

Supplementary Online Content

Wehner MR, Chren M-M, Nameth D, et al. International prevalence of indoor tanning: a systematic review and meta-analysis. *JAMA Dermatol*. Published online January 29, 2014.
doi:10.1001/jamadermatol.2013.6896.

eMethods. Supplementary Methods

eTable 1. Study Characteristics

eTable 2. Results of Sensitivity Analyses

eFigure. Results of Meta-Regressions of Past-Year Exposure Prevalence and Year of Data Collection

eReferences

eMethods

SUPPLEMENTARY METHODS

DATA SOURCES AND LITERATURE SEARCH

Searches of electronic databases were performed using the following search text.

Pubmed: *"indoor tanning" or "sunbed*" or "tanning bed*" or "tanning booth*" or "tanning salon*" or "solarium*" or "solaria" or "sunlamp*" or "artificial tanning" or "UV tanning" or "non-solar ultraviolet radiation" or "non-solar UV radiation" or "nonsolar ultraviolet radiation" or "nonsolar UV radiation."*

Scopus: *TITLE-ABS-KEY("indoor tanning" OR "sunbed*" OR "tanning bed*" OR "tanning booth*" OR "tanning salon*" OR "solarium*" OR "solaria" OR "sunlamp*" OR "artificial tanning" OR "UV tanning" OR "non-solar ultraviolet radiation" OR "non-solar UV radiation" OR "nonsolar ultraviolet radiation" OR "nonsolar UV radiation").*

Web of Science: *TS=("indoor tanning" OR "sunbed*" OR "tanning bed*" OR "tanning booth*" OR "tanning salon*" OR "solarium*" OR "solaria" or "sunlamp*" OR "artificial tanning" OR "UV tanning" OR "non-solar ultraviolet radiation" OR "non-solar UV radiation" OR "nonsolar ultraviolet radiation" OR "nonsolar UV radiation").*

Additionally, we reviewed the articles identified in our database search and relevant review articles to locate published articles missed by the database searches and to locate publicly available data not yet published in the scientific literature. Publicly available data were located by noting named surveys used in the published literature. We searched online for nine named surveys (American Cancer Society Sun Survey, Growing Up Today Survey, National Longitudinal Study of Adolescent Health, National Health Interview Survey Cancer Control Supplement, Youth Risk Behavior Survey, Health Information National Trends Survey, Sunbed-Use: Needs for Action Study, New South Wales Population Health Survey, and New South Wales School Students Health Behaviors Survey) to identify recent iterations of these surveys whose data on indoor tanning prevalence were available publicly but not published in the scientific literature.

STUDY SELECTION

In one case, two studies using the same original data were both included. Choi et al¹ and the United States (US) National Cancer Institute (NCI)² independently reported on the US Health Information National Trends Survey in 2005. The data available from the NCI² reported overall population prevalence, while Choi et al¹ reported gender specific prevalence. These two reports were included in separate meta-analyses (Choi et al¹ when we summarized prevalence according to gender and the NCI² when we summarized prevalence overall) and so were both kept in our review.

DATA EXTRACTION

Because complete data was not consistently available for all studies, and in order to include as many studies as possible, we made several content-specific decisions that applied to individual studies. These decisions were felt to be the most reasonable course of action after detailed review of manuscripts and discussion by two authors (EL and MRW). The following decisions were made during data abstraction:

- Nielsen et al³ stated that "the overall use of sunbeds" was "approximately 50%." We used 50% as the ever exposure prevalence estimate.

- For one publicly available record⁴, the number of participants was not available. We obtained this through electronic correspondence with the US National Cancer Institute.
- Koster et al⁵ presented prevalences for four distinct data points in an adolescent population but only the total number of adolescent participants was available. We divided that total number of participants by four in order to estimate the number of participants for each data point.
- Savona et al⁶ presented a figure showing the prevalence of indoor tanning as a bar graph without any numbers reported. Two reviewers independently visually estimated the prevalence. In one data point out of four, the estimates differed by 2% and the mean was used as the final estimate.
- Zhang et al⁷ asked participants if they had ever been exposed to indoor tanning during certain periods of their lives (high school through college and age 25 through 35). We used the higher of the two prevalences reported (that for age 25 through 35) in ever prevalence analyses.
- Veierod et al⁸ asked participants aged 30 to 50 about ever exposure to indoor tanning between the ages of 10 and 39, which we used in ever prevalence analyses.
- Unverricht et al⁹ asked participants about whether they were exposed to indoor tanning during different seasons in the past year. We used the winter season's estimate, which was the highest prevalence estimate, as the best estimate of exposure in the past year.
- For studies with prevalence results and participant numbers available for females and males separately or for a range of age groups separately¹⁰⁻¹⁸, we calculated the prevalence for the overall population ourselves using the gender or age group specific prevalences and numbers of participants in each group. In one study¹⁹, the prevalences for males and females were calculated using the number of participants in each group and the percentages of females and males in participants reporting exposure.

DATA SYNTHESIS AND STATISTICAL METHODS

Primary analyses

When separating studies into categories for analysis (adults, university students, and children), we prioritized separating study populations into adult and child categories over retaining any age-adjustment or weighting used. Age-adjusted data was available and used for 10 out of 84 records.

We calculated the standard error for each study assuming probability to be a Bernoulli random variable, p , with variance= $p(1-p)$ in all but three records. In three instances of extremely low prevalences (0% and 3%,²⁰ 0.3%,²¹ all in males) and in one instance of very low prevalence with a small number of participants (7.9% in 38 males)²² this calculation yielded negative lower confidence intervals. Because negative prevalences are impossible, we used an exact confidence interval calculation as the input into the analyses for these four prevalence data points.

Sensitivity analyses

In the first sensitivity analysis, six studies were included that did not report exposure measures that specifically fit our 'ever exposure' nor 'past year exposure' definitions. A study that reported "use"²³ was included in an ever exposure sensitivity analysis. Studies that reported "regular" use,²⁴ use at least once per year,^{25,26} use in the past six months,^{27,28} and use at least once per month,⁹ were included in the past year exposure sensitivity analyses.

