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Cécile Durand, Lyvia Magloire, Florence Cousson-Gélie, Apolline Bord, Leïla Saboni, et al.. Efficacy of an appearance-based and a health-based sun protection intervention on summer vacationers' behaviours, PRISME cluster randomized crossover trial, France. British Journal of Health Psychology, 2023, 28 (3), pp.724-739. 10.1111/bjhp.12650 . hal-04806748

HAL Id: hal-04806748

https://ut3-toulouseinp.hal.science/hal-04806748v1

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Check for updates

Received: 7 July 2022 | Accepted: 24 January 2023

DOI: 10.1111/bjhp.12650

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ARTICLE

Efficacy of an appearance-based and a health-based sun protection intervention on summer vacationers' behaviours, PRISME cluster randomized crossover trial, France

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Funding information

Santé Publique France (France's Public Health Agency); Regional Health Agency of Occitanie

Abstract

Objectives: Sun-seeking vacationers are particularly vulnerable to melanoma. Appearance-based interventions (ABi) showing skin damage of ultraviolet exposure may be a promising prevention tool to improve skin protection. This study aimed to measure and compare the efficacy of an ABi and a health-based intervention (HBi) on French summer vacationers' behaviours and to identify differences between subpopulations.

Design: A cluster randomized crossover trial with three intervention groups (control, ABi, HBi) was conducted in eight campsites on the French Mediterranean coast in summer 2019.

Methods: 1355 vacationers of both sexes and aged 12–55 years were included and followed up after 4 days (T1) and 14 months (T2). Efficacy of interventions was evaluated using multilevel mixed-effect models comparing groups on three outcomes: self-reported sun protection behaviours, sunbathing and skin colour measures. Protection behaviours were analysed according to subpopulations.

Results: Compared to controls, the ABi group had a higher protection and sunbathed for fewer hours at T1 and T2. In the HBi group, the skin colour was lighter than controls at

PRISME: PRevention and Impact of Sun exposure on the French MEditerranean coast.

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T1. When comparing ABi to HBi, ABi participants had lower exposure than HBi at T1 and T2. The protection of people with a 3-years university degree was higher in the HBi group than in others groups while that of people with a secondary school certificate was higher in the ABi group.
Conclusions: Our study provides further evidence of individual sun protection interventions effect in a touristic setting and highlights the relevance of ABi messages to supplement HBi messages, particularly in certain subpopulations with low to intermediate education levels.

KEYWORDS
appearance-based interventions, cluster randomized crossover trial, health-based interventions, sun protection behaviours, ultraviolet exposure, ultraviolet photographs, vacationers

Statement of Contribution

What is already known on this subject?

- Melanoma cases are increasing in most European countries and are largely preventable by sun protection behaviours.
- Sun-seeking vacationers are particularly fond of tanning and overexpose themselves to the sun during vacations.
- Appearance-based interventions focusing on photoaging may be promising to improve behaviours but deserve to be further evaluated.

What does this study add?

- Appearance-based intervention could moderately improve sun protection and reduce sunbathing in a touristic setting.
- Appearance-based intervention is more effective than health-based intervention to reduce sunbathing.
- Appearance-based interventions seem to be more effective in less educated people and could contribute to reducing social health inequalities regarding sun protection.

INTRODUCTION

Melanoma is the most serious skin cancer and is primarily caused by ultraviolet (UV) radiation (Arnold et al., 2018). Incidence has steadily increased in fair-skinned populations over the last 50 years (Erdmann et al., 2013) and cases are estimated to increase by about 50% by 2040 (Arnold et al., 2022). In 2020, an estimated 325,000 melanoma cases with 57,000 related deaths occurred worldwide (Arnold et al., 2022). Western Europe has the second highest incidence rate after Australia/New Zealand (Arnold et al., 2022), with 15,500 cases and 1975 related deaths occurring in France in 2018 (Defossez et al., 2019).

The main risk factor is sun exposure, which depends on individual sun behaviours, making this cancer largely preventable. More specifically, melanomas primarily result from inappropriate and repeated sun exposure as well as a history of sunburn, especially before the age of 15 (Dervault et al., 2005). Intermittent sun exposure, as experienced during the summer vacations, means that vacationers seeking sunny and

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warm destinations are particularly vulnerable (Dervault et al., 2005). In fair-skinned European populations, overexposure is partially driven by vacationers' desire for a tan, which is still a positive social norm associated with beauty and well-being (Les représentations associées au soleil et au bronzage: analyse sociologique. [press release], 2007; Ory, 2008).

Given the positive societal perception of tanning, the literature suggests that appearance-based interventions (ABi) highlighting the aesthetic skin damage caused by UV exposure (wrinkles, aging), especially with photoaging information and UV photographs, may be effective at increasing sun protection intention and sun protection behaviours, and sometimes at reducing exposure (Dodd & Forshaw, 2010; Persson et al., 2018; Williams et al., 2013a). ABi may be more effective than interventions not using these techniques in touristic settings, where sun-seeking vacationers are particularly fond of tanning (Rodrigues et al., 2013). In fact, the latter being particularly sensitive to the positive image that tanning reflects, they could also be more particularly sensitive to the negative image of photoaging induced by excessive sun exposure. ABi could be especially effective for young adults and adolescents who give precedence to the immediate appearance-related benefits of tanning over its negative health effects (Dodd & Forshaw, 2010), which occur in the distant future (Johnson et al., 2009; Rossi et al., 1995). In comparison, health-based interventions (HBi) are more traditional approaches that most often highlight the risk of skin cancer, and it is therefore possible that they mainly affect people at immediate high health risk, i.e. the oldest and people with highly sensitive skin. However, strong evidence is still lacking about the efficacy of ABi to improve sun protection compared to HBi, and in particular according to different at-risk sub-populations. A recent literature review (Persson et al., 2018) pointed out that to properly evaluate ABi, further studies were needed with theoretically constructed interventions, a sufficient sample based on power calculation, a longer follow-up period and more diverse populations in terms of age, sex, ethnicity and exposure location. Indeed, ABi have more frequently been evaluated in students, white women and highly exposed populations in the United States (Persson et al., 2018). Moreover, we may assume that the effect of aesthetic arguments may differ according to individual characteristics such as socioeconomic position or the national context that affects the social norms, which deserve further investigation.

