UV sunbed measurements worldwide

Lill Tove Nilsen[1], Merete Hannevik[1], Marit B. Veierød[2]

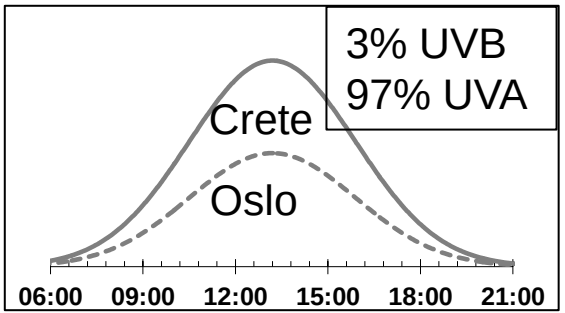
1. Norwegian Radiation Protection Authority
2. University of Oslo, Oslo Center for Biostatistics and Epidemiology

3rd International Conference on UV and Skin Cancer Prevention, Melbourne, December 2015

Statens strålevern
Norwegian Radiation Protection Authority

www.nrpa.no

Sun versus sunbeds



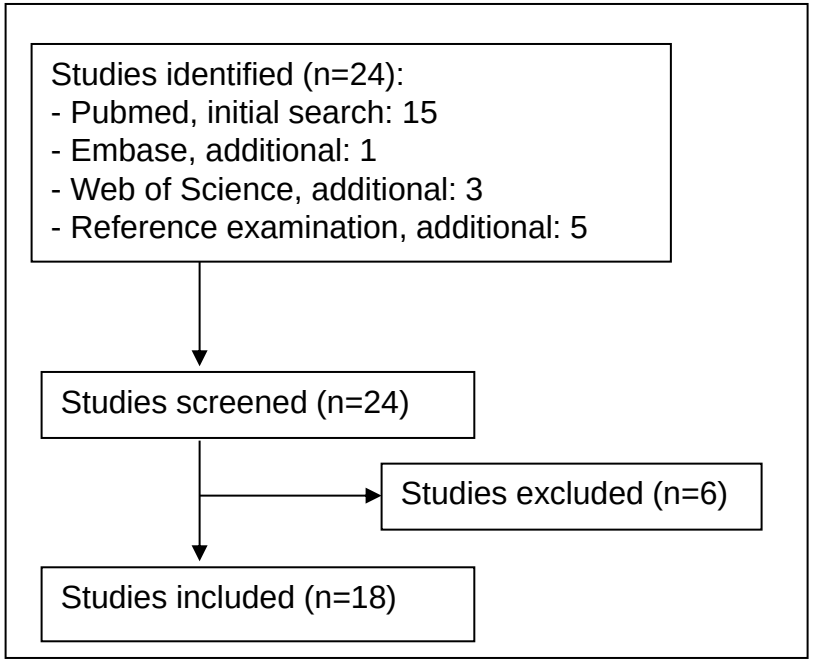
Erythemal UV
85% E_UVB
15% E_UVA

Irradiance limits

	Erythema weighted UV (W/m²)			
	UVB 250-320 nm	UVA 320-400 nm	Total UV 250-400 nm	UVI
International standard **All devices, since 2004** **Additional for UV type 3 devices, since 1989**	< 0.15	< 0.15	**0.7** 0.3	**28** 12
European standard **All devices, since 2010** **Additional for UV type 3 devices, since 1989**	< 0.15	< 0.15	**0.3** 0.3	**12** 12
Australian/New Zealand standard **All devices, since 2008** **All devices, 2002-2008**			**0.9** 1.5	**36** 60
USA, FDA regulations			No limits	
Brazil, since 2009			Total ban	
Natural sun:				
Crete, Greece, 35°N	0.23	0.04	0.27	11
Tropical sun, 23°S-23 °N			0.3	12