In the second sensitivity analysis, records of specific occupational groups not representative of the general population were included: pilots and flight attendants,¹³ indoor office workers,²⁹ outdoor workers,⁹ and healthcare workers.^{7,17,30}

In the third sensitivity analysis, seven studies^{5,12,25,31-34} that reported combined results of teenagers (> 15 years old or > 16 years old) and adults that could not be split into child and adult

subgroups were excluded from the adult category. One study³⁵ reported results from a population of university students and high school students and was excluded from the university students category.

In the fourth sensitivity analysis, we excluded studies of potentially lower methodologic quality. These studies had unclear sampling methods, used convenience sampling, or had a sample size less than 500. Two studies^{36,37} had unclear sampling and six studies^{6,32,33,38-40} were specifically reported as convenience samples. We also considered analyses of parents or caregivers whose children were enrolled in a study or children whose parents were enrolled in a study,^{36,41-44} participants recruited in healthcare settings,^{12,22,31,45} pilot studies,^{46,47} and school based studies that did not sample more than two schools^{21,47-50} as convenience samples. Two studies not excluded for the sampling reasons above were excluded for sample size less than 500.^{5,10} This sensitivity analysis was not performed in the university student category because the records in this category almost all contained fewer than 500 participants.

eTable 1: Study characteristics

Reference	Year published	Year(s) of data collection ^a	Participants in study (N)	% female	Population description	Ever prevalence			Past-year prevalence		
						Males	Females	Overall	Males	Females	Overall
USA											
Bagdasarov ⁵¹	2008	2005	745	--	Undergraduates <25 years old and not dark skinned			95.0%			
Baker ⁵²	2010	2008-2009	227	100%	Undergraduates 18-30 years old		69.2%				
Bandi ⁴²	2010	1998	1187	--	Parents of adolescents in the American Cancer Society Sun Survey I ^b						8.6%
		2004	1931	76%	Parents of adolescents in the American Cancer Society Sun Survey II ^b				5.3%	14.8%	12.8%
Banerjee ⁵³	2012	Pre-2012	551	--	Undergraduates <25 years old			39.6%			
Banks ⁴⁵	1992	1989	96	42%	16-19 year old patients at a general pediatric clinic ^b	16.1%	32.5%	22.9%			
Basch ⁵⁴	2012	2009	139	58%	Undergraduates 18-25 years old			60.4%			
Bolek-Berquist ³⁸	2009	2004	184	53%	18-40 year olds ^b						34.8%
Brooks ³⁹	2006	2004	448	58%	18-30 year olds ^b						33.0%
CDC ^c & NCI ^d ⁵⁵	2012	2010	25233	--	≥18 year olds in the National Health Interview Survey				2.2%	8.9%	5.6%
Choi ¹	2010	2005	2869	--	White 18-64 year olds in the Health Information National Trends Survey				6.3%	18.1%	
					Parents of 9-16 year olds at a general pediatric clinic						49.5%
Cohen ⁵⁶	2013	2010	301	93%	9-16 year olds at a general pediatric clinic			4.3%			
			301	53%	11-18 year olds in the American Cancer Society Sun Survey I						10.1%
Cokkinides ⁵⁷	2009	1998	1196	--	11-18 year olds in the American Cancer Society Sun Survey II						11.1%
		2004	1613	--	Undergraduates 18-23 years old				15.9%	56.8%	35.0%
Danoff-Burg ⁵⁸	2006	2003	164	50%	White 13-19 year olds in the National Longitudinal Study of Adolescent Health Wave II	11.2%	36.8%	24.1%			
Demko ⁵⁹	2003	1996	6903	51%	University students	58.3%	99.3%	88.2%	52%	94%	83%
Dennis ¹⁵	2009	Pre-2009	162	73%	College students <35 years old						7.3%
Fogel ⁶⁰	2012	2011	576	52%	12-18 year olds in the Growing Up Today Study (children of the participants of the Nurses Health Study II) ^b				2.4%	14.4%	9.5%
Geller ⁴⁴	2002	1999	10079	59%	College students 18-25 years old				11%	22%	17%
Gillen ^e ²⁶	2012	Pre-2012	277	53%	High school students in the Youth Risk Behavior Survey				6.7%	25.4%	15.6%
Guy ⁶¹	2011	2009	14590	50%	Adults in the National Health Interview Survey				10.7%	16.1%	13.4%
Heckman ¹¹	2008	2005	29394	52%	Fair-skinned university students	46.5%	80.0%	68.7%	21.3%	48.5%	39.3%
Hillhouse ¹⁶	1999	Pre-1999	254	66%	University students		55.6%				
Hillhouse ⁶²	2005	Pre-2005	126	100%	College students			53.7%			
Hillhouse ⁶³	2012	2008-2009	296	--	Parents of adolescents in the CITY100 (Controlling Indoor Tanning in Youth) study ^b			23.9%			
Hoerster ⁴¹	2007	2005	5274	78%	14-17 year olds in the CITY100 (Controlling Indoor Tanning in Youth) study ^b				3.5%	18.1%	11.2%
		2005	5274	53%	Undergraduate and graduate students			61.0%			47.0%
Knight ⁶⁴	2002	1999	489	70%	14-17 year olds	12.0%	41.5%	30.3%			
Lazovich ⁶⁵	2004	2000	1273	62%	≥18 year olds	30.2%	44.9%	38.0%			
Lazovich ⁶⁶	2005	2002	802	55%	Unknown ^b			74.0%			
Lazovich ⁴⁶	2008	Pre-2008	24	83%	Junior high and high school students 12-18 years old						18.0%
Lucci ^e ²⁷	2001	1999-2000	210	44%	High school students ^b						12.2%
Ma ⁴⁷	2007	Pre-2007	369	--	Whites >15 years old ^{b†}			34.0%			
Mawn ³²	1993	Pre-1993	477	63%	High school students	7.4%	18.5%	13.3%			
Mermelstein ⁶⁷	1992	Pre-1992	1703	53%							

©2014 American Medical Association. All rights reserved.

