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Utility Of The Information-Motivation-Behavioral Skills Model In Measuring And Predicting Protection Behaviors Among Skin Cancer Patients

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UTILITY OF THE INFORMATION-MOTIVATION-BEHAVIORAL SKILLS MODEL IN MEASURING AND PREDICTING SUN PROTECTION BEHAVIORS AMONG SKIN CANCER PATIENTS

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ABSTRACT

Adoption of effective sun protection behaviors (SPB) is of paramount importance, particularly among individuals previously diagnosed with non-melanoma skin cancer (NMSC), since they have a considerably higher risk of new NMSC and malignant melanoma; the most lethal form of skin cancer (Nahar et al., 2015). The objective of the current study was to examine the utility of the information-motivation-behavioral skills (IMB) model in measuring and predicting SPB among people who have had NMSC. For this descriptive cross-sectional study, a convenience sample of NMSC patients was recruited at the University of Mississippi Medical Center between July 2015 and April 2016. Inclusion criteria were as follows: a) patients diagnosed with NMSC and b) ages 18 years or older. Participants were excluded from this study if they had severe physical or cognitive impairments. Demographic information and IMB model variables (i.e., knowledge, perceived risk, attitudes, social support, self-efficacy, and SPB) were assessed using a 114-item content valid questionnaire. A total of 311 NMSC patients participated in this study. The mean age of the participants was 64.12 (±12.02) years. Majority (58.8%) of the participants were males. Between 14% and 43% of the participants reported always engaging in SPB while outdoors. Internal consistency reliabilities for the subscales of IMB model ranged from acceptable to excellent (Cronbach's α = 0.70-0.95). Confirmatory factor analysis verified construct validity and confirmed that the set of constructs in a hypothesized IMB model provides an acceptable fit to the empirical data (X^2 = 287.618 [df = 133], p < 0.001; RMSEA = 0.06; CFI = 0.93; TLI = 0.91; SRMR = 0.05). Path analysis showed SPB was directly predicted by self-

efficacy ($\beta = 0.5$, $p < 0.001$) and social support ($\beta = 0.199$, $p = 0.010$). Another important finding to emerge from the analysis is that SPB was indirectly predicted (through self-efficacy) by social support ($\beta = 0.160$, $p < 0.001$) and attitudes ($\beta = 0.192$, $p = 0.001$). The explained variances for self-efficacy and SPB were 43% and 35.4%, respectively. Findings of this study demonstrated partial utility of IMB model in predicting SPB among NMSC patients. Sun safety intervention programs are needed for NMSC patients and should be especially focused on improving motivation (attitudes and social support) and behavioral skills (self-efficacy).

DEDICATION

I dedicate this dissertation work to my family and friends. I also would like to dedicate this work to all cancer patients.

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CHAPTER I

INTRODUCTION

Non-melanoma skin cancer (NMSC) is the most frequently diagnosed cancer in the United States (US) (Rogers et al., 2010). Over 3.5 million cases of NMSC are reported annually in the US, and estimates indicate that approximately 2000 people succumb to this disease every year (American Cancer Society [ACS], 2015). The annual estimated health care expenditure for NMSC treatment is roughly $4.8 billion in this country (Guy et al., 2015). Of particular concern, individuals with a previous history of NMSC are at a considerably higher risk of not only reoccurrence but also of developing a cutaneous melanoma; the most fatal type of skin cancer (Song et al., 2013; Wheless, Black, & Alberg, 2010).

Exposure to ultraviolet radiation (UVR) from the sun is the primary environmental risk factor of skin cancer development, making it one of the highly preventable types of cancer (Koh, Geller, Miller, Grossbart, & Lew, 1996; Parkin, Mesher, & Sasieni, 2011). Various professional agencies recommend skin protection from the sunlight by seeking shade, limiting 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) of 30 or higher, and using sunglasses (American Academy of Dermatology [AAD], 2015).

To date, a relatively limited number of published studies have focused on the prevalence of sun protection behaviors among people diagnosed with NMSC (Goldenberg, Nguyen, & Jiang, 2014; Harth et al., 1995; Maser, Berg, & Solish, 2001; Rhee et al., 2004; Renzi et al., 2007; Rhee

et al., 2008; Woolley, Buettner, & Lowe, 2004). According to the findings obtained from these studies, NMSC patients 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). For example, a recent US based study demonstrated that, of NMSC patients who were aware of sun protection methods, 62% used protective clothing and 36% used sunscreen routinely (Goldenberg, Nguyen, & Jiang, 2014). It is therefore particularly crucial to better identify the intervention strategies to improve sun protection behaviors among patients diagnosed with NMSC.

Across the studies, only one Australian study was found that targeted two to three components of the Health Belief Model and the Theory of Reasoned Action to understand in some detail the potential socio-cognitive factors influencing sun protection practices among people who had a diagnosis of NMSC (Woolley, Buettner, & Lowe, 2004). It appears that the literature in this domain lacks theoretical foundation for sun protection determinants that may contribute toward the development and implementation of more efficacious skin cancer prevention programs. Moreover, no single study could be identified that wholly tested the ability of any psychosocial theory/model in explaining skin cancer preventive behaviors in this population.

The Information-Motivation-Behavioral skills (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, & Harman, 2009). The information construct of the IMB model includes accurate information and faulty heuristics or mis-information concerning health behavior (Gao, Wang, Zhu, & Yu, 2013). Motivation is composed of attitudes towards preventive acts, perceived social support for performing such acts, and perceived personal susceptibility of contracting a disease in question (Robertson, Stein, and Baird-

Thomas, 2006). Behavioral skills, the second fundamental construct of this 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 (Egede & Osborn, 2010)

According to the model (See Figure 1), information and motivation assets work largely through behavioral skills to influence health promoting behaviors or behavioral changes. In essence, information and motivation with regard to 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 specific behavior (Seacat & Northrup, 2010). Furthermore, information and motivation are often regarded as independent factors, because individuals who are well-informed may or may not be well-motivated to engage in preventive behaviors and individuals who are well-motivated may or may not be well-informed regarding preventive behaviors (DiClemente, Crosby, & Kegler, 2009).

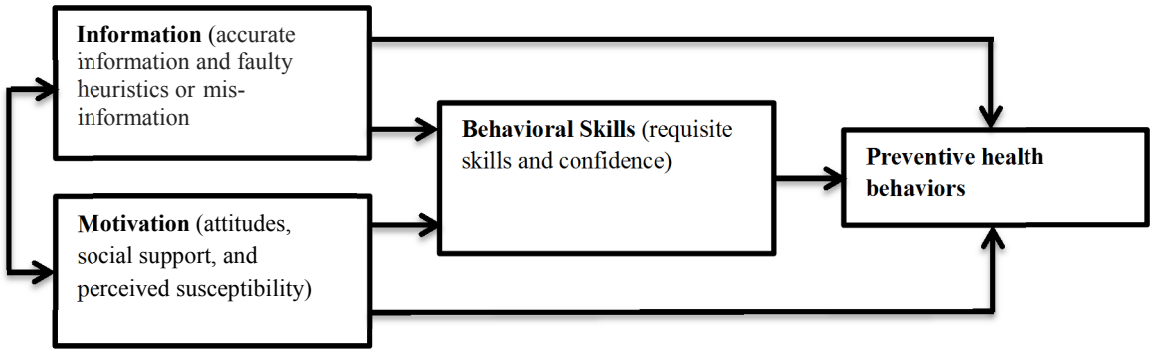


Figure 1: Information-Motivation-Behavioral skills (IMB) model

In the past two decades of research, this theoretical framework has been extensively validated with a broad range of populations in cross-cultural settings (Cornman, Schmiege, Bryan, Benziger, & Fisher, 2007). The IMB model has been applied as a basis for conceptualizing a

variety of preventive health-related behaviors, including HIV preventive behaviors, breast self-examination, diabetes self-care, and motorcycle safety gear use (DiClemente, Crosby, & Kegler, 2009). However, to the best of our knowledge, the predictive efficacy of the IMB model has yet to be explored in behavioral research on skin cancer prevention.

The objective of the current study was to examine the utility of IMB model in measuring as well as predicting sun protection behaviors among people who have had NMSC. More specifically, this study will addressed the following research questions: (1) How reliable were scales measuring IMB model domains within the sample of NMSC patients?; (2) What proportion of the variance in preventive behaviors among NMSC patients was accounted for by the IMB model constructs?; (3) What were the direct effects of information and motivation on preventive behaviors?; and (4) What were the indirect effect of information and motivation on preventive behaviors through behavioral skills? We hypothesized, based on the theoretical underpinnings of IMB model, that information has direct relationship with preventive behaviors and an indirect relationship through behavioral skills. Moreover, it is hypothesized that motivation has direct relationship with preventive behaviors and an indirect relationship through behavioral skills. This study provides theoretical evidence for suitable preventive behavior change interventions and programs for patients previously diagnosed with NMSC - a population group that is at heightened vulnerability of developing skin cancer in the future.

CHAPTER II

REVIEW OF LITERATURE

Review 1: Sun-related Behaviors among Individuals Previously Diagnosed with Non-melanoma Skin Cancer: A Review

Introduction

Non-melanoma skin cancers (NMSC), including squamous cell carcinoma (SCC) and basal cell carcinoma (BCC), are the most frequently diagnosed forms of skin cancer (Skin Cancer Foundation, 2014). At the population level, the likelihood of developing SCC tumors is less compared to BCC; however, SCC metastasizes (invades and spreads to other body parts) more frequently and has a greater mortality rate (Rittié, Kansra, & Stoll, 2007). Worldwide, between 2 and 3 million SCC and 10 million BCC are reported annually (Lucas et al., 2008; Vernez et al., 2015). In White populations, since 1960 the incidence of NMSC has increased annually by an average of 3 - 8% in countries such as Australia, Canada, Europe, and US (Trakatelli et al., 2007). Australia has the highest NMSC incidence rates in the world, approximately ten times higher than that recorded in the United Kingdom (Lomas, Leonardi-Bee, & Bath-Hextall, 2012). In the US, around 3.5 million people are diagnosed with NMSC, and nearly 2000 of these individuals succumb to this disease each year (American Cancer Society, 2014). Although NMSCs do not account for high mortality rates, these malignancies cause significant morbidity and lead to enormous annual health care costs (Rogers et al., 2010). The annual financial cost associated with NMSC treatment is approximately $4.8 billion in the US (Guy, Machlin, Ekwueme, & Yabroff, 2015).

The diagnosis of NMSC portends a significantly increased risk of developing new skin cancers of all kinds including malignant melanoma. A meta-analysis showed that, after an index SCC, the mean three years cumulative risk of developing another SCC is 18%, representing about 10-times increase in incidence compared with the incidence rate of first tumors in a comparable general population (Marcil & Stern, 2000). After the first BCC, the mean three-year cumulative risk of subsequent BCC is 44%. This also represents a 10-fold increase in incidence compared to the first-time BCC rate in the general population (Marcil & Stern, 2000). More alarmingly, there was a 3.45% increased risk of developing malignant melanoma during the four-year period after the diagnosis of NMSC (Rhee et al., 2008).

Approximately 90% of all NMSC are caused by sunlight exposure (Koh et al., 1996) However, the risk of skin cancer could be lowered dramatically by engaging in sun protection practices. Recommended primary prevention strategies involve seeking shade during the midday when sun is strongest (between 10:00 A.M. to 2:00 P.M.), wearing protective clothing (e.g., wide-brimmed hat, long sleeved shirts, long pants, and sunglasses), and appropriately using sunscreen with a sun protection factor (SPF) of at least 30 (American Academy of Dermatology, 2014).

In recognition of the increased risk of skin cancer in patients previously diagnosed with NMSC, we carried out a systematic review, the first to our knowledge in this domain, to provide an overview of ultraviolet radiation (UVR) exposure and sun protection behaviors in people with a history of NMSC across the US and other countries. A secondary goal was to discuss the correlates of sun-related behaviors among this population group. Lastly, we included recommendations to guide future research and develop intervention programs specifically targeting individuals with a history of skin malignancy.

Methodology

The methodology section of this review was comprised of two stages. In stage one, without placing date restrictions, systematic literature searches were conducted in PubMed, PsycINFO, CINAHL, EMBASE, ERIC, and ScienceDirect. In order to identify pertinent studies, the following Boolean terms were used: "Skin Cancer Survivors AND UVR exposure" and "Skin Cancer Survivors AND Sun Protection Behaviors." Further searches were performed in Google Scholar and a University library to make sure relevant published papers were not missed. No attempt was made in the present study to assess gray literature.

In stage two, papers retrieved through electronic computerized searching were combined and then duplicates were eliminated from the list. After accounting for eligibility criteria, titles and abstracts were analyzed and irrelevant studies were removed. Next, remaining studies were considered for full-text review to assess potentially eligible studies. Reference lists of eligible studies were scanned for additional relevant articles.

Studies were included in this review if they: (1) exclusively targeted NMSC survivors; (2) used observational design; (3) measured either UVR exposure or sun protection practices; (4) were English language literature published in a peer-reviewed journal. The criteria for excluding studies from this review were: (1) qualitative methodology; (2) review papers, meta-analyses, and conference abstracts.

Two independent reviewers (VKN and AFW) completed each aforementioned stage of methodology. Disagreements that occurred between the reviewers at any stage were resolved through discussion.

Because of very limited data available and differences in the measurement of sun protection behaviors, we could not use statistical techniques to combine the quantitative data extracted from

the included studies. Therefore, a narrative approach was adopted to review literature on this topic. Associations with a *p*-value below 0.05 were considered statistically significant. If a study consisted of both bivariate and multivariate analysis findings, then only multivariate relationships were extracted for this review.

Results

A total of 85 studies were retrieved through online electronic searches. After eliminating duplicates, 55 titles and abstracts were scanned, which resulted in 19 papers for full-text review. Based on predetermined inclusion and exclusion criteria, eight studies were included in this review. Additionally, one study was generated through reference list screening of eight potentially eligible studies. In all, nine studies that met the eligibility criteria were included in this systematic review (see Figure 1).

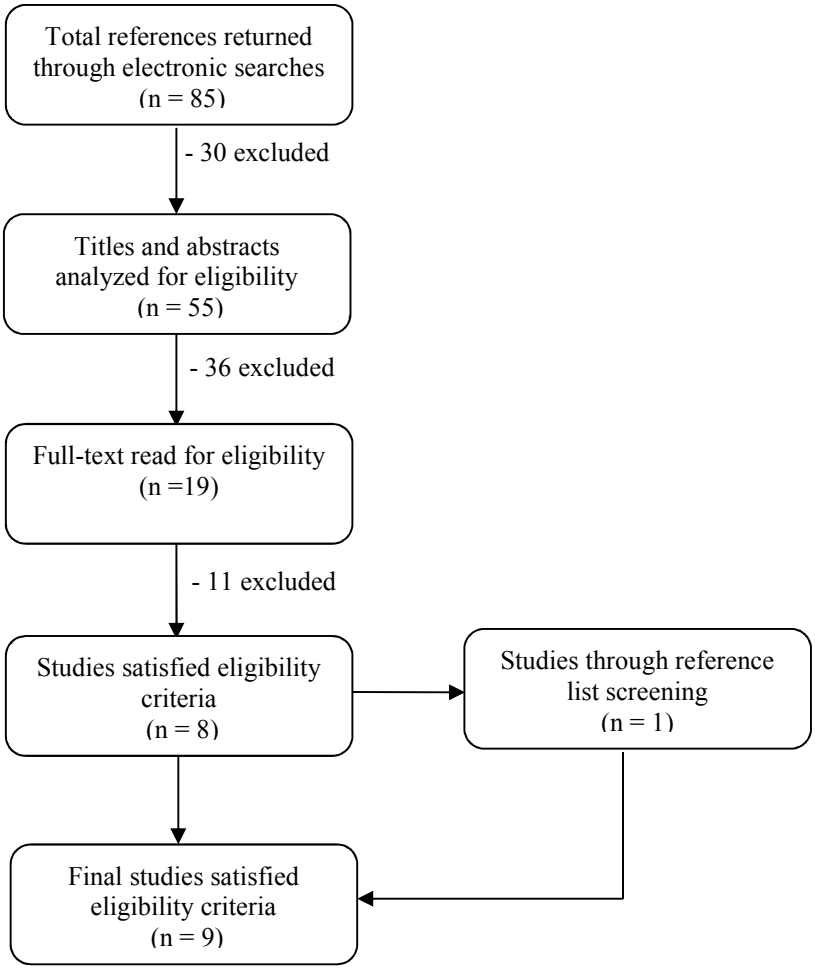


Figure 2 Literature search procedure

In Table 1, we summarized the study characteristics (e.g., year of publication, country, methodology, and number of participants), participant characteristics (e.g., gender, ethnicity, and age), measures (e.g., UVR exposure and sun protection behaviors), and correlates of sun protection behaviors. The data is arranged in ascending order of the year of publication.

