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Funding sources: The first 6 years of the Melbourne Atopy Cohort Study were funded (study formula and staff) by Nestec Ltd, a subsidiary of Nestle Australia. The National Health and Medical Research Council (NHMRC) of Australia funded the 18-year follow-up (GNT454856). Drs Dharmage, Lodge, Southey and Lowe are funded by the NHMRC.

Disclosure: Dr Abramson holds investigator-initiated grants from Pfizer and Boehringer Ingelheim for unrelated research and has undertaken an unrelated consultancy and received support for conference attendance from Sanofi. Drs Lowe, Lee, Orchard, King, Allen, Hui, Southey, Lodge, and Dharmage have no conflicts of interest to declare.

IRB approval status: Approved by the Human Research Ethics Committee of Royal Children's Hospital (reference number 28035).

Reprints not available from the authors.

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https://doi.org/10.1016/j.jaad.2020.01.083

Characteristics of postinflammatory hyper- and hypopigmentation in patients with psoriasis: A survey study

To the Editor: Although psoriasis is commonly associated with postinflammatory hyper- and hypopigmentation, their description remains limited. Postinflammatory hyperpigmentation appears to be more frequent than hypopigmentation.[1,2] Interestingly, a pattern of hyperpigmentation called lentiginous hyperpigmentation has been described in areas of previously affected skin after various topical or systemic treatments.[3,4] However, the literature remains speculative regarding the clinical factors associated with this phenomenon.

The aim of this monocentric study was to describe the prevalence of hyper- and hypopigmentation in patients with psoriasis and their association with their demographic and clinical features (see "Patients and Methods" in the Supplemental Appendix 1; available via Mendeley at https://doi.org/10.17632/r5dxjnn8fc.1). The study included 459 patients: 287 men and 172 women (Table I). The mean age was 49.9 years ($\sigma = 16.2$ years). The mean duration of psoriasis was 19.8 years ($\sigma = 18.2$). A total of 81.5% of patients had psoriasis vulgaris (Supplemental Appendix 2; available via Mendeley at https://doi.org/10.17632/r5dxjnn8fc.1). The prevalence of skin hyper- and hypopigmentation was 23.7%. Overall, 63 (13.7%) and 46 (10.0%) patients developed skin hyperpigmentation or hypopigmentation, respectively. Hyper- and hypopigmentation were observed only in areas previously affected by psoriasis. Hypopigmented lesions showed a homogeneous pattern with a sharp border and the presence of residual pigmentation confirmed by Wood's lamp examination (Fig 1, *A-D*). Two clinical patterns of hyperpigmentation were observed: (1) the lentiginous or nevus spilus–like pattern, characterized by the presence of multiple lentigines on a hyperpigmented background (Fig 1, *C*), and (2) a homogeneous pattern with well-defined borders (Fig 1, *D*). Hyperpigmentation was significantly associated with darker Fitzpatrick skin phototype (≥IV) (odds ratio [OR], 3.99; 95% confidence interval [CI], 1.60-10.00). In contrast, no significant association was found between hypopigmentation and skin phototype. Hypopigmentation was significantly observed with younger age (OR, 0.96; 95% CI, 0.93-0.99). No significant association was found between other clinical features including BMI, cardiovascular risk factors, and hyper- and hypopigmentation (Supplemental Appendix 2). Although univariate analyses showed no significant

