ORIGINAL REPORT

Evaluating the Frequency of Mole Checks by a Dermatologist and Correlated Variables in a Global Survey across 17 Countries: HELIOS Project

Henry William LIM[1], Thierry PASSERON[2,3], Chee Leok GOH[4], Hee Young KANG[5], Fatimata LY[6], Akimichi MORITA[7], Jorge OCAMPO-CANDIANI[8], Susana PUIG[9], Sergio SCHALKA[10], Liu WEI[11], Anne Laure DEMESSANT[12], Caroline LE FLOC'H[12], Delphine KEROB[12], Brigitte DRENO[13] and Jean KRUTMANN[14]

[1]Department of Dermatology, Henry Ford Health, Detroit, MI, USA, [2]Department of Dermatology, Côte d'Azur University, Nice University Hospital Center, Nice, France, [3]INSERM U1065, C3M, Côte d'Azur University, Nice, France, [4]National Skin Centre, Singapore, Singapore, [5]Department of Dermatology, Ajou University School of Medicine, Suwon, South Korea, [6]Department of Dermatology, Cheikh Anta Diop Dakar University, EPS Institute of Social Hygiene, Dakar, Senegal, [7]Department of Geriatric and Environmental Dermatology, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan, [8]Universidad Autonoma de Nuevo León, Facultad de Medicina, University Hospital, "Dr. Jose E. González", Monterrey, Mexico, [9]Dermatology Department, Hospital Clinic de Barcelona, Barcelona University, Barcelona, Spain, [10]Medecin Skin Research Center and Biochemistry Department, Chemistry Institute of Sao Paulo University, Sao Paulo, Brazil, [11]Department of Dermatology, The General Hospital of Air Force PLA, Beijing, China, [12]La Roche-Posay International, Levallois-Perret, France, [13]Nantes University, Univ Angers, INSERM, Immunology and New Concepts in ImmunoTherapy, INCIT, UMR 1302, Nantes, France, and [14]IUF Leibniz Research Institute for Environmental Medicine, Duesseldorf, Germany

Secondary prevention of skin cancer consists in early detection of malignant lesions through patients' mole self-examination and medical examination. The objective of this study was to assess the self-reported frequency of mole examination in a large, representative sample of the adult general population of 17 countries from all continents. Of a total of 17,001 participants, 4.8% had their moles checked by a dermatologist more than once a year, 11.3% once a year, 8.4% every 2–3 years, 12.4% once in a while, 10.3% once in lifetime, and 52.6% of participants had never performed a mole examination. Egypt was the country with the highest prevalence of people who performed a moles check more than once a year (15.9%), followed by Brazil and the USA. A higher frequency of mole checks was associated with sex (man vs woman), higher education, higher income, fair phototype, history of skin cancer, medical insurance, and sun-protective behaviours. Despite recommendations by health providers, it appears that the frequency of mole checks in the general population is still low. It is necessary for dermatologists to keep informing at-risk populations about the importance of moles check, with particular care regarding categories that less frequently adhere to secondary prevention measures.

Key words: mole; sun prevention; public health.

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Corr: Anne Laure Demessant, Scientific Communication Director, La Roche-Posay International, France. E-mail: anne-laure.demessant@loreal.com

SIGNIFICANCE

A regular moles check is important for skin cancer prevention. Early detection significantly improves outcomes. This study assessed the self-reported frequency of moles examinations by dermatologists across 17 countries all over the world and revealed that less than half of participants have ever had their moles checked by a dermatologist, with only 15% doing so annually. This means that it is necessary to increase awareness of the importance of mole checks for skin cancer prevention, with particular care regarding categories that less frequently adhere to secondary prevention measures, such as people with lower education and income.

Skin cancer is a significant public health concern. Melanoma and non-melanoma skin cancers are among the most common cancers worldwide (1), and their overall incidence and prevalence have increased in recent decades (2). Primary prevention consists in preventive strategies aimed at mitigating the impact of modifiable risk factors. The main primary prevention of skin cancer is avoiding excessive exposure to ultraviolet rays, which represent the main risk factor for disease occurrence (3). In particular, melanoma is mainly associated with acute sunburn during adolescence, and non-melanoma skin cancers with cumulative sun exposure. Secondary prevention consists in identifying risk factors for disease progression or recurrence. In skin cancer this involves early detection of malignant lesions through patients' skin self-examination and medical examination (4). Early diagnosis is paramount for successful intervention and patient outcomes. Regular mole checks by a dermatologist can help identify suspicious moles or skin changes, detecting melanoma at an early stage, when survival rates are high (5). It has been observed that whole-body clinical skin examination in the 3 years before diagnosis of melanoma significantly reduced the incidence of thick melanomas (6), and as survival from melanoma is strongly related to tumour thickness, this suggests that screening would reduce melanoma mortality.

