

# Psychosocial Mediators of a Nurse Intervention to Increase Skin Self-examination in Patients at High Risk for Melanoma

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## Abstract

This prospective study examines psychosocial mediators of an efficacious skin self-examination (SSE) intervention that includes provision of a whole-body digital photography book depicting the entire skin surface. Individuals ( $n = 100$ ) with established risk factors for melanoma were recruited from the Memorial Sloan-Kettering Cancer Center Pigmented Lesion Clinic during their initial dermatologist visit and were randomized to receive a photobook immediately ( $n = 49$ ) or

4 months after intervention delivery ( $n = 51$ ). Potential mediators included self-efficacy and response efficacy drawn from Social Cognitive Theory, melanoma worry, and SSE anxiety drawn from Self-Regulation Theory, and skin cancer knowledge, and skin awareness. Only self-efficacy was a significant mediator, accounting for 8% of the total effect of photobook enhancement on SSE adherence at 4 months. (Cancer Epidemiol Biomarkers Prev 2006;15(6):1212–6)

## Introduction

Melanoma is one of the most rapidly increasing cancers in the United States (1). Established risk factors for melanoma include strong intermittent sun exposure, large numbers of dysplastic nevi, cutaneous phenotype (red hair, blue eyes, and poor tanning ability; ref. 2), and a family history of the disease (3). Fortunately, there is a 95% survival rate if melanoma is diagnosed at a local stage (4), making early detection an important strategy for reducing melanoma mortality and morbidity. Skin self-examination (SSE) by patients is a potentially useful, but as of yet unproven, strategy to reduce incident and invasive diagnoses (5). Additionally, over half (53–68%) of melanomas are originally detected by the patients, spouses, or partners (6); thus, increasing individuals' ability to recognize new or changing lesions represents an important goal for early detection of melanoma, especially among those with melanoma risk factors (7). Even among those with a family history of melanoma, recent (last 12 months) screening rates vary widely (28–62%; refs. 8, 9). Novel intervention strategies to increase SSE use among those at high risk for developing melanoma are warranted.

Among those at high risk for developing melanoma, demographic predictors of adherence to SSE include being female, younger, and having a higher educational level (10). Medical factors related to SSE performance include having a history of skin cancer and greater sun sensitivity (10). Psychosocial predictors of SSE in high-risk populations include higher knowledge about SSE (10), high self-efficacy, or confidence that they can perform efficacious screening (8, 10), a positive attitude about SSE and the benefits of SSE, low levels of perceived barriers to SSE performance (10–12), and physician recommendation and counseling to perform SSE (12). Finally, increased SSE is related to ability to ask for help from a spouse or partner (8, 10) and increased levels of melanoma concern and risk perceptions (10, 11).

Prior research indicates that SSE educational interventions can increase SSE utilization and diagnostic accuracy. In the general population, Mickler et al. (13) found that the provision of an SSE educational brochure, videotape, or one-on-one instruction from a nurse practitioner led to sustained (3 weeks) increases in skin cancer knowledge, SSE use, and accurate discrimination of lesions compared with a no-intervention control group. In addition, the provision of photographic examples combined with written information about different types of skin lesions has also been shown to be a useful strategy to increase participants' ability to accurately discriminate benign from suspicious lesions. Among those at high risk for developing melanoma, dermatologic examination and nurse-provided SSE education increase knowledge and use of SSE sustained through 18 months (14).

The provision of digital photographs of the entire skin surface, in tandem with SSE education, may further enhance SSE over educational interventions alone. Digital photography has the potential to act as an at-home reminder to engage in monthly SSE, as well as a concrete point of comparison for patients as they search for new or changing skin lesions on their skin surface during SSE (15). The use of digital photography increases high-risk individuals' diagnostic accuracy (16) and, integrated into a nurse and dermatologist-provided educational intervention, results in significantly increased use of SSE after 4 months over the intervention alone (17).