Table I. Demographic and psoriasis features of patients included

Features	Total	Pigmentation disorders		No pigmentation disorder
		Hyperpigmentation	Hypopigmentation	
Demographic features				
n (%)	459	63 (13.7)	46 (10)	350 (76.6)
Age, mean (σ), y	49.9 (16.2)	49.7 (17.5)*	40.6 (15.3)*	51.2 (15.7)*
Sex ratio, male/female, n (%)	287 (62.5)/ 172 (37.5)	44 (70)/19 (30)	20 (43.5)/26 (56.5)	223 (63.7)/ 127 (36.3)
BMI, kg/m^2, mean (σ)	27.2 (6.1)	27.1 (5.6)	27.2 (6.3)	27.2 (6.1)
Psoriasis features				
Years since psoriasis onset, mean (σ)	19.8 (18.2)	19.7 (22.5)	17.3 (12.1)	20.1 (18.1)
DLQI mean(σ)	4.5 (6.3)	2.7 (4.2)	5 (5.5)	4.1 (6.6)
PASI mean(σ)	4.2 (7.1)	3.8 (5.1)	3.8 (3)	4.4 (7.8)
Phototype, n (%)				
I	9	0	1 (11.1)	8 (88.1)
II	112	18 (16.1)	13 (11.6)	81 (72.3)
III	266	31 (11.6)	26 (9.7)	209 (78.6)
IV	34	9 (26.5)*	6 (17.6)	19 (55.9)*
V	3	3 (100)*	0	0*
VI	2	1 (50)*	0	1 (50)*
Autoimmune disease, n (%)	26	4 (15.4)	4 (15.4)*	18 (96.2)†
Atopic dermatitis	8	0	1 (12.5)	7 (87.5)
Thyroiditis	10	2 (20)	2 (20)	6 (60)
Alopecia areata	1	0	0	1 (100)
Other	13	2 (15.4)	2 (15.4)	9 (70.2)
Treatment duration, mo, mean (σ)	32.1 (35.5)	26.8 (33.4)*	16.4 (27.8)*	35 (36.2)*
PASI75 after 4-8 months of treatment, n (%)	170	27 (15.9)	18 (10.6)	125 (73.5)
PASI90 after 4-8 months of treatment, n (%)	112	16 (14.3)	7 (6.3)†	89 (79.4)†
Previous or current NB-UVB therapy, n (%)	259	40 (15.4)	31 (12)	188 (75.6)
Visual numerical scale for pigmentation disorder, mean (σ)	—	1.9 (2.6)	2.1 (2.8)	—

BMI, Body mass index; *DLQI*, Dermatology Life Quality Index; *NB-UVB*, narrow-band ultraviolet B; *PASI*, Psoriasis Area and Severity Index; *PASI75*, 75% reduction in Psoriasis Area and Severity Index; *PASI90*, 90% reduction in Psoriasis Area and Severity Index.
*$P < .01$.
†$P < .05$.

association between the occurrence of hyper- and hypopigmentation and the treatment received by patients, multivariate regression analysis showed that past or current treatment with phototherapy was significantly associated with hyperpigmentation (OR, 2.21; 95% CI, 1.05-4.67). Hypopigmentation was significantly associated with a shorter course of treatment ($P = .0053$) and negatively associated with a 90% reduction in Psoriasis Area and Severity Index (OR, 0.28; 95% CI, 0.10-0.72) and age (OR, 0.96; 95% CI, 0.93-0.99). Overall, hyper- and hypopigmentation were not associated with high impact on quality of life, as assessed by the use of a visual analog scale. Although underestimated in the literature, the occurrence of hyper- and hypopigmentation appears to be frequent. These abnormalities are consistently located on areas previously affected by psoriasis. Patients with higher Fitzpatrick skin phenotype had an increased risk of developing hyperpigmented lesions. Our results suggest that hyper- and/or hypopigmentation mostly occur independently of the treatment for psoriasis, except for phototherapy. Hypopigmentation developing shortly after the beginning of treatment suggests that it is restricted to the first months of therapy and may resolve afterward, in contrast to hyperpigmented lesions, which may persist longer. The development of hyper- and hypopigmentation could be explained by the skin inflammatory environment associated with increased production of tumor necrosis factor-α and interleukin 17, which have been shown to affect melanogenesis.[5]

We thank Dr Ray Cooke, University of Bordeaux, for critical revision of the manuscript.