Table 1 Summary of Reviewed Studies

Author, year of publication, and country	Methodology and number of participants	Demographics	Sun protection behaviors	Correlates
Harth, Y., 1995, and Israel	Case-control, self-administered survey (In person/ mailed), and n = 63/ 117	Gender: 58.7% female Age: $\bar{x}$ = 54 yrs	Sunscreen: 64% Wide brimmed hat: 49% Long-sleeved shirt: 19% Sun avoidance: 82%	---
Maser, E., 2001, and Canada	Cross-sectional, self-administered survey, and n = 214	Gender: 52.8% female Age: 52.3% were more than 64 yrs	UVR exposure: Time spend outdoor for 65% of the participants remained same after removal of skin cancer Sunscreen: 70.1% of the participants began using sunscreen after removal of skin cancer	---
Rhee, J. S., 2003,and USA	Cross-sectional, self-administered survey (In person/ mailed), and n = 121	Gender: 54% female Ethnicity: 100% Caucasians Age: 63 yrs (median) (Range = 19-90 yrs)	Sunscreen: 41% (often or always) and 59% (rarely or never) Hat and clothing: 55%	*Sun protection* Better quality of life
Rhee, J. S., 2004,and USA	Longitudinal, self-administered survey (In person/ mailed), and n = 121	Gender: 54% female Ethnicity:100% Caucasians Age: 63 yrs (median) (Range = 19-90 yrs)	Sunscreen: 41% (often or always) (before surgery), 68.6% (1 mo after surgery), and 68.3% (4 mo after surgery) Hat and clothing: 55% (before surgery), 61.2% (1 mo after surgery), and 65.3% (4 mo after surgery) Sun avoidance: 34.7% (before surgery), 44.8% (1 mo after surgery), and 60.4% (4 mo after surgery)	*Sun protection* Older age Being female

Table 1 Summary of Reviewed Studies (continued)

Author, year of publication, and country	Methodology and number of participants	Demographics	Sun protection behaviors	Correlates
Woolley, T., 2004,and Australia	Cross-sectional, self-administered mailed survey, and $n = 300$	Gender: 100% male Age: $\bar{x} = 51$ yrs	UVR exposure: 19% receive high levels of sun exposure Sunscreen: 60% Wide brimmed hat and long-sleeved shirt: 28%	*Sun protection* Older age Lived most of their life in the tropics Midday sun avoidance More previously excised skin cancers Not enjoying sun exposure Belief that suntan benefits do not outweigh the risks Fewer barriers Skin cancer is not easily treatable Mandatory sun protection policy
Rhee, J. S., 2008,and USA	Longitudinal, self-administered survey, and $n = 183$	Gender: 51% female Ethnicity: 99% Caucasians Age: 63 yrs (median) (Range = 21-85 yrs)	Sunscreen: $\bar{x} = 3.16$ (SD = ±1.47) (before surgery) and $\bar{x} = 3.34$ (SD = ±1.38) (after surgery) Hat: $\bar{x} = 3.26$ (SD = ±1.43) (before surgery) and $\bar{x} = 3.56$ (SD = ±1.37) (after surgery) Protective clothing: $\bar{x} = 2.73$ (SD = ±1.23) (before surgery) and $\bar{x} = 3.10$ (SD = ±1.24) (after surgery) Shade: $\bar{x} = 3.10$ (SD = ±1.16) (before surgery) and $\bar{x} = 3.34$ (SD = ±1.10) (after surgery) Limit time in sun 11 am – 3 pm: $\bar{x} = 2.79$ (SD = ±1.34) (before surgery) and $\bar{x} = 3.33$ (SD ±1.34) (after surgery) Total sun protection behavior: $\bar{x} = 15.01$ (SD = ±4.47) (before surgery) and $\bar{x} = 16.65$ (SD = ±4.37) (after surgery)	*Increased sun protection* Poor skin tanning ability No employment Less comorbid conditions Previous NMSC treatment

Table 1 Summary of Reviewed Studies (continued)

Author, year of publication, and country	Methodology and number of participants	Demographics	Sun protection behaviors	Correlates
Renzi, C., 2008, and Italy	Cross-sectional, telephone survey, and $n = 315$	Gender: 55.6% male Age: $\bar{x} = 70.8$ yrs,	Sunscreen: 58.4% (regularly) and 41.6% (rarely or never)	*Sun protection* Being female Higher education Higher knowledge Past skin examinations Physician recommended sun protection
Goldenberg, A., 2013, and USA	Cross-sectional, face-to-face survey, and $n = 140$	Gender: 70% male Age: $\bar{x} = 65$ yrs (healthy group with NMSC) and $\bar{x} = 62$ yrs (immunocompromised group with NMSC)	Sunscreen: Of participants who mentioned sunscreen as protective method, 36% (healthy group) and 27% (immunocompromised group) used regularly Hat: Of participants who mentioned hat as protective method, 84% (healthy group) and 75% (immunocompromised group) used regularly Protective clothing: Of participants who mentioned protective clothing as protective method, 62% (healthy group) and 47% (immunocompromised group) used regularly	---
Cartmet et al., 2013, and USA	Cross-sectional, self-administered online survey, and $n = 178$	Ethnicity: 100% Caucasians	Indoor tanning: 15%	---

Discussion

Although the data are very limited, the findings of this study are particularly alarming and worthy of consideration for future research and intervention programs. The NMSC patients continued to practice health-compromising behaviors, such as working in a heavy sun exposure environment and engaging in indoor tanning behaviors (Woolley, Buettner, & Lowe, 2004; Cartmel et al., 2013). It was also reported that about 40% do not avoid outdoors in the middle of the day when the sun is at its peak (Rhee et al., 2004). This suggests not only that more research is required in this area, but also that health care professionals should continue to inform NMSC patients about the dangerous effects of natural and artificial exposure to UVR. It appears that patients with NMSC continue to harbor cognitive beliefs about the positive benefits of sun tanning, even after skin cancer diagnosis. Evidence suggests that individuals' beliefs that suntan improves physical attractiveness strongly influences intentional UVR exposure (Hillhouse, Turrisi, & Kastner, 2000). Future survey studies should consider incorporating additional items to assess survivors' appearance-related attitudes. One strategy would be to emphasize the negative effects of UV exposure on future appearance such as premature aging or perhaps to substitute safe sun-less tanning options.

Another troubling finding relates to skin cancer primary preventative behaviors. An Israel-based study indicated that 49% of NMSC patients wore wide-brimmed hats, and only 19% wore long-sleeved shirts on a regular basis during the summer months (Harth et al., 1995). Furthermore, just 28% of North Australian men who had a history of NMSC reported wearing a wide-brimmed hat and long sleeved shirt (Woolley, Buettner, & Lowe, 2004). An Italian study targeting a large sample of NMSC patients revealed that a substantial percentage (41.6%) "rarely or never" applied sunscreen (Renzi et al., 2007). Recently, a US study showed that, of respondents that recognized

sun protection strategies, 36% applied sunscreen and 62% wore protective clothing regularly (Goldenberg et al., 2014). These data suggest that health care professionals are not effectively presenting the risks of UVR to their patients with NMSC in a manner that motivates them to engage in protective behaviors.

One possible explanation for inadequate protective behaviors is that patients' perceived risk of skin cancer is not as high as would be desired (Rhee et al., 2008; Maser, Berg, & Solish, 2001). This result may be partially explained by the fact that patients showed low levels of skin cancer knowledge (Renzi et al., 2007). According to the Health Belief Model, a health behavior change is more likely to occur in individuals who perceive themselves to be at risk for a health problem, and the perceived risk to a given health problem depends on knowledge about the problem (Glanz, Rimer, & Viswanath, 2008).

Aside from these explanations, some studies have attempted to establish the primary barriers cited for not engaging in sun-safety practices. They were "sunscreen is too messy and oily" and "clothing is too hot to wear" (Woolley, Buettner, & Lowe, 2004; Goldenberg et al., 2014).

All of the aforementioned concerns highlight the need for continuous development of psycho-educational interventions that increase knowledge about the risk factors, modify attitudes about sun exposure, and motivate behavioral health change among NMSC patients. This will help in improving their sun protection practices which may decrease the risk of future skin cancer among this highly susceptible group.

Limitations

The present systematic review has some limitations that should be acknowledged. This systematic review was limited to studies that were written in the English language, published in peer-reviewed journals, and electronically available; therefore, the impact of publication bias on our findings cannot be precluded. The findings are based on respondents' self-reports that may have been affected by recall bias. This also could have introduced a social desirability bias into responses of sun protection practices.

Collectively, the literature can be characterized as lacking wide generalizability. This is in part due to the fairly low methodological quality; for example, the majority of the reviewed studies used convenient sampling strategies recruited from a single site. Furthermore, the studies that reported information on ethnicity involved a vast majority of Caucasians. One of the obvious reasons for studies involving large proportion of Caucasians is the high rate of skin cancer among this population group (Leiter & Garbe, 2008). However, there is growing evidence suggesting that the incidence rate of skin cancer diagnosis among non-Caucasian populations is increasing (Hu et al., 2009; Skin Cancer Foundation, 2014; McLeod et al., 2013). Consequently, future studies should focus on identifying strategies to recruit more diverse populations to capture racial and ethnic disparities in relation to sun protection attitudes and behaviors among NMSC patients.

Skin cancer continues to increase worldwide, yet existing literature is based mostly on Western nations, suggesting research from other regions is warranted. Doing so may strengthen how the health community responds to one of the most commonly diagnosed cancers in the US and across the globe

The instruments used also constrain the external validity. There is a lack of valid and reliable instruments that can be used to increase the rigor of this work. In addition, due to the variety of ways in which sun protection was assessed in earlier studies, a comparison between populations cannot be carried out. Researchers should be encouraged to take standardized scales into consideration to allow uniformity in the measurement of preventive behaviors across the literature in this domain.

The current literature lacks rigor in terms of research design. Because of the cross-sectional design of most of the included studies, a possible temporality of the associations cannot be established. Prospective studies are warranted to provide a level of compelling evidence in order to assert causality or directionality between explanatory variables and skin cancer prevention behaviors among patients with skin malignancies.

Conclusions

The studies included in this systematic review highlight the need for continuing research on the prevalence of UVR exposure and sun protection behaviors in people diagnosed with NMSC. The findings, although limited, strongly suggest that intervention programs for NMSC survivors should focus on increasing knowledge and perceived risk of skin cancer. At the same time, barriers that prevent individuals from engaging in sun-safe practices should be minimized. Health care professionals should be encouraged to provide education to patients regarding skin cancer risk and primary prevention strategies (e.g., wearing protective clothing, using sunscreen, and staying in shade). Educational programs should include family members to influence patients' engagement in sun protection behaviors. In addition, free skin cancer screening programs at the community level should be implemented to prevent and identify skin cancer during early stages. Finally, the

medical community should work in partnership with mass media to raise awareness about the benefits of sun protection behaviors and consequences of overexposure to the UVR.

Further studies are required with the NMSC population to draw firm conclusions regarding the associations that may correlate with sun protection behaviors. A theoretical approach would be beneficial to conceptualize sun protection behaviors among this at-risk group. Hopefully, these efforts will guide future interventions, as well as provide a greater understanding of potential factors related to sun protection behavior change.

Review 2: Compliance with Sun Protection and Screening Practices among Melanoma Survivors: A Systematic Review

Introduction

Malignant melanoma (MM) accounts for approximately 75% of all deaths from skin cancer, constituting an important and growing public health problem (American Cancer Society, 2014). Nearly 86% of MM cases are linked with exposure to ultraviolet radiation (UVR) emitted by the sun (Parkin et al., 2011). Adoption of effective sun protection and regular skin surveillance behaviors is of paramount importance, particularly among individuals previously diagnosed with MM, as they are at an increased risk of developing an additional MM in the future. Epidemiologic evidence has demonstrated that for MM survivors, the risk of development of a subsequent MM is nearly nine times greater when compared with the risk of developing first primary MM in the general population (Bradford et al., 2010). Furthermore, these survivors remain at increased risk of developing another MM for over 20 years (Bradford et al., 2010).

Considering the life threatening nature of MM, and the elevated risk of new primary lesions in these patients, it is imperative to understand the degree to which patients engage in recommended skin cancer risk-reduction behaviors. Moreover, exploration of skin cancer related knowledge and attitudes would augment the potential for health professionals to design targeted interventions in order to promote methods of skin cancer prevention in this population group. Accordingly, the goal of the present systematic review is to assess relevant existing research studies to address the following specific questions: "What is the prevalence of UVR exposure, sun protection, and screening behaviors among individuals diagnosed with MM?" and "What are knowledge levels and attitudes concerning skin cancer among this potentially vulnerable group?" Additionally, this review will identify gaps in the currently available literature and propose

recommendations for future research in this topic area. To the best of our knowledge, no such systematic review has yet been published.

Methods

Eligibility Criteria

A priori inclusion and exclusion criteria were specified to select studies for this systematic literature review.

The following inclusion criteria were used for retrieving as well as reviewing the studies:

Population: Post MM diagnosis.

Measures (at least one of the following): UVR exposure, primary and secondary preventive behaviors.

Article type: Original research communication that constitutes entire set of empirical data.

Study design: Observational.

Language of publications: English.

Journal type: Peer-reviewed.

Studies were excluded if:

All of the inclusion criteria were not met.

Did not feature "individuals diagnosed with MM" as the primary sample of the study.

Duplicates, conference abstracts, editorials, news, letters to the editor, comments, reviews, feature articles, white papers, and guidelines.

Literature Sources and Search Strategy

The steps outlined by internationally established guidelines were followed to direct the search strategy for this systematic review (Moher et al., 2009). In order to identify potentially relevant articles, an exhaustive search was conducted in July 2014 on six bibliographic electronic

databases (i.e., PubMed, CINAHL, PsycINFO, ScienceDirect, EMBASE, and ERIC). To ensure that no studies were missed, additional searches were conducted in the University library and Google Scholar. The searches were not restricted by the date of publication. Furthermore, key dermatology journals were hand searched to supplement database searching. The search process did not include any strategy to access gray literature including unpublished or other difficult to access works. All search strategies were executed by two independent reviewers of this research.

To capture every possible study, keywords were derived through scanning previous literature related to skin cancer. A list of synonyms of the identified keywords was created for other search terms. Boolean operators ('AND' and 'OR') were used to construct the search strings, which were pilot tested and further modified to assure that they locate available significant literature to address the review objective. The final search strings entered were as follows:

(Skin Cancer OR Melanoma) AND (Survivors OR Diagnosed OR History) AND (Primary OR Secondary) AND (Protect OR Prevent*) AND (Knowledge OR Attitudes) AND (Sun* OR UV*) AND (Tan* OR Expos* OR Risk) AND (Behavior OR Habits)*

All retrieved references were then manually examined and duplicates were removed. Titles, abstracts, and full texts were reviewed for inclusion or exclusion based on the aforementioned criteria. The reference lists of primary articles were checked to obtain additional pertinent studies. Finally, researchers screened all the included studies to ascertain if the studies met the predefined eligibility criteria. There were no disagreements between reviewers over the eligibility assessment.

Quality Appraisal of Studies

To evaluate methodological strength of the included studies, questions were specifically adapted from instruments previously used in systematic reviews (Estabrooks et al., 2009; Kajermo et al., 2010). The tool consisted of 6 items covering aspects of sampling, measurement, and statistical analysis. A full list of assessment questions are presented in Table 1. All items were scored with yes (1) or no (0). The overall quality assessment score of a study was calculated by summing the scores of each item and then dividing the total points scored by the total possible points (6). The final maximum score for each study that could be obtained was 1. Studies were then rated as weak quality (<0.50), moderate quality (0.50 to 0.74), and strong quality (0.75 to 1). The rating results were not used to determine eligibility for inclusion, but to provide information about the quality of the selected studies, and to aid in identifying factors that might affect the findings of this research. The first reviewer and second reviewer independently assessed methodological quality of all the included studies. Using SPSS (Statistical Package for Social Sciences) version 22, Cohen's kappa coefficient (K) was calculated to establish inter-rater reliability. Any conflicts that emerged were resolved by consensus discussion between the reviewers.

Data Extraction

A data extraction table was predetermined by the reviewers. After the first reviewer extracted the data independently, the second checked for accuracy. Again, discrepancies between both the reviewers were discussed and reconciled by consensus.

Data Synthesis

Data were presented descriptively. A formal meta-analysis was prohibited by methodological shortcomings of the studies, insufficient data for statistical pooling, and wide

variability in operationalization of outcome measures. As such, a narrative synthesis was performed on results extracted from the set of studies included in this review.

Results

Search Outcome

The electronic and manual searches identified a total of 410 references. After removing duplicates, titles and abstracts of 255 articles were screened for relevance, after which 53 articles remained for full-text reading. Of the latter, 40 articles were eliminated based on preceding eligibility criteria. The reference list scanning uncovered other two potential articles. This searching process resulted in 15 articles meeting all inclusion criteria. Figure 1 depicts the flow diagram of the literature search procedure. The outcome of data extraction from each included study can be found in Table 2, chronologically arranged.

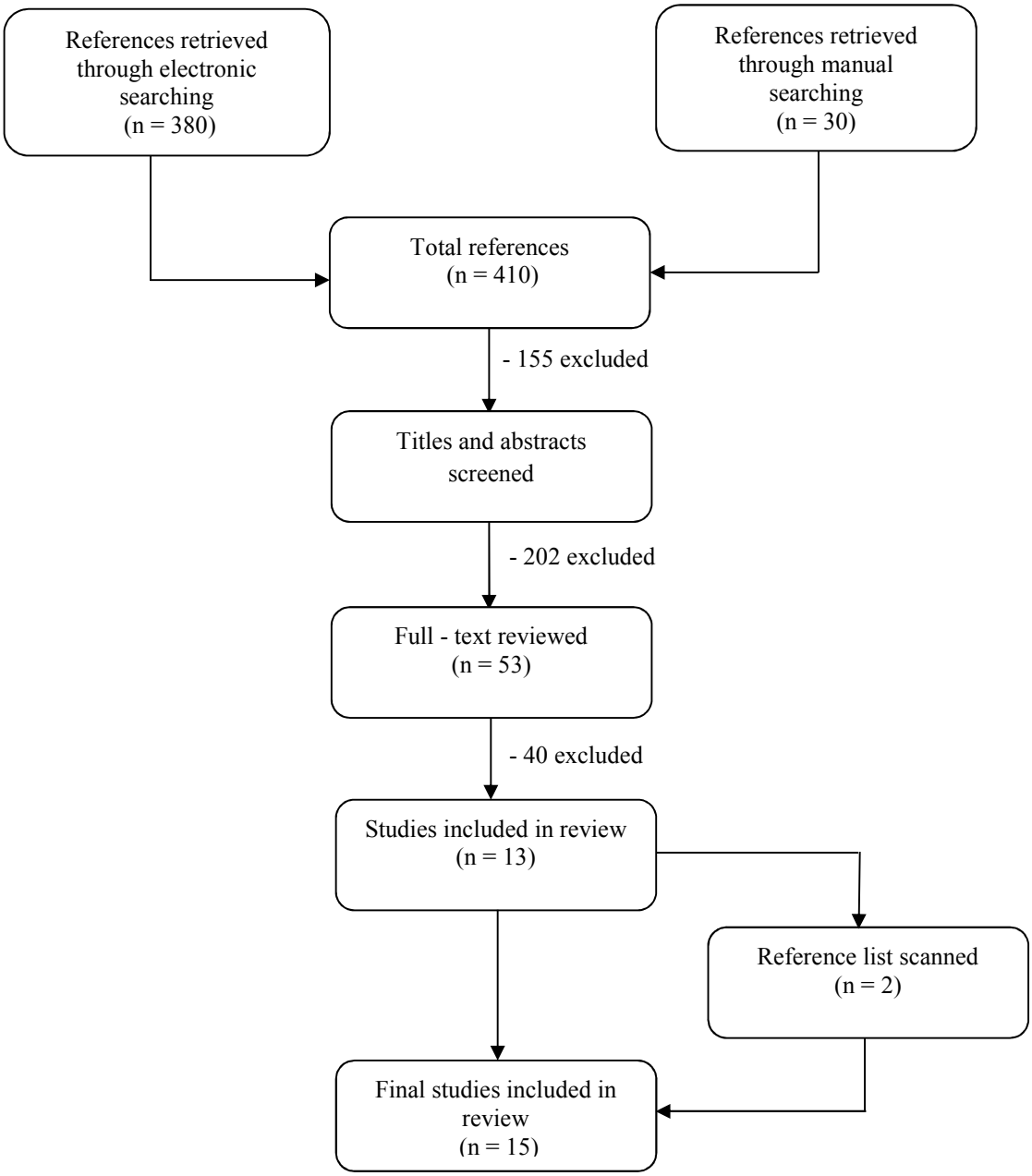


Figure 3 Literature search procedure

Appraisal of the Quality of Studies

Of the final 15 included studies, only two studies indicated strong methodological quality, four studies indicated moderate quality, and the remaining nine studies indicated weak quality. Inter-rater reliability between assessors on the quality measurements of the studies was very good (K=0.81).

