Improvement in Patient Performance of Skin Self-examinations After Intervention With Interactive Education and Telecommunication Reminders

A Randomized Controlled Study

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Objective: To determine if interactive computerized patient education, skin self-examination (SSE) tutorials, and telecommunication reminders could be combined to increase patient performance of SSEs, increase confidence in ability to identify melanoma, and influence individual melanoma risk perception.

Design: A total of 132 adult participants from our dermatology clinics were enrolled in an interventional study and randomized to a control group or an intervention group. Survey data were collected from all participants on the day of enrollment and 3 months after enrollment.

Setting: University Hospitals Case Medical Center outpatient dermatology clinics.

Participants: English speakers older than 18 years.

Interventions: The intervention group (1) participated in a computer-assisted learning tutorial, (2) took part in a hands-on SSE tutorial, (3) received monthly telecommunication reminders to perform SSEs for 12 weeks, and (4) received a brochure on melanoma detection. The control group received only the brochure on melanoma detection.

Main Outcome Measures: Self-report of performance of SSEs. Melanoma risk perception and confidence in ability to identify melanoma were secondary considerations. Logistic regressions, controlling for race, age, sex, education, and family history of melanoma, were used to assess the effectiveness of the intervention.

Results: At the 3-month follow-up, those in the intervention group were more likely to perform SSEs (odds ratio [OR], 2.36; P = .05). In addition, those who participated in the intervention were more likely to report being confident in their ability to identify melanoma during an SSE (OR, 2.72; P = .05).

Conclusion: Computer-assisted patient education used in conjunction with a hands-on SSE tutorial and telecommunication reminders can increase patient performance of SSEs and confidence in the ability to identify melanoma.


The rate of malignant melanoma (MM) continues to increase, with current estimates that 1 in 53 adults in the United States will be diagnosed as having MM of the skin during their lifetime. The most common subtypes of MM demonstrate early radial growth and only later enter a vertical or invasive growth phase. Mortality is largely dependent on a Breslow depth at time of diagnosis. Early detection of MM has been associated with thinner lesions and improved survival. Stage I disease exhibits a 5-year survival of 97%, whereas stage IV metastatic disease is associated with a 1-year survival rate of 33% to 62%. Early detection remains the primary strategy for reducing the morbidity and mortality of MM.

Patients and their partners are integral to the diagnosis of MM and detect anywhere from 57% to 72% of primary MM and 62% of recurrent MM. Consequently, patient education of MM symptoms, including change or irregularity in symmetry, border, color, or diameter (“ABCDs” of MM), and implementing preventive behaviors, such as skin self-examinations (SSEs) and UV protection, has the potential to improve patient survival. Furthermore, a lack of understanding of MM symptoms has
been associated with delayed diagnosis and poorer prognosis.\textsuperscript{11,12}

Early detection and prevention of melanoma can be facilitated by regular SSEs. A large case-control study (N = 1199) demonstrated a 63% decrease in mortality from primary and secondary MM in patients who performed SSEs compared with those who did not.\textsuperscript{13} A retrospective review of Italian patients diagnosed as having MM reported an association between MM detection by SSEs and thinner lesion at time of diagnosis.\textsuperscript{14} Despite the potential for decreased mortality, many barriers to the performance of SSEs still exist, and few prospective trials regarding interventions to increase the regular use of SSEs have been performed.\textsuperscript{15}

Exploring methods for patient behavior modification is an evolving area of research. Interactive computer-assisted learning (CAL) has been used successfully to increase knowledge and patient protective behavior relating to breast cancer screening,\textsuperscript{16,17} asthma control,\textsuperscript{18} and sun safety.\textsuperscript{19,20} More recently, interactive CAL has also been applied to melanoma prevention and early detection. An intervention known as Skinsafe, an interactive computer-based educational module, was developed to increase patient awareness of melanoma symptoms, melanoma risks, sun protective behaviors, and the importance of SSEs.