In France, despite annual public health campaigns since 1996, people continue to overexpose themselves to the sun without comprehensive skin protection. Some misconceptions about sun exposure and protection are growing over time, in particular those in relation to the consequences of sunburns in childhood or photoaging (Ménard & Thuret, 2018). Social differentiation exists, with socially and economically disadvantaged people (Bocquier et al., 2016; Durand et al., 2022) and teenagers (Bruce et al., 2017; Falk & Anderson, 2013; Ménard & Thuret, 2018) reporting lower sun protection. With a high level of UV radiation and millions of vacationers each summer, the French Mediterranean coastline is a particularly relevant place to evaluate sun protection interventions, although such evaluations are still rare. To our knowledge, no study to date has tested the hypothesis in the French touristic context that ABi might be more effective than HBi or explored whether age, sex and socioeconomic position influence this efficacy.

For this purpose, the PRISME (PRevention and Impact of Sun exposure on the French MEditerranean coast) study was conducted in 2019 (Durand et al., 2020), with two preventive interventions based on health and appearance messages being developed, and evaluated among French vacationers. The objectives of the present analysis were (1) to measure and compare the efficacy of ABi and HBi in influencing the behaviours of French summer vacationers on the Mediterranean coast and (2) to analyse the effect of these interventions on sun protection behaviours by age, sex, skin sensitivity and education levels.

METHODS

The PRISME methodology and interventions have been described in detail in the previously published protocol (Durand et al., 2020). In the present article, the general methodology of the trial is recalled and the method for meeting the objective of evaluating the efficacy of the interventions is particularly detailed in the outcomes, the covariates and the statistical analyses sections.

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Trial design

PRISME is a cluster randomized crossover trial. Participants belong to three different groups:

- Control group (CG): no preventive intervention;
- HBi group: health-based intervention;
- ABi group: appearance-based intervention.

This trial was approved by the Expert Committee for Research, Studies and Evaluations in the field of Health (CEREES) of the French National Institute of Health Data (INDS; TPS 303174) and the French data protection authority (CNIL; Decision DR-2019-110 of 25 April 2019 relating to request no. 919075; Durand et al., 2020).

Location, follow-ups and participants

Interviewers collected data face-to-face at baseline (T0) and first follow-up (T1, 4 days later) in July and August 2019 (8 weeks) in eight campsites located on the Occitanie Mediterranean coast (southern France). For the second follow-up (T2), participants were contacted by email and telephone, inviting them to participate in an online questionnaire between October and November 2020.

The target population was French vacationers aged 12–55 years staying in campsites along the Mediterranean coast. Additional exclusion criteria were not a French speaker, living abroad, health problem totally forbidding sun exposure, departure before 4 days after inclusion and, for minors, staying without a legal guardian (Durand et al., 2020).

Interventions

For the two intervention groups, sun protection interventions (Durand et al., 2020) were carried out individually by prevention workers, just after the baseline data collection by the interviewers at T0. The intervention consisted of an approximately 30 min verbal exchange with the participant using an intervention booklet with pictures and informations and finally given to the participant (material available in [Durand et al., 2020]). Both interventions were theoretically constructed from the theory of planned behaviour and the transtheoretical model (Ajzen, 1991; Glanz, Rimer, & Viswanath, 2008; Prochaska & DiClemente, 1983). The mechanisms of change used were improved knowledge of sun exposure effects, perception of one's own vulnerability, decisional balance, perceived behavioural control and, in ABi, change in social norm regarding tanning. HBi informed on the negative health effects of sun exposure: sunburn, eyes problems and cancer. To make participants aware of their own health vulnerability, it used a skin sensitivity classification using a quiz taking into account the self-assessed colour of constitutive skin (i.e. on unexposed area), hair, eyes, number of moles and skin tendency to burn or tan in the sun. ABi informed on photoaging and the aesthetic effects of sun exposure on the skin and used UV photographs to allow participants to visualize their own skin damage invisible to the naked eye. The photograph was printed and given to the participant. The same sun-safety messages were given to participants in both intervention groups. The content of the interventions is described in Appendix S1 and in a previous publication (Durand et al., 2020). The control group participants have not received any intervention or seen any prevention worker at T0, and interviewers were alone for data collection. Between T1 and T2, two emails were send to all participants. In the HBi group, the email contained information on health risk, personal skin sensitivity determined during intervention at T0 and tailored sun-safety message. In the ABi group, the email provided information on photoaging, the personal UV photographs taken at T0 were attached and general sun-safety messages were included. In the CG, the emails thanked the participants for their participation and gave general information about the study without any sun preventive message.

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Intervention group allocation

To limit intergroup contamination, the same intervention group was allocated to all participants in a particular campsite for a given week (Durand et al., 2020). Moreover, disparities were observed between campsites with differences of populations, in terms of age, for example, and differences of infrastructures in terms of shaded area or presence of a swimming pool for example. To better take into account these disparities, a crossover design was chosen whereby the allocation of intervention groups was alternated for each campsite on a weekly basis during the 8 weeks of the study inclusion. Additionally, in each campsite, one washout week was included after each week with a prevention intervention (ABi or HBi) to limit contamination by vacationers staying at the campsite for several weeks (Durand et al., 2020).

Sampling and sample size

The survey sampling included three levels: first, eight campsites were randomly selected among a list of 244 campsites on the Mediterranean coast stratified by location (northern or southern of the region) and official campsite classification (0–2 stars, 3 stars and 4–5 stars); second, pitches were randomly drawn each week in each campsite from booking listings; and finally, participants were randomly drawn among the eligible vacationers on each pitch by the interviewers' computer. Sample size calculation indicated that 984 pitches and 1276 participants would be required to observe an increase of 10 points between T0 and T2 in the frequency of fully protected participants (Durand et al., 2020).

Outcomes

Sun protection behaviours were collected by six items using a 5-point scale (never = 0, rarely = 1, sometimes = 2, often = 3, always = 4) and measuring the self-reported frequency of the following recommended behaviours when staying outdoors for more than 15 min: (a) wearing a t-shirt that covered the shoulders, (b) wearing a hat, (c) wearing sunglasses, (d) applying sunscreen every 2 h, (e) staying in the shade and (f) avoiding high-risk hours (i.e., noon to 4 pm). Consistency between these items was analysed in a previous work (Durand et al., 2022). A sun protection score, adapted from Glanz (Glanz, Yaroch, et al., 2008), was constructed with the sum of these six items and ranged from 0 to 24.

A secondary outcome measured an exposure behaviour using the number of hours of sunbathing per day on sunny days (no sunbathing = 0, <30 min = .25, 30 min–1 h = .75, 1–2 h = 1.5, […], 9–10 h = 9.5, >10 h = 10.5).

