A Cross-sectional Study Examining the Correlation Between Sunless Tanning Product Use and Tanning Beliefs and Behaviors

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Objectives: To establish the effect of sunless tanning products on tanning behaviors and to determine characteristics of sunless tanning product users.


Setting: The Emory University campus and surrounding locations in Atlanta, Georgia.

Participants: Four hundred fifteen community and university-affiliated women.

Main Outcome Measures: Self-reported use of sunless tanning products and UV radiation tanning methods.

Results: Forty-eight percent of participants had used sunless tanning products, 70.6% had tanned in the sun, and 26.0% had used tanning beds at least once in the past year. Most participants (92.7%) believed that tanned skin is more attractive than untanned skin, and 79.2% reported feeling better about themselves when tan. Many sunless tanning product users reported decreased frequency of tanning in the sun (36.8%) or in tanning beds (38%) because of product use. Frequent users were more likely to have decreased their UV radiation exposure. Lighter complexion, frequent use of UV radiation tanning methods, feeling better about oneself when tan, and having a history of skin cancer were independently associated with sunless tanning product use.

Conclusions: The desire for tanned skin remains strong despite growing awareness of the dangers of UV radiation exposure. In some women, sunless tanning product use is associated with decreased UV radiation tanning frequency, especially in women who use them repeatedly. Improvements in the appearance of sunless tanning product tans may allow wider acceptance by the public and further decreases in UV radiation tanning practices.


Despite the growing popularity of sunless tanning products (STPs),¹ their effect on tanning behaviors has yet to be fully explored. In the medical literature,²⁻⁸ the prevalence of recent STP use in the United States and elsewhere has been variable and relatively low. Although some studies have supported the use of STPs as an acceptable substitute for UV radiation (UVR) tanning methods (tanning bed use and sunbathing), others have raised concerns that promoting the use of STPs may encourage, rather than lessen, intentional UVR exposure.²⁻⁹ This remains a controversial topic.

In this study, we interviewed women concerning their tanning beliefs and behaviors, particularly as they pertain to STP use. We chose to focus on women only because previous studies²⁻⁴ have demonstrated that the prevalence of STP use is much higher in women than in men. The primary objective of this study was to assess the effect of STPs on UVR tanning habits. Secondary objectives included determining qualities predictive of STP use and ascertaining reasons for using or not using STPs. We predicted that STP use is beginning to replace UVR tanning practices.

METHODS

STUDY POPULATION

Surveys were administered to community and university-affiliated women 18 years and older on the Emory University campus and in surrounding areas in Atlanta, Georgia, between May 30, 2007, and December 4, 2007. Recruitment locations included dining facilities, common areas, workout facilities, recreational centers, and sorority meeting locations. We

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TANNING SURVEY

Items on the survey (eAppendix; http://www.archdermatol.com) were developed by us based on expert opinion. Most of the items are similar to those used in other recent tanning research studies.3,3,10 The survey included demographic items (age, educational level, and annual income) and skin-characterizing items (skin color, susceptibility to sunburn, and personal history of skin cancer). Sunless tanning products were defined on the survey as temporary tanning agents that are self-applied (ie, lotions, gels, or foams) or professionally applied (ie, spray-on or airbrushed tan). It was emphasized that tanning beds do not constitute STPs. Participants were asked how many times they had used STPs, tanned in the sun, and tanned in tanning beds during the past year. They also reported on a 5-point Likert-type scale ranging from 1 (never) to 5 (always) how often they believed that tanned skin is more attractive than untanned skin and how often being tan made them feel better about themselves.

Women who had used STPs 1 or more times during the preceding year were defined as STP users for this study. Users of STPs were asked if they had increased, decreased, or not changed their intentional UVR exposure because of STP use. In addition, STP users rated the level of importance of several potential reasons for using STPs based on a 3-point Likert-type scale ranging from 1 (not important) to 5 (very important). Reasons listed on the survey for using STPs included safety, convenience, affordability, and desire to prevent skin cancer, sunburns, and wrinkles.