In this study, we examine potential theory-based psychosocial mechanisms of the effect of digital photography on adherence to SSE. In behavioral science, the relationship of an intervention on an intervening variable on a behavioral outcome is defined as mediation (18); whereas in epidemiology, this relationship is termed an intermediate end point effect (19). An understanding of the mechanisms through which provision of digital photography enhances SSE use has practical and theoretical importance, as this information could guide the development of additional enhancements for SSE interventions and booster interventions aimed at SSE maintenance. Additionally, clarification of the psychological processes through which digital photography leads to increased SSE would provide guidance concerning the development of other personal, hands-on aids for screening and provide evidence for or against theoretical approaches used to develop intervention enhancements. Unfortunately, even when health behavior theories are used to guide the development of intervention

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components, examinations of whether the expected theory-based constructs are actually responsible for behavior change are rarely conducted. The Task Force on Community Preventive Services (20) has advocated for further examination of the theoretical mechanisms responsible for community interventions aimed to reduce sun exposure; these recommendations are similarly warranted for SSE interventions provided in clinical settings.

## Materials and Methods

**Sample.** As described previously (21), the sample included new patients recruited from the Memorial Sloan-Kettering Cancer Center outpatient Pigmented Lesion Clinic of the Dermatology Service. All new dermatology visits were assessed for presence and number of clinically dysplastic or atypical nevi by the physician during the clinical examination. Patients ages  $\geq 18$  years with five or more clinically dysplastic or atypical nevi who were willing to have digital whole-body photography and agreed to be randomized to an intervention arm were recruited and informed consent obtained ( $N = 100$ ). Among these participants, self-reported melanoma risk factors included a personal history of skin cancer (50%), a history of dysplastic moles (81%), and a history of previous skin biopsy (80%). Half of these individuals ( $n = 49$ ) were designated to receive their whole-body digital photography (photobook) to take home with them. We stratified by personal history of skin cancer during patient enrollment to ensure that this variable was equally distributed between the two intervention arms. Patients who were visually or physically impaired, had been previously photographed, or had previously received a photobook were not eligible. The participation rate for the study was 95%, with those refusing involvement in the study doing so because of time constraints or a lack of interest in research participation. This study was reviewed and approved by the Institutional Review Board at Memorial Sloan-Kettering Cancer Center.

**Study Design and Description of the Intervention.** The intervention for this study (21) consisted of a 2-hour meeting with a dermatologist and a dermatologic nurse. As a preliminary step, an explanation of the study was provided; consent was obtained; and randomization to intervention A (photobook) or intervention B (no photobook) was completed. The first intervention module consisted of a dermatologist encounter where the physician explained the importance of SSE, instructed the patient to focus on size/color/shape of the lesions during SSE, and conducted a discussion of any changes that should prompt a dermatology visit, types of skin cancer, and sun protection advice. Next, the nurse asked each patient to remove all clothing and put on a robe. The nurse then did whole body digital photography incorporating 27 body sectors, including close-ups of patients' moles. After patients changed back into their clothing, they viewed a 3-minute video on SSE: *Skin Cancer: Can you Spot it?* (22). Next, the nurse conducted a guided imagery exercise where she asked each patient to close their eyes, try to relax, and visualize being at home in a comfortable, well-lit room. The nurse then systematically described the patient conducting SSE at home. The group randomized to SSE intervention with photobook (intervention A) received their personal whole-body photographs compiled in the form of a booklet. The nurse showed how to use the photobook as an adjunct to SSE. The group randomized to receive SSE intervention with no photobook (intervention B) received a written pamphlet on how to perform SSE and how to record moles in a diary format as an adjunct to SSE. The nurse showed in a systematic fashion how to look at all body parts and how to record current moles. After the 4-month assessment, intervention B participants received their own photobook with nurse instruction.

**Proposed Mediational Model.** We proposed a set of psychosocial factors to explain the effect of provision of whole-body digital photography photobook as an intervention enhancement on increased use of SSE. First, we hypothesized that provision of the photobook would increase use of SSE through increased confidence in SSE performance (self-efficacy) and a stronger belief that SSE is an effective means of detecting early skin cancer (response efficacy). These constructs are derived from Social Cognitive Theory (23), which emphasizes the importance of beliefs about the efficacy of one's efforts in behavioral performance as an important mechanism of behavior change. Empirically, self-efficacy and response efficacy are related to increased use of SSE in high-risk individuals (8, 10-12). We hypothesized that the provision of the photobook, a personalized, concrete, take-home guide and point of comparison of the appearance of moles would further enhance efficacy beliefs, and thus adherence with SSE, over educational intervention alone. Second, we hypothesized that the effect of provision of whole-body digital photography on SSE adherence would be mediated by reductions in negative affect related to developing melanoma and performing SSE. Given the potential for negative affect related to SSE and melanoma in individuals with high numbers of dysplastic or atypical nevi, we anticipated that the provision of the photobook would aid in the management of negative affect over and above the educational intervention alone because providing more personalized, concrete guidance may provide these high-risk patients with an additional level of structure to help them manage their risk by conducting regular SSE. This is consistent with Leventhal's Self-Regulation Theory (24). Empirically, as well, there is evidence that those who anticipate that SSE will increase their anxiety about skin cancer prefer to rely on physician examination (11). We also hypothesized that skin cancer knowledge and heightened skin awareness would mediate the intervention effect because skin cancer knowledge is an outcome of SSE intervention (13), and both knowledge and awareness are key predictors of SSE performance.