These items were collected at each of the three collection times. At T0, the items corresponded to the vacationers' intentions to adopt the behaviour during their current stay, assuming that the majority started their vacations at this time (*2.7 days on average since arrival at the campsite according to our data*). At T1, the items represented their behaviours during their stay since T0 four days earlier. Then, 14 months later at T2, the items represented their behaviours during their last vacations (minimum length of 4 days in order to be comparable) during the summer of 2020.

Finally, to analyse a more objective measure than self-reported data, another secondary outcome was skin colour measured by a colorimeter at three exposed points and representing the acquired tan: top of the shoulder, bridge of the nose and cheekbone (Durand et al., 2020). The outcome was the mean of these measures expressed as the individual typology angle (ITA), with a lower ITA representing darker skin (Del Bino & Bernerd, 2012). These measures were taken at T0 and T1.

Covariates

Variables likely to influence the relation between intervention group and sun protection behaviours were collected at T0: age, sex, professional category of the person in their household with the highest income,

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education level (for minors, the highest degree obtained by either one of their parents), personal or family history of cancer, place of residence and skin sensitivity. Skin sensitivity was self-reported and collected in the questionnaire for all participants by six items representing the self-assessed constitutional skin colour (i.e. the colour on an unexposed area of skin from "very light" to "black"), eye and hair colour, presence of moles and skin reactivity to the sun in terms of tanning and sunburn and analysed with a factorial analysis presented in (Durand et al., 2022). Variables related to the survey context were also collected: time since arrival in the campsite, week and campsite. Coding can be viewed in Table 1 and Appendix S2.

Statistical analysis

First, participation at T0 and attrition at T1 and T2 were described. At T0, covariates were compared between groups to identify differences induced by cluster randomization.

Second, a linear multilevel mixed-effect model was used. Random-effect intercepts were introduced for the three sampling levels: campsite, pitch and individual. We applied an unstructured variance–covariance matrix of residuals. For each outcome, the dependent variable (Y) included the observations of the outcome at T1 and T2, and the baseline level of the outcome at T0 was included as a covariate. First, in order to measure the effect of each intervention on the outcome, the difference of marginal predictive mean between each intervention group and the CG was estimated at T1 and at T2, using a group term and an interaction term: group × T2. Second, in order to compare the effect of the two interventions, the difference between the ABi and the HBi at T1 and T2 was estimated by changing the reference group. The week of inclusion was included as a covariate, as it was a component of the randomization process, potentially associated with weather effects (Pocock et al., 2002). The initial model was thus:

$$\text{Model 0}: Y(T1 - T2) = Y(T0) + \text{group} + T2 + \text{group} \times T2 + \text{week}$$

with random-effect intercepts for campsite, pitch and individual.

A second model was applied (Model 1), consisting of the initial Model 0 adjusted for an additional set of baseline variables that were associated with both intervention group and the outcome in order to decrease the risk of confounding bias (Pocock et al., 2002).

Finally, to increase the power and accuracy of the estimates (Kahan et al., 2014; Permutt, 1990; Pocock et al., 2002; Senn, 1989), a final model was applied (Model 2), consisting of Model 1 adjusted for variables that were a priori expected to be strongly associated with the outcome: age, sex, education level and skin sensitivity.

Additional analyzes were conducted based on the protection score outcome.

Per-protocol analysis was performed to exclude participants lost to follow-up or those with an incomplete intervention at each time point (e.g., missing UV photo, shortened intervention, protocol not respected, emails before T2 unreceived or unread).

Sensitivity analysis was performed by changing the construction of the protection score. Instead of a sum score, a factor score was constructed using the first component of principal component analysis. This choice was justified by the assumption that items do not hold the same weight in terms of sun prevention: for example, staying in the shade and wear protective clothing are emphasized more than other behaviours in the recommendations (HCSP, 2020).

Finally, as we assumed that age, sex, education level and skin sensitivity may modify the efficacy of the interventions, the effect was measured by subpopulations by including successively in Model 2 the triple interaction for these possible moderation variables (group × time × X; Models 2.1–2.4).

All descriptive and analytical statistics were performed on weighted data taking into account the three levels of sampling and the stratification of campsites of the survey design. Statistical significance was defined by a two-sided p-value < .05 (noted $*p < .05$, $**p < .01$, $***p < .001$). Analyses were performed using Stata® version 14.2.

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TABLE 1 Description of participants at baseline in the three intervention groups, PRISME, France, 2019.

	Total		Baseline (T0)			
			CG	HBi	ABi	
	n	%[a]	%[a]	%[a]	%[a]	*p*
Total	1355	100.0	28.3	27.6	44.1	
Age						
12–14 years	208	12.3	12.0	12.6	12.3	*.303*
15–24 years	295	25.0	28.4	27.4	21.3	
25–34 years	165	13.4	13.6	11.9	14.2	
35–44 years	313	25.4	23.0	21.1	29.6	
45–55 years	374	23.9	23.0	27.0	22.6	
Sex						
Men	599	48.3	49.6	48.5	47.3	*.870*
Women	756	51.7	50.4	51.5	52.7	
Education level						
Less than secondary school certificate	431	32.9	35.2	29.1	33.7	*.901*
Secondary school certificate	404	31.6	29.5	34.3	31.2	
1 or 2-year university diploma	225	17.2	16.2	19.3	16.6	
3-year university degree	140	9.8	9.1	9.1	10.7	
4-year university degree or higher	146	8.5	10.0	8.2	7.8	
Professional category						
Tradespeople, farmers	99	6.5	12.2	7.6	2.2	***.004***
Senior manager	181	14.6	15.6	12.1	15.5	
Intermediate professionals	402	29.1	22.7	28.8	33.5	
Administrative and service staff	274	20.7	20.8	17.8	22.4	
Manual workers	323	23.4	23.8	25.8	21.6	
Retired, not working	76	5.7	4.9	8.0	4.8	
Skin sensitivity						
Highly sensitive	456	33.5	37.9	32.8	31.1	*.419*
Sensitive	619	46.1	44.8	42.4	49.2	
Slightly sensitive	226	15.6	14.3	19.1	14.3	
Dark to black skin	54	4.8	3.0	5.7	5.4	
Place of residence						
Coast	373	25.6	27.8	22.6	26.1	***.023***
Mountain	363	27.9	30.3	36.0	21.3	
North	415	31.6	25.1	29.0	37.5	
South	204	14.9	16.8	12.4	15.2	
Time since arrival						
0 day	90	5.3	4.5	9.6	3.2	***.007***
1 day	521	43.0	48.8	43.0	39.2	
2 days	296	21.9	18.2	21.5	24.6	
3 days	120	8.2	7.5	3.2	11.7	
4 or 5 days	103	6.2	7.5	3.7	6.9	
6 or 7 days	76	5.1	5.4	5.3	4.8	
8 days or more	149	10.3	8.1	13.8	9.6	

Abbreviations: ABi, Appearance-based intervention group; CG, Control group; HBi, Health-based intervention group.