The frequency of mole examination by a dermatologist or of self-examination may depend on different factors (7), such as sociodemographic factors, personal risk

factors for skin cancer, awareness, beliefs, and medical advice. Moreover, it may be hypothesized and association with social security coverage, incidence of skin cancer in the country concerned, dermatologists/general population ratio, and delay in having an appointment. The knowledge of the factors influencing individual mole examination habits is relevant, because it can help healthcare professionals and public health organizations design effective strategies to encourage regular mole checks by dermatologists and skin self-examinations.

The aim of this study was to assess the self-reported frequency of moles examinations by a dermatologist in a large sample of the general population of 17 countries, and its association with demographic characteristics, socioeconomic background, and sun-protective behaviours.

METHODS

An online survey was conducted from 28 September to 18 October 2021in 17 countries from all continents: the United States of America (USA), Brazil, Mexico, Argentina, Canada, Germany, France, Spain, Italy, United Kingdom, Russia, South Africa, Egypt, China, Japan, Indonesia, and Australia. Methodology has been described in a previous paper (8). The study population included men and women aged 18 years or older selected from the Ipsos Online Panel and adjusted in order to ensure representative samples based on sex, age, employment status, and country region. Samples of 1,000 individuals per country fitted the quotas defined above. The auto-administered questionnaire collected information on demographics, personal medical history, sun exposure, and skin cancer prevention habits. Phototype was indicated by the participants using the Fitzpatrick classification together with a description of the colour of the skin and colour picture representations. The primary outcome of the present study was the frequency of mole checks, investigated by the question "Do you have your moles checked by a dermatologist?", with possible answers "more than once a year", "once a year", "every 2 or 3 years", "once in a while", "only once in my life", "never". For each country, the number of dermatologists per 100,000 inhabitants and the incidence of melanoma per 100,000 inhabitants were extrapolated from the literature or from web information of national cancer associations. Spearman's rho was calculated to evaluate the correlation among those 2 variables and the frequency of mole checks.

Categorical data were described using numbers and percentages, and continuous variables by mean and standard deviation. Frequency of moles check was compared in different subgroups of participants using a χ^2 test. A linear regression model was tested with the frequency of mole checks as the dependent variable, and sex, age, income, education, phototype, personal history of skin cancer, and medical insurance as independent variables. The same model was tested in each of the 17 countries.

RESULTS

The study population consisted of 17,001 participants in the survey. Of these, 47% were men and the mean age was 44.4 years (SD: 16.0). Characteristics of the study population were described in a previous publication (8). **Table I** lists the number of dermatologists per 100,000 inhabitants in each country, as well as the incidence of melanoma, and the frequency of mole checks at least every 2 or 3 years. A high variability among countries was observed, with the lowest incidence of melanoma in Egypt and the highest in Australia. Frequency of mole checks was positively correlated with the incidence of melanoma (Spearman's rho=0.498). The correlation with the number of dermatologists was 0.350 (not significant). The number of dermatologists was significantly correlated with the incidence of melanoma (r=0.532). Frequencies of mole check-ups according to different variables are presented in **Table II**. The percentage of participants who performed a moles check more than once a year was 4.8%, and was higher in men than in women, in people with a higher education level, a higher income, who lived in densely populated areas, with fair phototype, with a history of skin cancer, and having medical insurance. Egypt was the country with the highest prevalence of people who performed a mole check more than once a year (15.9%), followed by Brazil and the USA. Frequency of mole checks was positively associated with sun protective behaviours (**Table III**), such as wearing a hat or protective clothes, using sunscreen, sunglasses, or looking for shade. The linear regression model (**Table IV**) confirmed the association between frequency of mole checks and sex (man vs woman), higher education, higher income, fair phototype, personal history of skin cancer, and medical insurance (beyond the national health service coverage, if present). Some differences were observed among countries in the association between frequency of mole checks and the other variables (**Table V**). However, a history of skin cancer was constantly associated with more frequent mole checks in all countries, as well as having medical insurance in almost all countries.