**Measurement Strategy.** In Table 1, we describe the measurement strategy for each proposed psychosocial mediator, including for each one the number and wording of the items used in the scales, the response categories employed, the score ranges, and level of internal consistency of each psychosocial factor. These psychosocial factors (see Table 1) were assessed by questionnaire at multiple time points, including baseline, before receipt of the intervention and follow-up, and after 4 months. At baseline, participants completed their questionnaire (demographics, medical and psychosocial factors, and SSE adherence) before their meeting with the dermatologist and nurse. Then, the dermatologic examination was conducted to collect information on the number of moles and dysplastic nevi. The nurse education module was also delivered at this appointment. All patients then underwent whole-body photography. Intervention A participants received their photobook immediately after the nurse-provided intervention, whereas intervention B participants received their photobook after follow-up 2, 4 months after their baseline visit. At 4-month follow-up, the questionnaires were either mailed directly to the patient for self-administration, or the nurse administered the questionnaire via telephone. Our primary dependent variable was adherence with SSE at 4 months, and we designated those who had completed three or more screenings during this time period as adherent, and those who had done fewer than three screenings as nonadherent. Most participants (95%) were retained through the 4-month assessment. We examined whether the five that dropped out differed from the 95 who were retained in demographic, medical history, or baseline psychosocial factors, and they differed significantly only on self-efficacy. The five who dropped out had significantly higher scores ( $m = 4.1$ ) than those who were retained ( $m = 3.4$ ,  $P = 0.04$ ).

**Table 1. Proposed psychosocial mediators of a 4-month SSE intervention effect**

Psychosocial factor	No. items	Item wording	Response category for each item	Score ranges	Baseline, M (SD)	Internal consistency*
Self-efficacy	3	How confident are you that you can: (1) perform SSE? (2) perform effective SSE? (3) I am not confident that I know what to look for when doing SSE <sup>†</sup>	1 = Not at all, 2 = a little, 3 = somewhat confident, 4 = very, 5 = extremely confident	1-5	3.4 (0.7)	0.77
Response efficacy	1	How certain are you that SSE is an effective means of detecting early skin cancer?	1 = Not at all, 2 = a little, 3 = somewhat certain, 4 = very, 5 = extremely certain	1-5	4.0 (0.9)	NA
Melanoma worry (30)	4	During the past two weeks: (1) how often have you worried about developing melanoma? (2) How often has your mood been affected by concern that you might get melanoma someday? (3) How often have thoughts about getting melanoma affected your abilities to perform your daily activities? (4) How emotionally distressed or concerned have you been about the possibility of getting melanoma?	Items 1-3: 1 = rarely or never, 2 = sometimes, 3 = often, 4 = all the time Item 4: 1 = not at all, 2 = somewhat concerned, 3 = moderately concerned, 4 = very concerned	4-16	7.5 (2.6)	0.84
SSE anxiety	1	When I think about doing SSE I become anxious	1 = Strongly disagree, 2 = somewhat disagree, 3 = undecided, 4 = somewhat agree, 5 = strongly agree	1-5	2.3 (1.0)	NA
Skin cancer knowledge	11	Knowledge concerning types of skin cancer, curability, prevention methods, performance of SSE, body parts in SSE, signs and appropriate follow-up of suspicious lesions, time interval for SSE, and appropriate reminders for SSE	0 = Incorrect, 1 = correct	0-11	7.1 (1.2)	0.65
Skin awareness (31)	1	Do you think you would notice changes on your skin if they occurred?	0 = No/DK, 1 = Yes	0-1	0.7 (0.4)	NA

Abbreviation: NA, not available.

