UV AND SKIN CANCER; SUNBEDS IN PERSPECTIVE

Frank R. de Gruijl,
Personal history:
“Skin Cancers from Ozone Layer Depletion” to “Vitamine D and health effects”
SKIN CANCERS in NL

BY FAR MOST FREQUENT FORM OF CANCER

In NL:
~ 14,000 lung cancers/yr
> 35,000 BCC/yr

Many UV mutations (10^4-10^5/cell), but not in drivers like Braf & Nras
UPWARD TRENDS IN SKIN CANCERS IN EUROPE

Norway; melanoma
UPWARD TRENDS IN SKIN CANCERS IN USA & EUROPE

MELANOMA INCREASES in SUCCESSIVE BIRTH COHORTS from < 1900

Skin Cancer UK, Diffey, Skin Care Forum, 2014

UP WITH SUNBATHING
In 1923, French style icon Coco Chanel “accidentally” developed a tan while on her yacht in France.

Increased (relative) risks in young females at low absolute risk & negligible mortality.
1992:
SOLAR AND ULTRAVIOLET RADIATION
Solar radiation (Group 1)
Ultraviolet A,B,C radiations (Group 2A)
Use of sunlamps and sunbeds (Group 2A)
Exposure to fluorescent lighting (Group 3)

2006:
“There is sufficient evidence in humans for the carcinogenicity of solar radiation.” (Group 1)
“There is sufficient evidence in humans for the carcinogenicity of the use of UV-emitting
tanning devices.” (Group 1)

2012 (part D of Volume 100 of the IARC Monographs):
Types of radiation classified in Group 1
• Ionising radiation
• Solar radiation
• Ultraviolet radiation (wavelengths 100–400 nm, encompassing UVA, UVB, and UVC)
SOLAR UV SPECTRUM HIGHLY VARIABLE – ARTIFICIAL UV LAMP SPECTRUM CONSTANT & SELECTED FOR SPECIFIC EFFECTS

UVB rich lamps:  
phototherapy of psoriasis,  
UV hardening,  
....

UVA rich lamps:  
phototherapy of scleroderma,  
NO (lowering blood pressure),  
tanning*,  
....

* UVA (98%) source faster tanning, with lower total UV dose (in SED), than with a summer-sun-like UV lamp (95% UVA 5% UVB) (Miller et al, BJD 2008).
INFLATION OF MELANOMA STATS:

DIAGNOSTIC DRIFT IN MELANOMA; more and more erring on the safe side confirmed by comparisons of historical samples


Levell et al. BJD 2009

Fig 2. European age-standardized incidence rates of malignant melanoma by stage in Norfolk, Suffolk and Cambridgeshire in 1991-2004.

clear “period effect” of increasing thin and in situ melanomas in the Netherlands (increases by birth cohort in “true” melanomas)

Van de Leest et al, Eur J Cancer 2015
INFLATION MELANOMA STATS:
UV-IRRADIATED NEVI: activation

Tronnier et al JID 1995
BJD 1997

Melanocytes in nevi:
PCNA, KiS7 (antiTopoisomeraseIIalpha), KiS11(antiKi67) up
after single UV overexposure (4 MED; more transient after 2 MED)
prognostic markers in melanoma

“The UV-irradiated nevus should be added to the list of so-called
simulators of malignant melanoma” (Tronnier & Wolff, Am Dermapathol. 1995)

mouse dermal melanocytes proliferate after overdosis UVB not UVA
Van Schanke et al, JID 2005
SUNBURNS
VERY
COMMON!!!

