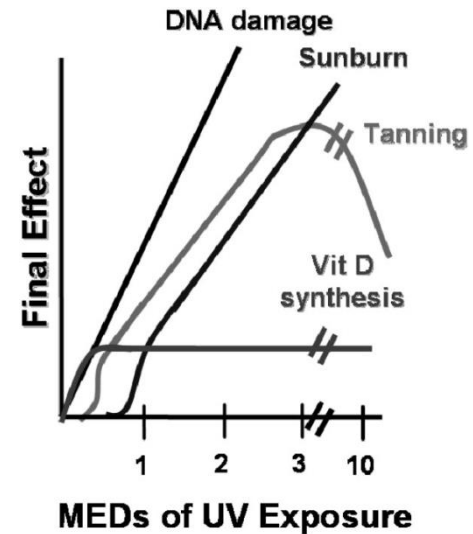
Datenquelle: Krebsregister Schleswig-Holstein, 2017 – Diagnosejahr 2014

The beneficial effects of sunbed use, such as the generation of vitamin D, are outweighed by the adverse effects. There is no need to use sunbeds to induce vitamin D production, because alternative sources of vitamin D are readily available.



- Sunburn and suntan
- - - Skin cancer
- - - Pre-vitamin D

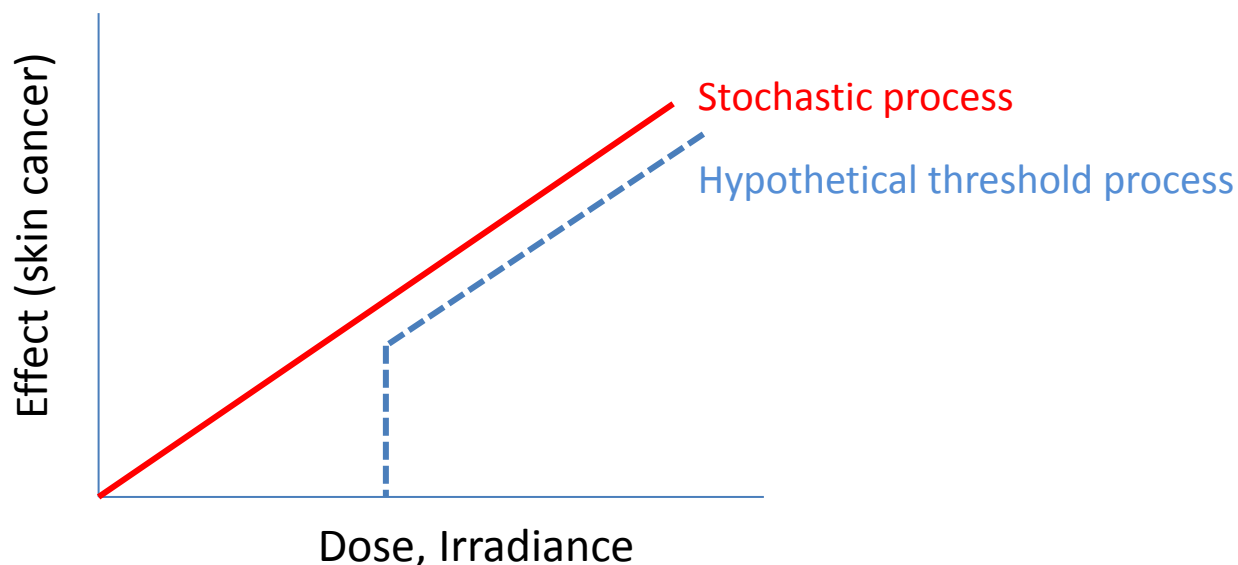
(Wolpowitz und Gilchrest 2006)



Gilchrest, B.A., Am J Clin Nutr, 88,570S-577S (2008)

There is no threshold level of UV-irradiance and UV-dose for the induction of skin cancer. Therefore, there is no safe limit for exposure to UV radiation from sunbeds.

Skin cancer induction is a stochastic process. These processes do not show threshold. No levels for irradiance or dose exist below which the risk of skin cancer is zero. At lower doses or irradiances only the probability for skin cancer induction becomes lower, But it's not zero.



An irradiance of

- $0.7 \text{ W/m}^2 = \text{UVI of } 28$ (International Electrotechnical Commission (IEC)) or
- $0.3 \text{ W/m}^2 = \text{UVI of } 12$ (European Norm Standard (EN60335-2-27:2013))

is, therefore, **not safe at all !**

**Scientific Committee on Health, Environmental and Emerging Risks
(SCHEER)**

**Opinion on
Biological effects of ultraviolet radiation
relevant to health with particular reference to sunbeds
for cosmetic purposes (November 2016)**

HEALTH EFFECTS - Epidemiology

Dr. Jean-François Doré
Research Professor INSERM

Exposures from sunbeds

Prevalence

The prevalence of sunbed use varies greatly from one country to another and according to sex and age. Prevalence of sunbed use for tanning purposes is higher in white-skinned populations from Northern Europe, and in young or middle-aged women.

