

Self-reported and genetically-determined pigmentation affects tanning behavior in UK youth



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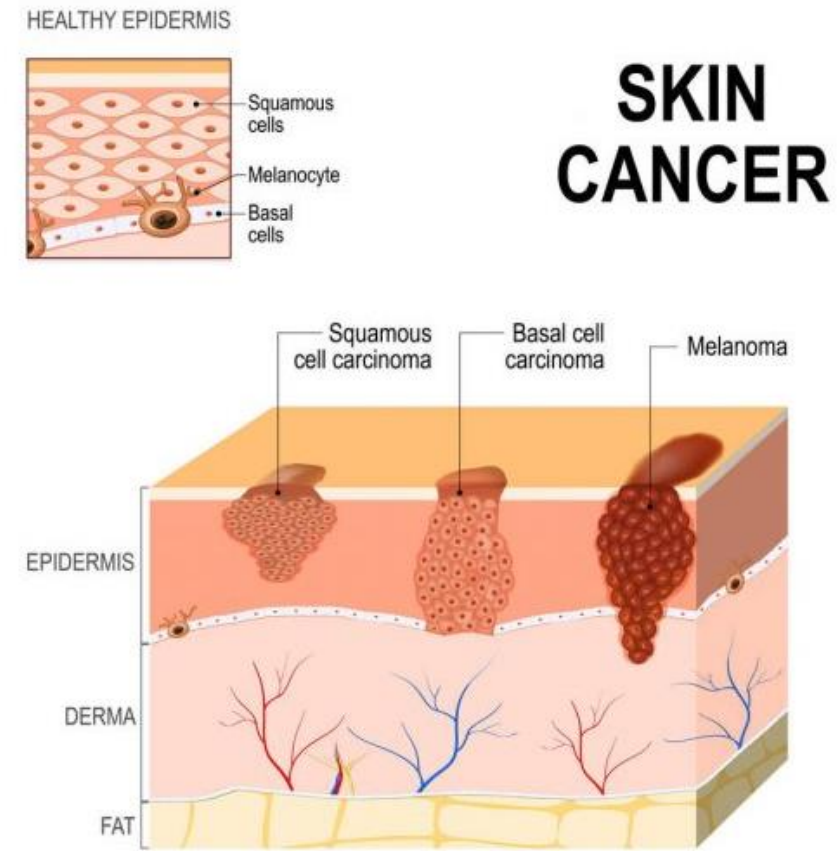


