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## Sun-Protective Behaviors in Patients with Melasma

Laura J. Conahan, Sue Robertson

## A B S T R A C T

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Melasma is an acquired, chronic hyperpigmentation disorder exacerbated by hormone fluctuations, heat, inflammation, and sun exposure. Sun exposure is the greatest triggering and exacerbating factor, yet few studies investigate how patients with melasma practice sun-protective behaviors (SPBs). This mixed-methods project explored barriers to SPBs in patients with melasma. The demographic questionnaire and Sun Exposure and Protection Index (SEPI) survey were completed by 21 participants, and 13 participants were interviewed. Only 5 participants (23%) reapplied sunscreen every 2 hours as recommended. Interviews revealed a lack of knowledge and perceived risk regarding incidental sun exposures and proper sunscreen use.

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## Introduction

Melasma is an acquired, chronic disorder characterized by hyperpigmentation in sun-exposed areas of the skin. Epidemiologic studies investigating cutaneous disorders suggest the prevalence of melasma ranges from 1% in the general population to 50% in higher-risk groups.<sup>1</sup> Clinical manifestations typically include light-to-dark brown irregular patches on the centrofacial, malar, and mandibular regions of the face.<sup>1,2</sup> Women of reproductive age with darker skin phenotypes are disproportionately affected.<sup>1-5</sup> The etiology of melasma remains complex and unclear, although female sex hormones, genetics, inflammation, medications, and ultraviolet (UV) radiation play a role.<sup>2,3,5,6</sup> Sun exposure is considered the greatest triggering and exacerbating factor in melasma.<sup>4</sup>

Melasma is a significant problem for patients and is associated with a negative impact on quality of life.<sup>2,7,8</sup> Because melasma typically occurs on the face, it is easily visible, contributing to its distressing impact on patients.<sup>4</sup> Management is multifactorial and may include prescriptions, laser therapies, and avoidance of triggers, such as practicing sun-protective behaviors (SPBs).<sup>9</sup> In addition to physical and emotional costs, the financial impact of melasma is also significant. Although melasma is chronic and requires long-term management, it is classified as cosmetic. Thus, treatments are not covered by insurance.

## Background

Practicing SPBs appears to be the most cost-effective way of reducing exacerbations. Examples of SPBs are using sunscreen, seeking shade, and wearing protective clothing. Most of the melasma literature focuses on treatment options, such as medications and laser modalities, with minimal attention given to preventative measures such as practicing SPBs. The search was expanded to

identify studies investigating SPBs in patients with or at risk for skin cancer, another condition in which prolonged sun exposure can have detrimental effects.

Two studies investigated SPBs in patients with melasma. Compared with other disorders of pigmentation, patients with melasma who were educated regarding sun exposure were more likely to use sunscreen and seek shade. Overall, 67.5% of all participants reported using sunscreen, but only 7.6% reapplied every 2 hours, leading the authors to conclude that even for motivated patients, more education is needed.<sup>10</sup>

Another study evaluated properties of UV-A/UV-B protective sunscreens, with and without visible light protection, in patients with melasma. Participants were instructed how to correctly apply sunscreen. The authors concluded that sunscreen with additional visible light protection benefitted patients with melasma.<sup>11</sup> A common theme in both studies was that patients adhere to SPBs when provided education.

Similar themes emerged when examining the literature regarding SPBs in participants with or at risk for skin cancer. Increased knowledge and greater perceived self-efficacy contributed to increased engagement in SPBs.<sup>12-16</sup> Conversely, participants who exhibited a lack of knowledge, a lack of perceived risk, and who experienced perceived barriers had decreased and inconsistent engagement in SPBs.<sup>15,17-23</sup> Participants who were provided personalized interventions had improved adherence to SPBs<sup>24-26</sup>; however, technology-based interventions were only helpful when actively used.<sup>27-30</sup>

## Purpose

Little is known about how patients with melasma understand and practice SPBs. This study sought to gain perspective about barriers to SPBs of patients with melasma and to develop evidence-

based practice recommendations for patient education. The Health Promotion Model (HPM) and Transtheoretical Model (TTM) guided this study. The HPM explores factors and relationships that motivate individuals to engage in healthy behaviors,<sup>31</sup> whereas the TTM describes the process of intentional behavioral change and has been used to evaluate SPBs in various populations.<sup>32,33</sup>

## Methods

A mixed-methods approach used a validated survey measuring SPBs and qualitative interviews to understand participants' perceptions of living with melasma.