[a]Distribution taking into account the sampling weights.

Bold significative *p*-value < .05.

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RESULTS

Participation and baseline description

The study included 1355 participants at baseline, 1283 at T1 (95%) and 595 at T2 (44%; Figure 1). At T1, participants lost to follow-up were younger than those who remained in the study. At T2, they were younger, less educated and had a lower baseline protection score.

Limited missing data were observed for the protection score at baseline and T1 (<1%). At T2, the outcomes data collection was restricted to 80% of participants who went on vacation for more than 4 days during the previous summer (n = 474). Among them, the protection score was missing for 9% (n = 45). Thus, the protection score was complete for 1350 participants at T0, 1279 at T1 and 429 at T2. A complete description of participants at T0, T1 and T2 is available in Appendix S2.

As the size of the target population varied greatly depending on the campsite and the week, the distribution of participants included in the three groups at baseline differed according to these two randomization variables: campsites ($p < .001$) and week ($p < .001$). Moreover, additional between-group differences at baseline were observed for professional category, place of residence (*not associated with the outcomes and so not included in models*) and time since arrival in the campsite, but not for age, sex, education level and skin sensitivity (Table 1). At the follow-ups, the between-group differences were similar (Appendix S2).

Sun protection behaviours

The distribution of the non-adjusted protection score at the three data collection times in the different groups is presented in Figure 2 and in Appendix S2. The mean of the score was rather similar in the three groups at baseline (p = .215), T1 (p = .419) and T2 (p = .479). The median score and percentiles increased over time in the HBi group, while this increase was visible only at T2 in the CG and ABi groups. However, this description did not take into account the correlation of observations in the same pitch or campsite and was not adjusted, in particular for the week, which was an important randomization variable that could influence behaviour due to weather differences from week to week.

Results from multivariate analyses are presented in Table 2 and Appendix S3.

The protection score was higher in the HBi group than in the CG at T1 in the Model 1 (p = .048), and this result was close to statistical significance in the other two models (p = .056 and .057). At T2, the difference with the CG was of the same size but was not significant in any of the models. In the ABi group, the protection score was significantly higher than in the CG in both the short and long term (p = .007 and p = .002, respectively). These differences were slightly higher after the inclusion of covariates in model 2. When compared to each other, the two interventions did not have significantly different protection score at T1 or at T2 (p = .240 and p = .622, respectively). The magnitude of these differences can be visualized in a graph in Appendix S3 (graph S3.1).

Results were similar when transforming the sum score into a factor score (Appendix S4).

Secondary outcomes: Sunbathing and skin colour

The number of hours spent sunbathing during the vacation was lower in the ABi group in the short and long term compared to the CG (Table 2; T1: p = .004, T2: p = .029) and to the HBi group (T1: p = .045, T2: p = .001). No difference was found between HBi and CG.

For skin colour measured by a colorimeter, the adjustment for skin sensitivity in Model 2 led to an important change in the results compared to Models 0 and 1 due to the strong link between the skin sensitivity (partially defined by the self-assessed constitutional skin colour on unexposed area) and the skin colour acquired after tanning and measured by a colorimeter on exposed areas. In this final Model

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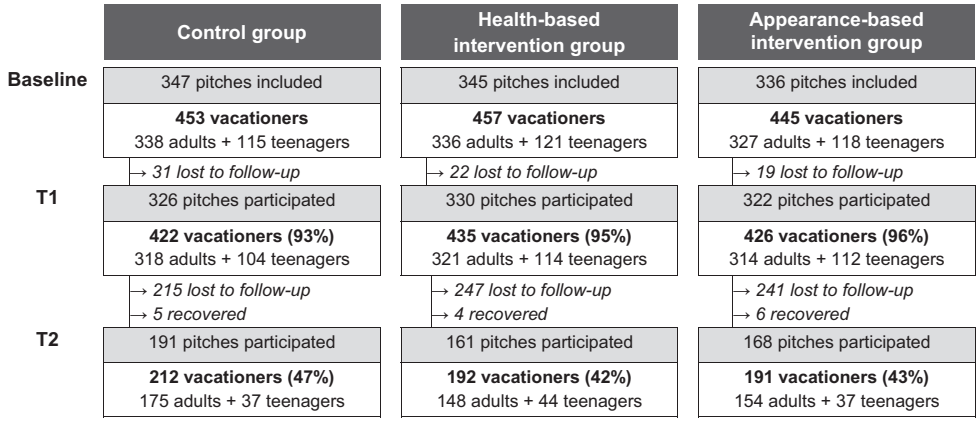

FIGURE 1 Flow diagram of participation from T0 to T2 in the different intervention groups, PRISME, France, 2019–2020.

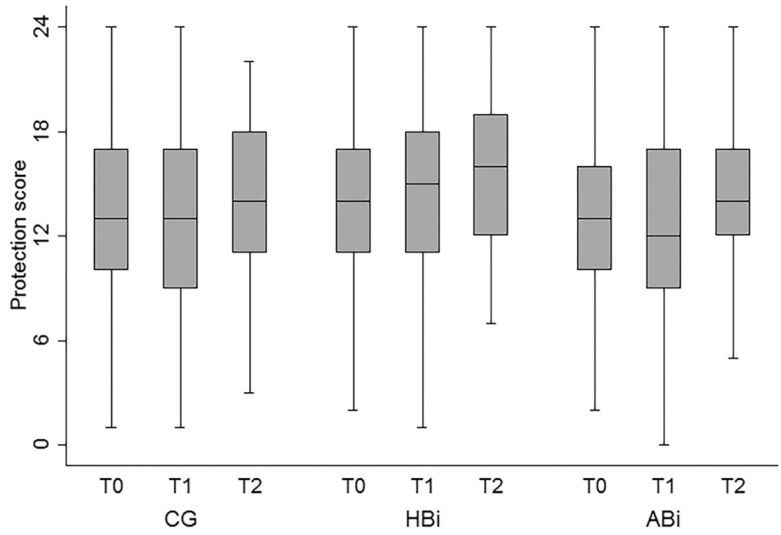

FIGURE 2 Box plot of the sun protection score in the control and intervention groups at baseline (T0), short-term (T1) and long-term (T2) follow-ups, PRISME, France, 2019–2020.
Abbreviations: ABi, Appearance-based intervention group; CG, Control group; HBi, Health-based intervention group.