Medicina Preventiva
FMUSP

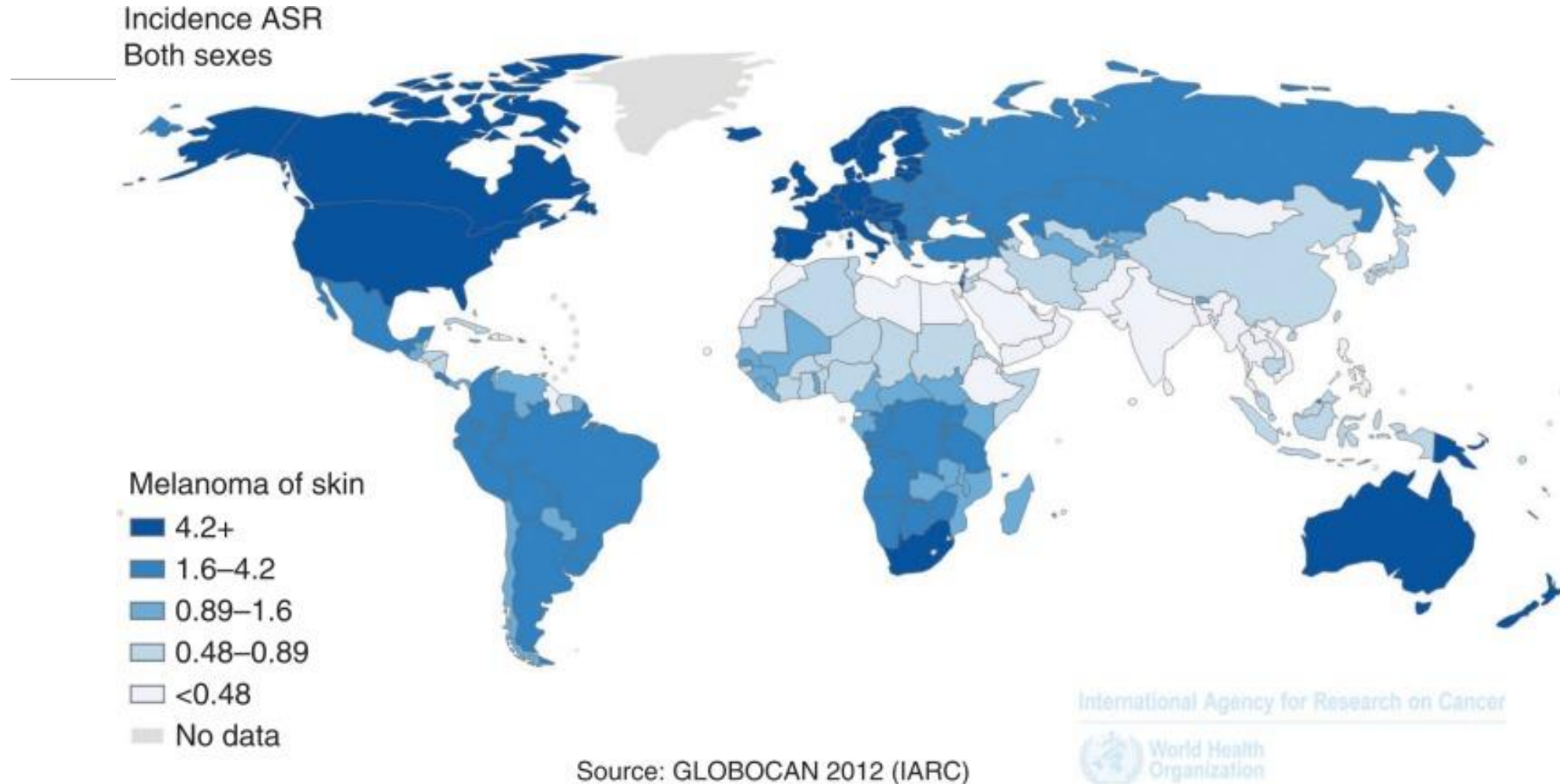
Background

Urban et al. (2021)

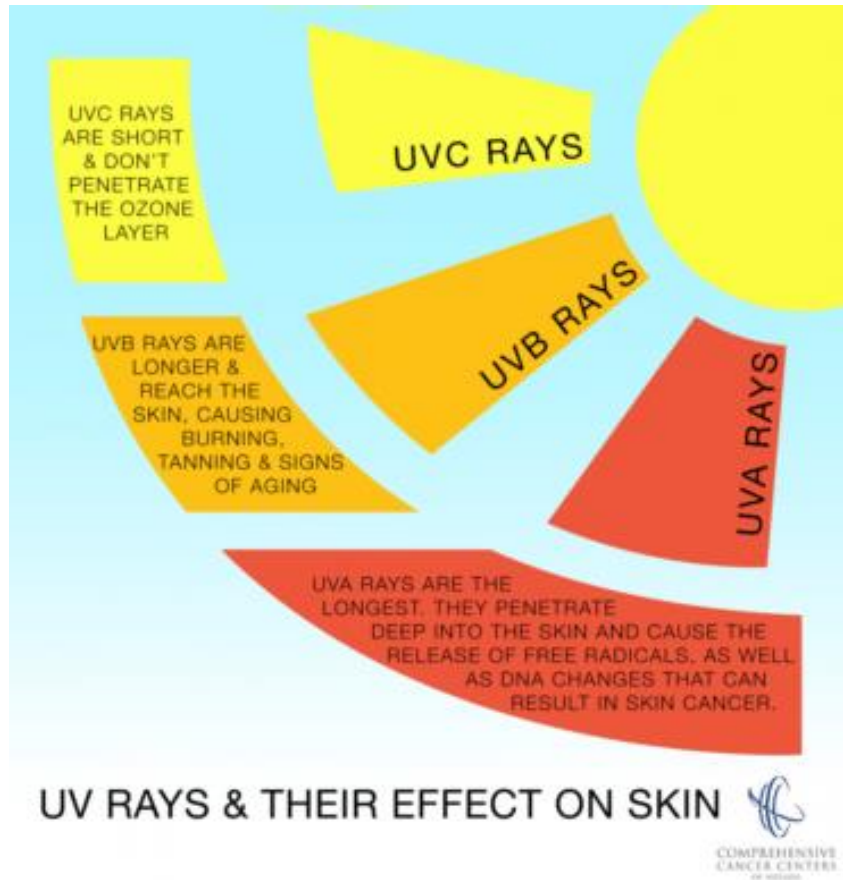
- ❑ The prevalence of skin cancer continues to increase and is a large contributor to skin-related disability.
- ❑ **Skin cancer** = melanoma + non-melanoma skin cancer (NMSC)
- ❑ **NMSC** = basal cell carcinoma (BCC) + squamous cell carcinoma (SCC)
- ❑ SCC and BCC increased by ~300% and 77%, respectively from 1990 to 2017
- ❑ melanoma increased by 161% from 1990 to 2017