Included studies

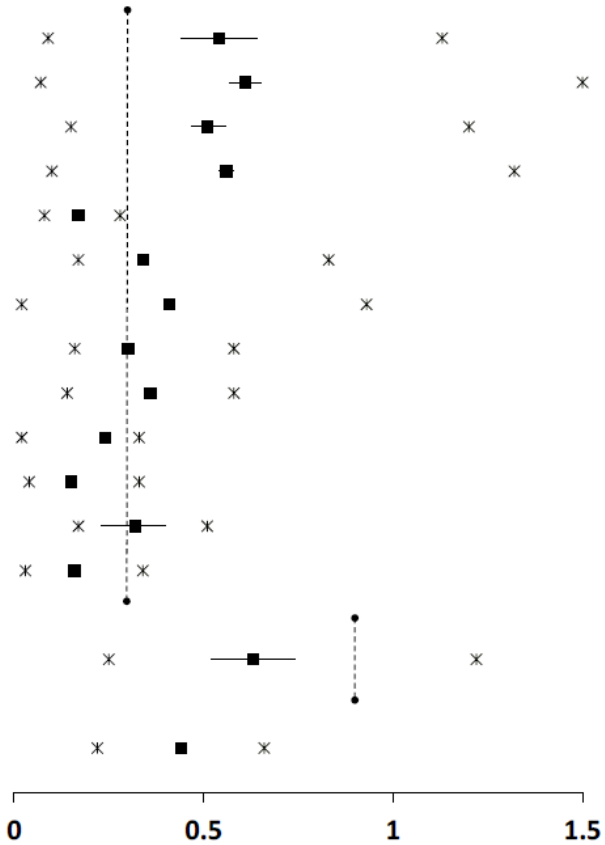
Fig 1



Nilsen et al., BJD 2016

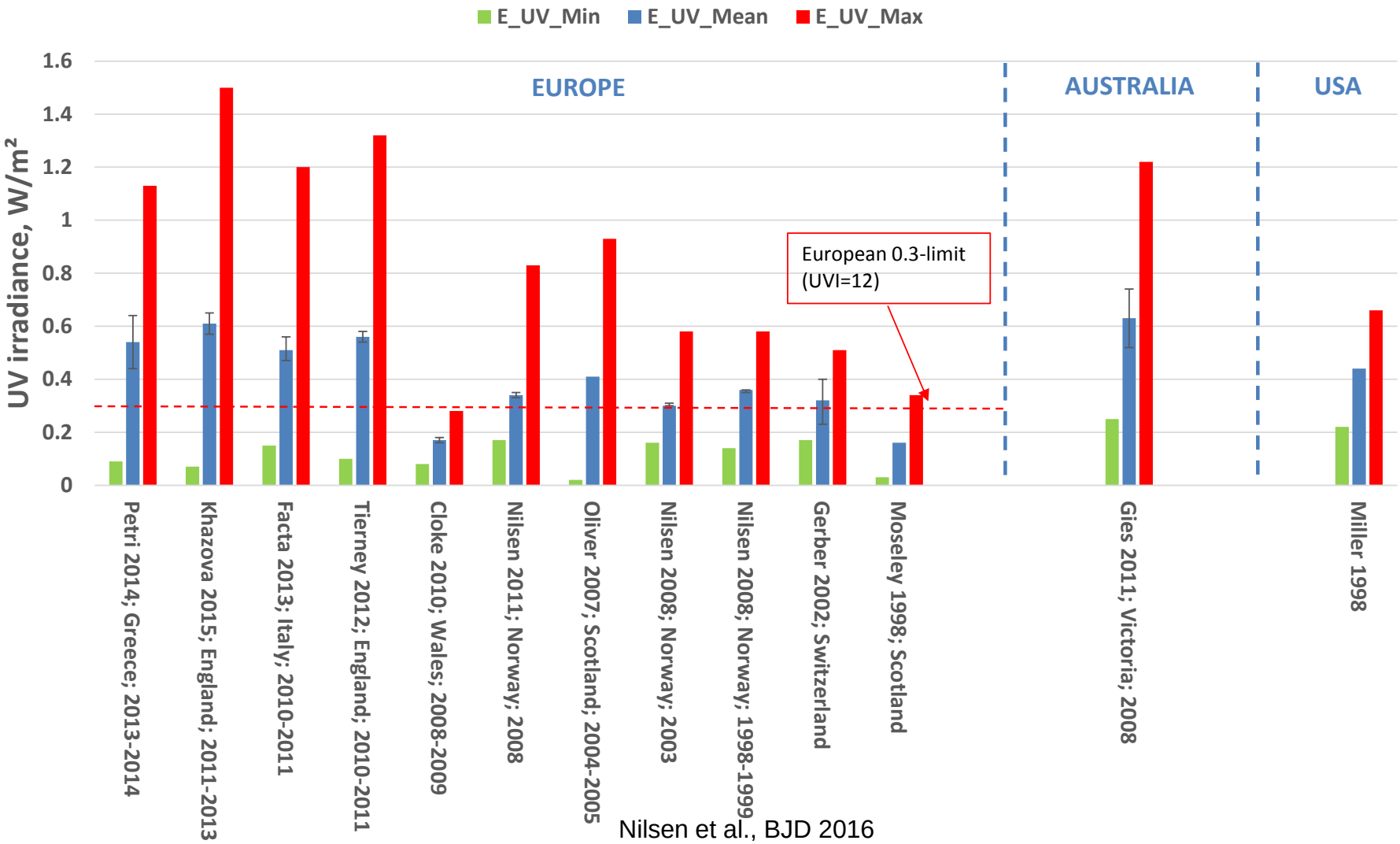
Erythema weighted UV irradiance

Study; country; measurement period	n	Erythema weighted UV (Wm^{-2}) Mean (95% CI)	Min-Max	Min, Mean with 95% CI, Max	UVI[a]
Europe					
Petri 2014[26]; Greece; 2013-2014	40	0.54 (0.44, 0.64)	0.09 - 1.13		**22**
Khazova 2015[25]; England; 2011-2013	188	0.61 (0.57, 0.65)	0.07 - 1.50		**24**
Facta 2013[27]; Italy; 2010-2011	96	0.51 (0.47, 0.56)	0.15 - 1.20		**20**
Tierney 2012[28]; England; 2010-2011	402	0.56 (0.54, 0.58)	0.10 - 1.32		**22**
Cloke 2010[31,b]; Wales; 2008-2009	65	0.17 (0.16, 0.18)	0.08 - 0.28		7
Nilsen 2011[30]; Norway; 2008	194	0.34 (0.33, 0.35)	0.17 - 0.83		**14**
Oliver 2007[33]; Scotland; 2004-2005	133	0.41	0.02 - 0.93		**16**
Nilsen 2008[32]; Norway; 2003	307	0.30 (0.30, 0.31)	0.16 - 0.58		12
Norway; 1998-1999	1034	0.36 (0.35, 0.36)	0.14 - 0.58		**14**
Approval[c]; Norway; 1993-2005	217	0.24 (0.23, 0.24)	0.02 - 0.33		9
Approval[c]; Norway; 1983-1992	229	0.15 (0.14, 0.15)	0.04 - 0.33		6
Gerber 2002[36]; Switzerland	9	0.32 (0.23, 0.40)	0.17 - 0.51		**13**
Moseley 1998[38]; Scotland	37	0.16	0.03 - 0.34		6
Australia					
Gies 2011[29]; Victoria; 2008	20	0.63 (0.52, 0.74)	0.25 - 1.22		**25**
USA					
Miller 1998[39]	2	0.44	0.22 - 0.66		**18**



