FEATURE ARTICLE

Factors Influencing Sun Protection Behaviors Among Patients With Skin Cancer: An Application of the Information–Motivation–Behavioral Skills Model

CE 1.5 Contact Hours

Vinayak K. Nahar, William H. Black, M. Allison Ford, Martha A. Bass, John P. Bentley, Paul Johnson, Robert T. Brodell

ABSTRACT: This study aimed to assess predictors of sun protection behaviors based on the information–motivation–behavioral skills (IMB) model among people diagnosed with nonmelanoma skin cancer (NMSC). For this descriptive, cross-sectional study, a convenience sample of 311 patients with NMSC was recruited at a medical center in Mississippi. Patients were invited to complete a face- and content-valid, IMB-model-based questionnaire. The average age of the participants was 64.12 (±12.02) years, and most (58.8%) were male. Most participants indicated not using sun protection behaviors while outdoors. Findings showed that sun protection behaviors were directly predicted by self-efficacy (standardized path coefficient = 0.504, $p < .001$) and social support (standardized path

Vinayak K. Nahar, MD, PhD, MS, FRSPH, *Center for Animal and Human Health in Appalachia, College of Veterinary Medicine, DeBusk College of Osteopathic Medicine, and School of Mathematics and Sciences, Lincoln Memorial University, Harrogate, TN.*
Department of Dermatology, School of Medicine, University of Mississippi Medical Center, Jackson, MS.
William H. Black, MD, *Department of Dermatology, School of Medicine, University of Mississippi Medical Center, Jackson, MS.*
Robert T. Brodell, MD, *Department of Dermatology, School of Medicine, University of Mississippi Medical Center, Jackson, MS.*
M. Allison Ford, PhD, *Department of Health, Exercise Science, and Recreation Management, School of Applied Sciences, University of Mississippi, University, MS.*
Martha A. Bass, PhD, *Department of Health, Exercise Science, and Recreation Management, School of Applied Sciences, University of Mississippi, University, MS.*
John P. Bentley, PhD, *Department of Pharmacy Administration, School of Pharmacy, University of Mississippi, University, MS.*
Paul Johnson, PhD, *Department of Management, School of Business Administration, University of Mississippi, University, MS.*

Vinayak K. Nahar, William H. Black, Allison Ford, Martha A. Bass, John P. Bentley, and Paul Johnson have no conflict of interest to report. Robert T. Brodell discloses the following potential conflict of interest: Honoraria have been received from presentations for Allergan, Galderma, and PharmaDerm, a division of Nycomed US, Inc. Consultant fees have been received from Galderma Laboratories, L.P. Clinical trials have been performed for Genentech and Janssen Biotech, Inc. The material in this article is not believed to be relevant to any of these reported conflicts.

Correspondence concerning this article should be addressed to Vinayak K. Nahar, MD, PhD, MS, FRSPH, Center for Animal and Human Health in Appalachia College of Veterinary Medicine, DeBusk College of Osteopathic Medicine, and School of Mathematics and Sciences, Lincoln Memorial University, 6965 Cumberland Gap Parkway, Harrogate, TN 37752.
E-mail: naharvinayak@gmail.com

DOI: 10.1097/JDN.0000000000000472

coefficient = 0.199, p = .010). In addition, sun protection behavior was indirectly predicted (through self-efficacy) by social support (standardized indirect effect = 0.160, p < .001) and attitudes (standardized indirect effect = 0.192, p = .001). The explained variances for self-efficacy and sun protection behaviors were 43% and 35.4%, respectively. In conclusion, the IMB model appears to be a useful theoretical framework for predicting sun protection behaviors among patients with NMSC. Sun safety intervention programs should be developed based on this theoretical model for patients with NMSC.

Key words: Sun Protection Behaviors, Skin Cancer Patients, Melanoma, Nonmelanoma Skin Cancer, Theory, Predictors, Sunscreen

Nonmelanoma skin cancer (NMSC) is the most commonly diagnosed cancer in the United States (Rogers et al., 2010). About 5.4 million cases are diagnosed every year in the United States, and estimates indicate that roughly 2,000 people die every year from NMSC (American Cancer Society, 2018). The estimated annual cost for NMSC treatment is roughly $4.8 billion in the United States (Guy, Machlin, Ekwueme, & Yabroff, 2015). Exposure to solar ultraviolet radiation (UVR) is the primary risk factor for skin cancer development, making it one of the highly preventable types of cancer (Koh, Geller, Miller, Grossbart, & Lew, 1996; Parkin, Mesher, & Sasieni, 2011). In addition, there is sufficient evidence that exposure to UVR emitted from indoor tanning significantly increases the risk of skin cancers (Wehner et al., 2014). Recommended skin cancer prevention strategies include seeking shade, limiting time outdoors during midday, wearing sun protective clothing (e.g., long-sleeved shirts, long pants or skirts, and wide-brimmed hat), appropriately applying sunscreen with sun protection factor (SPF), using sunglasses, and avoiding tanning beds (American Academy of Dermatology, 2019).

Individuals with a previous history of NMSC are at a considerably higher risk not only of reoccurrence but also of developing a cutaneous melanoma—the most fatal type of skin cancer (Song et al., 2013; Wheless, Black, & Alberg, 2010). Our previous results suggest that patients with NMSC improve their sun protection behaviors after a diagnosis of NMSC is made; however, they do not protect themselves optimally from the hazards of UVR (Nahar et al., 2015). Therefore, the current study was conducted to identify the factors that may influence sun protection behaviors among patients diagnosed with NMSC. We utilized the information–motivation–behavioral skills (IMB) model as a theoretical framework. The findings of this study are beneficial to physicians and public health professionals for the development and implementation of programs to increase the use of sun protection strategies among individuals diagnosed with NMSC, a population group that is at heightened vulnerability of developing skin cancer in the future.