Nonusers of STPs were defined as those who had not used STPs at all during the preceding year. Nonusers rated the level of importance of several potential reasons for not using STPs based on a 5-point Likert-type scale ranging from 1 (not important) to 5 (very important). Reasons listed on the survey for not using STPs included lack of desire for a tan, preference for UVR tanning methods, dislike of STP color or quality, and concern about the safety of STPs. Sorority membership was captured by recording which sorority participants were recruited from sorority meeting locations rather than by a self-reported item on the survey.

STATISTICAL ANALYSES

Univariate and multivariate analyses were conducted. To compare STP users with nonusers, we used t tests and analysis of variance for continuous variables and χ² tests for categorical variables. To determine the effect of frequency of STP use on UVR tanning behavior, we selected a threshold of 5 STP uses in the preceding year. This threshold was determined qualitatively by comparing the distribution of STP frequency categories (ie, 1-2 times, 3-5 times, 5-15 times, etc) of those who had decreased their UVR exposure with those who had not decreased their UVR exposure. Specifically, we chose a threshold of use of STPs 5 times because it fell between the mean number of times STPs were used in the group that decreased their UVR tanning and the mean number of STP uses in the group that did not decrease their UVR tanning. Based on this threshold, we defined high-frequency STP users as those who had indicated that they were in the 5 to 15 times, 15 to 30 times, and more than 30 times groups and low-frequency STP users as those who had reported being in the 1 to 2 times or 3 to 5 times groups. We then performed a χ² test to determine whether high-frequency STP users (those who had used STPs ≥5 times in the previous year) were more likely to have decreased their UVR tanning than were low-frequency STP users. Despite the overlap of 5 times in the 3 to 5 times and 5 to 15 times groups, the participants themselves decided whether they fit more closely in the 3 to 5 times group or the 5 to 15 times group.

To determine independent predictors of STP use, we conducted a multivariate logistic regression in which we adjusted for variables that were statistically significant or trending significant in the univariate analyses. These variables were age, sorority membership, skin color, skin cancer history, strength of belief that tanned skin is more attractive, strength of feeling better about oneself when tan, and frequency of use of UVR tanning methods.

For these analyses, we combined age and skin color categories based on clinical usefulness and the hypothesis that younger women and women with lighter skin colors are more likely to use STPs. The distribution of frequencies of participants in the age and skin color categories also affected the choices. P < .05 was considered statistically significant. Data analyses for this study were generated using a commercially available software program (SAS, version 9.2; SAS Institute, Inc).

RESULTS

DEMOGRAPHIC AND SKIN-CHARACTERIZING ITEMS

Demographic and skin-characterizing data are summarized in Table 1. Of 448 women approached, 415 chose to participate (response rate of 92.6%). Those who declined to participate did so because of lack of time.

Overall, the mean (SD) participant age was 28.3 (12.4) years (age range, 18-71 years). Most participants (61.0%) were young women aged 18 to 25 years, 22.0% were 26 to 40 years old, and 16.9% were older than 40 years. More than 40% of the participants reported no income, and most had completed at least high school. Approximately half of the participants (46.3%) were members of sororities. Users of STPs were younger than nonusers (26.9 years vs 29.7 years, P = .05) and were more likely to belong to a sorority (53.7% vs 39.3%, P = .004).

Most of the women were fair complexioned (very white and white), and more than half burned at least sometimes after 30 minutes of direct sunlight exposure without sunscreen. We categorized study participants’ self-reported skin colors into 3 groups. Because the Fitzpatrick skin type scale uses characteristics that we did not collect (eg, eye color, hair color, and length of time for a tan to develop), we did not use this scale. However, the categories that we used closely approximate the Fitzpatrick scale as follows: very white/freckled (Fitzpatrick types I and II, 16.9%), white and white to olive (Fitzpatrick types III and IV, 68.1%), and brown, dark brown, and black (Fitzpatrick types V and VI, 15.0%). For the sake of brevity, we subsequently refer to these skin color categories as light, medium, and dark complexioned, respectively. Users of STPs were more likely than nonusers to perceive themselves as having lighter skin color (light or medium complexioned) (95.5% vs 73.1%, P < .001). They
also sunburned more easily than did nonusers; 64.6% of STP users reported sometimes to always burning after 30 minutes of exposure to direct sunlight compared with only 48.9% of nonusers (P = .001).