Nilsen et al., BJD 2016

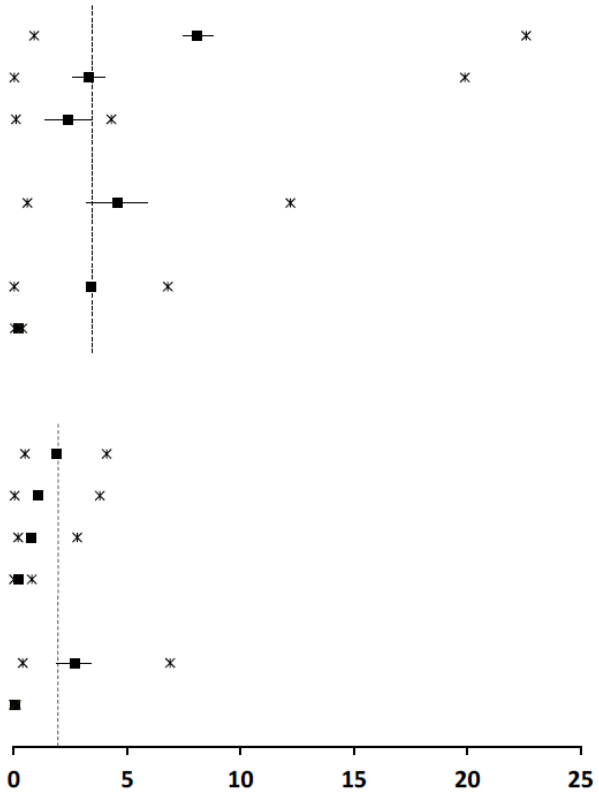
Erythema Weighted UV irradiance



Nilsen et al., BJD 2016

UVB irradiance

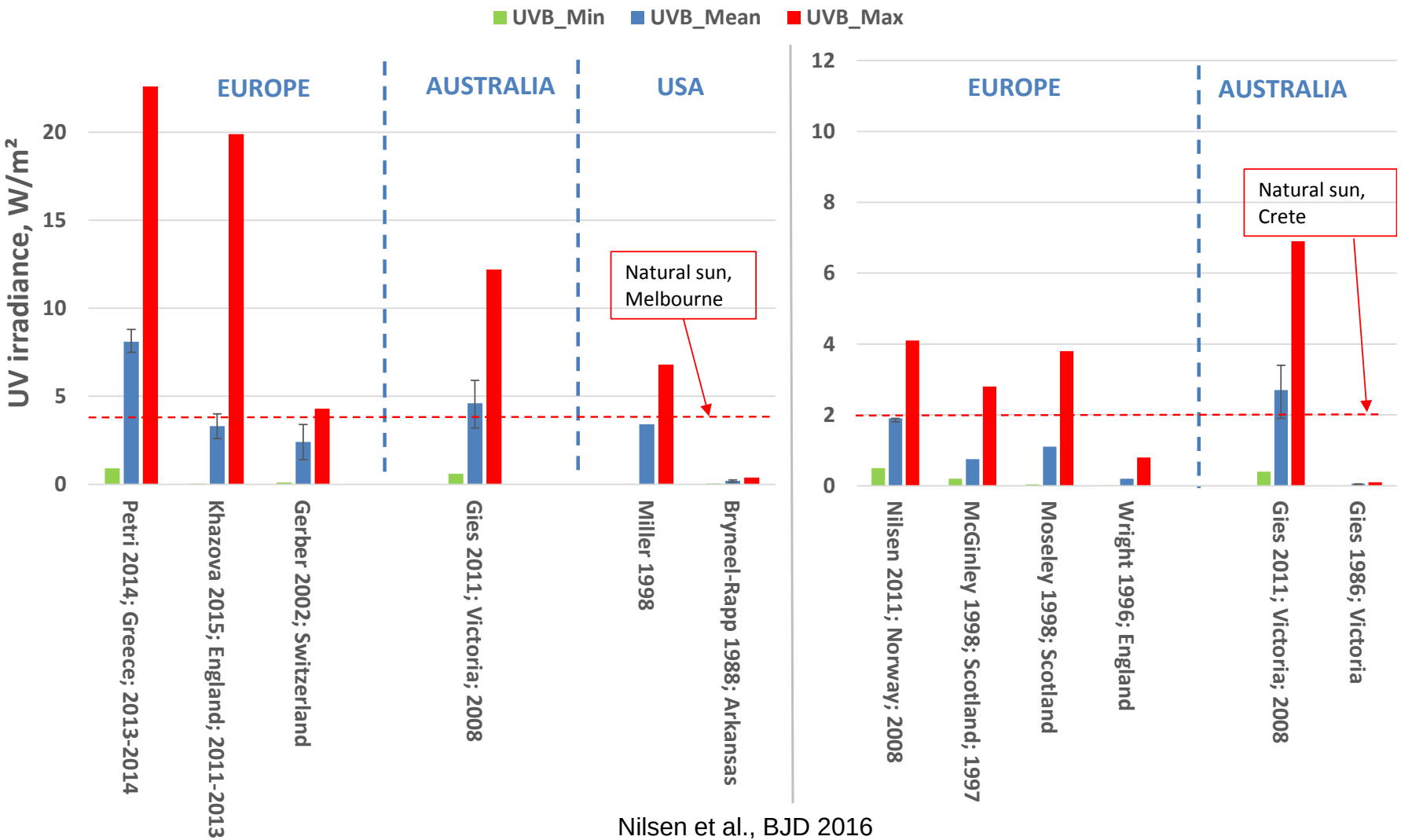
Study; country; measurement period	n	Unweighted UVB irradiance (Wm^{-2}) Mean (95% CI)	Min-Max
Wavelength region 280-320 nm			
Europe			
Khazova 2015[25]; England; 2011-2013	188	8.1 (7.5, 8.8)	0.9 - 22.6
Facta 2013[27]; Italy; 2010-2011	96	3.3 (2.6, 4.0)	0.03 - 19.9
Gerber 2002[36]; Switzerland	9	2.4 (1.4, 3.4)	0.1 - 4.3
Australia			
Gies 2011[29]; Victoria; 2008	20	4.6 (3.2, 5.9)	0.4 - 12.2
USA			
Miller 1998[39]	2	3.4	0.02 - 6.8
Bryneel-Rapp 1988[41]; Arkansas	14	0.2 (0.1, 0.3)	0.05 - 0.38
Wavelength region 280-315 nm			
Europe			
Nilsen 2011[30]; Norway; 2008	194	1.9 (1.8, 1.9)	0.5 - 4.1
Moseley 1998[38]; Scotland	37	1.1	0.04 - 3.8
McGinley 1998[37,a]; Scotland; 1997	89	0.75	0.2 - 2.8
Wright 1996[40,b]; England	50	0.2	0.01 - 0.8
Australia			
Gies 2011[29]; Victoria; 2008	20	2.7 (1.9, 3.4)	0.4 - 6.9
Gies 1986[43]; Victoria	15	0.06 (0.02, 0.05)	0.003 - 0.1