THEORETICAL FRAMEWORK

The IMB model, developed by Fisher and Fisher (1992), posits that an individual's particular health behavior performance is a function of his or her behavior-specific information, motivation to engage in preventive behaviors, and behavioral skills for enacting the health behavior (Fisher, Fisher, Amico, & Harman, 2006; Fisher, Fisher, & Harman, 2003). According to the model, information and motivation assets work largely through behavioral skills to influence health promoting behaviors or behavioral changes. In essence, information and motivation with respect to a particular behavior activate the relevant behavioral skills, and these skills then result in the initiation and maintenance of preventive health behavior (DiClemente, Crosby, & Kegler, 2009). This theoretical model further asserts that information and motivation may also exert direct effects on preventive health behavior, particularly when complex or novel behavioral skills are not required to accomplish a specific behavior (Seacat & Northrup, 2010).

METHODS

Study Design, Sampling, and Participants

This study utilized a descriptive, cross-sectional design. A convenience sample of participants was recruited between July 2015 and April 2016. Participants were included if they had been diagnosed with NMSC and were aged 18 years or older. Participants were excluded if they had severe physical or cognitive impairments.

Setting and Procedure

After approval of the University of Mississippi Medical Center Institutional Review Board, individuals diagnosed with NMSC were invited by their attending physician to participate in the study. Data were collected at the medical center. Adequate information about the study was provided to the potential participants. Individuals who decided to participate were asked to complete an IMB-model-based self-administered questionnaire. Most patients required approximately 15–20 minutes to complete the questionnaire.

Instrumentation

A questionnaire was developed primarily using items derived from survey instruments used in previous studies (Cottrell, McClamroch, & Bernard, 2005; Gillespie, Watson, Emery, Lee, & Murchie, 2011; Hammond, Reeder, Gray, & Bell, 2008; Jackson & Aiken, 2000; Manne & Lessin, 2006; Marlenga, 1995; Patel et al., 2010; Rosenman, Gardiner, Swanson, Mullan, & Zhu, 1995; Salas, Mayer, & Hoerster, 2005; Shoveller, Lovato, Peters, & Rivers, 2000; Von Ah, Ebert, Park, Ngamvitroj, & Kang, 2004). Wordings of some of the questions were revised to adequately address our research purpose. The questionnaire first measured the IMB model constructs followed by an assessment of sociodemographic data.

IMB Model Constructs

Information

The information construct of the IMB model includes accurate information and faulty heuristics or misinformation concerning health behavior (Gao, Wang, Zhu, & Yu, 2013). The information construct was measured by using 24 skin cancer knowledge items (e.g., "Most skin cancers can be prevented" and "One should look for a sunscreen that offers both UVA and UVB protection"). Knowledge was measured based on the number of correct responses. Correct responses for each item were summed to obtain a total score for knowledge. Higher scores indicate higher skin cancer knowledge.

Motivation

According to the IMB model, motivation is composed of attitudes related to preventive acts, perceived social support for performing such acts, and perceived personal susceptibility of contracting a disease in question (Robertson, Stein, & Baird-Thomas, 2006).

The participants' attitudes toward sun protection behaviors were assessed by 16 items (e.g., "Sun protection is very important for people with my history of cancer" and "I believe I should practice sun protection to reduce my chances of getting skin cancer"). The items were measured on a 5-point Likert response format (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*). The scores for each item were summed to obtain a total score for attitudes toward sun protection behaviors. Higher scores indicate more positive attitudes toward sun protection behaviors.

Perceived social support for sun protection was measured by 11 items (e.g., "Most people who are important to me, think that when I am in the sun I should seek shade" and "Most people who are important to me, think that when I am in the sun I should minimize sun exposure between 10 AM and 4 PM"). The items were measured on a 5-point Likert response format (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*). The scores for each item were summed to obtain a total score for perceived social support for sun protection. Higher scores indicate higher perceived social support for sun protection.

The perceived skin cancer risk was measured by eight items (e.g., "It is extremely likely that I will get skin cancer in the future" and "Because of my personal history, I am more likely to get skin cancer"). The items were measured on a 5-point Likert response format (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*). The scores for each item were summed to obtain a total score for perceived risk. Higher scores indicate higher skin cancer perceived risk.

Behavioral Skills

Behavioral skills, the third fundamental construct of the IMB model, refer to skills necessary to implement a specific health behavior and the confidence in the individual's ability to do so across different situations (Osborn & Egede, 2010). Self-efficacy was used to measure behavioral skills in this study (John, Walsh, & Weinhardt, 2017). Self-efficacy refers to the degree of confidence that an individual has in his or her ability to perform a specific behavior (Glanz, Rimer, & Viswanath, 2008). The self-efficacy to engage in sun protection behaviors was measured by 11 items (e.g., "When in the sun for more than 15 minutes, I am confident or certain that I can wear a wide-brimmed hat" and "When in the sun for more than 15 minutes, I am confident or certain that I can wear sunscreen with SPF of 15 or higher to protect my skin from the sun"). The items were measured on a 5-point Likert response format (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*). The scores for each item were summed to obtain a total score for self-efficacy to engage in sun protection. Higher scores indicate higher self-efficacy to engage in sun protection.

Sun Protection Behaviors

To determine the use of sun protection methods, participants were asked to indicate on a 5-point verbal frequency response format (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *frequently*, and 5 = *always*) how often they perform the following sun protection behaviors when out in the sun for 15 minutes or more: seek shade, minimize sun exposure between 10 a.m. and 4 p.m., wear a wide-brimmed hat, wear something on your head (any type of hat, cap, and visor), wear sunscreen with an SPF of 15 or higher to protect your skin from the sun, wear sunscreen with an SPF of 15 or higher on your face, wear sunscreen with an SPF of 15 or higher on all exposed areas of your body, wear clothing to protect your skin from the sun, wear a long-sleeved shirt or blouse, wear long pants or long skirt, and wear sunglasses to protect your eyes from the sun. The scores for each item were summed to obtain a total score for sun protection behaviors. Higher scores indicate higher use of sun protection behaviors.