2, short-term ITA was higher in the HBi group compared to CG (p = .002), which indicates lighter skin. The same tendency was found in the ABi group, although statistical significance was not achieved (p = .053). The effect of the two interventions was not different (p = .269).

Subpopulation analysis

The protection score of women in the two interventions groups was higher than in the CG in the short term (HBi p = .002, ABi p = .019), but without difference between the two interventions. The long-term effect of both interventions was observed in 35–44-year-olds (at T2: HBi p = .004, ABi p < .001). The 12–14-year-olds in the HBi also had a higher protection score than those in the CG (at T1: p = .009, T2: p = .005). HBi was effective for people with highly sensitive skin in the short and long term (T1: p = .012,

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TABLE 2 Effect of the two interventions on protection behaviours, sunbathing behaviour, and skin colour measured at short-term (T1) and long-term (T2) follow-ups, PRISME, France, 2019–2020.

		Health-based intervention (HBi)						Appearance-based intervention (ABi)					
		T1			T2			T1			T2		
	N	D	CI 95%	*p*	D	CI 95%	*p*	D	CI 95%	*p*	D	CI 95%	*p*
Sun protection score													
Model 0	1288	.76	[−.02; 1.53]	.057	.77	[−.28; 1.82]	.150	.45	[.16; .74]	.002**	.37	[−.06; .79]	.092
Model 1	1288	.76	[.01; 1.52]	.048*	.78	[−.24; 1.80]	.133	.43	[.20; .67]	.000***	.34	[−.04; .72]	.078
Model 2	1280	.76	[−.02; 1.53]	.056	.75	[−.34; 1.84]	.178	.47	[.13; .81]	.007**	.52	[.19; .85]	.002**
Sunbathing (no. of hours)													
Model 0	1290	−.04	[−.22; .14]	.627	.04‡	[−.55; .64]	.883	−.16	[−.28; −.05]	.005**	−.45‡	[−.91; .01]	.058
Model 1	1290	−.03	[−.22; .16]	.759	.06‡	[−.56; .68]	.848	−.15	[−.27; −.03]	.016*	−.45‡	[−.93; .03]	.067
Model 2	1282	−.03†	[−.20; .14]	.705	.07‡	[−.51; .65]	.811	−.18†	[−.30; −.06]	.004**	−.49‡	[−.94; −.05]	.029*
Skin colour measured by a colorimeter (mean of shoulter, nose and cheekbone measures)													
Model 0	1239	.73	[−.30; 1.77]	.166				.23	[−.65; 1.11]	.605			
Model 1	1239	.70	[−.19; 1.59]	.122				.41	[−.64; 1.47]	.440			
Model 2	1231	1.27	[.45; 2.10]	.002**				.55	[−.01; 1.10]	.053			

Note: Model 0: adjusted to baseline score and week + random-effect intercepts for campsite, pitch, and individual. Model 1: Model 0 + adjusted to professional category, and time since arrival. Model 2: Model 1 + adjusted to age, sex, skin sensitivity, and education level. D: Difference of the predicted marginal means between the intervention group and the control group. *p*: *p*-value test of D. *$p < .05$; **$p < .01$; ***$p < .001$. †/‡ significative difference of Health-based versus Appearance-based intervention marginal prediction at T1/T2.

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T2: $p = .048$), while ABi was effective for sensitive skin people in the long term (T2: $p < .001$). The most educated people had a higher sun protection at short term in the HBi than in the other two groups (T1: 3-year university degree $p = .001$, 4-year or higher $p < .001$), while people with a secondary school certificate had a higher protection at short and long term in the ABi (T1: $p = .009$, T2: $p < .001$) (Appendix S5).

Per-protocol analysis

Participants with a complete intervention and follow-up (analysis 2b) up to T2 were more often graduates and had a higher baseline protection score than the initial sample. In this population including people with better sun protection, the difference of predictive mean at T2 between HBi and CG and between ABi and CG was slightly higher than in the analysis with all the participants (HBi: 1.56* vs. .75, ABi: .92 vs. .52; Appendix S6).

DISCUSSION

Main results

The efficacy of HBi to improve sun protection behaviours was not demonstrated although the results in the short term were close to the threshold of statistical significance. ABi significantly improved protection behaviours and reduced sunbathing in the short and long term. Several days after the intervention, the measured skin colour of people in the HBi group was lighter than those in CG. This result was not significant for ABi. Overall, the magnitude of the differences found was moderate. The efficacy of the two interventions were not statistically different regarding protection and measured skin colour, but ABi gave better results for sunbathing behaviour. The results for sun protection behaviours were confirmed in sensitivity analysis using another method to construct the protection score. In both intervention groups, women as well as 35–44 year-olds seemed particularly concerned about increasing protection compared to the CG. Moreover, HBi seemed more effective on highly sensitive skin and the most educated people, while ABi seemed more effective on sensitive skin and people with a secondary school certificate. Per-protocol analysis in a biased sample showed slightly larger effects and represented the maximum long-term efficacy of the intervention and study participation.

Limitations and strengths

Our study had several limitations relating to data collection. First, self-reported behaviours may be prone to social desirability bias. Participants in intervention groups may have been more inclined to overestimate their protection to comply with the recommendations given by the prevention worker. However, the prevention worker was not present at the T1 and T2 follow-ups, which may have limited this bias. Indeed, the change in data collection method from face to face at T0 and T1 to an online questionnaire at T2 may have reduced this bias because of a probably lower desirability bias with a self-administrated questionnaire compared to an interviewer-administrated questionnaire (Heerwegh, 2009; Kreuter et al., 2009). Second, the time between T0 and T1 was very short and potentially insufficient to observe any behavioural changes.

Some limitations were also associated with participation. With an attrition rate of 56% at T2, participation after 14 months was substantially reduced, though acceptable and consistent with what was expected based on the sample size calculation (Durand et al., 2020). Despite numerous telephone and email reminders, the T2 sample may lack power to conclude about the intervention effect in the subpopulation analysis for which cautious interpretation should be made. Moreover, participants at T2 presented a specific profile (older, more often university graduates and with a higher baseline protection score than

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participants lost to follow-up), suggesting that they were probably more sensitive to prevention messages and thus more likely to change their behaviours, as found in many longitudinal studies (Davis et al., 2002). These points suggest caution in interpreting less stable T2 results.

Moreover, the results on measured skin colour deserve further analysis given the influence of skin sensitivity and constitutional skin colour on acquisition of tanning and a possible saturation of the tan at the end of summer.