Reference	Year published	Year(s) of data collection ^a	Participants in study (N)	% female	Population	Ever prevalence			Past-year prevalence		
						Males	Females	Overall	Males	Females	Overall
MMWR ^{g 68}	2012	2010-2011	15425	48%	Adolescents in the Youth Risk Behavior Survey				6.2%	20.9%	13.3%
Moore ²²	2003	2002	106	64%	>18 year old patients at a primary care clinic ^b	7.9%	25.0%	19.0%			
Mosher ⁶⁹	2010	Pre-2010	421	68%	College students			56.3%	24.1%	59.5%	47.7%
NCI ^{d 2}	n/a	2005	5523	--	≥18 year olds in the Health Information National Trends						8.4%
		2007	7424	--	≥18 year olds in the Health Information National Trends						8.8%
NCI ^{d 4}	n/a	2005	3064	49%	14-17 year olds in the National Health Interview Survey-Cancer Control Supplement				2.0%	15.5%	8.7%
		2008	2204	49%	14-17 year olds in the National Health Interview Survey-Cancer Control Supplement				1.1%	10.2%	5.5%
		2010	2751	49%	14-17 year olds in the National Health Interview Survey-Cancer Control Supplement				1.2%	7.9%	4.4%
Neenan ⁷⁰	2012	2010	487	60%	Community college students >18 years old	17.7%	50.4%	37.2%			
Oliphant ⁴⁸	1994	1991	1008	52%	13-19 year olds ^b	15%	51%	34%			
Poorsattar ⁷¹	2007	2005-2006	375	65%	University students <30 years old	17%	42%	33%			
Reynolds ⁴⁹	1996	Pre-1996	465	49%	European-American 6th graders ^b			3.3%			
Robinson ^{e 24}	1997	1986	1012	50%	>18 year olds						2%
		1996	1000	53%	>18 year olds						6%
Robinson ⁷²	1997	Pre-1997	658	48%	11-19 year olds				1.2%	16.4%	8.5%
Sahn ⁴⁰	2012	2007	415	100%	>18 year olds ^b					51.3%	
Savona ⁶	2005	1999-2001	483	47%	13-19 year olds ^b	14%	27%				
Stapleton ⁷³	2008	Pre-2008	174	72%	Undergraduates						42.9%
Stryker ⁴³	2004	2000-2001	1284	100%	Caregivers of adolescents in the Minnesota and Massachusetts Indoor Tanning Study ^b					15.4%	
Woodruff ³⁶	2006	Pre-2006	94	--	Parents of adolescents ^b			22.34			
		Pre-2006	94	--	14-17 year olds ^b			11.7%			
Zhang ^{h 7}	2012	2005	73494	100%	Nurses in the Nurses Health Study		19.8%				
Canada											
Genuis ³¹	2009	2001-2007	1411	74%	Adult and pediatric patients seen in 3 general medical clinics ^b						9.4%
Gordon ¹⁹	2009	2006	1202	54%	Grade 10 students	7.6%	19.4%	14%			
Rhainds ⁷⁴	1999	1996	1003	58%	Whites 18-60 years old				8.6%	12.8%	11.1%
Northern and Western Europe											
UK											
Amir ^{h 30}	2000	1996	470	89%	Adult healthcare employees	29.0%	48.0%	44.0%			
Hamlet ^{e 28}	2004	2003	1405	--	8-11 year olds						6.8%
Jackson ¹²	1999	1995	3105	--	>16 year old patients at 16 general medical practices ^{b f}			17.0%			
Mackay ³⁷	2007	Pre-2007	496	50%	14-16 year olds ^b	25%	60%	43%			
Thomson ⁷⁵	2010	2008-2009	3101	49%	11-17 year olds in the National Prevalence Study in England	3.5%	8.6%	6.0%			
		2008-2009	6209	50%	11-17 year olds in the Six Cities Study	7.3%	14.4%	10.8%			
Ireland											
Pertl ³³	2010	2007-2008	590	60%	16-26 year olds ^{b f}			11.0%			
Iceland											
Rafnsson ^{h 13}	2003	Pre-2003	1095	78%	Pilots and cabin attendants	52.3%	90.5%	82.2%			
		Pre-2003	1918	76%	Sample of general population age and sex matched to the pilots and cabin attendants	64.1%	87.8%	82.2%			