Table 1 Quality Assessment of Included Studies

	Yes	**No**
Sampling:		
Was probability sampling used?	2	13
Was sample drawn from more than one site?	7	8
Was the response rate more than 60%?	4	11
Are the participants likely to be representative of the target population? (Very likely=2; Somewhat likely=3)	5	10
Measurement:		
Was validity or reliability obtained?	6	9
Statistical analysis:		
Were the results reported based on inferential statistical analyses?	12	3
Study Quality Rating:		
Weak quality (< 0.50): 9 studies		
Moderate quality (0.50 to 0.74): 4 studies		
Strong quality (0.75 to 1): 2 studies		

Study Characteristics

All studies included were performed over the past decade. Studies were conducted in the US (*n*=7), Canada (*n*=3), Denmark (*n*=2), Australia (*n*=1), Croatia (*n*=1), and Spain (*n*=1). Over the years, studies in this area have been predominantly cross-sectional research designs (*n*=10). Five studies found were case-control, of these, the methodology of three studies was in essence cross-sectional (Lee et al., 2007; Mayer et al., 2012; Zivkovic et al., 2012), and other two were performed prospectively (Idorn et al., 2013; Idorn et al., 2014). Self-administered survey (*n*=8) was the most frequently used method of data collection.

Participant Characteristics

The number of MM patients in the studies ranged from 20 to 313. The majority of the studies (*n*=8) noted a higher proportion of females (range, 51-65%). Seven studies provided data on ethnicity, of which six reported that >90% of the respondents were Caucasians, and one study's sample was composed of all Caucasians. The mean age of the participants varied from 43-65 years across the 10 studies that presented this information.

UVR exposure

Studies indicated that MM patients are still involved in summer outdoor activities (Lee et al. 2007), sunbathing (Freiman et al., 2004; Gómez-Moyano et al., 2010; Soto et al., 2010; Zivkovic et al., 2012), and indoor tanning (Freiman et al., 2004; Mayer et al., 2012; Zivkovic et al., 2012). Moreover, findings of the studies based on personal UVR dosimeters revealed that patients increased their amount of time spent under the sun following diagnosis (Idorn et al., 2013; Idorn et al., 2014). Even more surprisingly, survivors reported experiencing sunburns after their diagnosis (Lee et al., 2007; Idorn et al., 2013; Idorn et al., 2014).

Primary Preventive Behaviors

Between 7% and 38% of the MM patients reported that they "never" apply sunscreen when outside on sunny days (Freiman et al., 2004; Mujumdar et al., 2009; Zivkovic et al., 2012; Mayer et al., 2012). Some research groups elicited hat and clothing use in combination, and their findings regarding engaging in this practice were strikingly high (85-96%) (Freiman et al., 2004; McMeniman et al., 2010). Contrarily, Mujumdar et al. (2009) reported that 41% "never" wore a long-sleeved shirt when out in the sun. Furthermore, in another study, a seven-day recall showed that 67% of the respondents "never" wore a wide brimmed hat and 35% "never" use something to cover their head (Bowen et al., 2012). In addition, 55% of the participants in the latter study indicated that they "never" avoid outdoors during the hottest hours of the day (Bowen et al, 2012). A population-based study noted that one-fourth of the MM survivors "never or rarely" stay in the available shade when out in the sun (Mayer et al., 2012)

Secondary Preventive Behaviors

With regard to skin screening, relatively fewer studies were identified. Overall, 14-33% of MM patients acknowledged engaging in thorough skin self-examinations (SSE) (Loescher et al., 2006; Manne et al., 2006; Mujumdar et al., 2009; Bowen et al., 2012). Recent surveys indicated that a high majority (88-94%) of MM patients had received clinical skin examination (Bowen et al., 2012; Palesh et al., 2014).

Skin Cancer related Knowledge and Attitudes

Moderate-to-high levels of knowledge about skin cancer and risk factors were documented in the reviewed studies (Manne et al. 2006; Lee et al. 2007), although these data are noticeably sparse. Furthermore, studies showed that MM survivors still possess positive attitudes towards tanning (e.g., tan looks healthier) (Freiman et al., 2004; Lee et al. 2007; Zivkovic et al., 2012).

Table 2 Summary of Included Studies

First author, year, location, design, and quality	Data collection method and sample size	Gender, ethnicity, and age	UVR exposure	Primary preventive behaviors	Secondary preventive behaviors
Freiman A, 2005, Canada, cross-sectional, and weak	Self-administered survey and *n*=217	52% male and $\bar{x}$=56 yrs	Sunbathing: 21% (at least sometimes) Indoor tanning: 2%	Sunscreen: 72% (often or always), 18% (sometimes), and 7% (never) Hat and clothing: 85% Sun avoidance: 82%	---
Loescher LJ, 2006, USA, cross-sectional, and weak	Self-administered survey and *n*=70	53% male, 97% Caucasians, and $\bar{x}$=65 yrs	---	---	Thorough skin self-exam: 33%
Manne S, 2006, USA, cross-sectional, and strong	Self-administered mailed survey and *n*=229	57.2% female, 99.1% Caucasians, and $\bar{x}$=53.8 yrs	---	Sunscreen: 59.4% (often or always) Hat: 44.5% (often or always) Long-sleeved shirt: 44.9% (often or always) Shade: 53.2% (often or always) Sunglasses: 70.7% (often or always)	Thorough skin self-exam: 13.7%
Lee TK, 2007, Canada, case-control, and moderate	Telephone survey and *n*=35/70	51% female, 100% Caucasians, and 54%≥50 yrs	Time spent in outdoor recreational activities per month: $\bar{x}$=23 hours Time spent outdoors during the working week: $\bar{x}$=17.1 hours Time spent outdoor during the weekend: $\bar{x}$=8.7 hours Sunburns: $\bar{x}$=0.7/person	Mean monthly protected episodes: 26.1 Mean monthly unprotected episodes: 32.2	---

Table 2 Summary of Included Studies (continued)

First author, year, location, design, and quality	Data collection method and sample size	Gender, ethnicity, and age	UVR exposure	Primary preventive behaviors	Secondary preventive behaviors
Mujumdar, UV, 2009, USA, cross-sectional, and moderate	Telephone survey and *n*=115	55% female, 99% Caucasians, and $\bar{x}$=60 yrs	---	Sunscreen: 57% (always or nearly always) and 7% (never) Hat: 32% (always or nearly always) and 32% (never) Long-sleeved shirt: 13% (always or nearly always) and 41 % (never) Shade: 43% (always or nearly always) and 3% (never)	Thorough skin self-exam: 17%
Gomez-Moyano E, 2010, Spain, cross-sectional, and weak	Self-administered survey and *n*=195	63% female	Sunbathing: 66.2% (at least sometimes) and 33.8% (never)	Sunscreen use: 49.2% (often or always) and 38.5% (never) Hat and clothing: 90.8% Sun avoidance: 75.4% (often or always) and 20% (never)	---
McMeniman E, 2010, Australia, cross-sectional, and weak	Telephone survey and *n*=52	50% female and $\bar{x}$=59 yrs	---	Sunscreen: 84.6% Hat and clothing: 96.2%	Skin self-exam: 86.6%
Soto E, 2010, USA, cross-sectional, and weak	Telephone survey and *n*=68	95%≥40 yrs	Sunbathing: ≈1% (daily), ≈8% (weekly), ≈5 % (monthly), ≈1% (yearly)	Sunscreen: 69% (most of time or always) Hat: 66% Clothing: 67% Sun avoidance: 74% (most of time or always)	---

Table 2 Summary of Included Studies (continued)

First author, year, location, design, and quality	Data collection method and sample size	Gender, ethnicity, and age	UVR exposure	Primary preventive behaviors	Secondary preventive behaviors
Bowen D, 2012, USA, cross-sectional, and moderate	Telephone survey and *n*=313	55.9% female, 98.7% Caucasians, and $\bar{x}$=56 yrs	---	Sunscreen: 45% (often or always) and 35.1% (never) Wide brimmed hat: 15.6% (often or always) and 67.1% (never) Something on head: 34.8% (often or always) and 34.8.1% (never) Long-sleeved shirt or blouse: 59.1% (often or always) and 14.7% (never) Long pants or long skirts: 79.9% (often or always) and 5.4% (never) Shade: 35.5% (often or always) and 27.5% (never) Sunglasses: 46% (often or always) and 26.8% (never) Sun avoidance: 19.5% (often or always) and 54.6% (never)	Thorough skin self-exam: 22% Clinical skin screening: 88%
Mayer D, 2012, USA, case-control, and strong	Self-administered mailed survey/ Telephone survey and *n*=156/11564	52.56% female, 91.03% Caucasians, and 86.5%≥50 yrs	Tanning bed: 6.4%	Sunscreen: 51.0 % (often or always) and 31% (rarely or never) Clothing: 74.3%% (often or always) and 0.18% (rarely or never) Shade: 43% (often or always) and 26% (rarely or never)	---

Table 2 Summary of Included Studies (continued)

First author, year, location, design, and quality	Data collection method and sample size	Gender, ethnicity, age, type of skin cancer	UVR exposure	Primary preventive behaviors	Secondary preventive behaviors
Zivkovic MV, 2012, Croatia, case-control, and moderate	Self-administered survey and *n*=120/240	58.3% male and $\bar{x}$=51.11 yrs	Natural sunlight sunbathing: 22.5% (during the whole year) and 13.3% (during the whole day) Artificial sunbathing: 1% (1-2 times a month)	Sunscreen: 41.6% (summer holidays), 28.3% (spring to autumn), 10% (whole year), and 16.6% (never)	---
Idorn LW, 2013, Denmark, prospective case-control, weak	Personal electronic dosimeter, sun exposure diary, and *n*=53/104	64% female and median=37 yrs (28-70) (recently diagnosed patients); 45 yrs (26-66) (patients diagnosed in the past)	Patients diagnosed in the past had higher UVR dose than recently diagnosed patients Sunburns: $\bar{x}$=2 ± 2 (recently diagnosed patients) and 1 ± 1 (patients diagnosed in the past)	Patients diagnosed in the past had significantly lower number of days wearing sunscreen compared to newly diagnosed patients	---
Korner A, 2013, Canada, cross-sectional, and weak	Self-administered survey and *n*=47	51.1% male and $\bar{x}$=55.39 yrs	---	---	Skin self-exam: 87.8%
Palesh O, 2014, USA, cross-sectional, and weak	Self-administered electronic survey and *n*=160	51% male, 94% Caucasians, and $\bar{x}$=61.9 yrs	---	---	Clinical skin screening: 94%
Idorn LW, 2014, Denmark, prospective case-control, weak	Personal electronic dosimeter, sun exposure diary, and *n*=20/40	65% female and $\bar{x}$=43 yrs	Increase in daily UVR dose across years Sunburns: 60% at least once during the 3 years	Number of days of sunscreen use remained stable across the 3 years	---

Discussion

Findings in the literature clearly illustrated that certain segments of MM survivors do not limit their exposure to UVR, which is regarded as a primary risk factor for skin cancers (Parkin et al., 2011). Episodes of sunburn were reported by patients after MM diagnosis (Lee et al., 2007; Idorn et al., 2013; Idorn et al., 2014), indicating that they intermittently expose themselves to erythema-inducing levels of UVR. This is of pressing concern because frequency of sunburn, even in adulthood, elevates individuals' chances of developing MM (Pfahlberg et al., 2001). Moreover, some evidence was found that over a period of time (Idorn et al., 2013; Idorn et al., 2014). MM patients increased their UVR exposure after diagnosis. These results suggest that periodic reinforcement is requisite to reduce the possibility of developing subsequent skin cancer later in life. Qualified professionals, such as physicians and nurses, have the potential to be a powerful channel to routinely discuss risks associated with UVR exposure and sunburn, for example, via regular follow-ups. Medical care providers could also play a vital role in periodically measuring sunburn prevalence among survivors to monitor adherence to sun safety recommendations (Saraiya et al., 2002). Additionally, efforts should focus on collecting rigorous longitudinal data after diagnosis to shed light on changes over time in psychosocial determinants of UVR exposure behaviors. Such studies may aid health care professionals to design and implement intervention strategies that have long-term behavior change potential.

Furthermore, engagement in intentional tanning behaviors among MM survivors was demonstrated in the studies (Freiman et al., 2004; Gómez-Moyano et al., 2010; Soto et al., 2010; Mayer et al., 2012; Zivkovic et al., 2012). This might be attributed to patients' desire to have a healthy appearance; findings from previous research on tanning suggest that the persistent belief that tan skin enhances body appearance is a driving psychological force of high risk tanning habits

(Robinson et al., 1997; Rhainds et al., 1999; Pagoto, 2009). Individuals who highly value the benefits of tanning are, for the most part, resistant to skin cancer prevention educational messages (Borland et al., 1990; Borland et al., 1991; Detweiler et al., 1999; Pagoto, 2009). Consequently, special preventive programs in the last decade were developed that focused on damaging effects of UVR exposure on appearance (e.g., sagging, wrinkles, and brown spots) to counteract positive tanning attitudinal beliefs in order to increase sun protection practices (Williams et al., 2013). A recent systematic review and meta-analysis showed that this intervention technique was consistently effective in a number of studies (Williams et al., 2013). Future research should evaluate the utility of an appearance-based educational intervention to minimize survivors' artificial and solar UVR exposure. Along with this, extensive work is greatly needed to examine the underlying mechanism of the decision making process regarding the adoption of UVR seeking behaviors among this specific population group.

Virtually all studies herein indicated that some MM patients fail to practice one or more sun safety methods. Sunscreen use was the most commonly measured sun protection strategy in the literature. However, only few studies have attempted to measure appropriateness of sunscreen application. In these studies, results revealed that a significant proportion of patients did not reapply sunscreen, failed to apply it to all exposed areas, and applied it for very short period of time during the year (Gómez-Moyano et al., 2010; Soto et al., 2010; Zivkovic et al., 2012). It was also found that a substantial portion of MM survivors used sunscreen with low SPF levels (Mujumdar et al., 2009; Zivkovic et al., 2012). Interestingly, in one of the studies, over 90% of the patients were advised by their doctors to utilize sunscreen, but many reported that they did not recall any form of advice on appropriate SPF values (Soto et al., 2010). Collectively, these findings highlight the need to incorporate specific instructions to guide patients about correct sunscreen use

to increase effectiveness of this practice. Moreover, in future research, attention should be given to in-depth assessment of sunscreen use behavior among MM patients.

Gender disparities in sun protection behaviors were also evident. For example, male MM survivors were less likely to use sunscreen and more likely to use hats than female MM survivors (Manne et al., 2006; Bowen et al., 2012). Moreover, studies noted that being female was a significant predictor of both regular sun protection and sun protection behavior change after MM diagnosis (Mujumdar et al., 2009; Gómez-Moyano et al., 2010). This could be explained by higher levels of skin cancer risk perceptions, greater positive sun protection attitudes, and fewer perceived sun protective barriers in females as compared to their male counterparts (Kasparian et al., 2009). However, higher sunscreen use among female survivors is of particular concern because it is related with a decrease in other sun protection strategies (e.g., protective clothing and sun avoidance) and an increase in exposure to sunlight (Autieret et al., 1999; McCarthy et al. 1999; Cho et al. 2010), which is generally referred to as "sunscreen paradox" (Bränström et al., 2010). Health care practitioners need to be cognizant that these differences exist and tailor educational programs in a manner to efficiently target their patients' particular sun protection needs.

Turning now to rates of clinical skin examination, studies (only US-based data available) that assessed this information showed that an overwhelming percentage of MM patients (88-94%) were being screened during their routine clinical care (Bowen et al., 2012; Palesh et al., 2014). This may imply that a large number of patients are frequently exposed to health care providers; hence, these encouraging findings showcase a viable opportunity to promote skin cancer prevention. It has been found that performance of SSE and sun protection behaviors in MM survivors were associated with physicians recommending these practices (Manne et al., 2006). During a visit, medical practitioners should provide instructions to survivors on how to

efficaciously conduct SSE in order to improve proficiency and possibly increase self-efficacy of performing SSE. They should also convey information about the frequency of SSE and specific tools to be used for this procedure, for example, wall mirror, hand mirror, and MM illustrations. In addition, counseling about sun protection should be incorporated into all routine visits of MM survivors. Robinson et al. (2007) showed that SSE skills training involving partners could also be an optimal strategy for clinicians to enhance SSE self-efficacy and SSE performance among MM patients. Moreover, a body of research in the area of other chronic conditions documented that interventions targeting patients and partners are promising in terms of managing illness and improving treatment adherence (Martire et al., 2010). The couple-oriented interventions seem therefore valuable for increasing compliance with skin cancer prevention practices. Health professionals should explore how to best practically integrate this approach into survivors' care plan.

Limitations

The potential limitations should be considered while interpreting the results of the present research. Although literature searches were performed in a wide range of electronic databases, some journals of interest were possibly missed because they may not have been indexed in these databases. Thus, it is plausible that some of the studies were not identified in the retrieval process that would otherwise have been qualified for inclusion. The search strategy included only English-language scientific studies, which may introduce a degree of bias; however, the influence of language bias on conclusions drawn from systematic reviews is minimal (Wright et al., 2007).