Skin cancer more frequent in populations of European ancestry



Ultraviolet radiation (UVR) is the main risk factor



Objective

- ❑ To investigate the association of pigmentation traits, reported via questionnaire and predicted using genetic variants, with tanning preferences in British young adults.

Observational study

Avon Longitudinal Study of Parents and Children (ALSPAC)



credit Dave Pratt

Section G: Tanning and Sun Exposure

G1) Do you like to tan?

Yes ☐

No ☐

➔ If no, please go to question G2

a. How do you usually tan? (Please cross all that apply.)

Outdoors ☐

Indoors, using a sunbed, sun lamp or tanning booth ☐

Indoors, going for a spray tan ☐

Indoors, using self-tanning lotions or creams ☐

b. Why do you like to tan (either outdoors or using any type of indoor tanning)? (Please cross all that apply.)

It gives me more confidence ☐

It makes me feel happier ☐

It makes me look better in photos ☐

It makes me look thinner ☐

It conceals body imperfections ☐

I look more attractive to others ☐

I think pale skin is unattractive ☐

It protects me from the sun ☐

Another reason (please specify) ☐

Genetically-informed study

41 SNPs

HirisPlex-S system

<https://hirisplex.erasmusmc.nl/>

14 predicted pigmentation traits



	Gene	SNP	Allele	No. of Alleles
1	MC1R	rs312262906	A	0 1 2 NA
2	MC1R	rs11547464	A	0 1 2 NA
3	MC1R	rs885479	T	0 1 2 NA
4	MC1R	rs1805008	T	0 1 2 NA
5	MC1R	rs1805005	T	0 1 2 NA
6	MC1R	rs1805006	A	0 1 2 NA
7	MC1R	rs1805007	T	0 1 2 NA
8	TUBB3	rs1805009	C	0 1 2 NA
9	MC1R	rs201326893	A	0 1 2 NA
10	MC1R	rs2228479	A	0 1 2 NA
11	MC1R	rs1110400	C	0 1 2 NA
12	SLC45A2	rs28777	C	0 1 2 NA
13	SLC45A2	rs16891982	C	0 1 2 NA
14	KITLG	rs12821256	G	0 1 2 NA
15	LOC105374875	rs4959270	A	0 1 2 NA
16	IRF4	rs12203592	T	0 1 2 NA
17	TYR	rs1042602	T	0 1 2 NA
18	OCA2	rs1800407	A	0 1 2 NA
19	SLC24A4	rs2402130	G	0 1 2 NA
20	HERC2	rs12913832	T	0 1 2 NA
21	PIGU	rs2378249	C	0 1 2 NA
22	LOC105370627	rs12896399	T	0 1 2 NA
23	TYR	rs1393350	T	0 1 2 NA
24	TYRP1	rs683	G	0 1 2 NA
25	ANKRD11	rs3114908	T	0 1 2 NA
26	OCA2	rs1800414	C	0 1 2 NA
27	BNC2	rs10756819	G	0 1 2 NA
28	HERC2	rs2238289	C	0 1 2 NA
29	SLC24A4	rs17128291	C	0 1 2 NA
30	HERC2	rs6497292	C	0 1 2 NA
31	HERC2	rs1129038	G	0 1 2 NA
32	HERC2	rs1667394	C	0 1 2 NA
33	TYR	rs1126809	A	0 1 2 NA
34	OCA2	rs1470608	A	0 1 2 NA