Reference	Year published	Year(s) of data collection ^a	Participants in study (N)	% female	Population	Ever prevalence			Past-year prevalence			
						Males	Females	Overall	Males	Females	Overall	
Denmark												
Bentzen ⁷⁶	2012	2011	5509	50%	14-18 year olds				28%	70%	38%	
Køster ⁵	2011	March 2007	3356	57%	15-59 year olds [†]			62.5%	21.8%	35.9%	29.9%	
		August 2007	3497	59%	15-59 year olds [†]			59.7%	17.2%	35.3%	27.8%	
		2008	3915	52%	15-59 year olds [†]			57.6%	17.5%	35.4%	26.7%	
		2009	3746	50%	15-59 year olds [†]			59.1%	16.7%	30.1%	23.3%	
		March 2007	342.25	--	15-19 year olds							50.3%
		August 2007	342.25	--	15-19 year olds							47.4%
		2008	342.25	--	15-19 year olds						44.2%	
		2009	342.25	--	15-19 year olds						32.9%	
Kraru ⁷⁷	2011	2008	1871	54%	8-18 year olds			20.8%			16.5%	
Savona ⁶	2005	1999-2001	668	53%	13-19 year olds ^b	52%	72%					
Norway and Sweden												
Boldeman ⁷⁸	2001	1999	2684	54%	20-50 year olds	51.3%	74.9%	64.0%				
Boldeman ⁷⁹	2003	1993	1190	--	14-19 year olds	43.0%	70.1%	56.1%				
		1999	2891	--	14-19 year olds	19.3%	44.8%	32.9%				
Brandberg ⁸⁰	1998	1996	2615	--	Adolescents			9.9%				
Bränström ⁸¹	2004	2001	1752	56%	18-37 year olds			35.0%				
Nielsen ³	2012	1990-1992	40,000	100%	25-64 year olds in the Melanoma Inquiry of Southern Sweden		50%					
Veierød ⁸	2010	1991-1992	79042	100%	30-50 year olds in the Norwegian-Swedish Women's Lifestyle and Health Cohort study		52.0%					
Wichstrøm ¹⁸	1994	1992	15169	55%	High school students				34.9%	74.9%	57.1%	
Belgium												
De Vries ⁸²	2006	Pre-2006	602	59%	14-18 year olds			36.5%				
Germany												
Börner ¹⁰	2009	2007	1419	52% ⁱ	18-90 year olds			28.8%				
		2007	81	52% ⁱ	14-17 year olds			18.5%				
Schneider ⁸³	2009	2008	500	49%	18-45 year olds in the SUN-Study (Sunbed-Use: Needs for Action-Study)	34.8%	59.0%	46.7%	16.0%	26.6%	21.0%	
Schneider ¹⁴	2012	2011-2012	4333	49% ⁱ	18-45 year olds in the SUN-Study (Sunbed-Use: Needs for Action-Study)			42.9%			15.7%	
		2011-2012	518	49% ⁱ	14-17 year olds in the SUN-Study (Sunbed-Use: Needs for Action-Study)			8.7%			5.2%	
Unverricht ^{e h 9}	2007	Pre-2007	149	--	20-65 year olds with outdoor occupations						12.8%	
Austria												
Schauberger ^e	1992	1990	1500	--	>16 year olds [†]						9.8%	
France												
Ezzedine ⁸⁴	2008	2001	7200	59%	35-60 year olds	6%	21%	15%				
Isvy ^{h 17}	2012	2010	570	70%	5th or 6th year medical students and first-year medical residents	9.2%	15.4%	13.5%				
Tella ^{b 21}	2012	2011	704	48%	<18 year olds	0.3%	2.7%	1.4%				

©2014 American Medical Association. All rights reserved.

Reference	Year published	Year(s) of data collection ^a	Participants in study (N)	% female	Population	Ever prevalence			Past-year prevalence		
						Males	Females	Overall	Males	Females	Overall
Spain											
Galán ⁸⁵	2011	2007	2007	51%	18-64 year olds in El Sistema de Vigilancia de Factores de Riesgo asociados a Enfermedades No Transmisibles				1.9%	6.6%	4.3%
Italy											
Fabbrocini ⁵⁰	2012	2011	191	61%	16-19 year olds ^b			40.0%			
Monfrecola ³⁵	2000		764	58%	High school and university students 16-21 years old ^f			12.3%			
Slovakia											
Jakusova ^{e 23}	2012	2003	311	--	College students			39%			
		2005	367	--	College students			30%			
		2008	163	--	College students			13%			
Australia											
CER, NSW ^{j 34}	n/a	2005	11241		≥16 year olds in the New South Wales Population Health Survey				2.0%	2.6%	2.3%
CER, NSW ^{j 86,87}	n/a	2005	2618	53%	12-17 year olds in the New South Wales School Students Health Behaviors Survey				11.5%	13.3%	12.4%
		2008	7448	56%	12-17 year olds in the New South Wales School Students Health Behaviors Survey				7.0%	7.5%	7.2%
Francis ²⁰	2010	2003/2004	5073	50%	18-69 year olds	6.5%	15.4%	10.9%	1.3%	3.0%	2.2%
		2006/2007	5085	50%	18-69 year olds	5.5%	15.7%	10.6%	0.9%	2.1%	1.5%
		2003/2004	699	49%	12-17 year olds	2.8%	3.8%	3.4%	0.3%	2.3%	1.2%
		2006/2007	652	49%	12-17 year olds	1.5%	3.4%	2.5%	0.0%	1.3%	0.6%
Gordon ^{h 29}	2012	2009	2867	60%	Indoor office workers						2.5%
Lawler ⁸⁸	2006	2004	9298	50%	20-75 year olds			10.7%	0.5%	1.3%	1.3%
Unknown											
Yoo ⁸⁹	2009	Pre-2009	155	0%	11-18 year olds	9.4%					

Entries listed by region, country, alphabetically by reference, date of publication, and date of data collection.

n/a indicates not applicable (i.e. study not published and has no publication date)

-- indicates data not available

^a 'Pre' indicates that no specific date of data collection was available

^b Unclear or convenience sampling. Excluded in the sensitivity analysis that excluded studies of potentially lower methodologic quality.

^c United States Centers for Disease Control (CDC)

^d United States National Cancer Institute (NCI)

^e Studies that reported exposure measures that did not specifically fit our 'ever exposure' nor 'past year exposure' definitions and were not included in primary analyses but only in sensitivity analyses.

^f Studies that reported combined results of children (> 15 years or > 16 years) and adults or children and university students that could not be split into subgroups. These were included in the adult category or the university student category for primary analysis and were removed in a sensitivity analysis.

^g Morbidity and Mortality Weekly Report Surveillance Summary (MMWR)

^h Studies that assessed specific occupational groups and were not included in primary analyses but only in sensitivity analyses.