Fifteen participants (3.6%) reported having had at least 1 skin cancer in the past: 11 reported a history of basal cell carcinoma, 1 a history of melanoma, and 1 a history of “other type of skin cancer” but did not report the type. Two participants reported a history of more than 1 type of skin cancer, 1 with melanoma and basal cell carcinoma and the other with melanoma, basal cell carcinoma, and squamous cell carcinoma. Three additional participants indicated a history of “other type of skin cancer” but wrote “atypical moles” or “AK” for type; thus, they were excluded from the analysis as having had skin cancer. Compared with nonusers, STP users were more likely to have had at least 1 skin cancer in the past (5.0% vs 2.3%, P = .03).

PERCEPTIONS ABOUT TANNED SKIN

Participants reported their opinions regarding tanned skin (Table 2). Most participants (92.7%) believed that tanned skin is sometimes to always more attractive than untanned skin, and 79.2% reported sometimes to always feeling better about themselves when tan. Users of STPs were more likely than nonusers to believe that tanned skin is more attractive (97.0% vs 88.7%, P < .001) and to feel better when tan (92.5% vs 66.7%, P < .001).

TANNING BEHAVIORS

Almost half the participants (48.4%) had used STPs at least once in the past year. Most STP users had used self-applied STPs most of the time; only 9.0% had used professionally applied STPs most of the time. Use of STPs was observed among all ages: 53.6% of 18- to 25-year-olds, 40.7% of 26- to 40-year-olds, and 41.4% of those older than 40 years.

The UVR tanning methods used during the preceding year are displayed in Table 2. Overall, 70.6% of participants had tanned in the sun, 26.0% had used tanning beds, and 25.3% had tanned both in the sun and in tanning beds at least once in the past year. Users of STPs were much more likely than nonusers to have tanned in the sun (85.6% vs 56.5%), in tanning beds (36.3% vs 16.4%), and in both the sun and tanning beds (35.3% vs 15.9%; P < .001 for all). However, nonusers were much more likely than STP users to have not tanned at all in the past year (43.0% vs 13.4%, P < .001).

| Table 1. Demographics and Skin Characteristics of the 415 Study Participants* |
|-----------------|-----------------|-----------------|-----------------|
| Variable         | STP Users (n=201) | Nonusers (n=214) | Overall (N=415) |
| Age, mean (SD), y | 26.9 (11.6) (n=201) | 29.7 (13.0) (n=212) | 28.3 (12.4) (n=413) |
| Annual income, No. (%) | | | |
| $0 | 89 (44.7) | 85 (41.1) | 174 (42.9) |
| <$25,000 | 38 (19.1) | 34 (16.4) | 72 (17.7) |
| $25,000-$35,000 | 7 (3.5) | 15 (7.2) | 22 (5.4) |
| >$35,000-$50,000 | 18 (9.0) | 27 (13.0) | 45 (11.1) |
| >$50,000-$75,000 | 27 (13.6) | 27 (13.0) | 54 (13.3) |
| >$75,000 | 20 (10.1) | 19 (9.2) | 39 (9.6) |
| Subtotal | 199 | 207 | 406 |
| Education completed, No. (%) | | | |
| High school | 111 (55.5) | 92 (43.0) | 203 (49.0) |
| Undergraduate school | 58 (29.0) | 72 (33.6) | 130 (31.4) |
| Graduate school | 31 (15.5) | 50 (23.4) | 81 (19.6) |
| Subtotal | 200 | 214 | 414 |
| Sorority member, No. (%) | | | |
| Very white/freckled | 39 (19.4) | 31 (14.6) | 70 (16.9) |
| White | 83 (41.3) | 68 (31.9) | 151 (36.5) |
| White to olive | 70 (34.8) | 61 (28.6) | 131 (31.6) |
| Brown | 7 (3.5) | 33 (15.5) | 40 (9.7) |
| Dark brown | 2 (1.0) | 11 (5.2) | 13 (3.1) |
| Black | 0 | 9 (4.2) | 9 (2.2) |
| Subtotal | 201 | 213 | 414 |
| Skin response to sun, No. (%) | | | |
| Never burns | 10 (5.0) | 36 (16.9) | 46 (11.1) |
| Very rarely burns | 41 (20.4) | 41 (19.2) | 82 (19.8) |
| Rarely burns | 20 (10.0) | 32 (15.0) | 52 (12.6) |
| Sometimes burns | 71 (35.3) | 54 (25.4) | 125 (30.2) |
| Usually burns | 36 (17.9) | 31 (14.6) | 67 (16.2) |
| Always burns | 23 (11.4) | 19 (8.9) | 42 (10.1) |
| Subtotal | 201 | 213 | 414 |
| Medical history of skin cancer, No. (%) | | | |
| Never had | 10 (5.0) (n=201) | 5 (2.3) (n=214) | 15 (3.6) (n=415) |
| Abbreviation: STP, sunless tanning product. |
| a All the percentages are based on the available data for each variable (shown in the subtotal row of each variable). |
| b This item asked participants to report their skin response to 30 minutes of direct sunlight without sunscreen. |
Users of STPs reported whether they had increased, decreased, or not changed their frequency of tanning from UVR sources as a result of using STPs. Of STP users who also tanned in the sun, 36.8% reported having decreased their intentional sun exposure because of STP use, and 38.0% of users who also tanned in tanning beds reported having decreased their tanning bed use. More frequent STP use was associated with decreased UVR tanning behavior. Those who had used STPs at least 5 times in the past year were more likely to have decreased their UVR exposure because of STPs. Of STP users who changed their UVR exposure and those who had not, there was not a statistically significant difference between the 2 groups on such items. Seven STP users (3.5%) wrote in a response for other reason for using STPs. These reasons were related to STPs being fast to use, knowing the dangers of sun exposure, having a family member with melanoma, dislike of sun spots, and thinking that the sun is uncomfortable.