Instrument Validity

A panel of three experts in the area of skin cancer prevention research was invited to evaluate the modified instrument for face and content validity. To provide evidence of construct validity, confirmatory factor analysis was conducted using Mplus Version 7. Findings for the confirmatory factor analysis showed that fit for the model was acceptable: likelihood ratio $\chi^2 = 287.618$ ($df = 133$), $p < .001$; root mean square error of approximation = 0.06; comparative fit index = 0.93; Tucker–Lewis index = 0.91; standardized root mean square residual = 0.05 (Hu & Bentler, 1999). Moreover, all item loadings were significant at $p < .001$.

Instrument Reliability

To establish internal consistency reliability, Cronbach's alpha was computed for subscales and the entire scale. Cronbach's alpha coefficient equal to or over .70 is considered acceptable (Sharma & Petosa, 2012). Internal consistency for the entire

scale was .92. Of subscales, social support had the highest internal consistency (α = .95). Both self-efficacy (α = .88) and sun protection behaviors (α = .83) showed very good internal consistency (Sharma & Petosa, 2012). Furthermore, knowledge (α = .70), perceived risk (α = .77), and attitudes (α = .79) showed respectable internal consistency (Sharma & Petosa, 2012).

Statistical Analysis

Before analysis, data were checked for missing and extreme values. To describe and interpret the data, descriptive statistics (means, standard deviations, and frequencies) were calculated for all measured variables. Preliminary analyses were conducted on the IMB model constructs to ensure that there were no violations of the following assumptions: linearity, normality, homoscedasticity, and lack of multicollinearity. After determining all assumptions were not violated, observed variable path analysis was conducted to assess if information (skin cancer knowledge) had a direct association with sun protection behaviors and an indirect effect through behavioral skills (confidence to engage in sun protection behaviors). Moreover, this analysis also assessed if motivation (attitudes toward sun protection behaviors, perceived social support for sun protection, and perceived skin cancer risk) had a direct association with sun protection behaviors and an indirect effect through behavioral skills (confidence to engage in sun protection behaviors). All data were analyzed using SPSS Version 21.0 and Mplus Version 7. For the analyses, an alpha was set at .05 a priori.

RESULTS AND DISCUSSION

Three hundred eleven patients with NMSC participated in this study. Most (58.8%) of the participants were male. Of the sample, 77.5% were married. The mean (±*SD*) age of the participants was 64.12 (±12.02) years. About one fourth (24.1%) of the participants had a graduate or professional degree. Moreover, over one fourth (30.6%) reported an annual income $101,000 or more. Most of the participants (97%) reported having health insurance coverage. Table 1 summarizes the sociodemographic characteristics of participants.

Results indicated that individuals diagnosed with NMSC continue to receive substantial sun exposure on a daily basis (between 10 a.m. and 4 p.m.). The high levels of sun exposure are concerning, when considering that 59.1% had a family history of skin cancer, 34.2% had a blue eye color, almost 40% had many moles/freckles, and between 10% and 48% had a high propensity to burn rather than tan. Moreover, 38.5% of the participants reported working as a part-time or full-time outdoor worker. Prior studies have also shown that individuals previously diagnosed with NMSC still expose themselves to UVR exposure by working in environments with heavy sun exposure or by practicing indoor tanning behaviors (Cartmel et al., 2013; Nahar et al., 2015; Woolley, Buettner, & Lowe, 2004).

TABLE 1. Sociodemographic Characteristics of Participants

Variables	*n* (%)
Gender	
Male	181 (58.8)
Female	127 (41.2)
Marital status	
Married	238 (77.5)
Never married	10 (3.3)
Divorced/separated	36 (11.7)
Widow, widower	16 (5.2)
Living with partner	7 (2.3)
Education	
Less than elementary school (Grade 8 or less)	2 (0.7)
Less than high school (Grade 11 or less)	7 (2.3)
High school diploma (including GED)	82 (26.7)
Associate degree (2 years)	60 (19.5)
Bachelor's degree	82 (26.7)
Graduate or professional degree	74 (24.1)
Income	
Less than $20,000	15 (5.5)
$21,000–$30,000	22 (8.1)
$31,000–$40,000	20 (7.4)
$41,000–$50,000	22 (8.1)
$51,000–$60,000	27 (10.0)
$61,000–$70,000	14 (5.2)
$71,000–$80,000	22 (8.1)
$81,000–$90,000	19 (7.0)
$91,000–$100,000	27 (10.0)
$101,000 or more	83 (30.6)

Given that some participants in the current study showed intention to sunbathe (7%) and perceive suntan to be attractive (21%), appearance-based educational interventions (focusing on negative effects of UVR exposure on appearance, such as wrinkles, sagging, and brown spots) should be beneficial (Nahar et al., 2016). A systematic review and meta-analysis showed that appearance-based interventions have a positive influence on UV exposure and sun safety behaviors and intentions (Williams, Grogan, Clark-Carter, & Buckley, 2013).