An additional important limitation encountered was that most of the reviewed studies were of weak quality with methodological shortcomings such as non-randomization, single-site data collection, and low response rate. As a consequence, results of this systematic review are subject

to risk of selection bias. More attention should be paid to enhancing the research design, by conducting prospective, longitudinal studies that draw on diverse samples.

Furthermore, all studies that reported ethnicity breakdown had a large proportion of Caucasian participants, thereby limiting the generalization of the findings to other ethnic groups. This suggests that in future research, efforts should be made to target a more varied population of survivors to determine ethnic differences in sun protection and skin cancer screening behaviors. Another possible limitation lies in the fact that sun protection behavioral data in the studies exclusively rely on participants' self-reports which may be influenced by recall and social desirability biases. However, previous studies have validated self-reports of sun protection practices against direct observation measures (Oh et al., 2004; Glanz et al., 2009).

Conclusions

Despite these limitations, this systematic review constitutes a potentially significant contribution toward assessing the extent to which MM diagnosed patients engage in skin cancer preventive behaviors. Taken together, sun exposure habits and inadequate levels of sun protection practices highlight the need for intensifying educational intervention strategies to reduce the risk of new primary MM in this group. At every follow-up encounter, clinicians should communicate with MM patients about their future increased risk of this disease, as well as motivate them to decrease UVR exposure and increase daily sun protection practices. In particular, information must be included regarding regular appropriate sunscreen application in conjunction with the use of other recommended sun safety measures. We found that limited information was available on survivors' knowledge and personal attitudes regarding skin cancer and UVR exposure; therefore, additional studies are required in this area to gain insights into cognitive barriers to sun protection behavior change. Although investigated in very few studies, MM patients reported positive

attitudes towards tanned skin. Efforts to stress the damaging effects of UVR on appearance should be studied with this population since this may supplement strategies that rely on the risk of future skin cancer. Lastly, future programs focusing on skin screening behaviors should encourage patients to routinely and thoroughly investigate individual body sites and to seek immediate medical attention for any suspicious skin lesions.

CHAPTER III

METHODOLOGY

Participants and Procedures

This descriptive cross-sectional study was conducted at the University of Mississippi Medical Center (UMMC) between July, 2015 and April, 2016. A convenience sample of participants was recruited at the Face and Skin Center, Grants Ferry, and Pavillion Suite K which are the offices of the Department of Dermatology, University of Mississippi Medical Center. After approval from the Institutional Review Board *(*IRB*)*, patients presenting for follow-up visits at UMMC were invited by their attending physician to participate in the study. A total of 200 or more participants were recruited to this study which is considered a large sample size for structural equation modeling (Kline, 2005).

Inclusion criteria was: a) diagnosed with NMSC and b) ages 18 years or older. Participants were excluded from this study if they had severe physical or cognitive impairments. Adequate information about the study was provided to the potential participants. Individuals who decide to participate were asked to read and sign an informed consent form. In addition, an IMB model-based self-administered questionnaire was handed to the participants which was completed in the waiting room. It took approximately 15 to 20 minutes to complete the questionnaire.

Instrumentation

A questionnaire was developed primarily using items derived from validated questionnaires used in the prior studies (Cottrell, McClamroch, & Bernard, 2005; Gillespie, Watson, Emery, Lee, & Murchie, 2011, Hammond et al, 2008; Jackson & Aiken, 2000; Marlenga, 1995; Patel et al., 2010; Rosenman et al., 1995; Sales et al, 2005; Shoveller et al, 2000; Von Ah, Ebert, Park, Ngamvitroj, & Kang, 2004; Von Ah, Ebert, Park, Ngamvitroj, & Kang, 2005). Wordings of some of the questions were revised to adequately address our research objectives. A panel of experts in the area of skin cancer prevention research were invited to evaluate face and content validity of the modified instrument. Readability of the final questionnaire was measured using Flesh Reading Ease Test and Flesh-Kincaid Grade Level Test which are available in Microsoft Word.

Measures

The questionnaire assessed following socio-demographic data: age (1 = 18-29 yrs, 2 = 30-39 yrs, 3 = 40-49 yrs, 4 = 50-59 yrs, 5 = 60-69 yrs, and 6 = 70 or older), sex (1 = Male, 2 = Female), ethnicity (1 = White, 2 = Black or African American, 3 = Hispanic or Latino, 4 = Native Hawaiian or Other Pacific Islander, 5 = Asian, 6 = American Indian or Alaska Native, and 7 = Other), education level (1 = Less than elementary school (Grade 8 or less), 2 = Less than high school (Grade 11 or less), 3 = High school diploma (including GED), 4 = Assoc. degree (2 year), 5 = Bachelor's degree, 6 = Graduate or professional degree, and 7 = I don't know), marital status (1 = married, 2 = never married, 3 = divorced/separated, 4 = widow, widower, 5 = living with partner, and 6 = I don't know), net income of household (1 = Less than $20,000, 2 = $21,000 to $30,000, and 3 = $31,000 to $40,000, 4 = $41,000 to $50,000, 5 = $51,000 to $60,000, 6 = $61,000 to $70,000, 7 = $71,000 to $80,000, 8 = $81,000 to $90,000, 9 = $91,000 to $100,000, 10

= $101,000 or more, and 11 = I don't know), and health insurance (1 = Yes, 0 = No, and 2 = I don't know).

Moreover, participants were asked to report their hair color (1 = Blonde, 2 = Red, 3 = Light brown, 4 = Medium brown, and 5 = Dark brown, 6 = Black, and 7 = I don't know), eye color (1 = Brown, 2 = Green/Hazel, 3 = Blue, 4 = Grey, 5 = Black, and 6 = I don't know), skin type (1 = Always burn, unable to tan, 2 = Usually burn, tans with difficulty, 3 = Sometimes mild burn, gradually tans to a light brown, 4 = Rarely burn, tan with ease to a moderate brown, 5 = Very rarely burns, tans very easily, 6 = Never burns, tans very easily, deeply pigmented, and 7 = I don't know), personal history of skin cancer (1 = Yes, 0 = No, and 2 = I don't know), family history of skin cancer (1 = Yes, 0 = No, and 2 = I don't know), sunburn history (1 = Yes, 0 = No, and 2 = I don't know), number of lifetime sunburns (1 = none, 2 = one, 3 = two, 4 = three to five, 5 = six to ten, 6 = more than ten, and 7 = I don't know), number of hours spent in sun on a weekday (1 = none, 2 = one, 3 = two, 4 = three, 5 = four, 6 = five, 7 = six, and 8 = I don't know), number of hours spent in sun on a weekend (1 = none, 2 = one, 3 = two, 4 = three, 5 = four, 6 = five, 7 = six, and 8 = I don't know), number of physician visits in the last three years (1 = none, 2 = one, 3 = two, 4 = three to five, 5 = six to ten, 6 = more than ten, and 7 = I don't know), and number of visits with a dermatologist in the last three years (1 = none, 2 = one, 3 = two, 4 = three to five, 5 = six to ten, 6 = more than ten, and 7 = I don't know).

The skin cancer knowledge was assessed by 24 items, and will be measured based on correct response. The items are following: "Which of the following is not a recommended way to reduce skin cancer risk? (Wear clothing that has a tight weave, Stay out of the sun from 10:00 am - 4:00 pm, Sunbathing, and Wearing sunglasses)," "Sunscreen should be reapplied to skin approximately every 2 hours," "Eighty percent of sun damage occurs before the age of 18, so if I

am older, it doesn't matter how much sun I get," "Sunscreens should be applied immediately before going out into the sun," "Most skin cancers can be prevented," "One should look for a sunscreen that offers both UVA and UVB protection," "If it is cold or cloudy outside, one does not need sun protection," "Experts suggest using sunscreen with a sun protection factor (SPF) of 15 or higher," "One should look for a sunscreen that offers both UVA and UVB protection," "If it is cold or cloudy outside, one does not need sun protection," "The sun's rays are the strongest at mid-day," "Sunscreen only needs to be worn while at the beach or pool?," "If you wear a hat you don't need to wear sunscreen?," "Which is not a way to prevent over-exposure to the sun (Use of a wide-brimmed hat, Drink plenty of non-carbonated fluids, Avoidance of the sun entirely, Use of a long-sleeved shirt)," "Which of the following are increased risk factors related to skin cancer? (Having dark colored skin, A personal history of skin cancer, Having black or dark brown hair, Having blue or green eyes, Drinking alcohol regularly, A personal history of sunburns, The number or type of moles on the body, Smoking, Having freckles, Overexposure to the sun or UV radiation, Having a particular diet, and A family history of skin cancer)"

The perceived skin cancer susceptibility was measured by eight items: "It is extremely likely that I will get skin cancer in the future," "Because of my personal history, I am more likely to get skin cancer," and "There is a good possibility that I will get skin cancer in the next 10 years," "I feel I will get skin cancer in the future," "I am more likely than the average person to get skin cancer," and "My chances of getting skin cancer are great." The items were measured on five-point Likert-type scale (1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly agree).

To assess use of sun protection methods, participants were asked to indicate on a 5-point Likert-type scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Frequently, and 5 = Always) how

frequently they perform the following sun protection behavior when out in the sun for 15 minutes or more: seek shade, minimize sun exposure between 10 AM and 4 PM, wear a wide-brimmed hat, wear something on your head (any type of hat, cap, and visor), wear sunscreen with SPF of 15 or higher to protect your skin from the sun, wear sunscreen with SPF of 15 or higher on your face, wear sunscreen with 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.

Items assessed participants' self-efficacy to engage in sun protection behaviors: "When in the sun for more than 15 minutes, I am confident or certain that I can seek shade," "When in the sun for more than 15 minutes, I am confident or certain that I can minimize sun exposure between 10 AM and 4 PM," "When in the sun for more than 15 minutes, I am confident or certain that I can wear a wide-brimmed hat," "When in the sun for more than 15 minutes, I am confident or certain that I can wear something on my head (any type of hat, cap, and visor)," "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," "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 on my face," "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 on all exposed areas of my body," "When in the sun for more than 15 minutes, I am confident or certain that I can wear clothing to protect my skin from the sun," "When in the sun for more than 15 minutes, I am confident or certain that I can wear a long-sleeved shirt or blouse "When in the sun for more than 15 minutes, I am confident or certain that I can wear long pants or long skirt," "When in the sun for more than 15 minutes, I am confident or certain that I can wear sunglasses

to protect my eyes from the sun." The items were measured on five-point Likert-type scale (1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly agree).

Perceived social support for sun protection was measured by using Likert-type items with five-point responses (1 = Strongly disagree, 5 = Strongly agree): Examples of the items: "Most people who are important to me, think that when I am in the sun I should seek shade," "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," "Most people who are important to me, think that when I am in the sun I should wear a wide-brimmed hat," "Most people who are important to me, think that when I am in the sun I should wear something on my head (any type of hat, cap, and visor)," "Most people who are important to me, think that when I am in the sun I should wear sunscreen with SPF of 15 or higher to protect my skin from the sun," "Most people who are important to me, think that when I am in the sun I should wear sunscreen with SPF of 15 or higher on my face," "Most people who are important to me, think that when I am in the sun I should wear sunscreen with SPF of 15 or higher on all exposed areas of my body," "Most people who are important to me, think that when I am in the sun I should wear clothing to protect my skin from the sun," "Most people who are important to me, think that when I am in the sun I should wear a long-sleeved shirt or blouse "Most people who are important to me, think that when I am in the sun I should wear long pants or long skirt," "Most people who are important to me, think that when I am in the sun I should wear sunglasses to protect my eyes from the sun."

The participants' attitudes towards sun protection behaviors were assessed with following items: "Sun protection is very important for people with my history of cancer," "Sunscreen is too expensive," "If I use sun protection, I am less likely to get skin cancer," "I believe I should practice sun protection to reduce my chances of getting skin cancer," "I look more attractive when I have

a suntan," "By using sun protection methods I can prevent myself getting another skin cancer," "Sun protective clothing is too hot to wear," "Whether or not a person develops skin cancer is related to how frequently they use sun protection," "Sunscreen takes too long to apply," "Using sun protection is a part of overall good health care," "I often forget to use sun protection methods," "Using sun protection would provide me peace of mind about my health," "Sunscreen is messy," "If people used sun protection, they wouldn't be as likely to get skin cancer," "I do not worry about sun protection because I did so much damage to my skin when I was younger." The items were measured on five-point Likert-type scale (1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly agree).

Statistical Analysis

Descriptive statistics were computed using SPSS 22.0. For research question 1 (i.e., evaluating the factor structure of the latent variables), confirmatory factor analysis (CFA) will be conducted. Additionally, structural equation modelling (SEM) will be performed to address the research question 2, 3, and 4 (i.e., predictive ability of the measurement model, structural relationships of IMB constructs with sun protection behaviors). For both CFA and SEM model, data fit will be tested by likelihood ratio chi-square, comparative fit index (CFI), and root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), and Standardized root mean square residual (SRMR). CFA and SEM will be estimated using Mplus version 7 For the analyses, an alpha will be set at 0.05 *a priori*.

CHAPTER 4

RESULTS

The purpose of this study was to examine the utility of Information-Motivation-Behavioral skills (IMB) model in measuring as well as predicting sun protection behaviors among people who have had non-melanoma skin cancer (NMSC).

This chapter includes: (1) sociodemographic, skin cancer risk and clinical related characteristics; (2) sunburns and sun exposure, visits to health care professionals, and source of skin cancer information; (3) Cronbach's alpha and descriptive statistics of study variables; and (4) measurement and prediction of the IMB model.

A total of 311 non-melanoma skin cancer (NMSC) patients participated in this study. The mean age of the participants was 64.12 (sd = 12.02) years. A majority (58.8%) of the participants were males. Of the sample, 77.5% were married. About one-fourth of the participants had a graduate or professional degree. Moreover, just over one-fourth reported annual income $101,000 or more. Most of the participants (97%) reported having health insurance coverage. Table 1 summarizes sociodemographic characteristics of participants.

From the Table 2 we can see that 14.9% and 9.3% of the participants described their hair color as blonde and red, respectively. Additionally, 38.2% of participants had green/hazel eyes and 34.2% had blue eyes. A majority of the responders (77.2%) indicated their untanned skin color as "very white" or "white." Nearly half (48%) reported skin type as "sometimes mild burn, gradually tans to a light brown." Almost similar percentages of participants reported many moles

(40.2%) and freckles (40.4%). The following breakdown of skin sensitivity to sun emerged in the data: extremely sensitive (24.4%), mildly sensitive (36.1%), moderately sensitive (31.4%), and not sensitive at all (8%). Approximately 60% of the participants reported family history of skin cancer. About 57% of responder described themselves as indoor worker.

Table 1. Sociodemographic characteristics of participants.

Variables	$\bar{x}$ ($\pm sd$)	*n* (%)
Age	64.12 (12.02)	
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 (0.6%)
Less than high school (Grade 11 or less)		7 (2.3%)
High school diploma (including GED)		82 (26.4%)
Assoc. degree (2 year)		60 (19.3%)
Bachelor's degree		82 (26.4%)
Graduate or professional degree		74 (23.8%)
Income		
Less than $20,000		15 (5.5%)
$21,000 to $30,000		22 (8.1%)
$31,000 to $40,000		20 (7.4%)
$41,000 to $50,000		22 (8.1%)
$51,000 to $60,000		27 (10%)
$61,000 to $70,000		14 (5.2%)
$71,000 to $80,000		22 (8.1%)
$81,000 to $90,000		19 (7%)
$91,000 to $100,000		27 (10%)
$101,000 or more		83 (26.7%)
Health Insurance Coverage		
Yes		295 (97%)
No		9 (3%)

Table 2. Skin cancer risk related characteristics of participants.

Variables	*n* (%)
Hair color	
Blonde	45 (14.9%)
Red	28 (9.3%)
Medium brown	76 (25.2%)
Dark brown	67 (22.2%)
Light brown	65 (21.5%)
Black	17 (5.6%)
White	1 (0.3%)
Grey	3 (1%)
Eye color	
Brown	78 (25.7%)
Green/Hazel	116 (38.2%)
Grey	6 (2%)
Blue	104 (34.2%)
Untanned skin color	
Very white	42 (14%)
White	198 (65.8%)
Olive/Dark White	24 (8%)
Light Brown	37 (12.3%)
Skin type	
Always burn, never tans	32 (10.8%)
Usually burn, tans with difficulty	47 (15.9%)
Sometimes mild burn, gradually tans to a light brown	142 (48%)
Rarely burn, tan with ease to a moderate brown	27 (9.1%)
Very rarely burns, tans very easily	44 (14.9%)
Never burns, tans very easily, deeply pigmented	4 (1.4%)
Moles	
None	10 (3.6%)
Few	158 (56.2%)
Many	113 (40.2%)

Table 2. Skin cancer risk related characteristics of participants (continued).

Variables	*n* (%)
Freckles	
None	45 (16%)
Few	123 (43.6%)
Many	114 (40.4%)
Skin sensitivity	
Extremely sensitive	73 (24.4%)
Mildly sensitive	108 (36.1%)
Moderately sensitive	94 (31.4%)
Not sensitive at all	24 (8%)
Family history	
Yes	159 (59.1%)
No	110 (40.9%)
Job type	
Indoor worker	163 (56.6%)
Part time outdoor worker	90 (31.3%)
Full time outdoor worker	21 (7.3%)
Retired	14 (4.9%)

Of the sample, around one-third (n = 105) were diagnosed with skin cancer more than five years ago. Little less than half (49.2%) reported head as a location of skin cancer. Furthermore, 41% of the participants indicated that so far they have had one skin cancer removed. Table 3 provides skin cancer related clinical characteristics of participants.

Table 3. Skin cancer related clinical characteristics of participants.

Variables	*n* (%)
Skin cancer diagnosis	
Less than 3 months ago	86 (28.8%)
3 to 6 months ago	20 (6.7%)
More than 6 months to 1 year ago	17 (5.7%)
More than 1 year to 5 years ago	71 (23.7%)
More than 5 years ago	105 (35.1%)
Location of skin cancer	
Head	147 (49.2%)
Neck	12 (4%)
Trunk	10 (3.3%)
Arms	7 (2.3%)
Legs	12 (4%)
Multiple	111 (37.1%)
Number of skin cancers	
1	121 (40.7%)
2	47 (15.8%)
3-5	74 (24.9%)
6-10	20 (6.7%)
More than 10	35 (11.8%)

Of all participants, 37.2% lifetime blistering sunburns and 29.3% reported being sunburned after first diagnosed with skin cancer. Moreover, 22.2% and 12% indicated no sun exposure on weekday and weekend, respectively. Table 4 presents episodes of sunburn and hours spent in sun on weekday and weekend.