ⁱ Percent female of the entire study, not specific to the population subset listed on this row

^j Center for Epidemiology and Research, New South Wales Department of Health (CER, NSW)

eTable 2: Results of sensitivity analyses

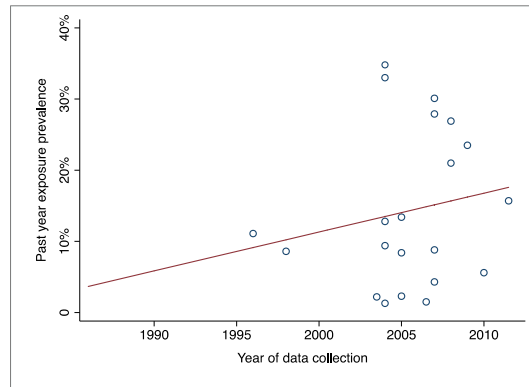
Ever exposure		Summary prevalence (95% CI)	No. of records
Adults	Primary analysis	35.7% (27.5%-44.0%)	22
	<i>Sensitivity - inclusion of occupational group records</i>	38.9% (30.1%-47.8%)	26
	<i>Sensitivity - exclusion of records that included participants <18 years old</i>	32.0% (24.8%-39.2%)	15
	<i>Sensitivity - exclusion of records of lower methodologic quality^a</i>	38.7% (27.4%-49.9%)	14
University students	Primary analysis	55.0% (33.0%-77.1%)	11
	<i>Sensitivity - inclusion of non-standard measures^b</i>	49.1% (29.9%-68.3%)	14
	<i>Sensitivity - exclusion of records that included high school students</i>	59.3% (41.6%-77.0%)	10
Adolescents	Primary analysis	19.3% (14.7%-24.0%)	23
	<i>Sensitivity - exclusion of records of lower methodologic quality^a</i>	19.2% (13.5%-24.8%)	14
Past year exposure			
Adults	Primary analysis	14.0% (11.5%-16.5%)	21
	<i>Sensitivity - inclusion of non-standard measures^b</i>	12.9% (10.7%-15.2%)	25
	<i>Sensitivity - inclusion of occupational group records</i>	13.4% (11.0%-15.8%)	23
	<i>Sensitivity - exclusion of records that included participants <18 years old</i>	11.3% (8.8%-13.8%)	15
	<i>Sensitivity - exclusion of records of lower methodologic quality^a</i>	12.7% (9.8%-15.5%)	16
University students	Primary analysis	43.1% (21.7%-64.5%)	7
	<i>Sensitivity - inclusion of non-standard measures^b</i>	39.8% (21.5%-58.2%)	8
Adolescents	Primary analysis	18.3% (12.6%-24.0%)	23
	<i>Sensitivity - inclusion of non-standard measures^b</i>	17.8% (12.4%-23.2%)	25
	<i>Sensitivity - exclusion of records of lower methodologic quality^a</i>	13.3% (6.4%-20.3%)	17

^a Records with lower methodologic quality were those with unclear sampling, convenience sampling, or sample sizes less than 500.

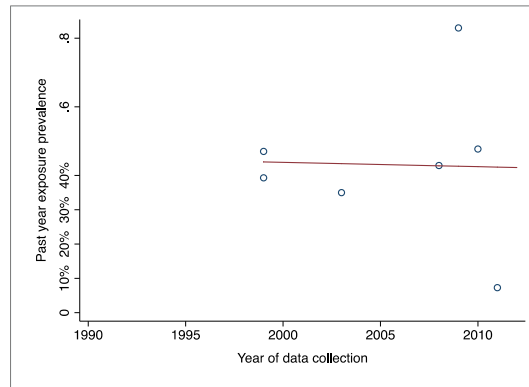
^b Non-standard measures were those that did not specifically fit our 'ever exposure' nor 'past year exposure' categories.

eFigure. Results of meta-regressions of past-year exposure prevalence and year of data collection

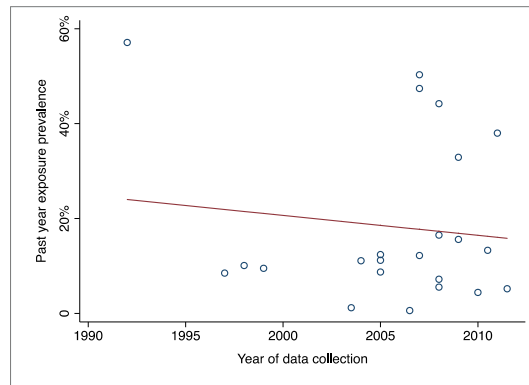
a. Adults



b. University students



c. Adolescents



Each circle represents a data point. Red lines represent the result of a meta-regression. All p-values >0.05.

eREFERENCES

1. Choi K, Lazovich D, Southwell B, Forster J, Rolnick SJ, Jackson J. Prevalence and characteristics of indoor tanning use among men and women in the United States. *Archives of dermatology*. Dec 2010;146(12):1356-1361.
2. National Cancer Institute. Health Information National Trends Survey 2005 & 2007. <http://hints.cancer.gov/question-details.aspx?dataset=2005&method=cati&qid=805>; <http://hints.cancer.gov/question-details.aspx?dataset=2007&method=combined&qid=805>. Accessed January 23, 2013.
3. Nielsen K, Måsbäck A, Olsson H, Ingvar C. A prospective, population-based study of 40,000 women regarding host factors, UV exposure and sunbed use in relation to risk and anatomic site of cutaneous melanoma. *International Journal of Cancer*. // 2012;131(3):706-715.
4. National Cancer Institute. Cancer Trends Progress Report - 2011/2012 Update. http://progressreport.cancer.gov/doc_detail.asp?pid=1&did=2011&chid=101&coid=1011&mid. Accessed January 23, 2013.
5. Køster B, Thorgaard C, Philip A, Clemmensen IH. Sunbed use and campaign initiatives in the Danish population, 2007-2009: A cross-sectional study. *Journal of the European Academy of Dermatology and Venereology*. // 2011;25(11):1351-1355.
6. Savona MR, Jacobsen MD, James R, Owen MD. Ultraviolet radiation and the risks of cutaneous malignant melanoma and non-melanoma skin cancer: perceptions and behaviours of Danish and American adolescents. *European journal of cancer prevention : the official journal of the European Cancer Prevention Organisation (ECP)*. Feb 2005;14(1):57-62.
7. Zhang MF, Qureshi AA, Geller AC, Frazier L, Hunter DJ, Han JL. Use of Tanning Beds and Incidence of Skin Cancer. *Journal of Clinical Oncology*. May 2012;30(14):1588-1593.
8. Veierød MB, Adami HO, Lund E, Armstrong BK, Weiderpass E. Sun and solarium exposure and melanoma risk: Effects of age, pigmentary characteristics, and nevi. *Cancer Epidemiology Biomarkers and Prevention*. // 2010;19(1):111-120.
9. Unverricht I, Knuschke P. Behavior of outdoor workers concerning solar UV exposure in occupation and leisure time. *Verhalten von im freien beschäftigten gegenüber solarer UV-strahlung in beruf und alltag*. // 2007;55(4):159-166.
10. Börner FU, Schütz H, Wiedemann P. A population-based survey on tanning bed use in Germany. *BMC dermatology*. // 2009;9:6.
11. Heckman CJ, Coups EJ, Manne SL. Prevalence and correlates of indoor tanning among US adults. *Journal of the American Academy of Dermatology*. May 2008;58(5):769-780.
12. Jackson A, Wilkinson C, Pill R. Moles and melanomas - who's at risk, who knows, and who cares? A strategy to inform those at high risk. *British Journal of General Practice*. Mar 1999;49(440):199-203.
13. Rafnsson V, Hrafnkelsson J, Tulinius H, Sigurgeirsson B, Olafsson JH. Risk factors for cutaneous malignant melanoma among aircrews and a random sample of the population. *Occupational and environmental medicine*. Nov 2003;60(11):815-820.
14. Schneider S, Diehl K, Bock C, et al. Sunbed Use, User Characteristics, and Motivations for Tanning: Results From the German Population-Based SUN-Study 2012. *Archives of dermatology*. Oct 15 2012:1-7.
15. Dennis LK, Kancherla V, Snetselaar LG. Adolescent attitudes towards tanning: does age matter? *Pediatric health*. Dec 1 2009;3(6):565-578.