It is noteworthy that almost one fourth (24.7%) of the individuals previously diagnosed with NMSC reported experiencing episodes of at least one or more sunburns after their skin cancer diagnosis. Moreover, studies conducted in Denmark and Canada also indicated episodes of sunburn among melanoma survivors (Idorn, Datta, Heydenreich, Philipsen, & Wulf, 2013, 2014; Lee, Brazier,

Shoveller, & Gallagher, 2007). These findings suggest that the level of sun exposure among patients with skin cancer was high enough to cause sunburn. This is alarming because sunburn frequency increases individuals' likelihood of developing melanoma (Nahar et al., 2016; Pfahlberg, Kölmel, & Gefeller for the Febim Study Group, 2001). At every encounter, physicians and dermatologists should communicate with patients with skin cancer about risks related with sunburn and UVR exposure (Nahar et al., 2016).

Finally, the sun protection behaviors measure ranged from 17 to 55 units on a possible range of 11–55 with a mean of 37.07 units (Table 2), indicating a moderate level of sun protection behaviors among patients with NMSC in this study. About one third of the participants indicated that they apply sunscreen on all exposed areas (36.1%) and wear long-sleeved shirts (34%) when out in the sun for more than 15 minutes. Similar percentages of participants reported wearing wide-brimmed hats (45.6%) and long pants (46.2%). The most frequently (68.8%) reported sun protection strategy among patients with NMSC was use of sunglasses. However, 15.6% and 28.2% reported that they "never or rarely" seek shade and use sunscreen, respectively. The results of sun protection behaviors in this study are fairly similar to the recently published population-based study with individuals previously diagnosed with NMSC (Fischer, Wang, Yenokyan, Kang, & Chien, 2016). Therefore, the current research confirms the prior studies' recommendations that there is a need to increase sun protection behaviors among previously diagnosed individuals with skin cancer (Nahar et al., 2015, 2016).

The inadequate sun protection behaviors could be partially explained by the barriers and attitudes toward sun protection strategies of patients with NMSC. The attitude score ranged from 40 to 79 on a possible range of 16–80 with a mean of 61.34 units (Table 2), indicating a moderate level of positive attitudes. In the path analysis (Figure 1), attitude had no direct effect on sun protection behaviors, but it had an indirect effect on sun protection behaviors (standardized indirect effect = 0.192, p = .001, bias-corrected 95% CI [0.078, 0.348]) through self-efficacy.

TABLE 2. Descriptive Statistics of Study Variables

Constructs	Possible Range	Observed Range	Mean (±*SD*)
Knowledge	0–24	1–24	17.43 (±3.35)
Perceived risk	8–40	8–40	28.29 (±4.87)
Attitudes	16–80	40–79	61.34 (±7.2)
Social support	11–55	11–55	44.53 (±7.49)
Self-efficacy	11–55	11–55	44.24 (±6.75)
Sun protection behaviors	11–55	17–55	37.07 (±8.15)

With regard to skin cancer knowledge, 16.5% did not know that sunscreen should be reapplied to the skin approximately every 2 hours, 20.1% did not know that they should look for a sunscreen that offers both UVA and UVB protection, and even more surprisingly, 63.9% reported that sunscreen should be applied immediately before going out in the sun. A little over one third (35.7%) of respondents correctly identified recommended sun protection methods to reduce skin cancer risk. Moreover, nearly one fourth (24.2%) did not know that sun is strongest at midday. These finding indicate that patients need to be educated on how to effectively apply sunscreen. This can be done by medical staff such as nurses and medical students on clinical rotations or health educators. One strategy would be to put an educational video on sunscreen use in clinic waiting rooms. Such intervention strategies have been effective in health behavior change (Besera et al., 2016).

The knowledge scores ranged from 1 to 24, with no participant getting a 0 and a mean of 17.43 units (Table 2), indicating moderate skin cancer knowledge among the patients with NMSC in this study. However, previous studies showed that skin-cancer-related knowledge among patients with NMSC remains limited (Goldenberg, Nguyen, & Jiang, 2014; Renzi et al., 2008). These differences in findings could be because of differences in the instrument used to measure knowledge about skin cancer. Researchers are encouraged to develop and utilize standardized scales to allow comparisons in the findings of knowledge and other constructs across the studies in the area of skin cancer prevention research (Nahar et al., 2015). A previous study conducted with 315 patients with squamous cell carcinoma showed a relationship between higher knowledge and increased likelihood of engaging in preventive behaviors (Renzi et al., 2008). On the contrary, this study showed no significant relationship between knowledge and sun protection behaviors. Moreover, knowledge had no significant indirect effect on sun protection behaviors through self-efficacy.

The perceived risk scores occupied the full range of 8–40, with a mean of 28.29 units (Table 2), indicative of a moderate perceived risk of skin cancer for the participants in this study. About 60% perceived that they are more likely than the average person to get skin cancer. Moreover, about 71% believed that it is extremely likely that they will get skin cancer in the future. However, only 16% believed that getting skin cancer is more serious than other diseases. A prospective study of 211 consecutive patients with NMSC conducted at the Medical College of Wisconsin showed that patients do not perceive an increased risk for melanoma and retained the same view of their personal skin cancer risk 4 months after their NMSC treatment (Rhee et al., 2008). The Health Belief Model suggests that individuals are more likely to carry out preventive actions if they perceive themselves to be at risk of developing a health problem (Glanz et al., 2008). As evidenced by the nonsignificant direct and indirect effects (Figure 1), this