Table I. Incidence of melanoma and number of dermatologists per 100,000 inhabitants in the different countries and frequency of mole checks

Country	Incidence of melanoma	*n* of dermatologists	Frequency of mole checks[a]
Egypt	0.17	0.8	6.2
Indonesia	0.58	3.5	2.5
China	1.40	2.1	14.0
Mexico	1.60	1.2	3.9
Japan	1.95	5.6	2.0
South Africa	2.60	0.5	5.5
Russia	4.27	1.6	7.4
Brazil	5.80	3.7	9.3
Argentina	10.20	7.3	7.2
Spain	12.64	3.6	9.1
Canada	22.45	2.1	5.9
Italy	22.67	7.3	15.5
France	23.63	6.0	10.4
UK	25.64	3.8	4.2
Germany	26.90	6.6	20.5
USA	29.73	3.8	8.7
Australia	63.46	3.2	10.8

[a]At least every 2–3 years.

DISCUSSION

In the present survey on a representative sample of the general population of 17 countries worldwide, less than

Table II. Frequency of mole checks in 17,001 survey participants

	More than once a year		Once a year		Every 2 or 3 years		Once in a while		Only once in my life		Never	
Factor	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Overall	824	4.8	1,927	11.3	1,431	8.4	2,112	12.4	1,755	10.3	8,952	52.6
Sex												
Man	477	6.0	906	11.3	677	8.5	950	11.9	790	9.9	4,194	52.5
Woman	347	3.9	1,021	11.3	754	8.4	1,162	12.9	965	10.7	4,758	52.8
Age												
18–24 years	103	4.8	207	9.7	158	7.4	230	10.8	153	7.2	1,280	60.1
25–34 years	208	6.0	426	12.3	292	8.4	392	11.3	317	9.1	1,840	52.9
35–44 years	184	5.5	315	9.5	282	8.5	398	12.0	352	10.6	1,796	54.0
45–59 years	168	3.9	483	11.2	350	8.1	579	13.4	469	10.8	2,274	52.6
≥ 60 years	161	4.3	496	13.2	349	9.3	513	13.7	464	12.4	1,762	47.0
Education level												
Low	78	2.9	267	10.0	187	7.0	311	11.6	283	10.6	1,546	57.9
Medium	239	3.9	600	9.7	482	7.8	720	11.7	640	10.4	3,476	56.5
High	507	6.2	1,060	13.0	762	9.3	1081	13.2	832	10.2	3,930	48.1
Income level												
Low	189	4.1	393	8.5	348	7.6	520	11.3	487	10.6	2,660	57.9
Medium	278	5.0	612	10.9	464	8.3	658	11.7	596	10.6	3,004	53.5
High	341	6.3	796	14.7	511	9.4	783	14.4	515	9.5	2,487	45.8
Population density												
Thinly populated	164	3.8	415	9.7	326	7.6	541	12.7	492	11.5	2,330	54.6
Intermediate density	134	3.9	419	12.1	355	10.3	463	13.4	427	12.4	1,659	48.0
Densely populated	485	5.9	1,026	12.4	695	8.4	1,024	12.4	759	9.2	4,287	51.8
Phototype												
1	213	9.1	362	15.5	229	9.8	281	12.0	223	9.5	1,029	44.0
2	234	4.1	708	12.4	549	9.6	811	14.2	618	10.8	2,810	49.0
3	198	4.1	495	10.3	389	8.1	601	12.5	523	10.9	2,602	54.1
4	115	4.4	241	9.2	180	6.8	290	11.0	257	9.8	1,547	58.8
5	41	3.8	83	7.7	55	5.1	112	10.3	110	10.2	682	63.0
6	23	5.6	38	9.2	29	7.0	17	4.1	24	5.8	282	68.3
Medical insurance												
Yes	663	6.0	1,526	13.9	1,093	9.9	1,493	13.6	1,103	10.0	5,129	46.6
No	161	2.7	401	6.7	338	5.6	619	10.3	652	10.9	3,823	63.8
History of skin cancer												
Yes	309	22.5	455	33.2	223	16.3	180	13.1	73	5.3	132	9.6
No	515	3.3	1,472	9.4	1,208	7.7	1,932	12.3	1,682	10.7	8,820	56.1
Country												
Argentina	20	2.0	129	12.9	72	7.2	164	16.4	102	10.2	513	51.3
Australia	68	6.8	167	16.7	108	10.8	113	11.3	103	10.3	441	44.1
Brazil	83	8.3	171	17.1	93	9.3	141	14.1	117	11.7	395	39.5
Canada	23	2.3	58	5.8	59	5.9	128	12.8	139	13.9	593	59.3
China	66	6.6	168	16.8	140	14.0	181	18.1	29	2.9	417	41.7
Egypt	159	15.9	142	14.2	62	6.2	117	11.7	84	8.4	436	43.6
France	30	3.0	113	11.3	104	10.4	168	16.8	151	15.1	434	43.4
Germany	37	3.7	193	19.3	205	20.5	123	12.3	146	14.6	296	29.6
Indonesia	42	4.2	51	5.1	25	2.5	88	8.8	65	6.5	729	72.9
Italy	34	3.4	170	17.0	155	15.5	189	18.9	130	13.0	322	32.2
Japan	8	0.8	15	1.5	20	2.0	19	1.9	60	6.0	878	87.8
Mexico	50	5.0	82	8.2	39	3.9	104	10.4	70	7.0	655	65.5
Russia	10	1.0	80	8.0	74	7.4	161	16.1	114	11.4	561	56.1
South Africa	41	4.1	67	6.7	55	5.5	84	8.4	77	7.7	676	67.6
Spain	51	5.1	102	10.2	91	9.1	125	12.5	170	17.0	461	46.1
UK	21	2.1	39	3.9	42	4.2	82	8.2	112	11.2	704	70.4
USA	81	8.1	180	18.0	87	8.7	125	12.5	86	8.6	441	44.1
Annual average sunlight hours												
Low	89	2.2	305	7.6	326	8.1	352	8.8	457	11.4	2,471	61.8
Medium	402	5.0	1,102	13.8	802	10.0	1,185	14.8	872	10.9	3,638	45.5
High	323	8.1	440	11.0	229	5.7	414	10.3	312	7.8	2,282	45.5