Table 4. Sunburns and sun exposure among participants.

Variables	*n* (%)
Sunburns (lifetime)	
None	14 (4.5%)
1	10 (3.8%)
2	19 (7.1%)
3-5	62 (23.3%)
6-10	62 (23.3%)
More than 10	99 (37.2%)
Sunburns (after skin cancer diagnosis)	
None	220 (75.3%)
1	17 (5.8%)
2	9 (3.1%)
3-5	23 (7.9%)
6-10	9 (3.1%)
More than 10	14 (4.8%)
Sun exposure (weekday)	
0	69 (22.2%)
1	77 (24.8%)
2	49 (18.7%)
3	26 (9.9%)
4	17 (6.5%)
5	11 (4.2%)
6	13 (5%)
Sun exposure (weekend or day off)	
0	34 (12%)
1	71 (25%)
2	74 (26.1%)
3	38 (13.4%)
4	28 (9.9%)
5	21 (7.4%)
6	18 (6.3%)

From the Table 5 we can see that a little over one-fourth of participants reported "6-10" (25.9%) and "more than 10" (26.3%) visits with physician (non-dermatology) in the last three years. Furthermore, we can also see that a little over one-fourth of participants reported "1" (26.9%) and "3-5" (29.8%) visits with dermatologist in the last three years.

Table 5. Participants visits to health care professionals.

Variables	*n* (%)
Physician (non-dermatology)	
1	13 (4.4%)
2	25 (8.5%)
3-5	102 (34.8%)
6-10	76 (25.9%)
More than 10	77 (26.3%)
Dermatologist	
1	82 (26.9%)
2	54 (17.7%
3-5	91 (29.8%)
6-10	49 (16.1%)
More than 10	29 (9.5%)

When asked which of the following sources have you received information about protecting yourself from too much sun, a majority reported their doctor or other health care providers (90.7%), followed by media (84.5%), friends/family (77.6%), health information pamphlet (66.1%), and internet/websites (43.7%). Table 6 presents sources from which participants received information about protecting yourself from too much sun.

Table 6. Information received about sun protection.

Variables	*n* (%)
Media (TV, radio, newspaper, magazine articles)	251 (84.5%)
Internet/websites	129 (43.7%)
Your doctor or other health care provider	272 (90.7%)
Health information pamphlet	195 (66.1%)
Friends/Family	232 (77.6%)

Table 7 shows reliability of subscales and entire scale. Cronbach alpha coefficient equal to or over 0.70 is considered acceptable (Sharma & Petosa, 2012). Internal consistency for entire scale was 0.92. Of subscales, social support had highest internal consistency ($\alpha = 0.95$). Both self-efficacy and sun protection behavior showed very good internal consistency (Sharma & Petosa, 2012). Furthermore, knowledge ($\alpha = 0.70$), perceived risk ($\alpha = 0.77$), and attitudes ($\alpha = 0.79$) showed respectable internal consistency (Sharma & Petosa, 2012).

Table 7. Cronbach alpha coefficients of the subscales and entire scale.

Constructs	Cronbach's alpha coefficient
Knowledge	0.70
Perceived risk	0.77
Attitudes	0.79
Social support	0.95
Self-efficacy	0.88
Sun protection behavior	0.83
Entire scale	0.92

Table 8 depicts the descriptive statistics (mean ± sd) of the key study variables. The knowledge scores occupied the range from 1-24 with no participant getting a 0 and a mean of 17.43 units indicating moderate knowledge. The perceived risk scores occupied the full range of 8-40 with a mean of 28.29 units indicative of moderate perceived risk. The attitudes score ranged from 40 to 79 on a possible range of 16-80 with a mean of 61.34 units indicating moderate level of positive attitudes. The social support scores ranged from 11 to 55 corresponding with the possible range and had a mean of 44.53 units indicating that social support was on the high end. Similarly, self-efficacy for sun protection ranged from 11 to 55 corresponding with the possible range and had a mean of 44.24 units once again indicating that self-efficacy was on the high end. Finally, sun protection behavior ranged from 17 to 55 units on a possible range of 11 to 55 with a mean of 37.07 units indicating moderate level of sun protection behaviors.

Table 8. Descriptive statistics of study variables.

Constructs	Possible Range	Observed Range	$\bar{x}$ ($\pm sd$)
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 behavior	11-55	17-55	37.07 (±8.15)

As can be seen from Table 9, 21 (7%) participants reported that they intend to sunbathe (i.e., exposing the skin to the sun for the purpose of getting a tan) within the next year. Whereas, only 2 (0.7%) participants intend to tan indoors within the next year.

Table 9. Intention of sunbathing and indoor tanning.

Variables	*n* (%)
Sunbathing	
Yes	21 (7%)
No	279 (93%)
Indoor tanning	
Yes	2 (0.7%)
No	303 (99.3%)

It can be seen from the data in Table 10 that 128 (41.5%) participants go out in the sun "much less" or "less" during the cooler months than in the summer. Moreover, 184 (60%) participants indicated that they wear "much less or "less" sun protection (e.g., sunscreen and protective clothing) during the cooler months than in the summer.

Table 10. Sun exposure and sun protection in cooler months compared to summer.

Variables	*n* (%)
Sun exposure	
Much less	19 (6.2%)
Less	109 (35.4%)
Same	119 (38.6%)
More	54 (17.5%)
Much more	7 (2.3%)
Sun protection	
Much less	56 (18.2%)
Less	128 (41.7%)
Same	96 (31.3%)
More	21 (6.8%)
Much more	6 (1.9%)

Findings for the confirmatory factor analysis showed that fit for the model was acceptable: $x^2 = 287.618$ ($df = 133$), $p < 0.001$; RMSEA = 0.06; CFI = 0.93; TLI = 0.91; SRMR = 0.05 (Hu & Bentler, 1999). Moreover, all item loadings were significant at $p < 0.001$. Table 11 presents indices for model fit.

Table 11. Indices for model fit.

Indices			
Chi-square	287.618	$df = 133$	$p < 0.001$
Root mean square of error of approximation (RMSEA)	0.06		
Comparative fit index (CFI)	0.93		
Tucker-Lewis index (TLI)	0.91		
Standardized root mean square residual (SRMR)	0.05		

As indicated in the figure 2, knowledge and perceived risk had no direct and indirect effects on sun protection behaviors. Although attitude had no direct effect on sun protection behavior, it had an indirect effect on sun protection behavior ($\beta = 0.192$, $p = 0.001$) through self-efficacy. Social support not only had direct effect on sun protection behaviors ($\beta = 0.199$, $p = 0.010$) but also had indirect effect on sun protection behaviors ($\beta = 0.160$, $p < 0.001$) through self-efficacy. The explained variances for self-efficacy and sun protection behaviors were 43% and 35.4%, respectively. Figure 4-8. depicts structural equation model presenting regression paths in the IMB model.

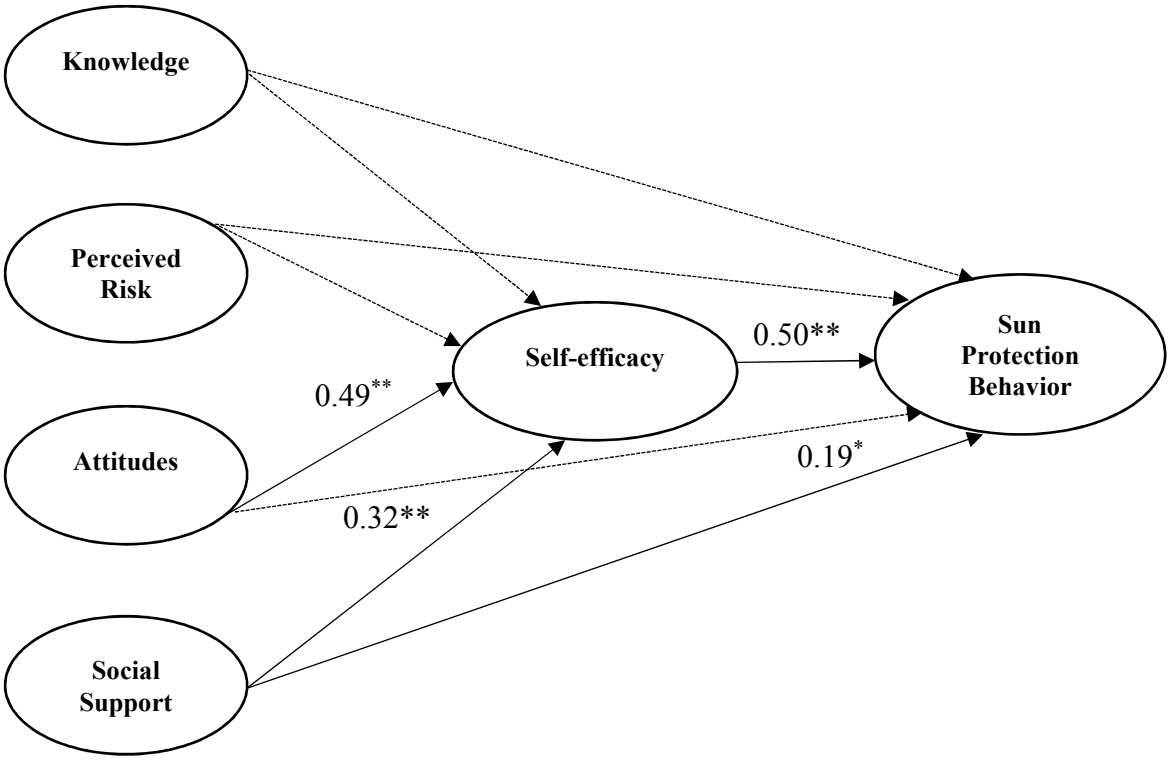
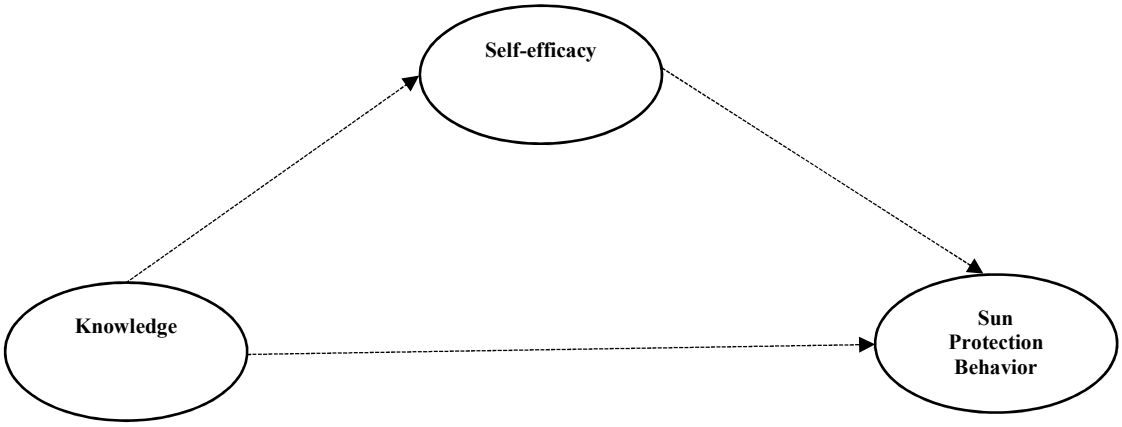


Figure 4. Structural equation model presenting regression paths in the IMB model. Single-headed arrows show regression coefficients of direct effects (*$p < 0.05$, **$p < 0.001$).

Solid line - Significant path

Dotted line - Insignificant path

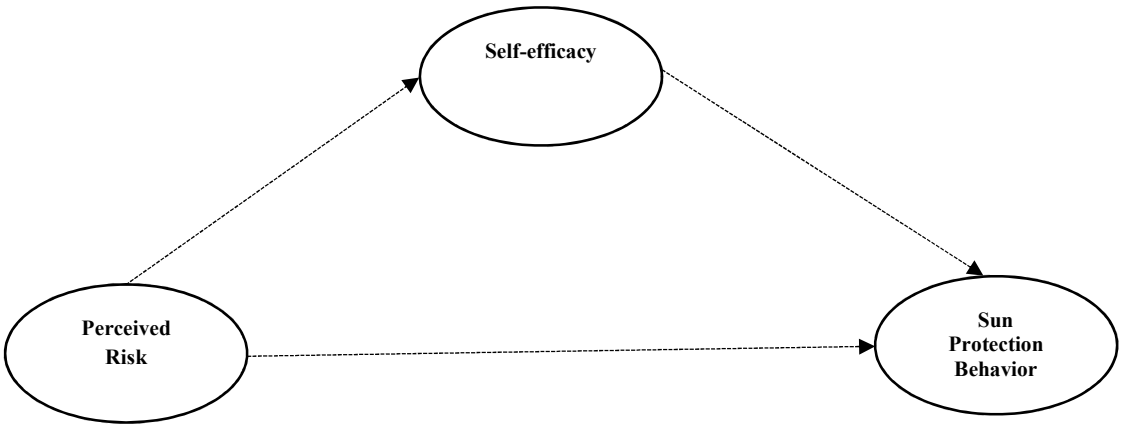


Indirect effect: $\beta = 0.043$, $p = 0.253$
Direct effect: $\beta = 0.01$, $p = 0.206$

Figure 5. Relationships of Knowledge with Sun Protection Behaviors

Solid line - Significant path

Dotted line - Insignificant path

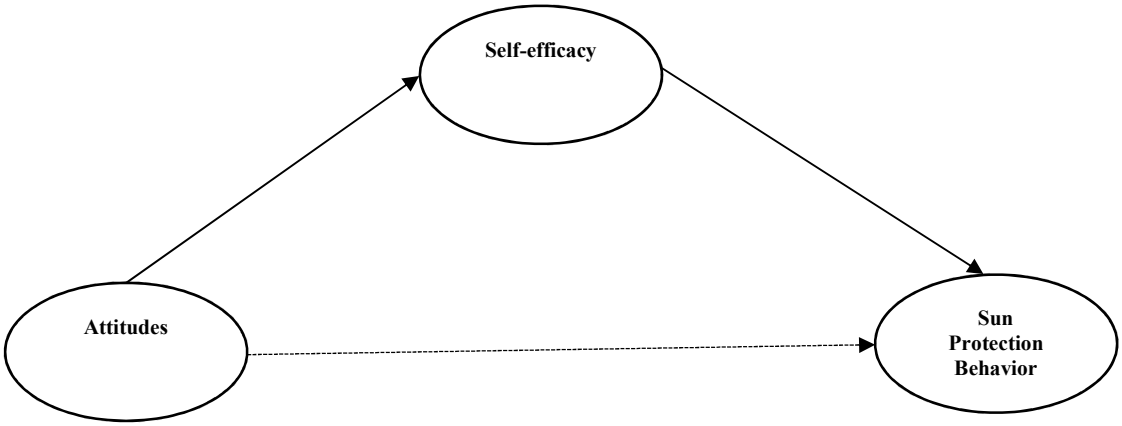


Indirect effect: $\beta = 0.025$, $p = 0.429$
Direct effect: $\beta = 0.004$, $p = 0.959$

Figure 6. Relationships of Perceived Risk with Sun Protection Behaviors

Solid line - Significant path

Dotted line - Insignificant path

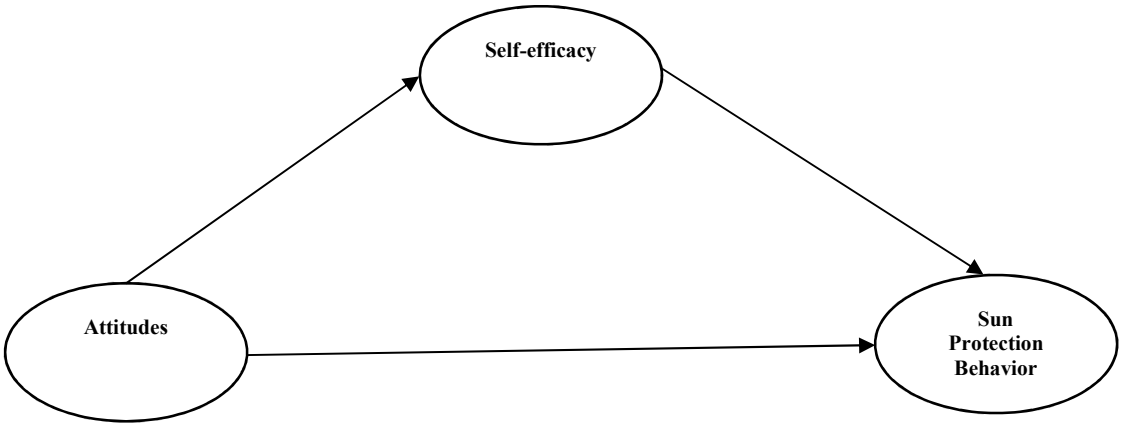


Indirect effect: $\beta = 0.192$, $p = 0.001$
Direct effect: $\beta = 0.128$, $p = 0.204$

Figure 7. Relationships of Attitudes with Sun Protection Behaviors

Solid line - Significant path

Dotted line - Insignificant path



Indirect effect: $\beta = 0.160$, $p < 0.001$
Direct effect: $\beta = 0.199$, $p = 0.01$

Figure 8. Relationships of Social Support with Sun Protection Behaviors

Solid line - Significant path

Dotted line - Insignificant path

CHAPTER 5

DISCUSSION

The primary objective of this research was to examine the utility of Information-Motivation-Behavioral skills (IMB) model in measuring as well as predicting sun protection behaviors among people who have had non-melanoma skin cancer (NMSC).

This was a descriptive cross-sectional study. A total of 311 NMSC patients completed survey based on IMB model. Data was collected at the University of Mississippi Medical Center (UMMC) between July 2015 and April 2016. Descriptive statistics was performed to describe the data. Confirmatory factor analysis (CFA) and structural equation modelling (SEM) were conducted to address the research questions of this study.

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. Moreover, this study provides evidence about utility of IMB model in the area of skin cancer prevention research.