Results - observational

- Association of self-reported pigmentation traits (SRP) with liking to tan
 - Reasons for liking to tan
- Association of SRP with usually tanning indoors using a UVR device

	liking to tan (N = 3722)		
exposure	OR	95% CI	p-value
sex (0=female/1=male)	0.40	(0.35,0.46)	< 0.001
skin colour			< 0.001
very fair	reference		
fair	3.10	(2.58,3.73)	< 0.001
olive	10.35	(8.04,13.33)	< 0.001
brown	8.57	(5.43,13.54)	< 0.001
eye colour			0.001
blue	reference		
green	1.27	(1.06,1.51)	0.009
grey	0.79	(0.55,1.14)	0.213
brown	1.33	(1.13,1.56)	0.001
other	1.20	(0.87,1.64)	0.262
natural hair colour			< 0.001
red	reference		
blonde	2.31	(1.58,3.39)	< 0.001
light brown	2.76	(1.91,3.98)	< 0.001
dark brown	2.41	(1.67,3.48)	< 0.001
black	1.58	(0.82,3.08)	0.175
other	2.40	(1.21,4.76)	0.013
tanning ability			< 0.001
always burns never tans	reference		
burns easily rarely tans	4.87	(3.20,7.43)	< 0.001
doesn't change	6.25	(3.77,10.35)	< 0.001
tans easily rarely burns	25.21	(16.52,38.48)	< 0.001
always tans never burns	26.65	(14.79,48.03)	< 0.001
sun burning in the past 2 years			< 0.001
never	reference		
once	1.03	(0.85,1.25)	0.737
twice	1.39	(1.14,1.68)	0.001
3 times	1.02	(0.80,1.29)	0.884
4 times	1.49	(1.10,2.02)	0.011
5 times or more	1.77	(1.22,2.58)	0.003

why do you like to tan?	yes/no	% yes
it gives me more confidence	1272/658	65.9
it makes me feel happier	1377/550	71.5
makes me look better in photos	1094/836	56.7
makes me look thinner	486/1444	25.2
conceals body imperfections	541/1389	28.0
I look more attractive to others	940/990	48.7
pale skin is unattractive	423/1507	21.9
protects me from the sun	100/1830	5.2
another reason	175/1755	9.1

	usually UV indoor tanning (N = 1930)		
exposure	OR	95% CI	p-value
sex (0=female/1=male)	0.47	(0.33,0.66)	< 0.001
mother's social class (0=manual/1=non-manual)	0.55	(0.39,0.78)	0.001
father's social class (0=manual/1=non-manual)	0.52	(0.40,0.67)	< 0.001
mother's education			< 0.001
< 0 level	reference		
0 level	0.98	(0.70,1.36)	0.885
> 0 level	0.50	(0.36,0.70)	< 0.001
skin colour			0.002
very fair	reference		
fair	1.92	(1.19,3.11)	0.007
olive	2.60	(1.57,4.30)	< 0.001
brown	2.10	(0.95,4.64)	0.066
tanning ability			0.001
always burns never tans	reference		
burns easily rarely tans	0.82	(0.27,2.48)	0.729
doesn't change	1.02	(0.29,3.58)	0.978
tans easily rarely burns	1.44	(0.49,4.22)	0.506
always tans never burns	2.47	(0.76,7.97)	0.132
can't say, skin always protected	0.69	(0.16,3.03)	0.619

Results - genetics

- Association of genetically-determined pigmentation traits (GDP) with liking to tan
 - Association of GDP with tanning outdoors
 - Association of GDP with sunblock use
- Association of GDP with usually tanning indoors using a UVR device

	liking to tan (N = 2820)		
HirisPlex-S probabilities	OR	95%	p-value
PBlueEye	0.76	(0.62,0.93)	0.007
PIntermediateEye	1.12	(0.39,3.20)	0.836
PBrownEye	1.40	(1.12,1.75)	0.003
PBlondHair	1.23	(0.88,1.71)	0.226
PBrownHair	1.26	(0.85,1.87)	0.257
PRedHair	0.36	(0.22,0.59)	< 0.001
PBlackHair	2.63	(1.08,6.41)	0.033
PLightHair	0.84	(0.62,1.14)	0.263
PDarkHair	1.19	(0.88,1.62)	0.263
PVeryPaleSkin	0.15	(0.06,0.35)	< 0.001
PPaleSkin	0.39	(0.24,0.62)	< 0.001
PIntermediateSkin	2.80	(1.88,4.16)	< 0.001
PDarkSkin	77.26	(1.74,3434.13)	0.025