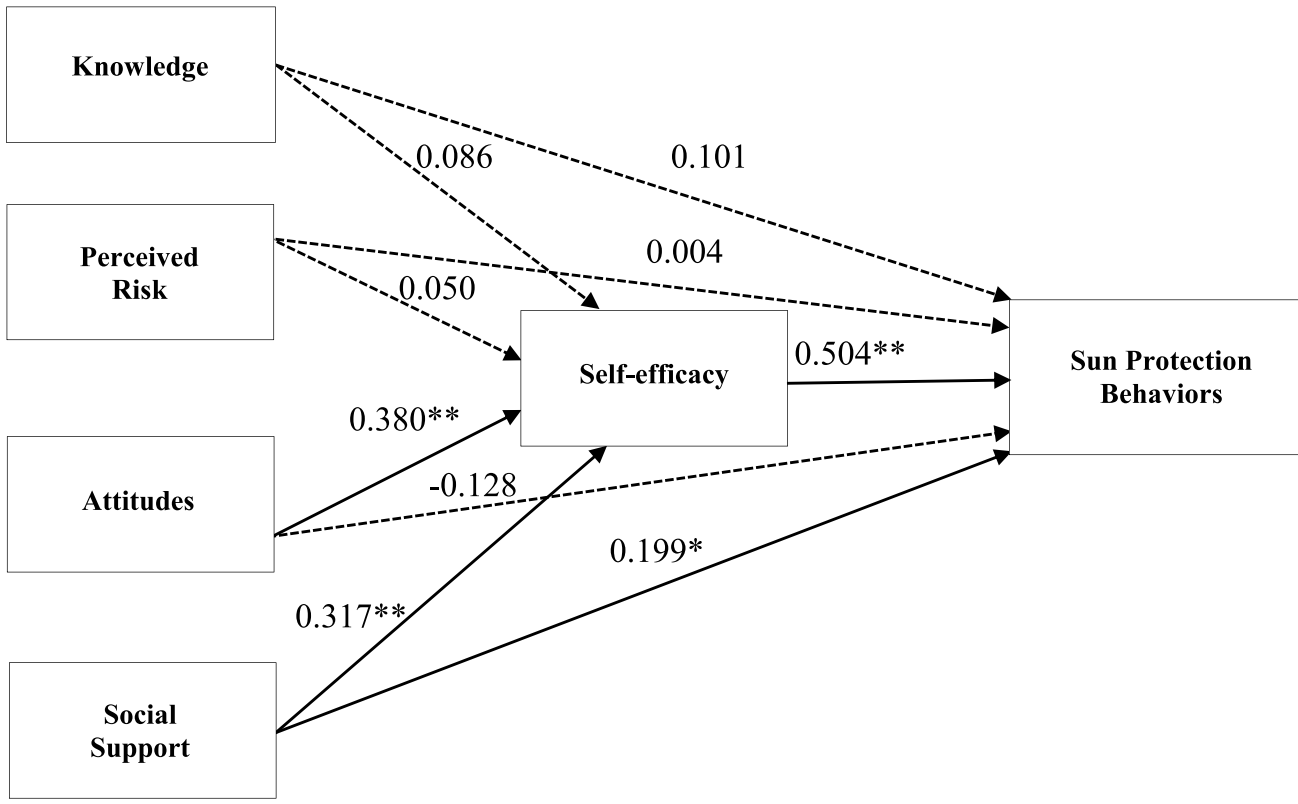

FIGURE 1. Regression paths in the information–motivation–behavioral skills model. Single-headed arrows show standardized path coefficients (*$p < .05$, **$p < .001$). Solid line: significant path; dotted line: nonsignificant path.

proposition is not supported in the current study. This could be explained by moderate knowledge among patients with NMSC and the cross-sectional design of this research. Moreover, previous studies have indicated no association or even a negative association between perceived risk and skin cancer preventive behaviors (Nahar, Vice, & Ford, 2013).

The social support scores ranged from 11 to 55 corresponding with the possible range and had a mean of 44.53 units (Table 2), indicating that social support was on the high end for the patients with NMSC in this study. Similarly, self-efficacy for sun protection ranged from 11 to 55 corresponding with the possible range and had a mean of 44.24 units (Table 2), indicating that self-efficacy was on the high end. Social support not only had a direct effect on sun protection behaviors (standardized path coefficient = 0.199, $p = .010$) but also had an indirect effect on sun protection behaviors (standardized indirect effect = 0.160, $p < .001$, bias-corrected 95% CI [0.075, 0.305]) through self-efficacy (Figure 1). The explained variances for self-efficacy and sun protection behaviors were 43% and 35.4%, respectively. Similar to findings from previous studies (Nahar, Ford, et al., 2013; Nahar et al., 2014), self-efficacy was found to be related to sun protection behaviors (standardized path coefficient = 0.504, $p < .001$), indicating that the higher the self-efficacy to engage in sun protections behaviors, the higher the likelihood of the use of sun protection methods (Figure 1). This suggests that interventions should include strategies such as vicarious experiences, performance attainment, and verbal persuasion to enhance the self-efficacy to engage in sun protection behaviors (Bandura, 1977).

This study has some potential limitations. First, convenience sampling limits generalizability of the findings. Future research should consider random sampling to make results generalizable to the patient population with NMSC. Second, a cross-sectional design was used in this study. Therefore, temporality of relationships between the IMB model constructs and sun protection behaviors cannot be established. In the future, researchers should consider longitudinal designs to establish directionality of the relationships. Third, because of the self-reported nature of data, results could have been affected by recall and social desirability biases. In the future, researchers should consider using objective measures for sun protection behaviors. Fourth, data were collected at one medical center, limiting the generalizability of study findings. Future research should utilize larger samples from multiples sites. Finally, test–retest reliability assessment of the survey instrument was not conducted in this study, questioning the external consistency of the instrument. Perhaps, future studies replicating this research should include a test–retest reliability assessment of the instrument.

Despite these limitations, this is the first study, to the best of our knowledge, to assess the utility of the IMB

model to predict sun protection behaviors in patients with NMSC. Findings of this study showed partial utility of the IMB model in this setting. The primary influencing factors of sun protection behaviors among patients with NMSC were self-efficacy and social support. Both social support and attitudes could contribute to sun protection behaviors by indirectly affecting self-efficacy. Future research should use a longitudinal research design to provide more insights into the relationships among the constructs in the IMB model.