16. Hillhouse J, Turrisi R, Holwiski F, McVeigh S. An examination of psychological variables relevant to artificial tanning tendencies. *Journal of health psychology*. Jul 1999;4(4):507-516.
17. Isvy A, Beauchet A, Saiag P, Mahé E. Medical students and sun prevention: Knowledge and behaviours in France. *Journal of the European Academy of Dermatology and Venereology*. // 2012.
18. Wichstrøm L. Predictors of Norwegian Adolescents' Sunbathing and Use of Sunscreen. *Health Psychology*. // 1994;13(5):412-420.
19. Gordon D, Guenther L. Tanning behavior of London-area youth. *Journal of cutaneous medicine and surgery*. Jan-Feb 2009;13(1):22-32.
20. Francis K, Dobbinson S, Wakefield M, Girgis A. Solarium use in Australia, recent trends and context. *Australian and New Zealand journal of public health*. Aug 2010;34(4):427-430.
21. Tella E, Beauchet A, Vouldoukis I, et al. French teenagers and artificial tanning. *Journal of the European Academy of Dermatology and Venereology : JEADV*. Oct 19 2012.
22. Moore J, Zelen D, Hafeez I, Ganti AK, Beal J, Potti A. Risk-awareness of cutaneous malignancies among rural populations. *Medical Oncology*. 2003;20(4):369-373.
23. Jakusova V, Capova K, Poljacek I, Cap I, Jakus J. Ultraviolet radiation - Level of knowledge and health protection of college students in Slovakia. An educational-questionnaire study. *Komunikacie*. // 2012;14(1):89-95.
24. Robinson JK, Rigel DS, Amonette RA. Trends in sun exposure knowledge, attitudes, and behaviors: 1986 to 1996. *Journal of the American Academy of Dermatology*. Aug 1997;37(2 Pt 1):179-186.
25. Schauburger G, Keck G, Cabaj A. Spread and use of solaria in Austria. *VERBREITUNG UND NUTZUNG VON SOLARIEN IN OSTERREICH*. // 1992;18(9-10):303-308.
26. Gillen MM, Markey CN. The role of body image and depression in tanning behaviors and attitudes. *Behavioral medicine (Washington, D.C.)*. 2012;38(3):74-82.
27. Lucci A, Citro HW, Wilson L. Assessment of knowledge of melanoma risk factors, prevention, and detection principles in Texas teenagers. *The Journal of surgical research*. May 15 2001;97(2):179-183.
28. Hamlet N, Kennedy K. Reconnaissance study of sunbed use by primary school children in Lanarkshire. *Journal of public health (Oxford, England)*. Mar 2004;26(1):31-33.
29. Gordon LG, Hirst NG, Green AC, Neale RE. Tanning behaviors and determinants of solarium use among indoor office workers in Queensland, Australia. *Journal of health psychology*. Sep 2012;17(6):856-865.
30. Amir Z, Wright A, Kernohan EEM, Hart G. Attitudes, beliefs and behaviour regarding the use of sunbeds amongst healthcare workers in Bradford. *European Journal of Cancer Care*. Jun 2000;9(2):76-79.
31. Genuis SJ, Schwalfenberg GK, Hiltz MN, Vaselenak SA. Vitamin D status of clinical practice populations at higher latitudes: analysis and applications. *International journal of environmental research and public health*. Jan 2009;6(1):151-173.
32. Mawn VB, Fleischer AB, Jr. A survey of attitudes, beliefs, and behavior regarding tanning bed use, sunbathing, and sunscreen use. *Journal of the American Academy of Dermatology*. Dec 1993;29(6):959-962.