half of participants reported having had their moles checked by a dermatologist at least once during their life, and only about 15% did so at least once a year. The frequency of mole checks is strongly dependent on the personal history of skin cancer. A positive melanoma history is related to a 10-fold increased risk of developing a subsequent melanoma compared with the general population (9), and thus follow-up with regular checks is necessary to detect recurrence. A systematic review (7) described that in different studies 71.6% of patients with a previous melanoma reported examining their skin in the past 2 months (10), 85–88% in the past year (11), and about 50% of patients reported that they examined their moles at least once per year (12). Conversely, in the general population skin examination and self-examination seem to be rare. For example, in a study on awareness and prevention of skin cancer in a group of Turkish students (13), knowledge was scarce and only 4.5% of them regularly practised mole self-examination. Among medical students, the level of knowledge regar-

Table III. Frequency of mole checks according to sun-protective behaviours

Factor	More than once a year/Once a year *n* (%)	Every 2 or 3 years/Once in a while *n* (%)	Only once in my life/Never *n* (%)	*p*-value (χ^2 test)
Overall	2,751 (16.2)	3,543 (20.8)	10,707 (63.0)	
Hat				<0.001
Yes	1,983 (21.1)	2,111 (22.5)	5,285 (56.3)	
No	768 (10.1)	1,432 (18.8)	5,422 (71.1)	
Protective clothes				<0.001
Yes	1,685 (22.2)	1,589 (21.0)	4,304 (56.8)	
No	1,066 (11.3)	1,954 (20.7)	6,403 (68.0)	
Sunscreen on face				<0.001
Yes	2,267 (21.9)	2,472 (23.9)	5,619 (54.2)	
No	484 (7.3)	1,071 (16.1)	5,088 (76.6)	
Sunscreen on hands, neck, ears				<0.001
Yes	2,097 (23.3)	2,245 (24.9)	4,660 (51.8)	
No	654 (8.2)	1,298 (16.2)	6,047 (75.6)	
Sunscreen on arms, legs, chest				<0.001
Yes	2,149 (22.5)	2,393 (25.0)	5,016 (52.5)	
No	602 (8.1)	1,150 (15.5)	5,691 (76.5)	
Sunglasses				<0.001
Yes	2,097 (21.9)	2,382 (24.9)	5,085 (53.2)	
No	654 (8.8)	1,161 (15.6)	5,622 (75.6)	
Shadow				<0.001
Yes	2,290 (17.4)	2,792 (21.2)	8,116 (61.5)	
No	461 (12.1)	751 (19.7)	2,591 (68.1)	