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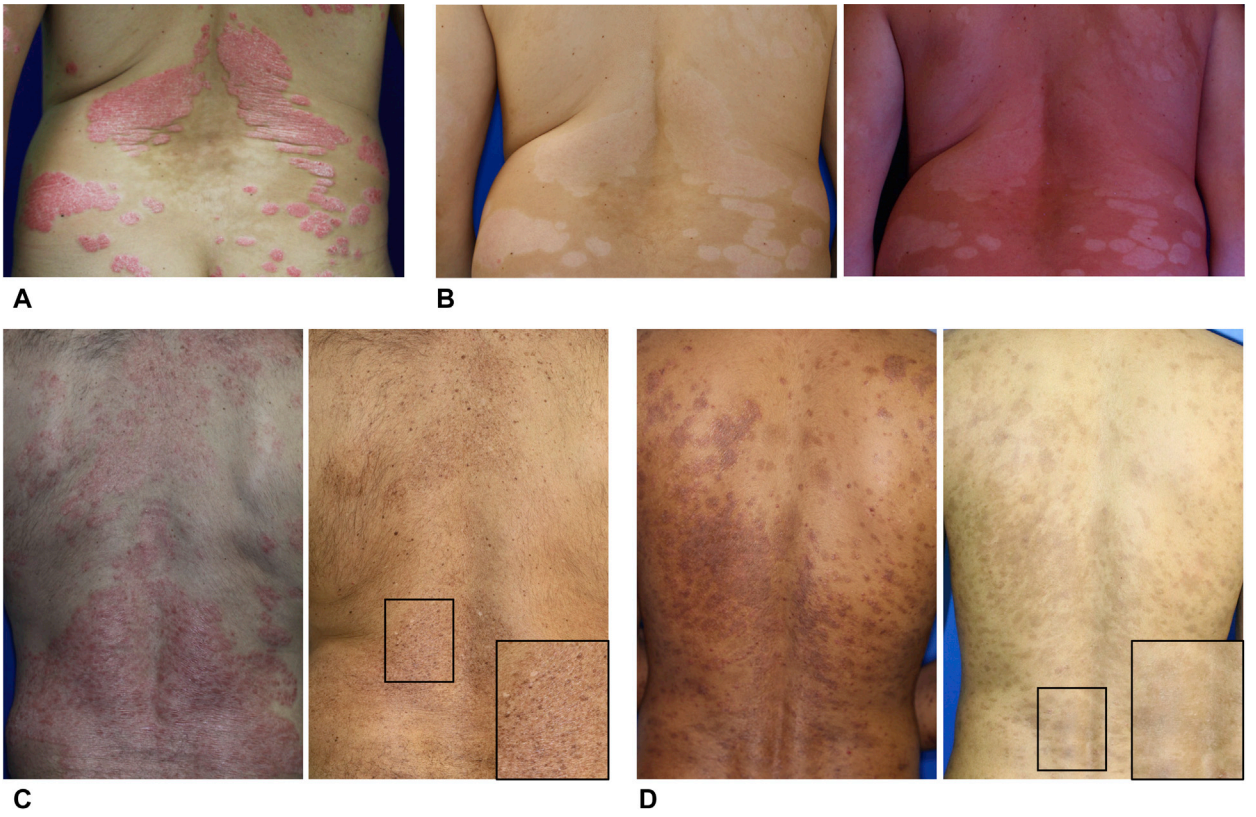

Fig 1. A and **B**, Hypopigmentation pattern. Lesional skin before the initiation of systemic therapy. Hypopigmented lesions shown under normal light and under UV light, observed on areas of previously affected psoriasis skin after 6 months of systemic therapy. Wood's lamp examination of hypopigmented skin showing well-defined borders of lesions. **C** and **D**, Hyperpigmentation patterns. **C**, Lentiginous hyperpigmentation pattern occurring on areas previously affected by psoriasis. **D**, Homogeneous hyperpigmented pattern occurring on areas previously affected by psoriasis.

on behalf of FHU ACRONIM (Fédération Hospitalo-Universitaire Aquitaine's Care and Research Organisation for Inflammatory and Immune-Mediated Diseases)

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Funding sources: None.

Disclosure: Dr Seneschal has received fees from AbbVie, Lilly, Janssen, Medac, Novartis, and Leo Pharma. Drs Amico, Barnetche, Dequidt, Fauconneau, Gérard, Boursault, Boniface, and Darrigade have no conflicts of interest to declare.

IRB approval status: The study has been approved by the Commission Nationale de l' Informatique et des Libertés (CNIL).

Reprints not available from the authors.

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https://doi.org/10.1016/j.jaad.2020.02.025

Temporal trends in primary and secondary skin cancer prevention in the United States

To the Editor: Skin cancer incidence is rising in the United States despite public health efforts encouraging skin cancer prevention.[1] We analyzed temporal trends of skin-cancer related primary (concerned with disease prevention) and secondary (concerned with early disease detection) preventive behaviors to look for potential areas for improvement.