\*Internal consistency calculated at 4-month assessment for each psychosocial factor.

<sup>†</sup>This variable was reverse coded.

**Analytic Approach.** Descriptive statistics, including medians, means, and SDs, were calculated for all patient characteristics and psychosocial factors. We also examined whether any of the psychosocial factors significantly varied across intervention arm.

Simple mediation models were evaluated for all psychosocial factors. Mediation was assessed using the following individual regression model methodology as described by Baron and Kenny (18) and expanded on by MacKinnon et al. (25).

$$M = \beta_{0(1)} + \alpha X + \varepsilon_{(1)} \quad (\text{A})$$

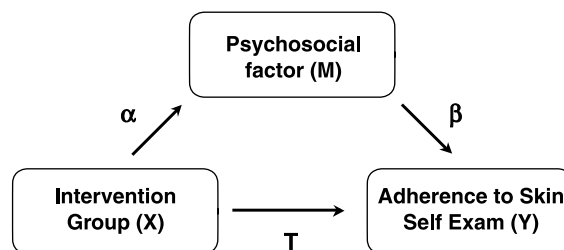
$$Y = \beta_{0(2)} + \tau X + \varepsilon_{(2)} \quad (\text{B})$$

$$Y = \beta_{0(3)} + \tau X + \beta M + \varepsilon_{(3)} \quad (\text{C})$$

In this analysis, the dependent variable (Y) is adherence to SSE at 4 months after intervention; the independent variable (X) is the intervention group to which the patient belonged (group A or B); and the possible mediator variables (M) are the psychosocial measures collected at 4 months after baseline. Eq. A tests the effect of the independent variable (X) on the mediator (M). Eq. B depicts the effect of the independent variable (X) on the dependent variable (Y). Eq. C tests the effect of the mediator (M) on the dependent variable (Y),

adjusting for the independent variable (X, see Fig. 1). Baron and Kenny (18) consider a variable to be a mediator if three conditions hold: first, the independent variable affects the mediator (Eq. A); second, the independent variable affects the dependent variable (Eq. B); and third, the mediator must affect the dependent variable after controlling for the independent variable (Eq. C).

The mediation variable effect was assessed for each psychosocial measure individually using the product of the coefficients  $\alpha$  (representing the relation between the mediator and the independent variable) and  $\beta$  (representing the relationship between the mediator and the dependent variable, adjusting for the effect of the independent variable) as outlined in MacKinnon et al. (25). The Sobel (26) estimate of the SE was also calculated. The mediator variable effect was calculated as the product of the coefficients ( $\alpha\beta$ ) divided by the Sobel



**Figure 1.** Simple mediational model.

**Table 2. Single mediator tests for each psychosocial factor (n = 95)**

Potential mediator variables	Eq. A: $X \rightarrow M$		Eq. C: $Y \rightarrow M.X$		Mediator variable effect	95% Confidence interval
	Estimate	P	Estimate	P		
Self-efficacy	0.5065	0.0030	0.1643	0.0076	0.0808	(0.0172, 0.1638)
Response efficacy	-0.0594	0.7593	-0.0164	0.7626	-0.0002	(-0.0259, 0.0253)
Melanoma worry	0.5045	0.2851	-0.0157	0.4856	-0.0085	(-0.0516, 0.0191)
SSE anxiety	-0.0989	0.7259	-0.0605	0.1001	0.0046	(-0.0354, 0.0461)
Skin cancer knowledge	1.5676	0.4758	0.0151	0.0086	0.0222	(-0.0473, 0.0998)
Skin awareness	-0.0590	0.4734	0.2026	0.1141	-0.0119	(-0.0541, 0.0287)

estimate of the SE. This procedure assumes that the error terms  $\varepsilon_1$  and  $\varepsilon_3$  are normally distributed, and that there was little measurement error. Because of the relatively limited sample size, bootstrap estimates of the product of the coefficients were also estimated along with 95% confidence intervals (27).

## Results

Participants were predominantly female (63%), White non-Hispanic (98%), married (61%), and with an average age of 40 (SD = 11.7). Almost half (40%) had education beyond college, and most (74%) saw a dermatologist regularly. Patients randomized to intervention A (photobook) versus intervention B (no photobook) did not differ significantly on any of the demographic or psychosocial factors (all  $P$ s > 0.05). Baseline descriptive statistics for all psychosocial factors are provided in Table 1.