ding skin cancer and its risk factors is generally higher, and in a study on 1,530 Jordanian medical students (14) more than 40% of them were in the habit of doing skin examinations. In a group of white adults in the USA (15), the percentage of those having a moles check in the past year was low, with a higher prevalence in men than in women (16% and 13%, respectively). Among adults participating in the 2000 National Health Interview Survey (NHIS [16]) only 15% had ever been screened for skin cancer by a physician and 8% had had recent screening. Similar results, with a lifetime prevalence of skin examination of 15%, were reported in a study on US adult workers (17). Differences in moles check frequency may also be due to the different incidence of skin cancer in the different countries. In fact, in our population these 2 variables were positively correlated. In 2 previous studies conducted in the USA (16, 17), higher reported screening rates were associated with older age, white race, higher educational level, having health insurance, greater use of sunscreen, and a family history of melanoma. In the study by Coups et al. (15), higher screening rates were associated with sex (higher in men), older age, personal history of skin cancer, and higher educational level. In our study, too, we observed a higher frequency of skin examination in men than in women, while the association with older age was not significant. Overall, the association between low screening rate and low socioeconomic status, which is associated with a lower level of education, was significant. This may explain the association between low socioeconomic status and poorer melanoma survival observed in a previous study (18). However, this association was not constantly observed in all countries. It is possible that in countries with good health coverage differences relative to socioeconomic status are not present. Moreover, there may be cultural dissimilarities and different healthcare services among countries that could explain the variation in the prevalence of mole checks, and their different correlates. It is interesting to observe that having medical insurance was consistently associated with frequent moles examination in all countries, even though healthcare services are very different among countries.

We observed a strong association between higher frequency of mole checks and sun-protective behaviours. It is possible that people who more frequently go to a dermatologist for moles check are also more aware of primary prevention of skin cancer, thanks to information provided by the dermatologists on risk factors for skin cancer, and the importance of early detection and sun-protection measures.

Despite recommendations by the dermatological societies and clinicians, it appears that the frequency of mole checks in the general population is still low. Even though there are no specific guidelines, the American Cancer Society recommends that in a periodic, general health examination, physicians should screen individuals aged 20 years and older for several cancers, including skin cancer (19).Campaigns are regularly organized in

Table IV. Results of the linear regression model with moles check as the dependent variable

Model	Beta standardized coefficient	95% confidence interval		*p*-value
		Lower limit	Upper limit	
(Intercept)		1.777	2.088	0.000
Sex (woman vs man)	–0.020	–0.116	–0.019	0.006
Age	–0.013	–0.003	0.000	0.079
Education level	0.045	0.068	0.135	0.000
Income	0.042	0.056	0.119	0.000
Phototype	–0.088	–0.141	–0.102	0.000
History of skin cancer (yes vs no)	0.327	1.347	1.472	0.000
Medical insurance (yes vs no)	0.141	0.441	0.545	0.000

Each variable is adjusted on all the others.

Table V. Beta standardized coefficients from the linear regression model with mole check as the dependent variable, separately for each country