This chapter includes: (1) a summary of the findings; (2) comparison of the findings with previous studies; (3) recommendations for future studies; (4) limitations of this study; and (5) conclusion based on the purpose of this study.

Results indicated that individuals diagnosed with NMSC continue to receive substantial sun exposure on daily basis (between 10 am to 4 pm). The high levels of sun exposure is concerning, when considering that 59.1% had family history, 34.2% had blue eye color, about 40%

had many moles/freckles, and10-48% had high propensity to burn than tan. Moreover, 38.5% of the participants reported working as a part-time or full-time outdoor worker. Prior studies have also demonstrated that previously diagnosed NMSC individuals still expose themselves to UVR exposure by working in a heavy sun exposure environment or by practicing indoor tanning behaviors (Cartmel et al., 2013; Nahar et al., 2015; Woolley, Buettner, & Lowe, 2004). Given that participants in current study demonstrated intention to sunbathe and that perceive suntan looks attractive, appearance-based educational interventions (focusing on negative effects of UVR exposure on appearance, such as wrinkles, sagging, and brown spots) will be beneficial (Nahar et al., 2016). A recently published systematic review and meta-analysis demonstrated that appearance-based interventions have a positive influence on UV exposure and sun safety behaviors and intentions (Williams et al., 2013).

It is noteworthy that almost one-fourth (24.7%) of the previously diagnosed NMSC individuals 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 (Lee et al., 2007; Idorn et al., 2013, Idorn et al., 2014). These findings suggest that level of sun exposure level among skin cancer patients was high enough to cause sunburn (Nahar, Ford, Hallam, Bass, Hutcheson, & Vice, 2013). This is alarming because sunburn frequency increases individuals' likelihood of developing melanoma (Pfahlberg et al. 2001; Nahar et al., 2016). At every encounter, physicians and dermatologist should communicate with skin cancer patients about risks related with sunburn and UVR exposure (Nahar et al., 2016).

With regard to sun protection behaviors, NMSC patients in this study displayed moderate levels. About one third of the participants showed that they apply sunscreen on all exposed area (35.7%) and wear long sleeved shirt (33.8%) when out in the sun for more than 15 minutes.

Moreover, almost similar percentages of participants reported wearing wide-brimmed hat (43.7%) and long pants (45.7%). Most frequently (68.8%) reported sun protection strategy among NMSC patients was use of sunglasses. However, 15.6% and 28.2% reported "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 et al., 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; Nahar et al., 2016). Health care professionals working with NMSC patients should educate and motivate patients to engage in sun protection behaviors to reduce their future risk of skin cancer, including melanoma (i.e., the most dangerous type of skin cancer).

The inadequate sun protection behaviors could be partially explained by the NMSC patients' barriers and attitudes towards sun protection strategies. About 32% reported that sunscreen is too messy and 33.8% reported that sun protective clothing is too hot to wear. This finding is consistent with a study conducted with 140 NMSC patients (57.1% had previous history) at University of California, San Diego Medical Center. Findings showed the primary barriers reported by the NMSC patients for not engaging in sun protection behaviors were "sunscreen is too messy and oily" and "clothing is too hot to wear" (Goldenberg, Nguyen, & Jiang, 2014). These finding suggest that health care professionals should educate NMSC patients about availability of clothing brands made up of fabric which is not hot and come with sun protection factor. At the same time, NMSC patients should be informed about sunscreens available in market which are not oily (Nahar et al., 2013). Another interesting finding to emerge from the data was almost half (49.2%) of the NMSC patients reported that they often forget to use sun protection methods.

Educational programs should target family members and encourage them to remind skin cancer patients to use sun protection methods. In a path analysis, attitude had no direct effect on sun protection behavior but it had an indirect effect on sun protection behavior ($\beta = 0.192$, $p = 0.001$) through self-efficacy.

With regard to knowledge of sunscreen use, 16.4% 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 immediately before going out in sun. Little over one-third (35%) of respondents correctly identified recommended sun protection methods to reduce skin cancer risk. Moreover, 24.2% did not know that sun is strongest at mid-day. These finding indicate that patients need to be educated on how to effectively apply sunscreen which 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 education video on sunscreen use in clinic waiting rooms. Such intervention strategies have been effective in health behavior change (Besera et al., 2016).

Overall, NMSC patients in this study demonstrated moderate levels of skin cancer related knowledge. However, previous studies showed that knowledge about skin prevention methods among NMSC patients remains limited (Goldenberg, Nguyen, & Jiang, 2014; Renzi et al., 2008). These differences in findings could be due to 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 skin cancer prevention research (Nahar et al., 2015). A previous study conducted with state park workers in Southern US showed that there was a significant relationship between knowledge and sun protection behaviors (Nahar et al., 2014). Another previous study conducted

with 315 squamous cell carcinoma patient showed relationship between higher knowledge increased the likelihood of engaging in preventive behaviors (Renzi et al., 2008). On the contrary, this study showed no significant relationship between knowledge and sun protection behavior. Moreover, knowledge had no indirect effect on sun protection behavior through self-efficacy.

Overall, this study demonstrated that participants moderately perceive that they are at risk of skin cancer. About 60% perceive that they are more likely than the average person to get skin cancer. Moreover, about 71% belief that it is extremely likely that they will get skin cancer in the future. However, only 16% believe that getting skin cancer is more serious than other diseases. At Medical College of Wisconsin, a prospective study of 211 consecutive NMSC patients demonstrated that they do not perceive an increased risk for melanoma and retained the same view of their personal skin cancer risk 4-months following their NMSC treatment (Rhee et al., 2008). The Health Belief Model suggests that individuals are more likely to carry out preventative actions if they perceive themselves to be at risk of developing a health problem (Glanz, Rimer, Viswanath, 2008). This proposition is not supported in the current study. This could be explained by moderate knowledge among NMSC patients and 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).

Results indicated that scores for social support and self-efficacy were on the high end. Social support not only had direct effect on sun protection behaviors ($\beta = 0.199$, $p = 0.010$) but also had indirect effect on sun protection behaviors ($\beta = 0.160$, $p < 0.001$) through self-efficacy. Health promoters should also involve families of skin cancer patients to increase efficacy of programs. There is evidence that skin cancer prevention information given by family members contributes to adoption of sun protection behaviors (Parrott & Lemieux, 2003). Similar to previous

studies finding (Nahar et al., 2013; Nahar et al., 2014), self -efficacy is related to sun protection behaviors ($\beta = 0.5$, $p < 0.001$), indicating that the higher the self-efficacy to engage in sun protections behaviors, the higher the likelihood of sun protection methods (Nahar et al., 2013). This suggest 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; Nahar et al., 2013).

Limitations

This research study has following limitations:

(1) Nonrandom sampling design. This limits generalizability of the findings. In future, researchers should consider random sampling to make results generalizable to NMSC patient population.

(2) Cross-sectional design. Therefore, temporality of relationships between IMB model constructs and sun protection behaviors cannot be established. In future, researchers should consider prospective design to establish directionality of the relationships.

(3) Self-reported data. Therefore, results could have been affected by recall and social desirability biases. In future, researchers should consider using objective measures for sun protection behaviors.

(4) One site data collection. This limits generalizability of this study findings. In future, researchers should consider larger sample from other states.

(5) Test-retest reliability 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.

Conclusion

Despite of these limitations, this is the first study, to the best of my knowledge, to assess utility of IMB model to predict sun protection in NMSC patients. Findings of this study demonstrated partial utility of IMB model in predicting sun protection behaviors among NMSC patients. The primary influencing factors of sun protection behavior among NMSC patients were self-efficacy and social support. Both social support and attitudes could contribute to sun protection behavior by indirectly affecting self-efficacy. Future research should use longitudinal research design to provide more insights of the relationships among IMB model.

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APPENDICES

APPENDIX A

Live Script for Questionnaire on Sun Exposure Distribution

Distributor: Have you completed a Questionnaire on Sun Exposure?
Participant: Yes or No
Distributor: If you would like to complete this questionnaire on sun exposure it is completely voluntary. Your name will be kept confidential, and any other identifying markers will be destroyed.

If you chose to complete the questionnaire - After you complete the questionnaire, please place it in the brown/white envelope and put it on the table.

If you refuse to participate entirely or If you want to stop while answering the questionnaire, please place it in the brown/white envelope and put it on the table.

If you have any questions, please do let me know.

Thank you for your time.

APPENDIX B

This section will ask **WHAT YOU KNOW ABOUT THE SUN PROTECTION AND SKIN CANCER RISK FACTORS**. Please read each of the following questions and check the correct answer. Please answer **ALL** questions if possible. If you are not certain of an answer, please select the "I don't know" response. Please choose only **ONE** answer per question. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

1. Which of the following is not a recommended way to reduce skin cancer risk?

◯ Wear clothing that has a tight weave
◯ Stay out of the sun from 10:00 am - 4:00 pm
◯ Sunbathing
◯ Wearing sunglasses
◯ I don't know

2. Sunscreen should be reapplied to skin approximately every 2 hours.

◯ True ◯ False ◯ I don't know

3. Eighty percent of sun damage occurs before the age of 18, so if I am older, it doesn't matter how much sun I get.

◯ True ◯ False ◯ I don't know

4. Sunscreens should be applied immediately before going out into the sun.

◯ True ◯ False ◯ I don't know

5. Experts suggest using sunscreen with a sun protection factor (SPF) of 15 or higher.

◯ True ◯ False ◯ I don't know

6. One should look for a sunscreen that offers both UVA and UVB protection.

◯ True ◯ False ◯ I don't know

7. If it is cold or cloudy outside, one does not need sun protection.

◯ True ◯ False ◯ I don't know

8. The sun's rays are the strongest at mid-day.

◯ True ◯ False ◯ I don't know

9. Most skin cancers can be prevented.

◯ True ◯ False ◯ I don't know

10. Which is not a way to prevent over-exposure to the sun?

◯ Use of a wide-brimmed hat
◯ Drink plenty of non-carbonated fluids
◯ Avoidance of the sun entirely
◯ Use of a long-sleeved shirt

◯ I don't know

11. Sunscreen only needs to be worn while at the beach or pool?

◯ True ◯ False ◯ I don't know

12. If you wear a hat you don't need to wear sunscreen?

◯ True ◯ False ◯ I don't know

Which of the following are <u>INCREASED RISK FACTORS RELATED TO SKIN CANCER?</u>

11. Having dark colored skin	◯ True	◯ False	◯ I don't know
12. A personal history of skin cancer	◯ True	◯ False	◯ I don't know
13. Having black or dark brown hair	◯ True	◯ False	◯ I don't know
14. Having blue or green eyes	◯ True	◯ False	◯ I don't know
15. Drinking alcohol regularly	◯ True	◯ False	◯ I don't know
16. A personal history of sunburns	◯ True	◯ False	◯ I don't know
17. The number or type of moles on the body	◯ True	◯ False	◯ I don't know
18. Smoking	◯ True	◯ False	◯ I don't know
19. Having freckles	◯ True	◯ False	◯ I don't know
20. Overexposure to the sun or UV radiation	◯ True	◯ False	◯ I don't know
21. Having a particular diet	◯ True	◯ False	◯ I don't know
22. A family history of skin cancer	◯ True	◯ False	◯ I don't know

This section will ask you about **YOUR BELIEFS REGARDING SKIN CANCER**. Please read each statement carefully and rate your response using the 5 point scale: **<u>1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.</u>** Please answer ALL questions if possible and choose only **ONE** answer per question. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

Please <u>CIRCLE</u> one answer for each statement below.	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. It is extremely likely that I will get skin cancer in the future	**1**	**2**	**3**	**4**	**5**
2. Because of my personal history, I am more likely to get skin cancer	**1**	**2**	**3**	**4**	**5**
3. There is a good possibility that I will get skin cancer in the next 10 years	**1**	**2**	**3**	**4**	**5**

4. I feel I will get skin cancer in the future	**1**	**2**	**3**	**4**	**5**
5. I am more likely than the average person to get skin cancer	**1**	**2**	**3**	**4**	**5**
6. My chances of getting skin cancer are great	**1**	**2**	**3**	**4**	**5**

This section will ask you about your **SUN PROTECTION BEHAVIORS.** Please read each question carefully and rate your response using the 5 point scale: **1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Always.** Please answer **ALL** questions if possible and choose only **ONE** answer per question. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

Please CIRCLE one answer for each statement below.

When in the sun for more than 15 minutes, HOW OFTEN DO YOU……..

	Never	**Rarely**	**Sometimes**	**Often**	**Always**
1…..seek shade?	**1**	**2**	**3**	**4**	**5**
2…..minimize sun exposure between 10 AM and 4 PM?	**1**	**2**	**3**	**4**	**5**
3…..wear a wide-brimmed hat?	**1**	**2**	**3**	**4**	**5**
4…..wear something on your head (any type of hat, cap, and visor)?	**1**	**2**	**3**	**4**	**5**
5…..wear sunscreen with SPF of 15 or higher to protect your skin from the sun?	**1**	**2**	**3**	**4**	**5**
6…..wear sunscreen with SPF of 15 or higher on your face?	**1**	**2**	**3**	**4**	**5**
7…..wear sunscreen with SPF of 15 or higher on all exposed areas of your body?	**1**	**2**	**3**	**4**	**5**
8…..wear clothing to protect your skin from the sun?	**1**	**2**	**3**	**4**	**5**
9…..wear a long-sleeved shirt or blouse?	**1**	**2**	**3**	**4**	**5**
10…..wear long pants or long skirt?	**1**	**2**	**3**	**4**	**5**
11…..wear sunglasses to protect your eyes from the sun?	**1**	**2**	**3**	**4**	**5**

2. Do you intend to SUNBATHE within the next 1 year?

◯ Yes ◯ No ◯ I don't know

3. Do you intend to use TANNING BOOTH or TANNING BED within the next 1 year?

◯ Yes ◯ No ◯ I don't know

4. Do you wear LESS or MORE sun protection during the cooler months than in summer?

○ Much less ○ Less ○ Same ○ More ○ Much more

5. For work or recreation, do you go out in the sun LESS or MORE during the cooler months than in summer?

○ Much less ○ Less ○ Same ○ More ○ Much more

This section will ask you about **HOW CONFIDENT YOU ARE TO PERFORM each of the following activities.** Please read each statement carefully and rate your response using the 5 point scale: **1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.** Please answer ALL questions if possible and choose only **ONE** answer per question. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

Please CIRCLE one answer for each statement below.

When in the sun for more than 15 minutes, I AM CONFIDENT OR CERTAIN THAT……

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1…..I can seek shade	1	2	3	4	5
2…..I can minimize sun exposure between 10 AM and 4 PM	1	2	3	4	5
3…..I can wear a wide-brimmed hat	1	2	3	4	5
4…..I can wear something on my head (any type of hat, cap, and visor)	1	2	3	4	5
5…..I can wear sunscreen with SPF of 15 or higher to protect my skin from the sun	1	2	3	4	5
6…..I can wear sunscreen with SPF of 15 or higher on my face	1	2	3	4	5
7…..I can wear sunscreen with SPF of 15 or higher on all exposed areas of my body	1	2	3	4	5
8…..I can wear clothing to protect my skin from the sun	1	2	3	4	5
9…..I can wear a long-sleeved shirt or blouse	1	2	3	4	5
10…..I can wear long pants or long skirt	1	2	3	4	5
	1	2	3	4	5

11…..I can wear sunglasses to protect my eyes from the sun

This section will ask you about your **ATTITUDES TOWARDS SUN PROTECTION.** In the following statements **SUN PROTECTION** means seeking shade, wearing protective clothing (e.g., wide-brimmed hat, long sleeved shirts or blouse, long pants or long skirts), using sunglasses, and applying sunscreen with a SPF of at least 15. Please read each statement carefully and rate your response using the 5 point scale: **1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.** Please answer ALL questions if possible and choose only **ONE** answer per question. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

Please CIRCLE one answer for each statement below.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Sun protection is very important for people with my history of cancer	1	2	3	4	5
2. Sunscreen is too expensive	1	2	3	4	5
3. If I use sun protection, I am less likely to get skin cancer	1	2	3	4	5
4. I have already had one or more skin cancers, so it is too late to use sun protection	1	2	3	4	5
5. I believe I should practice sun protection to reduce my chances of getting skin cancer	1	2	3	4	5
6. I look more attractive when I have a suntan.	1	2	3	4	5
7. By using sun protection methods I can prevent myself getting another skin cancer	1	2	3	4	5
8. Sun protective clothing is too hot to wear	1	2	3	4	5
9. Whether or not a person develops skin cancer is related to how frequently they use sun protection	1	2	3	4	5
10. Sunscreen takes too long to apply	1	2	3	4	5
11. Using sun protection is a part of overall good health care	1	2	3	4	5
12. I often forget to use sun protection methods	1	2	3	4	5
13. Using sun protection would provide me peace of mind about my health	1	2	3	4	5
14. Sunscreen is messy	1	2	3	4	5
15. If people used sun protection, they wouldn't be as likely to get skin cancer	1	2	3	4	5

16. I do not worry about sun protection because I did so much damage to my skin when I was younger.	**1**	**2**	**3**	**4**	**5**

This section will ask you about **SUPPORT THAT WOULD BE AVAILABLE TO YOU TO ENGAGE IN SUN PROTECTION.** Please read each statement carefully and rate your response using the 5 point scale: **1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.** Please answer ALL questions if possible and choose only **ONE** answer per question. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

Please CIRCLE one answer for each statement below.

Most people who are important to me,
THINK THAT WHEN I AM IN THE SUN…..