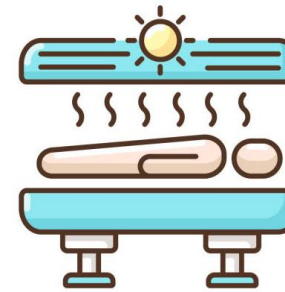
	usually tanning outdoors (N = 1488)		
HirisPlex-S probabilities	OR	95%	p-value
PBlueEye	0.95	(0.61,1.48)	0.819
PIntermediateEye	0.49	(0.05,5.15)	0.551
PBrownEye	1.10	(0.67,1.81)	0.707
PBlondHair	1.43	(0.67,3.04)	0.357
PBrownHair	1.09	(0.43,2.76)	0.849
PRedHair	0.23	(0.09,0.60)	0.003
PBlackHair	12.45	(1.23,126.33)	0.033
PLightHair	0.54	(0.25,1.16)	0.113
PDarkHair	1.85	(0.86,3.97)	0.113
PVeryPaleSkin	0.04	(0.01,0.21)	< 0.001
PPaleSkin	0.37	(0.13,1.09)	0.073
PIntermediateSkin	4.53	(1.75,11.76)	0.002
PDarkSkin	86.10	(0.02,4.90x10 ⁵)	0.313

	usually UV indoor tanning (N = 1489)		
HirisPlex-S probabilities	OR	95% CI	p-value
PBlueEye	0.98	(0.69,1.41)	0.930
PIntermediateEye	1.33	(0.19,9.22)	0.773
PBrownEye	1.01	(0.68,1.50)	0.969
PBlondHair	1.43	(0.77,2.65)	0.254
PBrownHair	0.64	(0.30,1.37)	0.253
PRedHair	0.99	(0.36,2.70)	0.987
PBlackHair	0.65	(0.13,3.30)	0.608
PLightHair	1.43	(0.79,2.58)	0.235
PDarkHair	0.70	(0.39,1.26)	0.235
PVeryPaleSkin	1.55	(0.32,7.60)	0.589
PPaleSkin	1.05	(0.45,2.42)	0.916
PIntermediateSkin	0.87	(0.42,1.80)	0.699
PDarkSkin	3.01	(0.04,248.52)	0.625

	applies sunblock (N = 2823)		
HirisPlex-S probabilities	OR	95%	p-value
PBlueEye	1.66	(1.14,2.41)	0.008
PIntermediateEye	0.37	(0.05,2.64)	0.322
PBrownEye	0.56	(0.37,0.85)	0.006
PBlondHair	0.88	(0.46,1.67)	0.698
PBrownHair	0.75	(0.35,1.61)	0.458
PRedHair	4.03	(1.19,13.59)	0.025
PBlackHair	0.24	(0.05,1.11)	0.067
PLightHair	1.10	(0.61,1.97)	0.755
PDarkHair	0.91	(0.51,1.64)	0.755
PVeryPaleSkin	8.44	(1.23,57.92)	0.030
PPaleSkin	3.93	(1.68,9.16)	0.002
PIntermediateSkin	0.28	(0.14,0.59)	0.001
PDarkSkin	0.01	(1.05x10 ⁻⁴ ,0.49)	0.022



Conclusions



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- ❑ Self-reported skin, hair and eye colour, tanning ability and sun burning in the past 2 years were strongly associated with liking to tan
 - ❑ Self-reported skin colour and tanning ability were also associated with tanning indoors using a UVR device
 - ❑ Genetically-determined pigmentation traits were associated with liking to tan, tanning outdoors, and using sunblock
 - ❑ Genetically-determined pigmentation traits were not associated with UV indoor tanning
 - ❑ Differences between observational and genetically-informed results suggest potential bias of the former and other causal factors for UV indoor tanning

Thank you!

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