The top 3 reasons for not using STPs were dislike of product streakiness, dislike of product color, and indifference about having tan skin. These reasons were considered, on average, to be of medium importance, so it is possible that there are more important reasons for avoiding STPs that were not captured by the survey. Thirty-one of 214 STP nonusers (14.5%) wrote in a response for other reason for not using STPs. These responses were related to not caring about being tan, not having a need for STPs because of naturally dark skin, STPs being difficult or time-consuming to apply, and STPs looking fake or having an unpleasant odor.

**MOTIVATIONS FOR AND BARRIERS AGAINST USING STPs**

The top 3 reasons for using STPs were the safety of STPs compared with tanning beds, the safety of STPs compared with sun exposure, and the desire to avoid wrinkles. These reasons were rated, on average, as moderately or very important. Compared with STP users who had not changed their UVR tanning practices, users who had decreased their UVR exposure more strongly believed that STPs are safer than sun exposure (P=.02) and that STPs are preferable to sun exposure during cold weather (P=.02). Although other reasons were considered important or moderately important by those who had decreased their UVR exposure and those who had not, there was not a statistically significant difference between the 2 groups on such items. Seven STP users (3.5%) wrote in a response for other reason for using STPs. These reasons were related to STPs being fast to use, knowing the dangers of sun exposure, having a family member with melanoma, dislike of sun spots, and thinking that the sun is uncomfortable.

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**PREDICTORS OF STP USE**

In the univariate analysis, several demographic and skin characteristics were significantly associated with an increased likelihood of using STPs: younger age, sorority membership, fair skin color, skin that burns easily, and history of skin cancer. Furthermore, those who believed that tanned skin is more attractive than untanned skin and those who reported feeling better about themselves when tan were also more likely to be STP users.

In the multivariate model, we found that independent predictors of STP use were history of skin cancer, frequent use of tanning beds or tanning in the sun, and...
feeling better about oneself when tan after adjusting for age, sorority membership, and belief that tanned skin is more attractive (Figure). In addition, light-complected participants had a more than 5-fold likelihood of using STPs than did those who were dark complected, and medium-complected participants had a more than 3-fold likelihood of using STPs compared with those who were dark complected. However, light-complected participants were not more likely to use STPs than were those who were medium complected (odds ratio, 1.61; 95% CI, 0.90-2.88).

Further analysis of the light- and medium-complected women (data not shown) revealed that compared with the light-complected group, those in the medium-complected group were more likely to believe that tanned skin is more attractive (96.1% vs 88.4%, P = .02). They were also more likely to feel better about themselves when tan (89.6% vs 73.9%, P = .001). Last, they were much more likely to frequently tan in the sun or in tanning beds (36.2% vs 15.7%, P < .001).