The National Health Information Survey (NHIS) was examined over a 10-year period from 2005 to 2015.[2] The NHIS conducts representative population-based annual interviewing of the adult US population and had response rates of 70.1% to 80.7% during the examined period.[2] Our outcomes of interest were use of sun-protective measures (including sun avoidance, protective clothing, and sunscreen use), lifetime history of full-body skin examination by a physician, and histories in the past year of indoor tanning and 2 or more sunburns. Specifically, use of sun-protective measures were defined as use always or most of the time when outside for more than 1 hour on a warm, sunny day. Protective clothing included at least 1 of the following: long pants, hat, or long-sleeved shirt. A small percentage of individuals answered the sun protection questions by stating that they don't go out in the sun.[2] These individuals and those with unknown or missing responses were excluded from the analysis.[2]

Multivariable logistic regression analyses were used to assess the association between time period and weighted prevalence of sun-protective behaviors, adjusting for sex, region, health insurance, alcohol use, smoking status, education, personal and family histories of skin cancer, income, race, and skin reaction to the sun. *P* values were adjusted for multiple comparisons. Because of substantial missing data for income, NHIS imputed data were used.[2]

The unweighted study included a total of 67,471 individuals. From 2005 to 2015, the unadjusted and adjusted prevalence of most skin cancer—preventive behaviors rose, including sun avoidance, sunscreen use, and full-body skin examination, with the

Table I. Unadjusted and adjusted prevalence of sun protective behaviors by survey year

	Year, unadjusted prevalence, % (95% CI)					Year, adjusted prevalence, % (95% CI)				
	2005	2010	2015	P_{trend} value*	Adjusted $P_{2015\ vs\ 2005}$ value†	2005	2010	2015	P_{trend} value*,‡	Adjusted $P_{2015\ vs\ 2005}$ value†
Sun avoidance	31.1 (30.2-32)	35.4 (34.5-36.3)	37.5 (36.5-38.4)	**<.001**	**<.001**	31.7 (30.9-32.6)	35.5 (34.7-36.4)	36.8 (35.9-37.6)	**<.001**	**<.001**
Protective clothing	35.5 (34.7-36.3)	38.5 (37.5-39.4)	37.5 (36.6-38.4)	**<.001**	**.006**	35.9 (35.1-36.7)	38.4 (37.5-39.2)	37.2 (36.3-38.1)	**<.001**	.098
Sunscreen ASE	30.6 (29.8-31.3)	32.7 (31.7-33.6)	35.5 (34.7-36.4)	**<.001**	**<.001**	31.5 (30.7-32.2)	33.1 (32.2-34)	34.3 (33.5-35.1)	**<.001**	**<.001**
Full body skin exam	18.1 (17.4-18.7)	22 (21.2-22.8)	23.6 (22.9-24.4)	**<.001**	**<.001**	19.0 (18.4-19.6)	22.4 (21.7-23.1)	22.4 (21.7-23)	**<.001**	**<.001**
Indoor tanning	14.8 (14.1-15.5)	6.2 (5.7-6.7)	3.9 (3.5-4.3)	**<.001**	**<.001**	14.1 (13.5-14.8)	6.2 (5.7-6.7)	4.1 (3.8-4.5)	**<.001**	**<.001**
Sunburn	18.7 (18.1-19.3)	21.0 (20.2-21.7)	19.6 (18.8-20.4)	**<.001**	.198	18.2 (17.7-18.8)	21.1 (20.4-21.8)	19.9 (19.2-20.7)	**<.001**	**.001**

Adjusting covariates include sex, census region, health insurance coverage, alcohol use, smoking status, education level, personal history of skin cancer, family history of skin cancer, income, race, and skin reaction to the sun. Bold *P* values are statistically significant at the .05 level.
*Wald tests based on the logistic regression were performed to test for any change in log odds over 2005, 2010, and 2015.
†Pairwise Wald tests based on the logistic regression were performed to test for change in log odds in any two time points. *P* values were adjusted for multiple comparisons using Benjamini & Hochberg (1995).[5]
‡Median *P* rule was used to obtain the final adjusted *P* values due to multiple imputation for income.