A recent meta-analysis (Wehner et al., 2014) of data from 16 Western countries including 406,696 participants showed that the overall summary prevalence of ever exposure to indoor tanning was as high as 35.7% for adults, 55.0% for university students (US studies only), and 19.3% for adolescents. The summary prevalence of past year exposure was 14.0%, 43.1% for university students (US), and 18.3% for adolescents, and higher among women compared with men. This meta-analysis further showed an increase in prevalence of sunbed use over time.

Trends in UV irradiance

Sunbed UV emitters have varied in the mix and intensity of UVA and UVB generated. Data from countries where restrictions in sunbed use have been introduced indicated a reduction of the prevalence of use. It is currently estimated that UV emission of a modern tanning appliance corresponds to an UV index of 12, i.e. equivalent to midday Equatorial sun. However there are large variations in the UV output of different machines and inspections showed violations of the maximum values. The UV spectrum emitted by tanning machines has evolved in recent years towards higher UVA irradiance.

Prevalence of indoor tanning (Wehner et al., 2014)

Overall			Female Participants		Male Participants	
Exposure by Group	Summary Prevalence (95% CI)	No. of Records	Summary Prevalence (95% CI)	No. of Records	Summary Prevalence (95% CI)	No. of Records
Adults						
Ever exposure	35.7 (27.5-44.0)	22	39.8 (30.0-49.7)	9	20.4 (12.4-28.3) ^a	7
Past-year exposure	14.0 (11.5-16.5)	21	19.0 (14.7-23.4)	15	9.0 (6.6-11.5)	13
US University students						
Ever exposure	55.0 (33.0-77.1)	11	69.3 (45.4-93.2)	5	40.0 (14.1-66.0)	3
Past-year exposure	43.1 (21.7-64.5)	7	64.9 (41.2-88.5)	4	26.8 (15.6-37.9)	4
Adolescents						
Ever exposure	19.3 (14.7-24.0)	23	31.5 (22.3-40.8)	16	14.1 (10.5-17.7)	17
Past-year exposure	18.3 (12.6-24.0)	23	21.3 (8.5-34.1)	14	7.5 (4.1-11.0)	14

Health effects: Melanoma

SCHEER review (studies published since 2006):

- 4 meta-analyses

All four recent meta-analyses show a consistent increased risk of approximately 20% for melanoma with ever use of artificial tanning. The two meta-analyses (IARC 2006, 2007, Boniol *et al.*, 2012a) that examined risk by age at first use both show a more pronounced risk when exposure began at a younger age (+59%).

In addition, the two meta-analyses (Boniol *et al.*, 2012a, Colantonio *et al.*, 2014) that investigated dose-response both indicate an increasing risk with increasing sunbed use.

Therefore there is strong evidence in the meta-analyses of a significantly increased risk from cutaneous melanoma associated with sunbed use. The risk increases with the number of sessions and frequency of use.

Health effects: Melanoma

- 9 case-control studies

The majority of the recent case-control studies show significantly increased risks of melanoma associated with sunbed use. Most have a large sample size and adjust for relevant confounders. The excess risk of melanoma associated with ever using a sunbed varied from 40% to double the risk. Only one study, in the UK, found no risk (but was unusual in design).

There is also moderate evidence from a few of the reviewed studies that the risk of melanoma increases with increasing number of sessions and increasing frequency of use (number of sessions per year).

- 3 cohort studies

All three most recent cohort studies show an increase in melanoma risk (up to double in one study) associated with sunbed exposure at a younger age.

In addition, since all analyses were adjusted for host factors and for sun exposure, they also suggest that sunbed use adds a specific risk of melanoma independently from individual susceptibility and behaviour in the sun.

Health effects: Non-Melanoma skin cancers / Ocular Melanoma

- **NMSC**

4 meta-analyses, 5 case-control studies, 2 cohort studies

There is consistent evidence from individual studies and meta-analyses of an increased risk of squamous cell carcinoma and to a lesser extent for basal cell carcinoma, especially when exposure takes place at a younger age.

Ever use of sunbeds approximately doubles the risk of SCC; the evidence of an increase of BCC is weaker being between 10% and 30%. Regular use and increasing years of use result in an increased risk of NMSC.

- **Ocular melanoma**

A new study (Schmidt-Pokrzywniak *et al.*, 2009) adds data to support the SCCP 2006 conclusion that '*there is some evidence that sunbed use is associated with ocular melanoma*', with the risk increasing when exposure started at a younger age.

Risk characterization

Although the increase in melanoma risk due to sunbed use may appear modest in the general population (+15%, according to the 2006 IARC report), most of the risk concentrates in the population that started sunbed use before the age of 35 (+75%, according to the 2006 IARC report, +59% in a more recent meta-analysis by the same team – Boniol et al., 2012a - and up to more than +200% for frequent use in the 10–39 years period – Veierød et al., 2010).

Based on figures in the meta-analysis of Boniol et al. (2012b) with a relative risk of 1.59, 37% of melanoma cases would be caused by sunbeds use among individuals who exposed themselves to sunbeds before the age of 35.