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1…..I should seek shade	**1**	**2**	**3**	**4**	**5**
2…..I should minimize sun exposure between 10 AM and 4 PM	**1**	**2**	**3**	**4**	**5**
3…..I should wear a wide-brimmed hat	**1**	**2**	**3**	**4**	**5**
4…..I should wear something on my head (any type of hat, cap, and visor)	**1**	**2**	**3**	**4**	**5**
5…..I should wear sunscreen with SPF of 15 or higher to protect my skin from the sun	**1**	**2**	**3**	**4**	**5**
6…..I should wear sunscreen with SPF of 15 or higher on my face	**1**	**2**	**3**	**4**	**5**
7…..I should wear sunscreen with SPF of 15 or higher on all exposed areas of my body	**1**	**2**	**3**	**4**	**5**
8…..I should wear clothing to protect my skin from the sun	**1**	**2**	**3**	**4**	**5**
9…..I should wear a long-sleeved shirt or blouse	**1**	**2**	**3**	**4**	**5**
10…..I should wear long pants or long skirt	**1**	**2**	**3**	**4**	**5**
11…..I should wear sunglasses to protect my eyes from the sun	**1**	**2**	**3**	**4**	**5**

This section will ask your **PERSONAL DETAILS.** Please read each of the following questions and check the answer that is most appropriate for you. Please answer **ALL** questions if possible. If you are not certain of an answer, please select the "I don't know" response. Please choose only **ONE** answer per question unless otherwise stated. **YOUR RESPONSES ARE IMPORTANT AND WILL BE KEPT ANONYMOUS.**

1. What is your gender? ◯ Male ◯ Female

2. What is your age?

_____ **years**

3. What is your marital status?

◯ Married ◯ Never married ◯ Divorced/separated
◯ Widow, widower ◯ Living with partner ◯ I don't know

4. What is the highest grade of school or year of college you have completed?

◯ Less than elementary school (Grade 8 or less) ◯ Less than high school (Grade 11 or less)
◯ High school diploma (including GED) ◯ Assoc. degree (2 year)
◯ Bachelor's degree ◯ Graduate or professional degree
◯ I don't know

5. If you added together the yearly incomes, before taxes, of all the members of your household for last year, 2014, would the total be:

◯ Less than $20,000 ◯ $21,000 to $30,000 ◯ $31,000 to $40,000 ◯ $41,000 to $50,000
◯ $51,000 to $60,000 ◯ $61,000 to $70,000 ◯ $71,000 to $80,000 ◯ $81,000 to $90,000
◯ $91,000 to $100,000 ◯ $101,000 or more ◯ I don't know

6. Do you have health insurance coverage?

◯ Yes ◯ No ◯ I don't know

7. What is your natural hair color?

◯ Blonde ◯ Red ◯ Medium brown
◯ Dark brown ◯ Light brown ◯ Black
◯ I don't know

8. What is your eye color?

◯ Brown ◯ Green/Hazel ◯ Grey
◯ Black ◯ Blue ◯ I don't know

9. How would you describe your untanned skin color?

◯ Very white ◯ White ◯ Olive/Dark white
◯ Light Brown ◯ Dark Brown ◯ Black
◯ I don't know

10. Which of the following best describes your skin's usual reaction to your first exposure to summer sun, without sunscreen, for one-half hour at midday?

◯ Always burn, never tans ◯ Usually burn, tans with difficulty

◯ Sometimes mild burn, gradually tans to a light brown
◯ Rarely burn, tan with ease to a moderate brown
◯ Very rarely burns, tans very easily
◯ Never burns, tans very easily, deeply pigmented
◯ I don't know

11. How many moles do you think you have on your body? Include any moles that have been removed. <u>Moles are spots on your skin that are tan, brown, or skin colored, that do not come and go with sun exposure.</u>

◯ None ◯ Few ◯ Many ◯ I don't know

12. How many freckles do you think you have on your body? <u>Freckles are flat small tan or light-brown spots.</u>

◯ None ◯ Few ◯ Many ◯ I don't know

13. What AGE were you when your first skin cancer was diagnosed?

_____ years

14. Location of skin cancer on your body? (please check as may circles as apply to you)

◯ Head ◯ Neck ◯ Trunk ◯ Arms ◯ Legs
◯ I don't know

15. How many skin cancers have you had removed?

◯ 1 ◯ 2 ◯ 3-5 ◯ 6-10 ◯ More than 10
◯ I don't know

16. How many times did you have blistering sunburns (when your skin burns and peels) after your first diagnosed skin cancer?

◯ None ◯ 1 ◯ 2 ◯ 3-5 ◯ 6-10
◯ More than 10 ◯ I don't know

17. Number of lifetime blistering sunburns (when your skin burns and peels):

◯ None ◯ 1 ◯ 2 ◯ 3-5 ◯ 6-10
◯ More than 10 ◯ I don't know

18. Has anyone in your immediate family (mother, father, brother, sister, child) been diagnosed with skin cancer?

◯ Yes ◯ No ◯ I don't know

19. In your opinion, how sensitive is your skin to the sun?

◯ Extremely sensitive ◯ Mildly sensitive ◯ Moderately sensitive
◯ Not sensitive at all ◯ I don't know

20. How would you describe your job?

◯ Indoor worker ◯ Part time outdoor worker ◯ Full time outdoor worker
◯ I don't know

21. What is the average number of hours you spend out in the sun on a <u>weekday</u>, between 10 AM and 4 PM?

◯ None ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6
◯ I don't know/not applicable as no current outdoor work

22. What is the average number of hours you spend out in the sun on a <u>weekend</u> OR <u>day off</u>, between 10 AM and 4 PM?

◯ None ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6
◯ I don't know

20. How many visits with a dermatologist you had in the last three years?

◯ 1 ◯ 2 ◯ 3-5 ◯ 6-10 ◯ More than 10 ◯ I don't know

21. How many physician (non-dermatology) visits you had in the last three years?

◯ 1 ◯ 2 ◯ 3-5 ◯ 6-10 ◯ More than 10 ◯ I don't know

VITAE

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ACADEMIC RECORD

Doctor of Philosophy, 2016 (Anticipated Graduation)
Major Area: Health Behavior and Promotion
Cognate Area: Research Methods and Statistics
Department of Health, Exercise Science & Recreation Management
School of Applied Sciences
University of Mississippi
Dissertation: Utility of Information-Motivation-Behavioral Skills Model in Measuring and Predicting Sun Protection Behaviors among Skin Cancer Patients.

Interdisciplinary Graduate Certificate in Applied Statistics, 2015
Graduate School
University of Mississippi
18 semester hours

Master of Science in Health Promotion, 2013
Department of Health, Exercise Science & Recreation Management
School of Applied Sciences
University of Mississippi
Thesis: Skin Cancer Knowledge, Beliefs, Self-efficacy, and Preventative Behavior among North Mississippi Landscapers.

Doctor of Medicine, 2008
School of Medicine
Vitebsk State Medical University
Republic of Belarus

ACADEMIC POSITIONS

Teacher Trainee, 2016 (Spring & Summer)
Department of Health, Physical Education, and Exercise Science
School of Allied Health Sciences
Lincoln Memorial University

Affiliate Clinical Faculty, 2015 (Spring) - Present
(90% Research; 10% Education)
Department of Dermatology
School of Medicine
University of Mississippi Medical Center
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Graduate Teaching Instructor, 2010 - 2015 (Fall)
Department of Health, Exercise Science & Recreation Management
School of Applied Sciences
University of Mississippi

Research Assistant, 2010 - 2015 (Fall)
Health Behavior and Promotion
Department of Health, Exercise Science & Recreation Management
School of Applied Sciences
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Research Assistant, 2010 - 2015 (Fall)
Bone Density Laboratory
Department of Health, Exercise Science & Recreation Management
School of Applied Sciences
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AWARDS/HONORS

2016	***2015-2016 Class Who's Who Honor Recipient***, University of Mississippi
2015	***Three Minute Thesis Competition Round 1 Winner (Finalist)***, University of Mississippi
2015	***Top Poster Submission Award***, Mississippi Public Health Association Annual Conference
2015	***Graduate Student Council Research Award***, University of Mississippi
2015	***First Prize in Graduate Student Council Poster Presentation***, University of Mississippi
2015	***Graduate School Dissertation Fellowship***, University of Mississippi
2015	***Graduate Achievement Award in Health, Exercise Science and Recreation Management***, University of Mississippi Honors Convocation
2014	***School of Applied Sciences Student of Month***, University of Mississippi http://sas.olemiss.edu/2014/10/27/students-of-the-month-vinayak-k-nahar-and-fredrick-gray/
2013	***School of Applied Sciences Student of Month***, University of Mississippi http://sas.olemiss.edu/applied-sciences-student-of-the-month/
2013	***First Prize in Graduate Student Council Poster Presentation***, University of Mississippi
2012	***Kevser Ermin Professional Development Award***, University of Mississippi
2012	***Graduate Student Travel Grant Award***, University of Mississippi
2012	***Graduate Assistantship Award,*** Doctoral Program, University of Mississippi
2011	***H. Leon Garrett Achievement Award in Health Promotion***, University of Mississippi Honors Convocation
2010	***Graduate Assistantship Award,*** Master's Program, University of Mississippi
2004	***Honored as bonafide, diligent and disciplined student throughout academic course***, Vitebsk State Medical University

PUBLICATIONS *Reflects corresponding author

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32. **Nahar, V. K.**, ……
The contents are embargoed until after publication. ……, *(In Press).*

31. Ford, M. A., Haskins M. A., & **Nahar, V. K.** Does Adherence to a Motivational Counseling Program Impact Weight Loss. *International Journal of Health Sciences, (In Press).*

30. Sharma, M., Knowlden, A. P., & ***Nahar, V. K.** Applying a New Theory to Alter Binge Drinking Behavior in College Students. *Family and Community Health, (In Press).*

29. Knowlden, A. P., Sharma, M., & ***Nahar, V. K.** Using Multi-Theory Model of Health Behavior Change to Predict Adequate Sleep Behavior. *Family and Community Health, (In Press).*

28. Sharma, M., Catalano, H. P., ***Nahar, V. K.**, Lingam, V., Johnson, P., & Ford, M. A. Using Multi-Theory Model of Health Behavior Change to Predict Portion Size Consumption among College Students. *Health Promotion Perspectives, (In Press).*

27. ***Nahar, V. K.**, Mayer, J. E, & Grant-Kels, J. M. The Case for Skin Cancer Screening with Total Body Skin Exams. *JAMA Oncology, (In Press).*

26. Davis, A. B., ***Nahar, V. K.**, Brodell, R. T. & Jacks, S. K. (2016). Top 10 Facts You Need to Know about Melanoma. *Journal of the Mississippi State Medical Association, (In Press).*

25. Abe, T., Loenneke, J. P., **Nahar, V. K.**, Ford, M. A., Bass, M. A., Owens, S. G., & Loftin, M. (2016). Site-specific Associations of Muscle Thickness with Bone Mineral Density in Middle-aged and Older Men and Women. *Physiology International, 103*(2):202-210.

24. ***Nahar, V. K.**, Sharma, M., Catalano, H. P., Ickes, M. J., Johnson, P., & Ford, M. A. Testing Multi-Theory Model in Predicting Initiation and Sustenance of Physical Activity Behavior among College Students. *Health Promotion Perspectives, 6*(2):58-65.

23. ***Nahar, V. K.** (2016). Sunburn and Sun-Protective Behaviors Among Adults With and Without Previous Nonmelanoma Skin Cancer (NMSC): A Population-Based Study-Commentary. *Dermatology PracticeUpdate,* Available from http://www.practiceupdate.com/content/sunburn-and-sun-protective-behaviors-among-adults-with-and-without-previous-nonmelanoma-skin-cancer/39677/65/4/1

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22. ***Nahar, V. K.**, Ford, M. A., Brodell, R. T., Boyas, J. F., Jacks, S. K., Biviji-Sharma, R. Haskins M. A., & 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.

21. Aloia C.R., Shockey T. A., ***Nahar, V. K.**, & Knight K. B. Pertinence of the Recent School-Based Nutrition Interventions Targeting Fruit and Vegetable Consumption in US: A Systematic Review (2016). *Health Promotion Perspectives, 6*(1), 1-9.

20. Boyas, J. F., **Nahar, V. K.**, & Brodell, R. T. (2016). Skin Protection Behaviors among Young Male Latino Day Laborers: An Exploratory Study Using a Social Cognitive Approach. *Dermatology Research and Practice,* 1-10.

19. ***Nahar, V. K.** (2015). Addressing Factors Influencing Skin Cancer Prevention Behaviors among Outdoor Workers. *Connect Newsletter - Myrlie Evers-Williams Institute for the Elimination of Health Disparities*, *1*(10), 3. Available from https://www.umc.edu/uploadedFiles/UMCedu/Content/Administration/Centers_and_Institutes/EversWilliams_Institute/Newsletter/Connect%20Volume%201%20Issue%2010.pdf

18. Abe, T., Loenneke, J. P., **Nahar, V. K.**, Ford, M. A., Bass, M. A., Owens, S. G., & Loftin, M. Bone Mineral Density in Master Cyclists: A 2-year Follow-up Study. (2015). *Journal of Aging Research & Clinical Practice, 4*(4), 226-229.

17. Vice, M. A., ***Nahar, V. K.**, Ford, M. A., Bass, M., Johnson, A. K., Davis, A. B., & Biviji-Sharma, R. (2015). Risk Factors for Low Bone Mineral Density in Institutionalized Individuals with Developmental Disabilities. *Health Promotion Perspectives, 5*(2), 147-152.

16. ***Nahar, V. K.**, Ford, M. A., Jacks, S. K., Thielen, S., 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), 568-575.

15. Johnson, A. K., Ford, M. A., Jones, T. L., **Nahar, V. K.**, & Hallam, J. S. (2015). Predictors of Bone Mineral Density in African-American and Caucasian College-Aged Women. *Health Promotion Perspectives, 5*(1), 14-23.

14. ***Nahar, V. K.** (2015). Patterns of Sunscreen Use among US Adults-Commentary. *Dermatology PracticeUpdate,* Available from http://www.practiceupdate.com/content/patterns-of-sunscreen-use-among-us-adults/25784

13. Abe, T., Loenneke, J. P., Young, K. C., Thiebaud R. S., **Nahar, V. K.**, Patterson, K. M., Stover, Ford, M. A., Bass, M. A., & Loftin, M. (2015). Validity of Ultrasound Prediction

Equations for Total and Regional Muscularity in Middle-aged and Older Men and Women. *Ultrasound in Medicine and Biology, 41*(2), 557-564.

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12. ***Nahar, V. K.**, Ford, M. A., Boyas, J. F., Brodell, R. T. Hutcheson, A., Davis, R.E., Beason, K.R., Bass, M. A., & Biviji-Sharma, R. (2014). Skin Cancer Preventative Behaviors in State Park Workers: A Pilot Study. *Environmental Health and Preventive Medicine, 19*(6), 467-474.

11. Abe, T., **Nahar, V. K.**, Young, K. C. Patterson, K. M., Stover, C. D., Lajza, D. G., Tribby, A. C., Geddam, D. A., Ford, M. A., Bass, M. A., & Loftin, M. (2014). Skeletal Muscle Mass, Bone Mineral Density and Walking Performance in Masters Cyclists. *Rejuvenation Research, 17*(3), 291-296.

10. Hobbs, C., ***Nahar, V. K.**, Ford, M. A., Bass, M. A., & Brodell, R. T. (2014). Skin Cancer Knowledge, Attitudes, and Behaviors of Collegiate Athletes. *Journal of Skin Cance*r, 1-7.

9. ***Nahar, V. K.** (2013). Skin Cancer Prevention among School Children: A Brief Review. *Central European Journal of Public Health, 21*(4), 227-232.

8. ***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.

7. Abe, T., Dabbs, N. C., **Nahar, V. K.,** Ford, M. A., Bass, M. A., & Loftin, M. (2013). Relationship between Dual-energy X-ray Absorptiometry-derived Appendicular Lean Tissue Mass and Total Body Skeletal Muscle Mass Estimated by Ultrasound. *International Journal of Clinical Medicine, 4*(6), 283-286.

6. ***Nahar, V. K.**, Ford, M. A., Hallam, J. S., Bass, M. A., & Vice, M. A. (2013). Socio-Demographic and Psychological Correlates of Sun Protection Behaviors among Outdoor Workers: A Review. *Journal of Skin Cancer,* 1-10.

5. ***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,* 1-7.

4. ***Nahar, V. K.** (2012). Health Promotion Across the World: Challenges and Future. *Indian Journal of Public Health Research and Development, 3*(4), 236-240.

PAPERS SUBMITTED FOR PUBLICATION (UNDER REVIEW)

3. **Nahar, V. K.**, Rosenthal, M., Lemon, S. C., Kane, K., Cheng, J., Oleski, J.L., Li, W., Hillhouse, J. J., & Pagoto, S. L. Youth access to indoor tanning salons in urban versus rural/suburban communities.

2. Blair, L., Aloia, C.R., Valliant, M.W., Chang, Y., Knight, K.B., Garner, J.C., & ***Nahar, V.K.** Association between Athletic Participation and the Risk of Eating Disorder and Body Dissatisfaction in College Students.

1. Sharma, M., Lingam, V., & ***Nahar, V. K.** A systematic review of yoga interventions as alternative and complementary treatment in breast cancer.

MANUSCRIPTS IN PROGRESS

6. **Nahar, V. K.**, Sharma, M., Jacks, S. K., Brodell, R. T., Atfi, A., Duhé, R. J., Ford, M. A., & Aloia, C. R. Skin Cancer Risk and Preventative Behaviors among Attendees of a Free Skin Cancer Screening.

4. Boyas, J. F & **Nahar, V. K.** Predictors of Sun Protective Behaviors among Latino Day Laborers.

3. **Nahar, V. K.**, Ford, M. A., Brodell, R. T., Bass, M. A., & Jacks, S. K. Utility of Information-Motivation-Behavioral Skills Model in Measuring and Predicting Sun Protection Behaviors among Skin Cancer Patients.

2. Nelson, K., **Nahar, V. K.**, Ford, M. A., Bass, M. A., Garner, J. C., & Haskins M. A. Osteoporosis Risk Factors and Bone Mineral Density among Asian Indian Population in North Mississippi.

1. **Nahar, V. K.**, Ford, M. A. Haskins M. A., & Bass, M. Osteoporosis Health Beliefs, Knowledge, Preventive Behaviors, among Asian Indian Population in North Mississippi.

PUBLISHED ABSTRACTS

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8. Sharma, M., & **Nahar, V. K., &** Lingam, V. (2016). Sharma, M., & **Nahar, V. K., &** Lingam, V. A Systematic Review of Yoga Interventions as Alternative and Complementary Treatment in Breast Cancer. *American Public Health* Association, Session 4357. (Abstract available from: https://apha.confex.com/apha/144am/meetingapp.cgi/Paper/340157)

7. Sharma, M., Lingam, V., & **Nahar, V. K.** Yoga as an Integrative Therapy for Breast Cancer. *Journal of Alternative and Complementary Medicine*, P05.67. (Abstract available from: http://online.liebertpub.com/doi/full/10.1089/ACM.2016.29003.abstracts)

6. Johnson, A. K., Ford, M. A., **Nahar, V. K.**, & Jones, T. L. (2015). Physical Activity Predicts BMD in African-American and Caucasian College-Age Women. *Medicine and Science in Sports and Exercise*, 47, 5.