Country	Sex	Age	Education	Income	Phototype	History of skin cancer	Insurance
Argentina	−0.126650062	**−0.010380618**	0.054890415	**−0.207842363**	**0.18014013**	**−1.166119178**	**−0.437129435**
Australia	**0.450009934**	−0.002700361	−0.051883687	**0.103096672**	0.056794928	**−0.995439421**	**−0.562778403**
Brazil	**−0.286003071**	−0.002669022	**0.167725007**	**0.183986056**	**0.082809053**	**−1.172581978**	**−1.01022926**
Canada	0.09265325	0.003197068	0.015092031	0.032299574	**0.06122612**	**−1.496887733**	0.009893715
China	0.154873526	−0.006987202	0.136017821	**0.282561438**	**0.09788455**	**−1.305918447**	0.127791146
Egypt	0.296786686	−0.004912438	**0.218053465**	**0.11709667**	**0.165897064**	**−1.633707948**	**−0.667180867**
France	**−0.291224937**	−0.001699449	**0.157312873**	0.089543426	0.030635162	**−1.37313372**	**−0.375384816**
Germany	**−0.211912494**	**−0.013275213**	−0.02126887	0.038772973	**0.092436602**	**−1.45844965**	0.56686275
Indonesia	**0.36869131**	−0.003567263	−0.02756893	**0.260354598**	**0.156110794**	**−1.84015686**	**−0.4971151**
Italy	−0.095559839	0.00448739	0.094752636	0.099118414	0.018725195	**−1.189670807**	**−0.77688511**
Japan	**0.123956257**	**0.004265812**	0.018583209	0.03987532	0.019391677	**−2.128101765**	**−0.18468588**
Mexico	−0.104920859	0.00163598	0.101226496	0.08245649	**0.098609847**	**−1.565149549**	**−0.543401032**
Russia	**−0.246567436**	0.003562695	**0.140013427**	**0.154273933**	**0.080239785**	**−1.922240582**	**−0.254612871**
South Africa	**0.182955685**	0.004397579	**0.101845954**	0.047089204	**0.132633733**	**−1.56043062**	**−0.620339689**
Spain	−0.037977938	0.003985647	−0.040793983	**0.129602051**	0.10640273	**−1.557791654**	**−0.703049627**
UK	0.035921387	**0.006991755**	0.035435288	**0.079558518**	0.03373725	**−1.100961339**	**−0.825764874**
USA	**0.257524837**	0.006261463	0.078377406	**0.16601601**	**0.090689906**	**−1.548961663**	**−0.545302448**

Each variable is adjusted on all the others.
Bold figures indicate a significant association between a variable and mole check ($p<0.05$).

different countries to promote awareness of skin cancer and its prevention, such as, for example, the Skin Cancer Awareness Month in the USA (https://www.skincancer.org/get-involved/skin-cancer-awareness-month/ [accessed 13 September 2023]).

Limitations

A limitation of the study is that participants were only asked about skin examination performed by a dermatologist, and not by other physicians or healthcare professionals or done by themselves. In some countries checking is mainly performed by general practitioners. This could explain, for example, the low frequency reported by the UK population. There may also be a recall bias in reporting the total skin examination received; however, it has been shown that self-reports of total skin examination have high sensitivity (20). Another limitation is that we considered only the incidence of melanoma in the correlation with moles screening, but data on non-melanoma skin cancer are more difficult to obtain and less precise. Also, data on incidence of melanoma and the "number of dermatologists"/"number of inhabitants" ratio were extrapolated from different sources and did not always refer to the last year. However, they should indicate with a good approximation the entity of the measures.

In conclusion, it is necessary that clinicians continue to inform at-risk patients about the warning signs of skin cancer, such as changes in the colour, size, shape, or texture of moles, as well as any bleeding or itching, and recommend such populations have a regular moles check by a healthcare professional. A comprehensive understanding of mole examination habits may help healthcare providers detect those who may be less vigilant about checking their skin, such as people ofa lower socioeconomic status, and provide them with targeted education and resources to reduce their risk.

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Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics statement: This survey has been carried out according to the ICC/ESOMAR code of conduct.

Conflicts of interest: HWL is an investigator for L'Oréal, has served as a consultant for La Roche-Posay, and has been a speaker on a general educational session for La Roche-Posay. TP reports personal fees from La Roche Posay during the conduct of the study and personal fees from L'Oréal. CLG reports receiving honorarium from La Roche-Posay, Galderma, and Cantabria Lab. HYK reports personal fees from L'Oréal during the conduct of the study. AM reports personal fees from L'Oréal during the conduct of the study. JO-C reports personal fees from La Roche Posay during the conduct of the study. SP reports personal fees from La Roche Posay during the conduct of the study and personal fees and non-financial support from La Roche Posay. SS has served as a consultant for La Roche Posay and has participated as a speaker in an educational session for La Roche-Posay. LW reports personal fees from La Roche Posay during the conduct of the study. ALD, CLF, and DK are employees of La Roche Posay. JK reports personal fees from La Roche Posay during the conduct of the study and grants and personal fees from L'Oréal. FL and BD have nothing to disclose.

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