Despite increasing awareness of the dangers of UVR exposure, our society still values a tanned appearance as more attractive and more desirable than an untanned appearance, a finding that the present study supports. Even medical students well versed on skin cancer and photoprotection prefer tanned skin. Sunless tanning products have a well-established safety profile, and photoprotection prefer tanned skin.14 Sunless tanning products have a well-established safety profile,15,16 and the use of such products may, therefore, be a practical means of reducing intentional sun exposure and tanning bed use.

The results of this study suggest that a higher percentage of the population may be using STPs than previously reported. Previous studies in the United States and elsewhere have found the prevalence of STP use in the previous 12 months to range from 9% to 28%. In the present study, the prevalence of STP use was much higher (48.4%). The inclusion of women only likely affected this finding because women are more likely than men to use STPs. However, the prevalence of STP use in this study was still markedly higher than that reported in other studies when analyzing females separately. A more probable explanation is that the present high prevalence of STP use is related to specific characteristics of the population studied. Nearly half of the participants were sorority women at Emory University, and most were members of a young demographic (>$60% being 18-25 years old), factors that likely affected use patterns. Furthermore, these data may reflect an increasing trend toward STP use. Another possibility is that some of the participants may have thought of bronzers or makeup as STPs and that the true prevalence of STP use is lower. We do not believe that the time of year that we surveyed the respondents affected the results given that the survey asked about STP use during the previous 12 months. Furthermore, surveys were administered between May and December, encompassing both warmer and colder months.

Based on the results of the multivariate model, women most likely to use STPs are those who are light or medium complected, feel better about themselves when tan, frequently sunbathe or use tanning beds, or have a history of skin cancer. We found that light-complected women were less likely than medium-complected women to believe that tanned skin is more attractive, feel better about themselves when tan, or frequently use UVR tanning methods. It may be that women with very fair skin may burn so easily that they tend to avoid UVR tanning, at least more so than do women with medium-complected skin. It may also be the case that they have tried STPs in the remote past and were displeased with the appearance, as it is those with medium (particularly golden-hued) skin tones who obtain a more aesthetically pleasing result from STPs. Therefore, in this subset of the population, we may be prudent to avoid promoting STP use and instead focus our efforts on photoprotection. For patients who strongly desire tanned skin, we may wish to offer STPs as an alternative to UVR tanning methods while continuing to encourage photoprotection.

To this end, we found that almost 40% of women who intentionally tan with UVR sources reported using STPs as a complete or partial replacement for sunbathing (36.8%) and tanning bed use (38.0%) rather than simply an addition to UVR tanning methods. Others studies have also demonstrated that STPs may be associated with decreased tanning, increased photoprotection, or intention to do so. In one such study, 73% of tanning bed users who underwent a professionally applied spray-on tan at a tanning parlor said that they had decreased or would decrease their tanning bed use because of using the spray-on tan. In a randomized controlled trial published in 2005, individuals who used sunless tanning lotions in addition to receiving an intervention (UVR photograph of self and photoaging video) tended to increase their photoprotective behaviors more so than did the group that underwent the intervention alone. In addition, a recently published randomized trial demonstrated that beachgoers who were encouraged to use STPs as a substitute for UVR tanning practices reported a greater use of such products.
decrease in sunbathing 2 months and 1 year after intervention relative to controls.

It seems that relatively infrequent use of STPs (≤5 times in the past year) is associated with decreased UVR tanning frequency. Thus, we do not necessarily have to convince our patients to use STPs daily, a task that many might find cumbersome, to reduce intentional UVR exposure. If we can persuade them to use STPs periodically or before special occasions, when they may otherwise choose to visit a tanning bed or a sunny beach, we may be able to significantly alter UVR tanning behaviors.

A brief discussion of the unusually high response rate is warranted. We suspect that there are several reasons driving this. Most important, almost half of the participants were recruited from sorority meeting locations and were, therefore, a captive audience. Almost all of these women agreed to participate, which certainly drove up the response rate. There are likely additional reasons contributing to the high response rate as well. First, women were asked in person to participate, making them less apt to decline than if they had been recruited over the telephone. Second, some women may have been motivated by the raffle, although survey participation was not required for raffle entry. Third, the survey was brief and could be completed in less than 5 minutes, thus placing a minimal time burden on participants. Fourth, the public may find the topic of tanning research more intriguing than some other research topics.