### Recruitment

After approval from the Institutional Review Board for the Protection of Human Subjects at California State University, Fullerton, this project was conducted at a small private practice in Orange County, California, that treats patients with melasma. An email describing the study was sent to current patients, and a flyer providing information about the study was placed at the front desk. Inclusion criteria were a melasma diagnosis, age  $\geq 18$  years, and fluent in English. Patients who met the inclusion criteria and requested information about the study were referred to the nurse practitioner (L.J.C.), who provided more information about the study, answered questions, and informed patients that participating (or not) in the study would not affect their medical care. Those agreeing to participate provided written consent. Patients took the survey while in the office or later, returning the survey with the included stamped envelope. A convenience sample of 21 patients participated; all completed the survey, and 13 consented to be interviewed. Patients were not compensated for participating.

### Survey

Self-reported SPBs were assessed through the Sun Exposure and Protection Index (SEPI) survey developed by Detert et al,<sup>33</sup> available online at <https://sepicore.com/>.

The survey has 2 sections, each scored using a 5-grade Likert scale (0-4 points). The first section contains 8 questions and assesses SPBs (score of 0-32 points). A high score reflects an increased risk of sun exposure.<sup>33</sup> The second section assesses readiness to increase SPBs and consists of 5 questions based on the TTM stages of behavioral change (score of 0-20 points). A high score indicates a decreased proclivity to increase sun protection.<sup>33</sup> The validity and reliability of the SEPI survey has been assessed in Australian and Swedish participants, as these populations have high incidence rates of skin cancer.<sup>33</sup> The demographic questionnaire collected the participant's age, education level, race/ethnicity, self-reported Fitzpatrick skin typing, years having a melasma diagnosis, how often one thinks about their melasma, and sunscreen use, including sun protection factor (SPF) and reapplication behaviors.

### Interviews

Patients were given the option to be interviewed in the office or by telephone. Office interviews were audio recorded, and telephone interviews were recorded using a secure online telephone and transcription service. The semistructured interview guide reflected key elements of the HPM (eg, personal characteristics,

**Table 1**  
Sample Characteristics

Variable	No. (N = 21)	%
Age, y		
25-34	8	38.10
35-44	5	23.81
45-54	7	33.33
$\geq 65$	1	4.76
Education level		
High school or GED	2	9.52
Some college/did not finish degree	3	14.29
Associate degree/technical degree	3	14.29
Bachelor's degree	6	28.57
Graduate degree	7	33.33
Race/ethnicity		
Hispanic/Latino	6	28.57
Asian/Pacific Islander	3	14.29
Caucasian/White	12	57.14
Fitzpatrick Skin Type		
I: Always burns easily, never tans	1	4.76
II: Always burns easily, tans slightly	1	4.76
III: Burns moderately, tans gradually	6	28.57
IV: Burns minimally, tans moderately	5	23.81
V: Rarely burns, tans profusely	7	33.33
VI: Never burns, tans profusely	1	4.76
Years with melasma		
1-2	3	14.28
3-4	7	33.33
5-6	5	23.81
$\geq 7$	6	28.57
Thinking about melasma		
Rarely	1	4.76
Occasionally	3	14.29
Often	8	38.10
Always	9	42.86
Sunscreen sun protection factor		
30-49	13	61.90
$\geq 50$	8	38.10
Sunscreen reapplication		
Do not reapply	8	38.10
Every 6-8 hours	2	9.52
Every 3-5 hours	6	28.57
Every 2 hours	5	23.81

Note. Due to rounding errors, percentages may not equal 100%.

benefits, barriers) and used open-ended questions. Follow-up questions were used to explore statements and clarify meanings. Interviews were conducted until data saturation was met.