5. **Nahar, V. K.**, Abe, T., Young, K. C., Patterson, K. M., Stover, C. D., Lajza, D. G., Tribby, A. C., Geddam, D. A., Ford, M. A., Bass, M. A., & Loftin, M. (2014). Absolute and Relative Skeletal Muscle Mass and Bone Mineral Density in Masters Cyclists and Moderately Active Young Men. *Medicine and Science in Sports and Exercise*, 46, 5.

4. Ford, M. A., **Nahar, V. K.**, Bass, M. A., Vice, M. A., Davis, R. E., & Hutcheson, A. (2014). Influences on bone mineral density among Asian Indians Residing in the US. *Medicine and Science in Sports and Exercise*, 46, 5.

3. Bass, M. A., Bankston, T., Ford, M. A., Valliant M. W., & **Nahar, V. K.** (2014). The Effect of Carbonated Soft Drinks on Bone Mineral Density in College Age Women. *Medicine and Science in Sports and Exercise*, 44(2), 5S.

2. **Nahar, V. K.**, Ford, M. A., Hallam, J. S., Bass, M., & Hutcheson, A. (2013). Skin Cancer Knowledge, Beliefs, Self-Efficacy, and Preventative Behaviors among North Mississippi Landscapers. *American Public Health* Association, Session 3304.2. (Abstract available from: https://apha.confex.com/apha/141am/webprogram/Paper277107.html)

1. Vice, M. A., **Nahar, V. K.**, Bass, M., & Ford, M. A. (2012). Risk Factors for Low Bone Mineral Density in Institutionalized Individuals with Developmental Disabilities. *Medicine and Science in Sports and Exercise*, 44(2), 5S.

PRESENTATIONS

National Level

14. Sharma, M., Lingam, V., & **Nahar, V. K.** "Yoga as an Integrative Therapy for Breast Cancer." *International Congress on Integrative Medicine & Health*, Annual Meeting, Las Vegas, NV, May, 2016.

13. Ball, S. A., **Nahar, V. K.**, & Ford, M. A. "Predictors of Sleep Quality among University Students in the Southeastern US: A Cross-Sectional Study." *Society for Public Health Education*, Annual Meeting, Charlotte, NC, April, 2016.

12. Johnson, A. K., Ford, M. A., **Nahar, V. K.**, & Jones, T. L. "Physical Activity Predicts BMD in African-American and Caucasian College-Age Women." *American College of Sports Medicine*, Annual Meeting, San Diego, CA, May, 2015.

11. Haskins, M. A., Ford, M. A., Morgan, R.G., & **Nahar, V.K. "**Adherence to On-campus Motivational Counseling Program Impacts Students' Weight Loss." *Society for Public Health Education*, Annual Meeting, Portland, OR, April, 2015.

10. **Nahar, V. K.**, Abe, T., Young, K. C., Patterson, K. M., Stover, C. D., Lajza, D. G., Tribby, A. C., Geddam, D. A., Ford, M. A., Bass, M. A., & Loftin, M. "Absolute and Relative Skeletal Muscle Mass and Bone Mineral Density in Masters Cyclists and Moderately Active Young Men." *American College of Sports Medicine*, Annual Meeting, Orlando, FL, May - June, 2014

9. Ford, M. A., **Nahar, V. K.**, Bass, M. A., Vice, M. A., Davis, R. E., & Hutcheson, A. "Influences on bone mineral density among Asian Indians Residing in the US." *American College of Sports Medicine*, Annual Meeting, Orlando, FL, May - June, 2014.

8. Bass, M. A., Bankston, T., Ford, M. A., Valliant M. W., & **Nahar, V. K.** "The Effect of Carbonated Soft Drinks on Bone Mineral Density in College Age Women." *American College of Sports Medicine*, Annual Meeting, Orlando, FL, May - June, 2014.

7. **Nahar, V. K.**, Ford, M. A., Hallam, J. S., Bass, M., & Hutcheson, A. "Skin Cancer Knowledge, Beliefs, Self-Efficacy, and Preventative Behaviors among North Mississippi Landscapers." *American Public Health* Association, Annual Meeting, Boston, MA, November, 2013.

6. Vice, M. A., **Nahar, V. K.**, Ford, M. A., & Bass, M. "Risk Factors for Low Bone Mineral Institutionalized Individuals with Developmental Disabilities." *American College of Sports Medicine*, Annual Meeting, San Francisco, CA, May - June, 2012.

Local Level

5. **Nahar, V. K.**, Ford, M. A., Jacks, S. K., Brodell, R. T., Boyas, J. F., Cromeans, E. M., Haskins M. A., & Bass, M. A. "Prevalence of sunscreen use and related factors among College Students in the Southeastern US: A Cross-sectional Study." *Mississippi Public Health Association*, Annual Conference, Jackson, MS, October, 2015.

4. Ford, M. A., **Nahar, V. K.**, Nelson, K. Bass, M. A., & Garner, J. C. "Predictors of Bone Mineral Density among Asian Indians in North Mississippi: A Pilot Study." *Mississippi Public Health Association*, Annual Conference, Jackson, MS, October, 2015.

3. Boyas, J. F., **Nahar, V. K.**, & Brodell, R. T. "Exploring Skin Cancer knowledge, Beliefs, and Preventive Behaviors of Latino Day Laborers." *Mississippi Public Health Association*, Annual Conference, Jackson, MS, October, 2015.

2. **Nahar, V. K.**, Ford, M. A., Brodell, R. T., Boyas, J. F., Jacks, S. K., Haskins M. A., & Bass, M. A. (2015). "Compliance with Sun Protection and Screening Practices among Melanoma Survivors: A Systematic Review." *Graduate Student Council Poster Presentation*, University of Mississippi, April, 2014.

1. **Nahar, V. K.**, Ford, M. A., Boyas, J. F., Brodell, R. T. Hutcheson, A., Davis, R.E., Beason, K.R., & Bass, M. A. "A Health Belief Model Approach to Assess Sun Protection Behaviors among State Park Workers." *Graduate Student Council Poster Presentation*, University of Mississippi, April, 2014.

ACCEPTED ABSTRACTS FOR PRESENTATIONS

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1. Sharma, M., & **Nahar, V. K., &** Lingam, V. A systematic review of yoga interventions as alternative and complementary treatment in breast cancer. *American Public Health* Association, Annual Meeting, Denver, CO, November, 2016.

2. **Nahar, V. K.**, Sharma, M., Jacks, S. K., Brodell, R. T., Atfi, A., Duhé, R. J., Ford, M. A., & Aloia, C. R. Skin Cancer Risk and Preventative Behaviors among Attendees of a Free Skin Cancer Screening. *Health, Wellness & Society Conference*, Annual Meeting, Washington, DC, October, 2016.

3. **Nahar, V. K.**, Sharma, M., Jacks, S. K., Brodell, R. T., Catalano H. P., Grigsby T. B., Ford, M. A. & Bass, M. A. Tanning Bed Use among Collegiate Athletes in the Southern United States. *Health, Wellness & Society Conference*, Annual Meeting, Washington, DC, October, 2016.

4. Bass, M. A., **Nahar, V. K.**, Ford, M. A., Sharma, M., & Shaikh, M. S. Assessing Osteoporosis Related Knowledge and Perceptions in Younger Populations. *Health, Wellness & Society Conference*, Annual Meeting, Washington, DC, October, 2016.

5. Sharma, M., Catalano H. P., **Nahar, V. K.**, Lingam, V., Johnson, P. & Ford, M. A. Instrument Development to Predict Portion Size Behavior in College Students. *Health, Wellness & Society Conference*, Annual Meeting, Washington, DC, October, 2016.

FUNDED GRANTS

Utility of Information-Motivation-Behavioral Skills Model in Measuring and Predicting Sun Protection Behaviors among Skin Cancer Patients, 2015
Department of Health, Exercise Science & Recreation Management
University of Mississippi
Investigators: **Nahar, V. K.**, Ford, M. A., & Brodell, R. T.
Role: Principal Investigator
Funded: $1,000.00

The impact of appearance-based educational intervention on skin cancer preventive behavior of skin cancer survivors, 2015
Graduate Student Council Research Grant
University of Mississippi
Investigators: **Nahar, V. K.**, Ford, M. A., & Brodell, R. T.
Role: Principal Investigator
Funded: $1,000.00

Latino Day Laborers in Mississippi: Exploring Skin Cancer Preventive Behaviors through a Social Cognitive Approach, 2014
School of Applied Sciences
University of Mississippi
Investigators: Boyas, J. F. & **Nahar, V. K.**
Role: Co - Principal Investigator
Funded: $4,200.00

Skin Cancer Prevention Program for University of Mississippi Landscapers, 2013
Graduate Student Council Research Grant
University of Mississippi
Investigators: **Nahar, V. K.** & Ford, M. A.
Role: Principal Investigator
Funded: $1,000.00

Sun Protection Behaviors of Park and Recreation Professionals in Mississippi, 2012
Department of Health, Exercise Science & Recreation Management
University of Mississippi
Investigators: **Nahar, V. K.** & Ford, M. A.
Role: Principal Investigator
Funded: $500.00

UNFUNDED GRANTS

The impact of appearance-based intervention on skin cancer knowledge, risk perceptions, and preventive behavior of skin cancer survivors, 2015
Intramural Research Support Program
University of Mississippi Medical Center
Investigators: Brodell, R. T. & **Nahar, V. K.**
Role: Co - Principal Investigator
Requested: 29,972.00

Testing the efficacy of a multi-theory model (MTM) based physical activity promotion intervention in college students, 2016
Institutional Mini-Grants Program
Lincoln Memorial University
Investigators: **Nahar, V. K.** & Sharma, M.
Role: Principal Investigator
Requested: $6,940.00

Using multi-theory model (MTM) of health behavior change to develop a scale to predict relaxation behavior instead of anxiety behavior in college students, 2016
Stress Measurement Network
National Institute of Aging
Investigators: Sharma, M. **Nahar, V. K.**, Hayes, T., & Lingam, V
Role: Consultant
Requested: $9,899.28

TEACHING EXPERIENCE

Lincoln Memorial University

Graduate (3 - Hour Credit Courses)

LSCI 683 - Graduate Research Project *(1 Semester)*

- *This course exposes graduates to current research methods and writing in the area of public health. Specifically, students will develop a working knowledge of how to interpret published research, design research, data interpretation, and present research in a scientific format. Students will learn the basic concepts of research and the research process.*

Undergraduate (3 - Hour Credit Courses)

PEXS 485 - Research Methods *(1 Semester)*

- *The main objective of this course was to introduce students to important concepts of research methodology and commonly used statistical techniques in the area of health and exercise science.*

HLTH 365 - Epidemiology *(1 Semester)*

- *This course offered an introduction to the basic concepts and principals of epidemiology. The design, analysis, and interpretation of epidemiological studies are covered in this course.*

HLTH 350 - Health Economics *(1 Semester)*

- *This course was designed to provide economic concepts that are used to analyze health, the market for health care and how economics should be used to set healthcare policies.*

HLTH 350 - Grant Writing and Procurement *(1 Semester)*

- *The goal of this course is to have students produce a grant proposal that will be submitted to a funding agency for consideration. Students will learn the various sections of a grant proposal including specific aims, background and significance, methodology, expected results and outcomes, and justification of proposed budget.*

Teaching Experience (continued)

University of Mississippi

Graduate (3 - Hour Credit Courses)

EDRS 701 - Educational Statistics - II ***PhD level** (1 Semester) **Teaching Assistant of Dr. Michael V. Namorato, Professor, Department of History, College of Liberal Arts***

- *SPSS data analysis and interpretation: Entering, exploring, handling data in SPSS; Tests of difference for two sample designs; Tests of nominal data; Tests of correlations; Analysis of variance; Analysis of covariance; Multiple regressions; Factor analysis.*

EDRS 601 - Educational Statistics - I ***Masters and PhD level** (1 Semester) **Teaching Assistant of Dr. Michael V. Namorato, Professor, Department of History, College of Liberal Arts***

- *Organizing and graphing data; Describing distributions; Sampling, probability, and sampling distributions; Hypothesis testing; Tests of difference for two sample designs; Tests of nominal data; Tests of correlations; Analysis of variance; Multiple regressions.*

Undergraduate (3 - Hour Credit Courses)

HP 191 - Personal and Community Health *(8 Semesters)*

- *A comprehensive health course including principles and practices of healthful living for the individual and community; major health problems; responsibilities of home, school, health agencies*.

ES 396 - Medical Terminology *(1 Semester)*

- *This course offered an introduction to medical terms through an examination of their composition, focusing on prefixes, suffixes, word roots and their combined forms by review of each body system and specialty area.*

HP 312 - Behavioral Aspects of Weight Management ***Web - based** (4 Semesters)*

- *An examination of different behavioral aspects of weight loss and weight gain. Several methods will be discussed and insight will be provided into the healthy approach of weight loss and weight gain.*

Teaching Experience (continued)

University of Mississippi

Undergraduate (3 - Hour Credit Courses)

ES 351 - Measurement & Statistics in Exercise Science *(4 Semesters)*

- *This course was a study of statistical techniques and measurement theory with emphasis upon their application to Exercise Science and related areas.*

HP 203 - First Aid and CPR *(3 Intersessions)*

- *Safety instruction and practices in the methods as prescribed in the American Red Cross Standard and advanced courses.*

University of Mississippi

Undergraduate (1 - Hour Credit Courses)

EL 124 - Racquetball *(4 Semesters)*

- *The course covered rules and skills associated with racquetball and provided the student with knowledge to pursue the sport on his/her own.*

EL 156 - Jogging *(4 Semesters)*

- *Exercise course designed to teach the fundamentals, technique, and benefits of jogging. This course provided opportunity to enhance students' jogging endurance and skills.*

PROFESSIONAL MEMBERSHIPS

Myrlie Evers-Williams Institute for the Elimination of Health Disparities, University of Mississippi Medical Center ***Affiliate Member***

Mississippi Partnership for Comprehensive Cancer Control (MP3C) Coalition ***Member***

Mississippi Public Health Association (MPHA) ***Student Member***

American Public Health Association (APHA) ***Student Member***

Republic of Belarus Medical Council ***Member***

PROFESSIONAL CONFERENCES/MEETINGS ATTENDED

Mississippi Public Health Association (MPHA), Annual Conference, Jackson, MS (2015)

American Public Health Association (APHA), Annual Meeting, Boston, MA (2013)

American College of Sports Medicine (ACSM), Annual Meeting, San Francisco (2012), CA; Orlando, FL (2014)

PROFESSIONAL SERVICE

Papers Reviewed for Journals

British Journal of Cancer *(1 Paper)*

British Journal of Education, Society & Behavioral Science *(2 Papers)*

British Journal of Medicine and Medical Research *(1 Paper)*

California Journal of Health Promotion *(2 Papers)*

Clinical and Experimental Dermatology *(1 Paper)*

Clinical Medicine Insights - Pediatrics (1 Paper)

Family and Community Health *(1 Paper)*

Food and Public Health *(1 Paper)*

International Journal of Behavioral Medicine *(1 Paper)*

International Journal of Environmental Research and Public Health *(2 Papers)*

International Journal of Health Promotion and Education *(1 Paper)*

International Journal of Tropical Disease and Health *(1 Paper)*

Journal of Behavioral Health Services & Research *(1 Paper)*

Journal of Carcinogenesis & Mutagenesis *(1 Paper)*

Journal of Environmental Health (1 Paper)

Professional service (continued)

Papers Reviewed for Journals

Journal of International Research in Medical and Pharmaceutical Sciences *(1 Paper)*

Journal of Trainology *(1 Paper)*

Patient Intelligence (3 *Paper*s)

Photodermatology, Photoimmunology & Photomedicine *(1 Paper)*

Public Health Research *(1 Paper)*

Abstracts Reviewed for Conferences

American Public Health Association (APHA), 143rd Annual Meeting, 2015 *(8 Abstracts)*
Australian Health Promotion Association, 21st National Conference, 2013 *(10 Abstracts)*

Other

Skin Cancer Screening, Cancer Institute and Department of Dermatology, University of Mississippi Medical Center, 2015 ***Coordinator***

Building Bones for Mothers and Daughters: A Community Event, Oxford, Mississippi, 2013 ***Coordinator***

Employee Health Fair, University of Mississippi, 2011, 2012 ***Coordinator***

UNIVERSITY SERVICE

Program Proposal Member: Masters of Public Health, Lincoln Memorial University, 2016

Graduate Student Advisor: Honors Thesis: Student Awareness of Genetically Modified Foods and the Related Health Risks: Differences Between American and European Students. Student Name-Maggie Hall, School of Liberal Arts, University of Mississippi, 2015 (Thesis Chair: Milorad M. Novicevic)

Graduate Student Advisor: Honors Thesis: Bone Density and Osteoporosis Risk Factors of Asian-Indians. Student Name-Kyle Nelson, School of Applied Sciences, University of Mississippi, 2015 (Thesis Chair: Martha A. Bass)

Search Committee Member: Health Promotion Faculty position, Department of Health, Exercise Science & Recreation Management, School of Applied Sciences, University of Mississippi, 2013

Search Committee Member: Assistant Dean position, School of Applied Sciences, University of Mississippi, 2013
Senate: Graduate Students Services, University of Mississippi, 2012 - 2013

COMMUNITY SERVICE

Volunteer: Rebel Man Triathlon, Oxford, Mississippi, 2012 - 2015

Judge: High School Science Fair, Oxford, Mississippi, 2012, 2013

Volunteer: Special Olympics, Oxford, Mississippi, 2011

CERTIFICATIONS

Interdisciplinary Graduate Certificate in Applied Statistics

Online Teaching and Learning

American Red Cross First Aid, CPR, and AED Instructor

Hologic X-ray Bone Densitometer Operator

TRAININGS

CITI (Collaborative Institutional Training Initiative), 2010, 2015

Dermatology, Nirvana Skin Clinic, Gujarat, India, 2009

General Medicine, Vitebsk State Medical University, Belarus, 2005 - 2008

General Medicine, Sardar Patel Hospital, Gujarat, India, 2005