Nilsen et al., BJD 2016

[a] Only canopies; [b] Only benches.

UVB irradiance

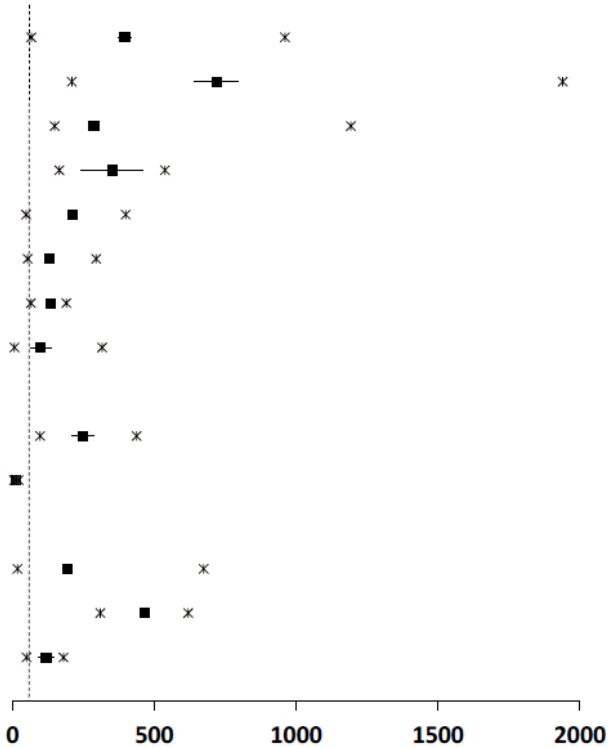


Nilsen et al., BJD 2016

UVA irradiance

Fig 4

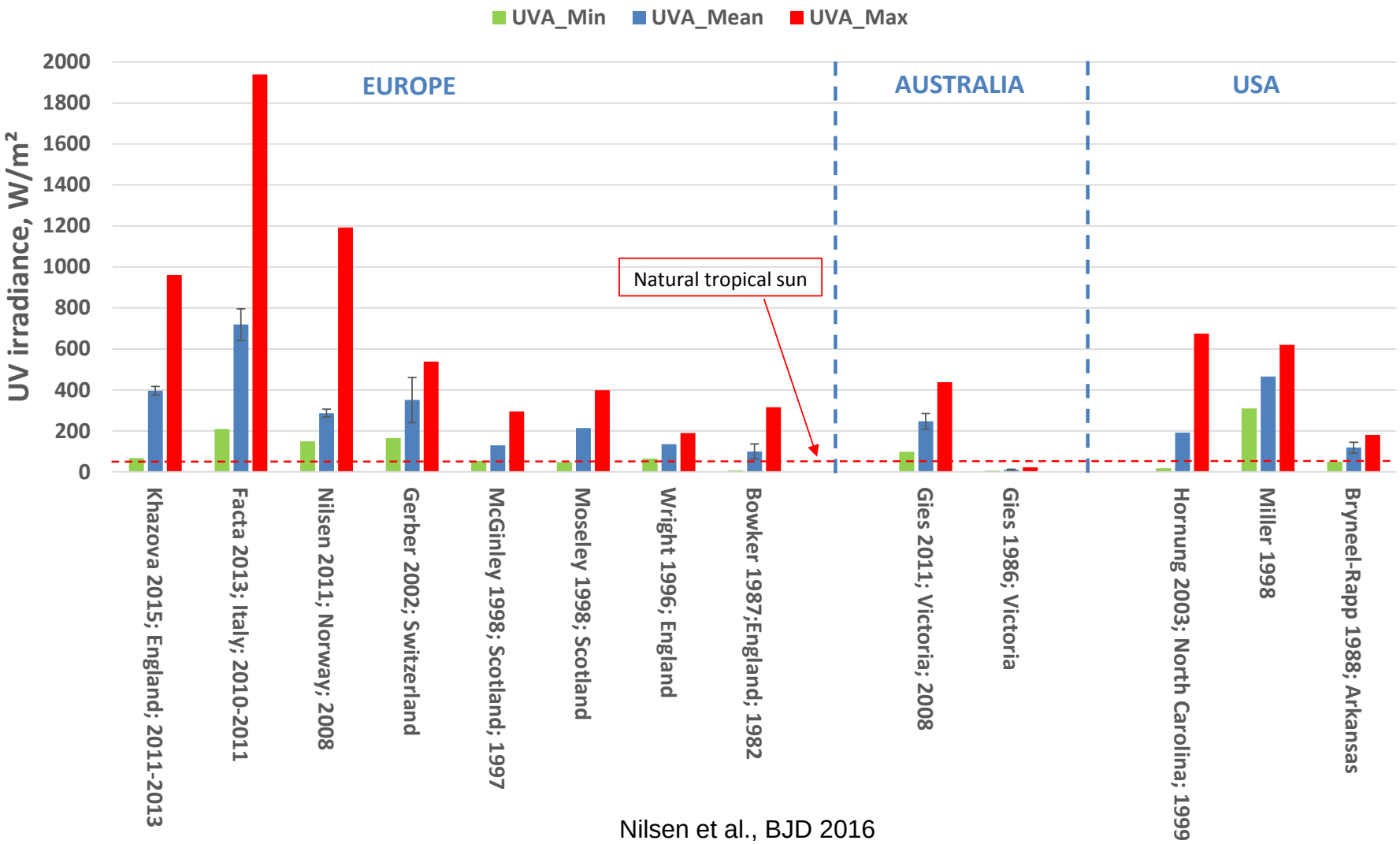
Study; country; measurement period	n	Unweighted UVA irradiance (Wm^{-2}) Mean (95% CI)	Min-Max
Europe			
Khazova 2015[25]; England; 2011-2013	188	396 (375, 417)	67 - 961
Facta 2013[27,a]; Italy; 2010-2011	96	719 (641, 796)	209 - 1940
Nilsen 2011[30,b]; Norway; 2008	194	287 (268, 306)	149 - 1193
Gerber 2002[36,a]; Switzerland	9	351 (240, 461)	165 - 538
Moseley 1998[38,b]; Scotland	37	214	48 - 399
McGinley 1998[37,c]; Scotland; 1997	89	130	54 - 295
Wright 1996[40,d]; England	50	135	65 - 190
Bowker 1987[42,b]; England ; 1982	17	100 (64, 136)	7.4 - 316
Australia			
Gies 2011[29,a]; Victoria; 2008	20	247 (208, 286)	98 - 438
Gies, 1986[43,b]; Victoria	15	11 (8.3, 13.6)	5.7 - 22
USA:			
Hornung 2003[34]; North Carolina; 1999	136	192	18 - 674
Miller 1998[39,a]	2	465	310 - 620
Bryneel-Rapp 1988[41,a]; Arkansas	14	119 (92, 145)	50 - 180



Nilsen et al., BJD 2016