Some of the limitations were related to the interventions themselves. Unlike sun protection interventions delivered in other settings such as schools, our face-to-face interventions in a touristic setting took place in a single 20- to 30-minute session. Although two reminder emails were sent during the year between T1 and T2 to reiterate the initial messages, especially at a key time before summer, the main part of the interventions, was delivered face to face at T0 in a very short time. Since it was impossible to measure a dose–response effect, we can wonder whether the intervention dose delivered was sufficient to induce a lasting change compared to an intervention repeated over time, particularly given the seasonal nature of sun protection. Moreover, despite the very complete intervention training, it is possible that these results were influenced by the different message delivery skills of prevention workers. Finally, some parameters may have impacted the proper delivery of the interventions: for example, for ABi, the UV photo quality may have been altered in cloudy conditions, in people with a heavy tan, or in those with make-up persisting after its removal. Finally, desirability and selection bias may have been reinforced by the absence of double-blindness, as the interviewer, prevention worker and participant were all aware of the allocated intervention group, even if limited information was given to participants about the other groups.

Despite these limitations, our study also had important strengths. It took into account the methodological issues previously identified in similar studies (Persson et al., 2018): theoretically constructed randomized interventions, a large sample size calculated *a priori*, a long follow-up at 14 months and diverse participants in terms of age and sex. The potentially biased self-reported behaviours were offset by an objective skin colour measure, and its analysis also demonstrated the efficacy of the interventions, particularly the HBi. Moreover, the results obtained from the different models and outcomes, sensitivity analysis and per-protocol analysis were consistent, which provides good confidence for our conclusions.

Interpretation

Previous studies highlighted the weak evidence for the efficacy of sun prevention interventions in a touristic setting, with a small and heterogeneous effect depending on the methodological quality of the study and the intervention components. In this context, better results were found among younger people and with ABi (Rodrigues et al., 2013). A meta-analysis of the efficacy of ABi demonstrated its promising approach with a medium effect size (Persson et al., 2018; Williams et al., 2013a). In our trial, we found that both ABi and HBi were effective at short term, although the magnitude of the effect was limited. When compared, ABi had better results than HBi for reducing sunbathing but not for sun protection or measured skin colour. In the literature, studies that compared the two approaches sometimes showed divergent results. Some found the higher effect of ABi compared to HBi to improve behaviours or intentions for sun protection (Cheng et al., 2019; Morris et al., 2014; Owen et al., 2016; Tuong & Armstrong, 2014; Williams et al., 2013b) or to decrease sunbathing (Blashill et al., 2018; Cornelis et al., 2014). However, other studies found no difference in terms of sun protection or sunbathing behaviours or intentions (Hevey et al., 2010; Mahler et al., 1997; Stock et al., 2009), and one study even showed the higher effect of HBi on intentions for sun protection (Christensen et al., 2014). Among the few studies that have investigated the conditions underlying this difference in efficacy between ABi and HBi, a higher efficacy of ABi was demonstrated for adults under 40 (Cheng et al., 2019), and for people with a positive attitude about tanning (Cheng et al., 2019; Cornelis et al., 2014), that is, populations particularly represented in our sample.

We found only one study that evaluated the effect of sun protective ABi according to socioeconomic position, showing the higher efficacy of ABi on individuals with a lower income (Weinstock et al., 2002).

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In our study, the impact of ABi on protection of vacationers with only a secondary school certificate supports this finding, although it should be investigated in future studies. As this population has poorer sun protection than those with a university degree (Bocquier et al., 2016; Durand et al., 2022), ABi may thus decrease social inequalities regarding sun protection. The mechanisms involved in the efficacy of the interventions should be analysed with the evolution of intermediate psychosocial outcomes such as knowledge, attitude or social norms. Conversely, the conclusive results regarding the efficacy of HBi on the most educated people, who are already better protected than other vacationers, suggest that this intervention could potentially increase social inequalities regarding sun protection.

Regarding age, as most ABi studies have been conducted with students, the benefits on a particular age group are not obvious (Persson et al., 2018). Some concluded about its higher efficacy among individuals under 25 years (Weinstock et al., 2002), while others only observed its efficacy for 25–43-year-olds (Mahler et al., 1997). Given the health impact of childhood exposure, our results for HBi among 12–14 year-olds were promising, whereas the ABi results in this age group, which did not significantly differ for CG and HBi, should be deepened by further evaluations. Given these findings, it may be relevant to conduct a new evaluation of the efficacy of interventions in this population in a different context such as in French middle schools.

Generalizability

Our results are generalizable to the target population, i.e., French summer vacationers staying at campsites along the French West Mediterranean coast, which is equivalent to approximately 2–3 million vacationers every summer (INSEE, 2019). The transferability of the interventions to this entire population is nevertheless limited, because our trial was conducted in an experimental research context using resources allocated specifically for the study. Future study protocols should now be developed to integrate the same messages and tools but with greater external validity using existing touristic or local medical resources.

CONCLUSIONS

Our study provides further evidence about the effect of interventions aimed at individual sun protection behavioural change, although the magnitude of the effect was limited. This was the first evaluation of ABi among French vacationers to identify the overall responsiveness of this population to this type of message. Our results highlight that it could be relevant to consider the relevance of ABi messages to complement evidence-based HBi messages in the touristic context, particularly in certain subpopulations with a low to intermediate education level. Additional studies are needed to confirm the effect of these interventions using the existing resources found in touristic settings such as lifeguards, tourist workers and coastal pharmacies. New prevention approaches still need to be investigated in certain at-risk populations such as 15–24-year-olds and people without a diploma for which our analysis showed no evidence of efficacy.

AUTHOR CONTRIBUTIONS

Cécile Durand: Conceptualization; formal analysis; methodology; project administration; software; visualization; writing – original draft; writing – review and editing. **Lyvia Magloire:** Formal analysis; software; writing – review and editing. **Florence Cousson-Gélie:** Methodology; resources; writing – review and editing. **Apolline Bord:** Resources; writing – review and editing. **Leïla Saboni:** Formal analysis; methodology; writing – review and editing. **Abdelkrim Zeghnoun:** Methodology; writing – review and editing. **Benoit Lepage:** Methodology; writing – review and editing. **Jean-Baptiste Richard:** Methodology; writing – review and editing. **Olivier Catelinois:** Conceptualization; writing – review and editing. **Damien Mouly:** Conceptualization; funding acquisition; supervision; writing – review and editing. **Cyrille Delpierre:** Conceptualization; methodology; supervision; validation; writing – review and editing.