IMPLICATIONS FOR NURSING PRACTICE

It is evident from this study that most of the patients with NMSC do not adequately engage in sun protection behaviors. It is therefore important that nurses working with patients with NMSC develop programs to educate and motivate patients to engage in sun protection behaviors in an effort to reduce their future risk of skin cancer, including melanoma (i.e., the most dangerous type of skin cancer). Messages that are clear, simple to understand, and easy to remember should be used to teach each strategy to prevent skin cancer (Barrow, 2010). For example, SunAWARE, a popular message used by many national organizations, incorporates message regarding both primary and secondary skin cancer prevention (Maguire-Eisen, 2013). "AWARE" is an acronym where A = "Avoid unprotected exposure to UVR, including tanning beds, and seek shade," W = "Wear sun-protection clothing, including a long-sleeved shirt, a hat with a three-inch brim and sunglasses," A = "Apply broad-spectrum sunscreen with an SPF 30 or higher to all unprotected skin 20 minutes before exposure and reapply every two hours while exposed," R = "Routinely check your skin for changes, understand the need for vitamin D, and report any concerns to your healthcare providers," and E = "Educate yourself and others about the need for sun protection" (Barrow, 2010).

On the basis of this study's findings, the IMB model offers a robust theoretical framework to influence sun protection behaviors among patients with NMSC. Skin cancer prevention interventions using the IMB model should be developed for patients with NMSC. Such theory-based interventions can be implemented by dermatology nurses or nurses in other specialties. To influence sun protection behaviors, the first IMB model construct that needs to be modified is attitudes toward sun protection behaviors. Nurses teaching about sun protection behaviors should emphasize the importance of sun protection and specify advantages or benefits of using sun protection, such as reducing chances of getting skin cancer and preventing sunburn and premature aging. Patients with NMSC in this study reported that sunscreen is too messy (32%) and sun protective clothing is too hot to wear (34%). This finding is consistent with a study conducted with 140 patients with NMSC (57.1% had previous history) at the University of California, San Diego Medical Center (Goldenberg et al., 2014). Nurses need to utilize communication messages that minimize these barriers so that patients with NMSC will use recommended sun protection methods. For example, nurses should educate patients with NMSC about the availability of clothing brands made of fabric that is not hot and provides sun protection. At the same time, patients with NMSC should be informed about sunscreens available in the market that are not oily (Nahar, Ford, et al., 2013). Another interesting finding to emerge from the data was half (50.3%) of the patients with NMSC reported that they often forget to use sun protection methods. Educational programs should target family members and encourage them to remind patients with skin cancer to use sun protection methods.

The second IMB model that needs to be strengthened is social support. Nurses should take the time and counsel patients' significant others (i.e., spouse, parents, other family members, and friends) about avoiding UVR exposure as well as the use of sunscreen and protective clothing. Significant others should also be encouraged to discuss sun protection with patients with NMSC. There is evidence that skin cancer prevention information given by family members contributes to the adoption of sun protection behaviors (Parrott & Lemieux, 2003). This is particularly important for family members of all patients with skin cancer.

The third IMB model that needs to be addressed is self-efficacy (confidence in one's ability to perform a behavior). One way to achieve this would be for nurses to teach about the use of sun protection in small targeted steps. Alternatively, nurses should take the initiative to become role models showing the correct application of sunscreen (i.e., amount of sunscreen to be used, what SPF sunscreen to be used, how to apply sunscreen on exposed areas of the body, and how to reapply sunscreen). This may help enhance self-efficacy of patients to engage in sun protection behaviors. ■

Acknowledgments

The authors would to thank the University of Mississippi Medical Center for its support in carrying out this research. In addition, they would like to thank all the participants who participated in this research study.

REFERENCES

American Academy of Dermatology. (2019). Prevent Skin Cancer. Retrieved from https://www.aad.org/public/spot-skin-cancer/learn-about-skin-cancer/prevent

American Cancer Society. (2018). Key Statistics for Basal and Squamous Cell Skin Cancers. Retrieved from https://www.cancer.org/cancer/basal-and-squamous-cell-skin-cancer/about/key-statistics.html

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*, 191–215.

Barrow, M. M. (2010). Approaching skin cancer education with a clear message: "Be safe. Be SunAWARE". *Journal of the Dermatology Nurses' Association*, *2*(5), 209–213.

Besera, G. T., Cox, S., Malotte, C. K., Rietmeijer, C. A., Klausner, J. D., O'Donnell, L., … Warner, L. (2016). Assessing patient exposure to a video-based intervention in STD clinic waiting rooms: Findings from the Safe in the City Trial. *Health Promotion Practice*, 1524839916631537.

Cartmel, B., Ferrucci, L. M., Spain, P., Bale, A. E., Pagoto, S. L., Leffell, D. J., … Mayne, S. T. (2013). Indoor tanning and tanning dependence in young people after a diagnosis of basal cell carcinoma. *JAMA Dermatology*, *149*(9), 1110–1111.

Cottrell, R., McClamroch, L., & Bernard, A. L. (2005). Melanoma knowledge and sun protection attitudes and behaviors among college students by gender and skin type. *Journal of Health Education*, *36*(5), 274–278.

DiClemente, R. J., Crosby, R. A., & Kegler,, M. (Eds.) (2009). *Emerging theories in health promotion practice and research*. San Francisco, CA: John Wiley & Sons.

Fischer, A. H., Wang, T. S., Yenokyan, G., Kang, S., & Chien, A. L. (2016). Sunburn and sun-protective behaviors among adults with and without previous nonmelanoma skin cancer (NMSC): A population-based study. *Journal of the American Academy of Dermatology*, *75*(2), 371–379.e5.