### Data Analysis

Quantitative data were analyzed using Intellectus Statistics Online Computer Software (Intellectus Statistics) and SPSS 23 software (IBM Corp). Descriptive statistics were used to calculate frequencies and percentages of the demographic data and SEPI survey scores. A Pearson correlation analysis was conducted to evaluate the strength of the relationship between SEPI Part I and II scales. A Spearman correlation analysis was conducted to evaluate the relationship between SEPI Part I and II scales with ordinal variables.

Conventional content analysis was used to analyze qualitative data. This method is used to describe a phenomenon when little is known about it, allowing researchers to gain "direct information from study participants without imposing preconceived categories."<sup>34(p1279)</sup> Interviews were transcribed, verified, and then read word-by-word to identify key concepts (codes). Once authors reached consensus on codes, codes were sorted into categories and clustered into themes.<sup>34</sup> After qualitative analysis was complete,

**Table 2**  
Theme and Subthemes With Supportive Quotes

Theme and Subthemes	Supportive Quotes
Living with melasma	Mine is from sun exposure, I can guarantee that 100%... I did permanent damage to myself. I understand that. Not happy with myself about it, but it is what it is... now the problem is that it's irreversible and it's now here and I've got to deal with it.
Sun-protective behaviors	I don't remember to reapply. How do you do that with makeup on? That is still challenging for me. Like with foundation and blush, I don't see how people do that.
Managing melasma	I've never really had to wear makeup, I felt, and so now it's something I feel like I have to cover up because it doesn't look nice. Yeah, it's just been a burden for me. It's something that's made me self-conscious where I haven't had to be self-conscious before.

qualitative and quantitative data were both integrated into an overall interpretation used to make recommendations for patient education.

## Results

### Quantitative Results

Participants were primarily White, 25 to 34 years old, had at least a bachelor's degree, were self-reported Fitzpatrick Skin Type III or V, had melasma for at least 3 years, and thought about their melasma often or always. Although all participants used sunscreen, only 24% followed the recommended application of every 2 hours (Table 1).

SEPI Part I assesses sun exposure and protection habits. When asked about sunbathing with the intention of tanning, 57% answered "never." Sixty-two percent had no episodes of sunburn in the prior 12 months. Many participants (48%) spent <30 minutes in the sun between the hours of 11 AM and 3 PM on a typical day and reported "never" (24%) or "seldom" (48%) taking a vacation to spend time in the sun. In addition, 76% of participants "always" used sunscreen, 66% reported "always" or "often" using clothes to cover skin, and 95% used a sun hat/cap for protection.

SEPI Part II assesses a participant's readiness to increase sun protection. Seventy-two percent of participants avoided sunbathing for a long time or had given up sunbathing recently. Most participants started using sunscreen (24%) or used it for a long time (67%). Sixty-eight percent reported using clothes, and 95% used a hat/cap for protection. Most participants (81%) stayed in the shade to decrease sun exposure.

A higher score on SEPI Part I (range, 0-32 points) indicates the participant engages in behaviors that increase risk for sun exposure.<sup>33</sup> The average total SEPI Part I score was 6.81 (SD, 4.68; SEM, 1.02; minimum, 1.00; maximum, 16.00). A higher score on SEPI Part II (range, 0-20 total points) indicates a decreased propensity to increase sun protection.<sup>33</sup> The average total SEPI Part II score was 4.48 (SD, 3.28; SEM, 0.72; minimum, 0.00; maximum, 12.00).

A significant negative correlation was observed between "age in years" and "sunscreen reapplication," suggesting that as age increases, sunscreen reapplication tends to decrease ( $r_s = -0.45, P = .039$ ). A significant positive correlation was observed between "thinking about melasma" and "sunscreen SPF," suggesting that as time spent thinking about melasma increases, sunscreen SPF numbers tend to increase ( $r_s = 0.44, P = .044$ ). A significant negative correlation was observed between "sunscreen reapplication" and the SEPI Part II score ( $r_s = -0.47, P = .030$ ), suggesting as sunscreen reapplication increases, SEPI Part II scores tend to decrease. A significant positive correlation was observed between SEPI Part I and SEPI Part II scores ( $r_s = 0.69, P < .001$ ), indicating that as SEPI Part I scores increase, SEPI Part II scores tend to increase.