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ACKNOWLEDGEMENTS

We would like to thank the eight participating campsites: La Pinède in Banyuls, Les Chênes Rouges and Les Marsouins in Argelès-sur-Mer, LVL Les Ayguades in Gruissan, Plages du Midi in Portiragnes, La Tama and La Clape in Agde and L'étoile de Mer in Sérignan. We acknowledge the Regional Health Agency of Occitanie for the partial funding of the Prevention Department Epidaure (Institut du cancer de Montpellier). We acknowledge the other members of the thematic support committee: Eric Bauvin (Onco-Occitanie), Pierre Cesarini (Sécurité solaire), Alice Desbiolles (Inca) and Emmanuel Mahé (CH d'Argenteuil). We also thank the other members of the Santé Publique France project group: Florence De Maria, Anne Thuret, (Non-communicable Diseases and Trauma Division), Agnès Verrier and Colette Ménard (Health Prevention and Promotion Division). Finally, we express thanks to Victoria Grace for copyediting the manuscript.

FUNDING INFORMATION

This study was funded by Santé Publique France (France's Public Health Agency) and the Regional Health Agency of Occitanie. Santé Publique France is fully responsible for the study protocol, data collection, analyses, interpretation of results and the writing of this article.

CONFLICT OF INTEREST STATEMENT

No conflicts of interest.

DATA AVAILABILITY STATEMENT

The materials of this study are available from the corresponding author. The data are not publicly available due to information that could compromise research participant privacy/consent. However, additional statistical data are available from the corresponding author on reasonable request.

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REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Arnold, M., Kvaskoff, M., Thuret, A., Guenel, P., Bray, F., & Soerjomataram, I. (2018). Cutaneous melanoma in France in 2015 attributable to solar ultraviolet radiation and the use of sunbeds. *Journal of the European Academy of Dermatology and Venereology*, *32*(10), 1681–1686.

Arnold, M., Singh, D., Laversanne, M., Vignat, J., Vaccarella, S., Meheus, F., Cust, A. E., de Vries, E., Whiteman, D. C., & Bray, F. (2022). Global burden of cutaneous melanoma in 2020 and projections to 2040. *JAMA Dermatology*, *158*, 495.

Blashill, A. J., Rooney, B. M., Luberto, C. M., Mt, G., & Grogan, S. (2018). A brief facial morphing intervention to reduce skin cancer risk behaviors: Results from a randomized controlled trial. *Body Image*, *25*, 177–185.

Bocquier, A., Fressard, L., Legleye, S., Verger, P., & Peretti-Watel, P. (2016). Social differentiation of sun-protection behaviors: The mediating role of cognitive factors. *American Journal of Preventive Medicine*, *50*(3), e81–e90.

Bruce, A. F., Theeke, L., & Mallow, J. (2017). A state of the science on influential factors related to sun protective behaviors to prevent skin cancer in adults. *International Journal of Nursing Sciences*, *4*(3), 225–235.

Cheng, J., Widjajahakim, R., Rajanala, S., B C Maymone, M., Secemsky, E., & Vashi, N. A. (2019). Appearance-based vs health-based sun protective messages: A randomized, double-blind controlled study. *Journal of Cosmetic Dermatology*, *18*(4), 1030–1036.

Christensen, K., Champion, J., & Wagner, C. (2014). The effects of appearance-based and health-based interventions on sun protection attitudes, intentions, and behaviors of college students. *Psycho-Oncology*, *23*, 317.

Cornelis, E., Cauberghe, V., & De Pelsmacker, P. (2014). Being healthy or looking good? The effectiveness of health versus appearance-focused arguments in two-sided messages. *Journal of Health Psychology*, *19*(9), 1132–1142.

Davis, L. L., Broome, M. E., & Cox, R. P. (2002). Maximizing retention in community-based clinical trials. *Journal of Nursing Scholarship*, *34*(1), 47–53.

Defossez, G., Le Guyader-Peyrou, S., Uhry, Z., Grosclaude, P., Colonna, M., Dantony, E., Delafosse, P., Molinié, F., Woronoff, A.-S., Bouvier, A.-M., Bossard, N., & Monnereau, A. (2019). *Estimations nationales de l'incidence et de la mortalité par cancer en France métropolitaine entre 1990 et 2018*. Santé Publique France; Volume 1 – Tumeurs solides: 372 p.

Del Bino, S., & Bernerd, F. (2012). Relation entre la couleur de la peau et sa réponse cutanée à la lumière ultraviolette. *International Journal of Dermatology*, *51*(s1), 5–8.

20448287, 2023, 3, Downloaded from https://bpspsychub.onlinelibrary.wiley.com/doi/10.1111/bjhp.12650 by Cochrane France, Wiley Online Library on [27/11/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Dervault, A. M., Secretan, B., Guinot, C., Bazex, J., Donadieu, J., Dore, J. F., Césarini, J. P., Richard, M. A., & Leccia, M. T. (2005). *Ultraviolets. Etat des connaissances sur l'exposition et les risques sanitaires*. Agence Française de Sécurité Sanitaire Environnementale.

Dodd, L. J., & Forshaw, M. J. (2010). Assessing the efficacy of appearance-focused interventions to prevent skin cancer: A systematic review of the literature. *Health Psychology Review*, *4*(2), 93–111.

Durand, C., Catelinois, O., Bord, A., Richard, J.-B., Bidondo, M.-L., Ménard, C., Cousson-Gélie, F., Mahé, E., Mouly, D., & Delpierre, C. (2020). Effect of an appearance-based vs. a health-based sun-protective intervention on French summer Tourists' behaviors in a cluster randomized crossover trial: The PRISME protocol. *Frontiers in Public Health*, *8*(654). https://www.frontiersin.org/articles/10.3389/fpubh.2020.569857/

Durand, C., Lamy, A., Richard, J.-B., Saboni, L., Cousson-Gélie, F., Catelinois, O., Bord, A., Lepage, B., Mouly, D., & Delpierre, C. (2022). Influence of Social and Psychosocial Factors on Summer Vacationers' Sun Protection Behaviors, the PRISME Study, France. *Int J Public Health*, *67*, 1604716. doi: 10.3389/ijph.2022.1604716

Erdmann, F., Lortet-Tieulent, J., Schuz, J., Zeeb, H., Greinert, R., Breitbart, E. W., & Bray, F. (2013). International trends in the incidence of malignant melanoma 1953–2008–are recent generations at higher or lower risk? *International Journal of Cancer*, *132*(2), 385–400.

Falk, M., & Anderson, C. D. (2013). Influence of age, gender, educational level and self-estimation of skin type on sun exposure habits and readiness to increase sun protection. *Cancer Epidemiology*, *37*(2), 127–132.