- 33.** Pertl M, Hevey D, Thomas K, Craig A, Chuinneagain SN, Maher L. Differential effects of self-efficacy and perceived control on intention to perform skin cancer-related health behaviours. *Health education research*. Oct 2010;25(5):769-779.
- 34.** Centre for Epidemiology and Research. 2005 Report on Adult Health from the New South Wales Population Health Survey. 2006. <http://www0.health.nsw.gov.au/pubs/2006/pdf/adultreport2005.pdf>. Accessed January 23, 2013.
- 35.** Monfrecola G, Fabbrocini G, Posteraro G, Pini D. What do young people think about the dangers of sunbathing, skin cancer and sunbeds? A questionnaire survey among Italians. *Photodermatology Photoimmunology & Photomedicine*. Feb 2000;16(1):15-18.
- 36.** Woodruff SI, Mayer JA, Clapp E. Effects of an introductory letter on response rates to a teen/parent telephone health survey. *Evaluation review*. Dec 2006;30(6):817-823.
- 37.** Mackay H, Lowe D, Edwards D, Rogers SN. A survey of 14 to 16 year olds as to their attitude toward and use of sunbeds. *Health Education Journal*. // 2007;66(2):141-152.
- 38.** Bolek-Berquist J, Elliott ME, Gangnon RE, et al. Use of a questionnaire to assess vitamin D status in young adults. *Public health nutrition*. Feb 2009;12(2):236-243.
- 39.** Brooks K, Brooks D, Dajani Z, et al. Use of artificial tanning products among young adults. *Journal of the American Academy of Dermatology*. Jun 2006;54(6):1060-1066.
- 40.** Sahn RE, McIlwain MJ, Magee KH, Veledar E, Chen SC. A Cross-sectional Study Examining the Correlation Between Sunless Tanning Product Use and Tanning Beliefs and Behaviors. *Archives of Dermatology*. Apr 2012;148(4):448-454.
- 41.** Hoerster KD, Mayer JA, Woodruff SI, Malcarne V, Roesch SC, Clapp E. The influence of parents and peers on adolescent indoor tanning behavior: findings from a multi-city sample. *Journal of the American Academy of Dermatology*. Dec 2007;57(6):990-997.
- 42.** Bandi P, Cokkinides VE, Weinstock MA, Ward E. Sunburns, sun protection and indoor tanning behaviors, and attitudes regarding sun protection benefits and tan appeal among parents of U.S. adolescents-1998 compared to 2004. *Pediatric dermatology*. Jan-Feb 2010;27(1):9-18.
- 43.** Stryker JE, Lazovich D, Forster JL, Emmons KM, Sorensen G, Demierre MF. Maternal/female caregiver influences on adolescent indoor tanning. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*. Dec 2004;35(6):528 e521-529.
- 44.** Geller AC, Colditz G, Oliveria S, et al. Use of sunscreen, sunburning rates, and tanning bed use among more than 10 000 US children and adolescents. *Pediatrics*. // 2002;109(6):1009-1014.
- 45.** Banks BA, Silverman RA, Schwartz RH, Tunnessen WW, Jr. Attitudes of teenagers toward sun exposure and sunscreen use. *Pediatrics*. Jan 1992;89(1):40-42.
- 46.** Lazovich D, Stryker JE, Mayer JA, et al. Measuring nonsolar tanning behavior: indoor and sunless tanning. *Archives of dermatology*. Feb 2008;144(2):225-230.
- 47.** Ma F, Collado-Mesa F, Hu S, Kirsner RS. Skin cancer awareness and sun protection behaviors in white Hispanic and white non-Hispanic high school students in Miami, Florida. *Archives of dermatology*. Aug 2007;143(8):983-988.
- 48.** Oliphant JA, Forster JL, McBride CM. The use of commercial tanning facilities by suburban Minnesota adolescents. *American journal of public health*. Mar 1994;84(3):476-478.
- 49.** Reynolds KD, Blaum JM, Jester PM, Weiss H, Soong SJ, Diclemente RJ. Predictors of sun exposure in adolescents in a southeastern U.S. population. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*. Dec 1996;19(6):409-415.

- 50.** Fabbrocini G, Mazzella C, Marasca C, De Vita V, Savastano R, Monfrecola G. Sunbathing and sunlamp exposure: awareness and risk among Italian teenagers. *Photodermatology, photoimmunology & photomedicine*. Aug 2012;28(4):224-225.
- 51.** Bagdasarov Z, Banerjee S, Greene K, Campo S. Indoor tanning and problem behavior. *Journal of American college health : J of ACH*. Mar-Apr 2008;56(5):555-561.
- 52.** Baker MK, Hillhouse JJ, Liu XF. The Effect of Initial Indoor Tanning With Mother on Current Tanning Patterns. *Archives of Dermatology*. Dec 2010;146(12):1427-1428.
- 53.** Banerjee SC, Hay JL, Greene K. College students' cognitive rationalizations for tanning bed use: an exploratory study. *Archives of dermatology*. Jun 2012;148(6):761-762.
- 54.** Basch CH, Hillyer GC, Basch CE, Neugut AI. Improving understanding about tanning behaviors in college students: a pilot study. *Journal of American college health : J of ACH*. 2012;60(3):250-256.
- 55.** Centers for Disease Control. National Health Interview Survey. <http://www.cdc.gov/nchs/nhis.htm>. Accessed February 8, 2013.
- 56.** Cohen L, Brown J, Haukness H, Walsh L, Robinson JK. Sun protection counseling by pediatricians has little effect on parent and child sun protection behavior. *Journal of Pediatrics*. // 2013;162(2):381-386.
- 57.** Cokkinides V, Weinstock M, Lazovich D, Ward E, Thun M. Indoor tanning use among adolescents in the US, 1998 to 2004. *Cancer*. Jan 1 2009;115(1):190-198.
- 58.** Danoff-Burg S, Mosher CE. Predictors of tanning salon use: behavioral alternatives for enhancing appearance, relaxing and socializing. *Journal of health psychology*. May 2006;11(3):511-518.
- 59.** Demko CA, Borawski EA, Debanne SM, Cooper KD, Stange KC. Use of indoor tanning facilities by white adolescents in the United States. *Archives of pediatrics & adolescent medicine*. Sep 2003;157(9):854-860.
- 60.** Fogel J, Krausz F. Watching reality television beauty shows is associated with tanning lamp use and outdoor tanning among college students. *Journal of the American Academy of Dermatology*. // 2012.
- 61.** Guy GP, Jr., Tai E, Richardson LC. Use of indoor tanning devices by high school students in the United States, 2009. *Preventing chronic disease*. Sep 2011;8(5):A116.
- 62.** Hillhouse J, Stapleton J, Turrisi R. Association of frequent indoor UV tanning with seasonal affective disorder. *Archives of dermatology*. Nov 2005;141(11):1465.
- 63.** Hillhouse JJ, Baker MK, Turrisi R, et al. Evaluating a measure of tanning abuse and dependence. *Archives of dermatology*. Jul 2012;148(7):815-819.
- 64.** Knight JM, Kirincich AN, Farmer ER, Hood AF. Awareness of the risks of tanning lamps does not influence behavior among college students. *Archives of dermatology*. Oct 2002;138(10):1311-1315.
- 65.** Lazovich D, Forster J, Sorensen G, et al. Characteristics associated with use or intention to use indoor tanning among adolescents. *Archives of pediatrics & adolescent medicine*. Sep 2004;158(9):918-924.
- 66.** Lazovich D, Sweeney C, Forster J. Prevalence of indoor tanning use in Minnesota, 2002. *Archives of dermatology*. Apr 2005;141(4):523-524.
- 67.** Mermelstein RJ, Riesenber LA. Changing knowledge and attitudes about skin cancer risk factors in adolescents. *Health Psychology*. // 1992;11(6):371-376.