Fisher, J. D., & Fisher, W. A. (1992). Changing AIDS-risk behavior. *Psychological Bulletin*, *111*(3), 455–474.

Fisher, J. D., Fisher, W. A., Amico, K. R., & Harman, J. J. (2006). An information–motivation–behavioral skills model of adherence to antiretroviral therapy. *Health Psychology*, *25*(4), 462.

Fisher, W. A., Fisher, J. D., & Harman, J. (2003). The information–motivation–behavioral skills model: A general social psychological approach to understanding and promoting health behavior. In J. Suls & K. Wallston (Eds.), *Social psychological foundations of health and illness* (pp. 87–106). London: Blackwell.

Gao, J., Wang, J., Zhu, Y., & Yu, J. (2013). Validation of an information–motivation–behavioral skills model of self-care among Chinese adults with type 2 diabetes. *BMC Public Health*, *13*(1), 1.

Gillespie, H. S., Watson, T., Emery, J. D., Lee, A. J., & Murchie, P. (2011). A questionnaire to measure melanoma risk, knowledge and protective behaviour: Assessing content validity in a convenience sample of Scots and Australians. *BMC Medical Research Methodology*, *11*(1), 123.

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: Theory, research, and practice*. San Francisco, CA: John Wiley & Sons.

Goldenberg, A., Nguyen, B. T., & Jiang, B. (2014). Knowledge, understanding, and use of preventive strategies against nonmelanoma skin cancer in healthy and immunosuppressed individuals undergoing Mohs surgery. *Dermatologic Surgery*, *40*(2), 93–100.

Guy, G. P., Machlin, S. R., Ekwueme, D. U., & Yabroff, K. R. (2015). Prevalence and costs of skin cancer treatment in the US, 2002–2006 and 2007–2011. *American Journal of Preventive Medicine*, *48*(2), 183–187.

Hammond, V., Reeder, A. I., Gray, A. R., & Bell, M. L. (2008). Are workers or their workplaces the key to occupational sun protection? *Health Promotion Journal of Australia*, *19*(2), 97–101.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Idorn, L. W., Datta, P., Heydenreich, J., Philipsen, P. A., & Wulf, H. C. (2013). Sun behaviour after cutaneous malignant melanoma: A study based on ultraviolet radiation measurements and sun diary data. *British Journal of Dermatology*, *168*(2), 367–373.

Idorn, L. W., Datta, P., Heydenreich, J., Philipsen, P. A., & Wulf, H. C. (2014). A 3-year follow-up of sun behavior in patients with cutaneous malignant melanoma. *JAMA Dermatology*, *150*(2), 163–168.

Jackson, K. M., & Aiken, L. S. (2000). A psychosocial model of sun protection and sunbathing in young women: The impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychology*, *19*(5), 469.

John, S. A., Walsh, J. L., & Weinhardt, L. S. (2017). The information–motivation–behavioral skills model revisited: A network-perspective structural equation model within a public sexually transmitted infection clinic sample of hazardous alcohol users. *AIDS and Behavior*, *21*(4), 1208–1218.

Koh, H. K., Geller, A. C., Miller, D. R., Grossbart, T. A., & Lew, R. A. (1996). Prevention and early detection strategies for melanoma and skin cancer. Current status. *Archives of Dermatology*, *132*(4), 436–443.

Lee, T. K., Brazier, A. S., Shoveller, J. A., & Gallagher, R. P. (2007). Sun-related behavior after a diagnosis of cutaneous malignant melanoma. *Melanoma Research*, *17*(1), 51–55.

Maguire-Eisen, M. (2013). Skin cancer: A growing health problem for children. *Seminars in Oncology Nursing*, *29*(3), 206–213.

Manne, S., & Lessin, S. (2006). Prevalence and correlates of sun protection and skin self-examination practices among cutaneous malignant melanoma survivors. *Journal of Behavioral Medicine*, *29*(5), 419–434.

Marlenga, B. (1995). The health beliefs and skin cancer prevention practices of Wisconsin dairy farmers. *Oncology Nursing Forum*, *22*(4), 681–686.

Nahar, V. K., Ford, M. A., Boyas, J. F., Brodell, R. T., Hutcheson, A., Davis, R. E., … Biviji-Sharma, R. (2014). Skin cancer preventative behaviors in state park workers: A pilot study. *Environmental Health and Preventive Medicine*, *19*(6), 467–474.

Nahar, V. K., Ford, M. A., Brodell, R. T., Boyas, J. F., Jacks, S. K., Biviji-Sharma, R., … Bass, M. A. (2016). Skin cancer prevention practices among malignant melanoma survivors: A systematic review. *Journal of Cancer Research and Clinical Oncology*, *142*(6), 1273–1283.

Nahar, V. K., Ford, M. A., Hallam, J. S., Bass, M. A., Hutcheson, A., & Vice, M. A. (2013). Skin cancer knowledge, beliefs, self-efficacy, and preventative behaviors among North Mississippi landscapers. *Dermatology Research and Practice*, *2013*, 496913.

Nahar, V. K., Ford, M. A., Jacks, S. K., Thielen, S. P., Johnson, A. K., Brodell, R. T., & Bass, M. A. (2015). Sun-related behaviors among individuals previously diagnosed with non-melanoma skin cancer. *Indian Journal of Dermatology, Venereology, and Leprology*, *81*(6), 568.

Nahar, V. K., Vice, M. A., & Ford, M. A. (2013). Conceptualizing and measuring risk perceptions of skin cancer: A review. *Californian Journal of Health Promotion*, *11*(3), 36–47.

Osborn, C. Y., & Egede, L. E. (2010). Validation of an Information–Motivation–Behavioral Skills model of diabetes self-care (IMB-DSC). *Patient Education and Counseling*, *79*(1), 49–54.