Table 2 shows the results of mediation testing for each psychosocial factor measure. Eq. A was significant for self-efficacy alone, as delivery of the photobook was significantly related to increased self-efficacy at 4 months after intervention. None of the other psychosocial factors met this condition. Eq. B was significant such that delivery of the photobook was related to adherence to skin self-examination, as we reported previously (17). The condition for Eq. C was met by self-efficacy as well as skin cancer knowledge; these potential mediators were associated with adherence to SSE controlling for photobook delivery. The only psychosocial factor that met all three conditions of mediation effect was self-efficacy. The bootstrap estimate for the mediating variable effect for self-efficacy was 0.0808. The 95% confidence interval for the indirect effect of self-efficacy did not overlap zero (0.0172-0.1638), indicating statistical significance at alpha of 0.05. Self-efficacy accounted for ~8% of the total effect of photobook delivery on SSE adherence.

## Discussion

This study examines psychosocial processes associated with an intervention to enhance the performance of SSE among patients at high risk for melanoma. We found that self-efficacy significantly mediated the relationship between provision of an SSE intervention enhancement, provision of digital photography photobook, and increased SSE adherence at 4 months over SSE intervention without provision of the photobook, with self-efficacy accounting for 8% of the total effect of the intervention enhancement on adherence to SSE. This confirms our hypothesis that those patients who had an objective comparison on which to evaluate any new or changing lesions felt more confident in their SSE ability, and that this helped explain their increased use of SSE.

These findings confirm that this SSE intervention enhancement (provision of the photobook) met the process goals of increasing efficacy beliefs (23). As such, the study dictates that

other methods aimed to increase and maintain SSE use should aim to address self-efficacy beliefs and could include methods for addressing any reductions in self-efficacy that could diminish adherence. We did not find evidence for mediation among the other psychosocial factors assessed, which could have been due to a lack of sensitivity in the proposed mediators and our small sample size. Despite this, it is also likely that there are other health behavior change processes at work driving increased SSE adherence in the presence of the photobook (28). There are opportunities to further explore and examine theory-based mechanisms of this and other novel SSE intervention components.

We note some limitations of the current study. The study comprised a relatively small number of participants and was conducted in a fairly ideal circumstance where high-risk patients were willing to be involved in a relatively time-consuming intervention strategy. Additionally, self-efficacy was assessed through direct questioning about level of confidence in performing SSE, which may not fully capture the self-efficacy construct. However, comprehensive and detailed information was obtained during this study, albeit on a small group of patients. Our sample size and potential measurement error in those psychosocial factors that were based on single items dictate the need for us to confirm our findings in a larger sample. Finally, our SSE end point was based on self-report rather than direct observation and thus is vulnerable to overestimation by participants. However, patients in this study were not privy to the underlying hypotheses, and any misclassification related to SSE self-report is not likely to have been differential between the two groups, thus not substantially biasing the study findings.

Additionally, a larger sample would allow for examination of potential moderators of the effect of the photobook on SSE adherence. In fact, photobook might be particularly useful in some subgroups of high-risk patients. We note that the five participants lost to 4-month follow-up had significantly higher levels of baseline self-efficacy than those retained; whereas this analysis is based on very few participants, it indicates interesting unanswered questions concerning psychosocial characteristics of those who might find the intervention strategy more or less relevant for themselves.

In sum, this study provides needed insight into the psychological mechanisms associated with a specific component of SSE intervention. Unique strengths of the study include focus on a cancer screening strategy that is equally applicable to men and women (unlike BSE), the prospective study design, and theory-driven nature of the photobook intervention. Additionally, this study examines these issues in a group of individuals where initiation and maintenance of SSE is highly recommended; thus, a greater understanding of the psychological mechanisms associated with adherence to SSE is of value. This study indicates the central importance of self-efficacy in driving increased SSE adherence rates after provision of advice, education, and personalized photobook. Finally, the study adds to our theoretical understanding of how cancer prevention behavior change takes place. The

development of new maintenance-focused theoretical models (29) and theory-driven empirical investigations will provide additional insight into the process and optimization of health behavior adherence, including SSE adherence, over time.

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