A variety of limitations of this study should be noted. First, there is likely a selection bias toward those who are focused on health and appearance because the participants were recruited mostly from university and fitness center settings. Second, some recall bias is inherent to a survey that requires self-reporting of behaviors occurring in the past. However, a recent study demonstrated that individuals can accurately recall frequency of STP use during the previous year, although lifetime frequency was not accurately reported. Thus, the impact of recall bias was likely minimal in this study. Third, because of an oversight, the groupings on the survey for frequency of STP use, tanning in the sun, and tanning in tanning beds were not mutually exclusive; answer choices included 3 to 5 times, 5 to 15 times, 15 to 30 times, etc. Because most of the analyses were based on the use of a given tanning method at least once vs not at all, the only analysis potentially affected by this oversight is where we compared those who had used STPs at least 5 times with those who had used STPs 1 to 5 times as relates to changes in UVR tanning behaviors. Nevertheless, we feel strongly that this minimally, if at all, affected the findings because participants themselves decided whether they fit more closely in the 3 to 5 times group or the 5 to 15 times group. Next, generalizability of the results is limited because most of the participants were young women and were located in the southeastern United States. However, this population is similar to the general US population at least in terms of skin cancer history. Another limitation is that tanning attitudes and behaviors may have changed since 2007, when these data were collected. Furthermore, this study was not designed to quantify the magnitude of changes in intentional UVR exposure. That is, of those who decreased their UVR tanning practices because of STP use, it is unknown how many decreased their UVR exposure enough to be clinically significant.

An additional limitation was the focus on skin color in the analysis rather than on the global Fitzpatrick skin type. However, to formally score the Fitzpatrick skin type on this self-administered questionnaire, we would have needed to include items about eye color, natural hair color, and freckles on unexposed skin, which would have added to the respondent burden. We could have performed the analysis based on the reaction to the sun exposure variable. However, many dermatologists assess the skin type of their patients by visual inspection (skin color) rather than by querying about ease of tanning or burning. Moreover, we performed a post hoc analysis correlating the skin color and the burning questions and another analysis correlating Fitzpatrick proxy score by skin color alone and by burning tendency alone. For both analyses, the Spearman correlation coefficient was significant (r=0.6, P<.001). Thus, although in future studies we recommend using the formal Fitzpatrick skin type assessment, we believe that the use of skin color was reasonable in this study.

Despite such limitations, this study provides valuable insight into how STPs are affecting UVR tanning behavior. It also adds to the growing body of literature documenting the pervasive perception that tanned skin is more attractive than untanned skin, even in the setting of increasing awareness of the risk of skin cancer from UVR exposure. Until this perception changes, STPs may be a practical means of reducing intentional UVR exposure. In this study population, STP use was associated with decreased sunbathing and tanning bed use in a substantial proportion of women. This study provides promising data suggesting that as the appearance of STP tans continues to be improved, STPs carry the potential to further decrease intentional UVR exposure and, subsequently, the risk of UVR-related skin cancer.

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matology; February 6, 2011; New Orleans, Louisiana. The abstract won First Place in the Everett C. Fox, MD, Award in the Clinical-Based Research category.


REFERENCES


Top-Accessed Article: Cantharidin Revisited


Moed and colleagues present a comprehensive review of cantharidin. They delineate the historical and folk uses of cantharidin as well as governmental regulatory issues. Although cantharidin lost Food and Drug Administration approval in 1962, it has been proposed for inclusion in the “Bulk Substances List” and may be obtained through compound pharmacies or proprietary sources. The authors outline the mechanism of action of cantharidin and its dermatologic applications. Although topical treatment with cantharidin rarely results in scarring or systemic intoxication, they note that deaths due to ingestion have been reported. The authors also review the symptoms of and treatment for systemic cantharidin poisoning. With this article, Moed and coauthors offer reassurance that proper in-office application of topical cantharidin remains a safe and valuable therapeutic option for warts and molluscum.

From August 2009 through August of 2010, this article was viewed 2036 times on the Archives of Dermatology Web site.

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