©2014 American Medical Association. All rights reserved.

- 68.** Centers for Disease Control. Use of indoor tanning devices by adults--United States, 2010. *MMWR. Morbidity and mortality weekly report*. May 11 2012;61(18):323-326.
- 69.** Mosher CE, Danoff-Burg S. Indoor tanning, mental health, and substance use among college students: the significance of gender. *Journal of health psychology*. Sep 2010;15(6):819-827.
- 70.** Neenan A, Lea CS, Lesesky EB. Reasons for tanning bed use: a survey of community college students in North Carolina. *North Carolina medical journal*. Mar-Apr 2012;73(2):89-92.
- 71.** Poorsattar SP, Hornung RL. UV light abuse and high-risk tanning behavior among undergraduate college students. *Journal of the American Academy of Dermatology*. Mar 2007;56(3):375-379.
- 72.** Robinson JK, Rademaker AW, Sylvester JA, Cook B. Summer sun exposure: knowledge, attitudes, and behaviors of Midwest adolescents. *Preventive medicine*. May-Jun 1997;26(3):364-372.
- 73.** Stapleton J, Turrisi R, Hillhouse J. Peer crowd identification and indoor artificial UV tanning behavioral tendencies. *Journal of health psychology*. Oct 2008;13(7):940-945.
- 74.** Rhainds M, De Guire L, Claveau J. A population-based survey on the use of artificial tanning devices in the Province of Quebec, Canada. *Journal of the American Academy of Dermatology*. Apr 1999;40(4):572-576.
- 75.** Thomson CS, Woolnough S, Wickenden M, Hiom S, Twelves CJ. Sunbed use in children aged 11-17 in England: face to face quota sampling surveys in the National Prevalence Study and Six Cities Study. *BMJ (Clinical research ed.)*. 2010;340:c877.
- 76.** Bentzen J, Krarup AF, Castberg IM, Jensen PD, Philip A. Determinants of sunbed use in a population of Danish adolescents. *European journal of cancer prevention : the official journal of the European Cancer Prevention Organisation (ECP)*. Aug 14 2012.
- 77.** Krarup AF, Køster B, Thorgaard C, Philip A, Clemmensen IH. Sunbed use by children aged 8-18 years in Denmark in 2008: A cross-sectional study. *British Journal of Dermatology*. // 2011;165(1):214-216.
- 78.** Boldeman C, Bränström R, Dal H, et al. Tanning habits and sunburn in a Swedish population age 13-50 years. *European Journal of Cancer*. // 2001;37(18):2441-2448.
- 79.** Boldeman C, Jansson B, Dal H, Ullén H. Sunbed use among Swedish adolescents in the 1990s: A decline with an unchanged relationship to health risk behaviors. *Scandinavian Journal of Public Health*. // 2003;31(3):233-237.
- 80.** Brandberg Y, Ullén H, Sjöberg L, Holm LE. Sunbathing and sunbed use related to self-image in a randomized sample of Swedish adolescents. *European Journal of Cancer Prevention*. // 1998;7(4):321-329.
- 81.** Bränström R, Ullén H, Brandberg Y. Attitudes, subjective norms and perception of behavioural control as predictors of sun-related behaviour in Swedish adults. *Preventive Medicine*. // 2004;39(5):992-999.
- 82.** De Vries H, Willems K, Mesters I, Reubsæet A. Skin cancer prevention behaviours during summer holidays in 14 and 18-year-old Belgian adolescents. *European journal of cancer prevention : the official journal of the European Cancer Prevention Organisation (ECP)*. Oct 2006;15(5):431-438.
- 83.** Schneider S, Zimmermann S, Diehl K, Breitbart EW, Greinert R. Sunbed use in German adults: risk awareness does not correlate with behaviour. *Acta dermato-venereologica*. 2009;89(5):470-475.

- 84.** Ezzedine K, Malvy D, Mauger E, et al. Artificial and natural ultraviolet radiation exposure: beliefs and behaviour of 7200 French adults. *Journal of the European Academy of Dermatology and Venereology* : JEADV. Feb 2008;22(2):186-194.
- 85.** Galán I, Rodríguez-Laso Á, Díez-Gañán L, Cámara E. Prevalence and correlates of skin cancer risk behaviors in Madrid (Spain). *Prevalencia y factores relacionados con las conductas de riesgo de cáncer de piel en Madrid (España)*. // 2011;25(1):44-49.
- 86.** Centre for Epidemiology and Research. New South Wales School Students Health Behaviours Survey: 2005 Report. <http://www0.health.nsw.gov.au/publichealth/surveys/hss/index.asp>. Accessed January 23, 2013.
- 87.** Centre for Epidemiology and Research. New South Wales School Students Health Behaviours Survey: 2008 Report. <http://www0.health.nsw.gov.au/publichealth/surveys/hss/index.asp>. Accessed January 23, 2013.
- 88.** Lawler SP, Kvaskoff M, DiSipio T, et al. Solaria use in Queensland, Australia. *Australian and New Zealand journal of public health*. Oct 2006;30(5):479-482.
- 89.** Yoo JJ. Peer influence on adolescent boys' appearance management behaviors. *Adolescence*. // 2009;44(176):1017-1031.