[a] UVA wavelength region from 320-400 nm; [b] UVA wavelength region 315-400 nm; [c] Only canopies; [d] Only Benches.

UVA irradiance



Nilsen et al., BJD 2016

Compliance with irradiance limits

Supplementary table 2 Compliance with standards from studies on indoor tanning devices included in the systematic review.

		Percentage compliance with radiation limits	
Study; country; measurement period	**0.3 Wm^{-2} limit, European standard[19]**	**UV type 3 limit, European standard[19]**	**0.9 Wm^{-2} limit in the Australian / New Zealand standard[20]**
Europe			
Petri 2014[26]; Greece; 2013-2014	38	20	
Khazova 2015[25]; England; 2011-2013	12		
Facta 2013[27]; Italy; 2010-2011	12		
Tierney 2012[28]; England; 2010-2011	10	10	
Cloke 2010[31]; Wales; 2008-2009		58	
Nilsen 2011[30]; Norway; 2008	42[a]	23	
Oliver 2007[33]; Scotland; 2004-2005		17	
Nilsen 2008[32]; Inspection; Norway; 2003		59	
Inspection; Norway; 1998-1999		28	
Australia			
Gies 2011[29]; Victoria; 2008		85	

[a] Nilsen et al.[30] published compliance with the UV type 3 requirement as well as the 0.3-limit, as it was introduced at the time of publication.

Nilsen et al., BJD 2016

For Peer Review