Telephone surveys:
30 – 50% of people got sunburned in last 12 months
SUMMER INCREASES IN MELANOMA

Downes et al Clin Exp Dermatol 2010

Challiol et al Mel Res 2011

Monthly numbers of invasive cutaneous melanomas of Breslow thickness less than 2 mm (continuous line) or 2 mm and greater (dotted line) diagnosed in Northern Ireland for the period 1984–2006 in (a) men aged below 50 years, (b) men aged 50 years and above, (c) women aged below 50 years, and (d) women aged 60 years and above.
SUNBED USE ASSOCIATED WITH SUNBATHING

Sunbed users more often outdoor sunbathers ($p < 0.01$); Thieden et al Arch Dermalol 2005

OddsRatio sunbeduser/sunbather = 7 overall = 10 for regular users
(Westerdahl J et al, Br J Cancer 2000:82:1593-9)
= 4.1 (95% 1.8 – 9.0)
(Gordon et al, J Hlth Physiol 2012)

for a user the odd to be a sunbather is 4 to 10 times higher than for non-users
→ a sunbed user is typically also a sunbather!

→ STRONG CORRELATION (COLLINEARITY) BETWEEN SUNBED USE AND SUNBATHING: (mostly not/inadequately handled):

HIGHEST RISK FROM SUNBED OR SUN?
Sunbed use, medians, 12 min/session (Bock et al BTD 2013) @ UVI 12 = 2.2 SED/session
6 sessions in 2012 on average by 14.6% of population of 14-45 yrs (Scheider et al, Hautarzt 2016)
180 min sunbed/yr (Bock et al BTD 2013) @ UVI 12 = 32 SED/yr

Annual sun dose, median, (DK, Thieden et al JID 2004) 166 SED/yr
95% range 37 – 551

Mediterranean holiday (Petersen et al BJD 2013) 57 SED/week
Average 10.5 days (UK office of Natl Stats 2013) = 86 SED/holiday
40 million holiday trips/yr from UK (population 63.2 million)

Annual dose (n=164) correlated far more strongly with sun than sunbed exposures
# days sun exposure shoulders/upper body: \( r = 0.51, p<0.001 \)
# days sun exposure during outdoor sports: \( r = 0.39, p<0.001 \)
# sunbed sessions: \( r = 0.26, p = 0.02 \)
\( r = \text{Spearman rank correlation coefficient} \)
(Thieden et al. JID 2004)
### Skin cancer type

<table>
<thead>
<tr>
<th>Skin cancer type</th>
<th>Number of cases</th>
<th>Extra cases</th>
<th>PAF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squamous cell carcinoma</td>
<td>8123</td>
<td>1998</td>
<td>24.6</td>
</tr>
<tr>
<td>Melanoma</td>
<td>4677</td>
<td>422</td>
<td>9.0</td>
</tr>
</tbody>
</table>

*The Netherlands 2010; TNO ‘PAF’ report 2014*

ESTIMATED PAF, population attributal fraction. not ‘hard figures’, but soft/dubious ones

arbitrary/dubious assumptions on RR and extrapolations to life long sun exposure; age independent RR from sunbed use, collinearity between sun and sunbed exposures?

RR from metastudy based on studies different in proxi of sun exposure, proper dose metrics, confounding correction, accuracy sun exposure vs sunbed exposure, proper sunbed exposure metric. RR constant, independent of age, location etc? collinearity sun & sunbed effects?

....
CONCLUSIONS

• trends of increasing skin cancer incidences date back to before WW II; long before sunbeds

• men use sunbeds less than women; but skin cancer, incl. melanoma (mortality!), more of a problem in men

• increases thin/in situ melanoma shift in diagnosis and UV activation of (atypical) nevi, not accompanied with increases in mortality → inflation of melanoma statistics (particularly in young female sunbed users?)

• population wide sun exposure dominated over sunbed exposure; sun (holidays) > sunbed exposure; appropriate UV dose metrics?

• sunbed users are commonly also sunbathers → high covariance/collinearity largely ignored and not/inadequately analyzed --- (sunbed risk = sun risk?)
THE CASE OF CLARE OLIVER († 2007, at age 26);
news coverage in Australia
- visited solaria 10 times (at age 19)
- mostly referred to solarium as the cause of the melanoma
- spent years acquiring a tan outdoors; only referred to in 1 out of 10 statements (>100)
- campaigned against solaria
- leading to solaria ban in Australia (?)