### Qualitative Results

Thirteen participants were interviewed. Twenty-three codes were identified and then collapsed into categories and clustered into agreed upon themes. Participants spoke of Living with Melasma as a process of considering Sun-Protective Behaviors and Managing Melasma (Table 2).

Living with melasma began when participants noted hyperpigmentation on their cheeks, forehead, and around the eyes. Participants attributed this to pregnancy, oral contraceptive medications, heat, and sun exposures. Part of living with melasma was experiencing feelings of guilt and regret over previous sun exposures. Some participants were ignorant to sun exposure risks: "our parents didn't apply sunscreen to us," whereas others believed their skin tone was protective: "I'm Italian... it takes a lot for me to burn... or get sun-damaged." Others knew the risks but wanting a tan outweighed any concern: "that's like the whole purpose, you want to get a tan."

After learning about melasma, most participants practiced SPBs, such as applying sunscreens with higher SPF levels, wearing hats/visors/sunglasses, using umbrellas, and avoiding sun during peak hours or avoiding outdoor activities. Nearly all participants reported using sunscreen daily, but reapplication did not occur consistently. Most participants found it difficult to reapply over makeup and inconvenient to remember to reapply: "Once I put it on... I'm busy. I go on with the rest of my day." Participants complained that sunscreen "stings your eyes" when sweating or in water and is "expensive."

Some participants only used sunscreens when at the beach or by the pool: "I don't know why I associate the sun being stronger at the beach... I go out in the sun every day." Another participant added she wears sunscreen "in the summer... to the pool... but on a daily basis... no I don't." Only 1 participant recognized sun exposure while driving: "I drive all the time... I feel like the left side of my face has more [pigment] than the right side."

Participants managed melasma through prescriptions, laser treatments, SPBs, and makeup. Makeup was used to manage the insecurity and self-consciousness associated with their appearance. Participants described themselves as looking "dirty" and "older" and were increasingly worried that other people would notice the pigment: "I'm always thinking... are they looking at my skin?"

Participants reported lower self-esteem: "I don't really want to date... I don't want anybody to really see how bad my skin looks without makeup..." Having to constantly apply makeup was described as "annoying," "time-consuming," and "inconvenient." One participant said: "It's awful. I cannot leave the house without wearing makeup..." Regarding time, another participant stated, "If you added it up, I'm sure it would be hours upon hours that I'm having to stop, put makeup on, instead of going out and enjoying my life."

Managing melasma left participants frustrated and unsatisfied, desiring options that were affordable and curative. Participants were concerned about ongoing costs, as procedures range from “a couple hundred dollars” to “thousands of dollars a treatment,” and they “aren’t 100% sure that they’re going to work.” Participants were also concerned about the cost of sunscreen and makeup and angered over a lack of insurance coverage for their condition: “It’s still looked at as cosmetic... I feel like it’s an actual disease, but the medical industry doesn’t treat it as that.”

## Discussion

Most participants had low scores on SEPI Part I which correlated with lower scores on SEPI Part II, indicating increased engagement and readiness to engage in SPBs. SEPI Part II scores tended to decrease as sunscreen reapplication increased, representing consistent engagement in a variety of SPBs. Data analysis revealed as time thinking about melasma increased, sunscreen SPF numbers increased. Participant interviews confirmed having melasma made them aware of wearing sunscreen with higher SPF ratings.