Parkin, D. M., Mesher, D., & Sasieni, P. (2011). 13. Cancers attributable to solar (ultraviolet) radiation exposure in the UK in 2010. *British Journal of Cancer*, *105*, S66–S69.

Parrott, R. L., & Lemieux, R. (2003). When the worlds of work and wellness collide: The role of familial support on skin cancer control. *Journal of Family Communication*, *3*(2), 95–106.

Patel, S. S., Nijhawan, R. I., Stechschulte, S., Parmet, Y., Rouhani, P., Kirsner, R. S., & Hu, S. (2010). Skin cancer awareness, attitude, and sun protection behavior among medical students at the University of Miami Miller School of Medicine. *Archives of Dermatology*, *146*(7), 797–800.

Pfahlberg, A., & Kölmel, K. F., Gefeller for the Febim Study Group. (2001). Timing of excessive ultraviolet radiation and melanoma: Epidemiology does not support the existence of a critical period of high susceptibility to solar ultraviolet radiation-induced melanoma. *British Journal of Dermatology*, *144*(3), 471–475.

Renzi, C., Mastroeni, S., Mannooranparampil, T. J., Passarelli, F., Caggiati, A., & Pasquini, P. (2008). Skin cancer knowledge and preventive behaviors among patients with a recent history of cutaneous squamous cell carcinoma. *Dermatology*, *217*(1), 74–80.

Rhee, J. S., Davis-Malesevich, M., Logan, B. R., Neuburg, M., Burzynski, M., & Nattinger, A. B. (2008). Behavior modification and risk perception in patients with nonmelanoma skin cancer. *WMJ*, *107*(2), 62.

Robertson, A. A., Stein, J. A., & Baird-Thomas, C. (2006). Gender differences in the prediction of condom use among incarcerated juvenile offenders: Testing the information–motivation–behavior skills (IMB) model. *Journal of Adolescent Health*, *38*(1), 18–25.

Rogers, H. W., Weinstock, M. A., Harris, A. R., Hinckley, M. R., Feldman, S. R., Fleischer, A. B., & Coldiron, B. M. (2010). Incidence estimate of nonmelanoma skin cancer in the United States, 2006. *Archives of Dermatology*, *146*(3), 283–287.

Rosenman, K. D., Gardiner, J., Swanson, G. M., Mullan, P., & Zhu, Z. (1995). Use of skin-cancer prevention strategies among farmers and their spouses. *American Journal of Preventive Medicine*, *11*(5), 342–347.

Salas, R., Mayer, J. A., & Hoerster, K. D. (2005). Sun-protective behaviors of California farmworkers. *Journal of Occupational and Environmental Medicine*, *47*(12), 1244–1249.

Seacat, J. D., & Northrup, D. (2010). An information–motivation–behavioral skills assessment of curbside recycling behavior. *Journal of Environmental Psychology*, *30*(4), 393–401.

Sharma, M., & Petosa, R. L. (2012). *Measurement and evaluation for health educators*. Burlington, MA: Jones & Bartlett Publishers.

Shoveller, J. A., Lovato, C. Y., Peters, L., & Rivers, J. K. (2000). Canadian National Survey on Sun Exposure & Protective Behaviours: Outdoor workers. *Canadian Journal of Public Health*, *91*, 34–35.

Song, F., Qureshi, A. A., Giovannucci, E. L., Fuchs, C. S., Chen, W. Y., Stampfer, M. J., & Han, J. (2013). Risk of a second primary cancer after non-melanoma skin cancer in white men and women: A prospective cohort study. *PLoS Medicine*, *10*(4), e1001433.

Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N., & Kang, D. H. (2004). Predictors of health behaviours in college students. *Journal of Advanced Nursing*, *48*(5), 463–474.

Wehner, M. R., Chren, M. M., Nameth, D., Choudhry, A., Gaskins, M., Nead, K. T., & Linos, E. (2014). International prevalence of indoor tanning: A systematic review and meta-analysis. *JAMA Dermatology*, *150*(4), 390–400.

Wheless, L., Black, J., & Alberg, A. J. (2010). Nonmelanoma skin cancer and the risk of second primary cancers: A systematic review. *Cancer Epidemiology Biomarkers & Prevention*, *19*(7), 1686–1695.

Williams, A. L., Grogan, S., Clark-Carter, D., & Buckley, E. (2013). 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.

Woolley, T., Buettner, P. G., & Lowe, J. (2004). Predictors of sun protection in northern Australian men with a history of nonmelanoma skin cancer. *Preventive Medicine*, *39*(2), 300–307.

For 2 additional continuing education articles related to sun protective behaviors, go to NursingCenter.com/CE.

Instructions:

- Read the article. The test for this CE activity can only be taken online at http://www.nursingcenter.com/ce/JDNA. Tests can no longer be mailed or faxed.
- You will need to create (it's free!) and login to your personal CE Planner account before taking online tests. Your planner will keep track of all your Lippincott Professional Development online CE activities for you.
- There is only one correct answer for each question. If you pass, you will receive a certificate of earned contact hours and answer key. If you fail, you have the option of taking the test again at no additional cost.
- A passing score for this test is 13 correct answers.
- Questions? Contact Lippincott Professional Development: 1-800-787-8985.

Registration Deadline: September 3, 2021

Provider Accreditation:
Lippincott Professional Development will award 1.5 contact hours for this continuing nursing education activity.

Lippincott Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation. This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.5 contact hours. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida #50-1223.

Your certificate is valid in all states.

Disclosure Statement:
The authors and planners have disclosed that they have no financial relationships related to this article.

Payment and Discounts:

- The registration fee for this test is $10 for members; $20 nonmembers.