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: Theory, research, and practice*. Jossey-Bass.

Glanz, K., Yaroch, A. L., Dancel, M., Saraiya, M., Crane, L. A., Buller, D. B., Manne, S., O'Riordan, D. L., Heckman, C. J., Hay, J., & Robinson, J. K. (2008). Measures of sun exposure and sun protection practices for behavioral and epidemiologic research. *Archives of Dermatology*, *144*(2), 217–222.

HCSP. (2020). Recommandations sanitaires associées aux index UV (complément) Haut conseil de la Santé Publique. https://www.hcsp.fr/explore.cgi/avisrapportsdomaine?clefr=887

Heerwegh, D. (2009). Mode differences between face-to-face and web surveys: An experimental investigation of data quality and social desirability effects. *International Journal of Public Opinion Research*, *21*, 111–121.

Hevey, D., Pertl, M., Thomas, K., Maher, L., Craig, A., & Chuinneagain, S. N. (2010). Body consciousness moderates the effect of message framing on intentions to use sunscreen. *Journal of Health Psychology*, *15*(4), 553–559.

INSEE. (2019). Été 2019: la fréquentation touristique en Occitanie repart à la hausse 2019. https://www.insee.fr/fr/statistiques/fichier/version-html/4255862/lm_inf_94.pdf

Johnson, K. M., Jones, S. C., & Iverson, D. (2009). Guidelines for the development of social marketing programmes for sun protection among adolescents and young adults. *Public Health*, *123*(Supplement 1), e6–e10.

Kahan, B. C., Jairath, V., Doré, C. J., & Morris, T. P. (2014). The risks and rewards of covariate adjustment in randomized trials: An assessment of 12 outcomes from 8 studies. *Trials*, *15*(1), 139.

Kreuter, F., Presser, S., & Tourangeau, R. (2009). Social desirability bias in CATI, IVR, and web surveys: The effects of mode and question sensitivity. *Public Opinion Quarterly*, *72*(5), 847–865.

Les représentations associées au soleil et au bronzage: analyse sociologique. [press release]. (2007). Inca, Juin.

Mahler, H. I., Fitzpatrick, B., Parker, P., & Lapin, A. (1997). The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *American Journal of Health Promotion*, *11*(6), 426–429.

Ménard, C., & Thuret, A. (2018). *Baromètre cancer 2015. Ultraviolets, naturels ou artificiels. Connaissance, croyances et pratiques de la population en 2015*. Santé publique France. https://www.santepubliquefrance.fr/determinants-de-sante/climat/uv/documents/enquetes-etudes/barometre-sante-cancer-2015-les-ultraviolets-naturels-ou-artificiels.-connaissances-croyances-et-pratiques-de-la-population-en-2015

Morris, K. L., Cooper, D. P., Goldenberg, J. L., Arndt, J., & Gibbons, F. X. (2014). Improving the efficacy of appearance-based sun exposure interventions with the terror management health model. *Psychology & Health*, *29*(11), 1245–1264.

Ory, P. (2008). L'invention du bronzage: Essai d'une histoire culturelle: Complexe.

Owen, A. L., Grogan, S., Clark-Carter, D., & Buckley, E. (2016). Effects of an appearance-focussed versus a health-focussed intervention on men's attitudes towards UV exposure. *International Journal of Men's Health*, *15*, 34.

Permutt, T. (1990). Testing for imbalance of covariates in controlled experiments. *Statistics in Medicine*, *9*(12), 1455–1462.

Persson, S., Benn, Y., Dhingra, K., Clark-Carter, D., Owen, A. L., & Grogan, S. (2018). Appearance-based interventions to reduce UV exposure: A systematic review. *British Journal of Health Psychology*, *23*(2), 334–351.

Pocock, S. J., Assmann, S. E., Enos, L. E., & Kasten, L. E. (2002). Subgroup analysis, covariate adjustment and baseline comparisons in clinical trial reporting: Current practiceand problems. *Statistics in Medicine*, *21*(19), 2917–2930.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, *51*(3), 390–395.

Rodrigues, A., Sniehotta, F. F., & Araujo-Soares, V. (2013). Are interventions to promote sun-protective behaviors in recreational and tourist settings effective? A systematic review with meta-analysis and moderator analysis. *Annals of Behavioral Medicine*, *45*(2), 224–238.

Rossi, J. S., Blais, L. M., Redding, C. A., & Weinstock, M. A. (1995). Preventing skin cancer through behavior change. Implications for interventions. *Dermatologic Clinics*, *13*(3), 613–622.

Senn, S. J. (1989). Covariate imbalance and random allocation in clinical trials. *Statistics in Medicine*, *8*(4), 467–475.

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Stock, M. L., Gerrard, M., Gibbons, F. X., Dykstra, J. L., Weng, C. Y., Mahler, H. I., Walsh, L. A., & Kulik, J. A. (2009). Sun protection intervention for highway workers: Long-term efficacy of UV photography and skin cancer information on men's protective cognitions and behavior. *Annals of Behavioral Medicine*, *38*(3), 225–236.

Tuong, W., & Armstrong, A. W. (2014). Effect of appearance-based education compared with health-based education on sunscreen use and knowledge: A randomized controlled trial. *Journal of the American Academy of Dermatology*, *70*(4), 665–669.

Weinstock, M. A., Rossi, J. S., Redding, C. A., & Maddock, J. E. (2002). Randomized controlled community trial of the efficacy of a multicomponent stage-matched intervention to increase sun protection among beachgoers. *Preventive Medicine*, *35*(6), 584–592.

Williams, A. L., Grogan, S., Clark-Carter, D., & Buckley, E. (2013a). Appearance-based interventions to reduce ultraviolet exposure and/or increase sun protection intentions and behaviours: A systematic review and meta-analyses. *British Journal of Health Psychology*, *18*(1), 182–217.

Williams, A. L., Grogan, S., Clark-Carter, D., & Buckley, E. (2013b). Impact of a facial-ageing intervention versus a health literature intervention on women's sun protection attitudes and behavioural intentions. *Psychology & Health*, *28*(9), 993–1008.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Durand, C., Magloire, L., Cousson-Gélie, F., Bord, A., Saboni, L., Zeghnoun, A., Lepage, B., Richard, J.-B., Catelinois, O., Mouly, D., & Delpierre, C. (2023). Efficacy of an appearance-based and a health-based sun protection intervention on summer vacationers' behaviours, PRISME cluster randomized crossover trial, France. *British Journal of Health Psychology*, *28*, 724–739. https://doi.org/10.1111/bjhp.12650

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