Although motivated to engage in SPBs, barriers to SPBs were identified, including a lack of knowledge, a lack of perceived risk, and inconsistent sunscreen use. Participants reported lack of knowledge started in childhood when parents did not place importance on sun protection. Studies suggest that most knowledge about SPBs comes from family members and that increasing knowledge leads to increased engagement in SPBs.<sup>10,12-16,35,36</sup>

Participants did not recognize incidental sun exposures. They practiced SPBs more consistently in summer months or at the beach/pool, not identifying sun exposures other times they were outside, next to open windows, or when driving. Lack of perceived risk during outdoor activities and while driving occurred elsewhere, suggesting additional education is needed.<sup>23,35,37</sup>

Statistical analysis indicated that as age increased, sunscreen reapplication decreased. This was not supported during interviews; rather, participants engaged in more sunscreen use when older and after receiving the melasma diagnosis. Participants who did not reapply sunscreen often were mainly Hispanic/Latino and Asian/Pacific Islander ethnicities. Lower perceived risk of sun damage in participants with darker skin has been investigated elsewhere, indicating education is needed in these populations.<sup>10,15,20</sup> Educational materials tailored to the patient’s age and ethnicity have increased SPBs in other studies.<sup>25</sup>

Although patients with melasma are motivated to engage in SPBs, sunscreen reapplication remained challenging. Most participants stated they “always” wear sunscreen; however, 77% did not reapply sunscreen at recommended intervals. This is similar to other studies, suggesting patient education is needed regarding sunscreen reapplication.<sup>10,37</sup> Barriers to sunscreen reapplication included forgetting to reapply, feeling it was inconvenient to reapply, feeling it was too expensive to reapply, and not wanting the sunscreen to “sting” the eyes. However, the most frequently answered reason why participants did not reapply sunscreen was because they did not want to reapply it over makeup. Many foundation products have UV protection, but reapplication is still required, as the protective effect of the sunscreen wears off every 2 hours.

## Implications for Practice

Implications are 3-fold: assessing patient understanding, inquiring about the patient’s experience of living with melasma, and providing education. Although patients are instructed to engage in SPBs, this study revealed a lack of knowledge and perceived risk of incidental sun exposures and proper sunscreen

use. Assessment of the patient’s understanding of these 2 issues must be ongoing and is especially important in patients with darker skin types, as patients may believe darker skin is protective against the sun’s damaging effects.

Providers should inquire about the patient’s experience of living with melasma and acknowledge their feelings. This information helps providers create individualized treatment plans to decrease hyperpigmentation and improve the patient’s feelings about their appearance. Providers should advocate on the patient’s behalf for treatments that are affordable. Educational materials should provide examples of incidental sun exposures and detail how to correctly apply sunscreen, emphasizing frequency of reapplication. Patients should be educated about the various types of sunscreens and encouraged to use the type most convenient to use consistently.

## Limitations

This study was limited by its small sample size of all female and mainly White, young adult participants, which may be difficult to generalize to other populations. The sample was restricted to patients in Orange County, California, which may not be representative of patients in different locations. Melasma disproportionately affects women with darker skin types, but can also affect men. Including a more diverse population sample would be important for future research. Statistically significant results are limited by the small sample size.

Potential bias may have occurred due to the open-ended nature of interview questions, although the author (L.J.C.) tried to avoid leading questions and remain neutral throughout the process. Reporter bias may have occurred if participants tried to answer questions in a way that would please the researcher.

## Conclusion

Sun exposure is the greatest triggering factor in melasma, yet few studies investigate how patients with melasma practice SPBs. It is imperative to practice SPBs to prevent melasma exacerbations and barriers to SPBs have been identified, including a lack of knowledge, a lack of perceived risk, and a lack of consistent sunscreen use. Patients with melasma would benefit from ongoing interventions that increase patient knowledge, address barriers, and promote personalized support. In addition to providing general sun-protective information, education should include how to recognize incidental sun exposures and how to use sunscreen correctly.

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Laura J. Conahan, DNP, FNP-C is an Assistant Professor of Nursing and Family Nurse Practitioner Program Coordinator at California State University in Long Beach, CA and can be contacted at [laura.conahan@csulb.edu](mailto:laura.conahan@csulb.edu). Sue Robertson, PhD, RN is an Associate Professor Emeritus at California State University in Fullerton, CA.

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