Sunbed use is associated with increased risk of early-onset melanoma (Ghiasvand et al., 2017).

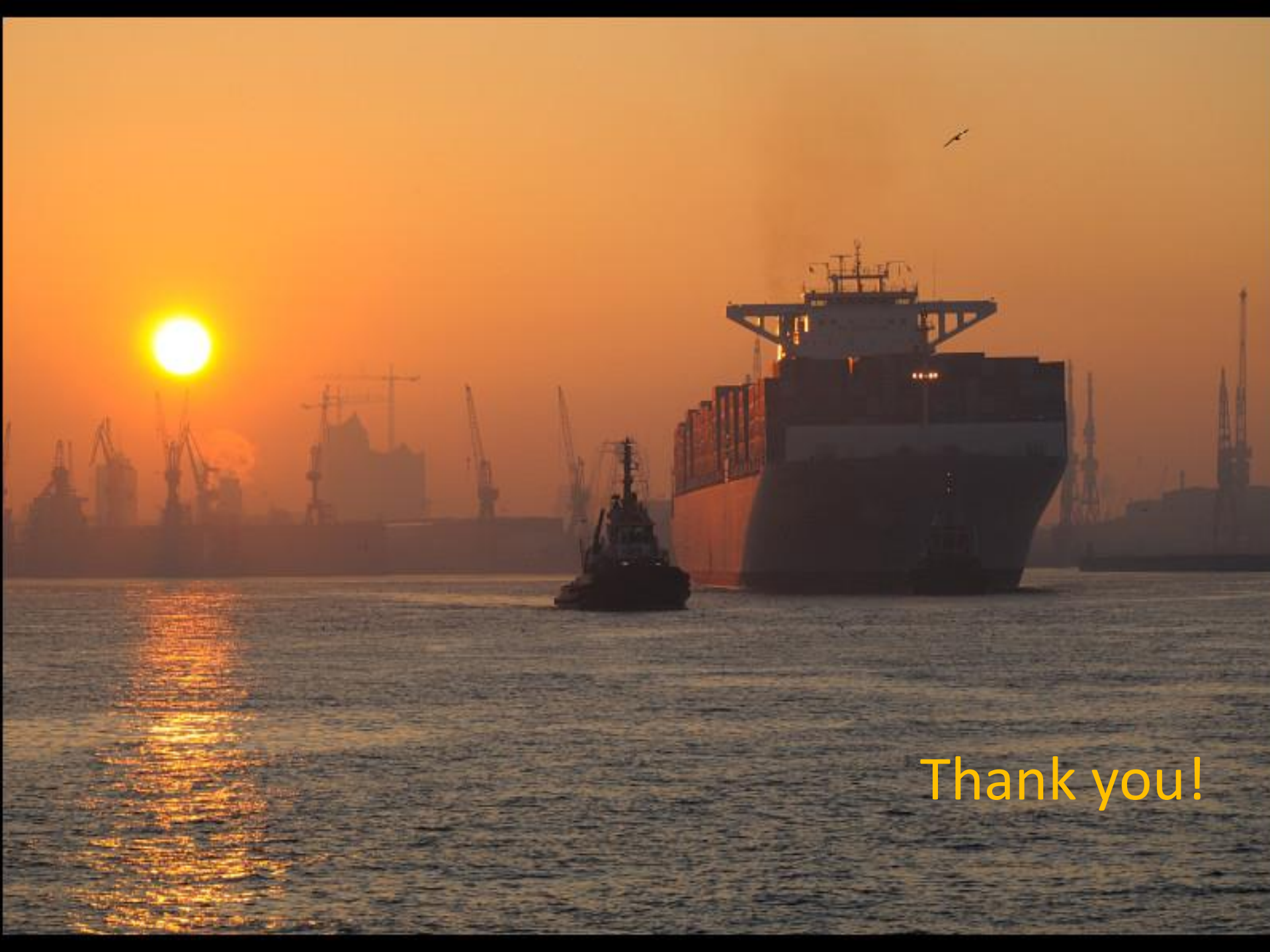
Thus, the fraction of risk attributable to sunbed use in patients diagnosed with a melanoma before the age of 30 may be very high: 76% in Australia among those who had ever used a sunbed and were diagnosed between 18-29 years of age, (Cust et al., 2011), and 43% in France (Boniol et al., 2010).

Health effects of sunbeds: conclusions

Based on the available scientific evidence SCHEER concludes that there is strong evidence that exposure to UVR, including that emitted by sunbeds, causes cutaneous melanoma and squamous cell carcinoma at all ages and that the risk for cancer is higher when the first exposure takes place in younger ages.

There is also moderate evidence that exposure to UVR, including that emitted by sunbeds, also increases the risk of basal cell carcinoma and ocular melanoma.

There is no threshold level of UV-irradiance and UV-dose for the induction of skin cancer. Therefore, there is no safe limit for exposure to UV radiation from sunbeds.



Thank you!