Telecommunication reminders have been used successfully to modify the behavior of patients with type 2 diabetes mellitus,\textsuperscript{21} raise awareness of breast health,\textsuperscript{22} manage pain for sickle cell patients,\textsuperscript{23} and aid in weight loss techniques.\textsuperscript{24} Text, e-mail, phone, and letter reminders deliver timely information to the patient in their home. Previous observations have concluded that this increases the likelihood of patient compliance.\textsuperscript{25} We propose that a multifactorial approach including interactive CAL, hands-on SSE tutorials, and telecommunication reminders can be combined to increase patient performance of SSEs. We sought to determine if interactive computer-assisted patient education, hands-on SSE tutorials, and telecommunication reminders could be combined to effectively increase patient performance of SSEs. Secondarily, we considered if these interventions influenced confidence in patients’ ability to identity melanoma during an SSE and individual perceived risk for melanoma.

METHODS

After receiving institutional review board approval, an interventional study was conducted at University Hospital Case Medical Center outpatient dermatology clinics (Cleveland, Ohio) from June 2010 to September 2010. Patients, accompanying family members, caregivers, or friends seen at the dermatology clinic who were at least 18 years old and spoke English were eligible.

Participants in the control group received only the melanoma education brochure, a common form of patient education distributed in dermatology clinics. The control group did not receive telecommunication reminders, Skinsafe tutorial, or hands-on SSE tutorial.

INTERVENTION

Participants were randomized into the control or intervention arm using permuted block randomization. The intervention group was involved as follows:

1. They participated in the Skinsafe (CAL) tutorial. This tool contained educational interactive modules on MM risk, MM symptoms, SSEs, and preventive measures. The program was developed in 1998 in the United Kingdom by a multidisciplinary team comprised of dermatologists and health psychologists. The participants were asked to complete 8 modules in a single setting on a laptop computer. These modules included a combination of animation cartoons, photographs, and text. Some modules asked the participants to correctly identify lesions that may be suspicious for melanoma in a quiz format, whereas other modules simply presented information on sun protection and melanoma risk factors that the participants could read on the screen. In addition, the CAL program calculated the participant’s risk for melanoma (“higher than average,” “average,” or “less average than”), which we compared with the participant’s self-perceived risk for melanoma. The computerized risk was based on the participant’s response to 10 standardized questions that asked participants about family history of melanoma, history of sunburns and sun exposure, skin and eye color, freckles, and number of moles on the skin. Completion of the CAL tutorial took 5 to 30 minutes.

2. The intervention group participated in a kinesthetic, hands-on, SSE tutorial, while clothed. The role-play SSE was led by the research assistant and demonstrated how to examine different angles of one’s body, including difficult-to-evaluate areas, such as the scalp, nails, and between fingers and toes.

3. They received a selected telecommunication reminder to perform SSEs, which the participant would receive throughout the study. The reminders contained a brief message, which contained a salutation from the principal investigator (A.K.B.) and a single statement reminding the participant to perform monthly SSEs. Participants could elect to receive a text message, e-mail, phone call, or letter reminder. Participants also indicated a desired day of week and time to receive the reminder. Reminders were sent to the participants once a month at the indicated time throughout the study period.

4. They received a melanoma education brochure, published by the American Academy of Dermatology,\textsuperscript{26} containing information on melanoma risk, warning signs, and SSEs.

MAIN OUTCOME MEASURES

On enrollment, each participant completed a baseline questionnaire (eFigure 1; http://www.archdermatol.com) that collected demographic data, assessed participants’ current performance of SSEs, their confidence in indentifying melanoma, self-perceived risk for melanoma, use of sunscreen, use of sun protective clothing, and knowledge of the ABCDs of melanoma. Other data collected from the baseline questionnaire were used to allocate participants into a high-risk group or low-risk group for developing melanoma to ensure that similar numbers of participants in the control and treatment groups were at high risk for melanoma. Allocation into the high-risk group was based on participant report of at least 1 of the following: a personal history of MM, a personal history of nonmelanoma skin cancer, a first-degree relative with history of MM, and/or 2 or more independent risk factors for melanoma: red or blonde hair, a personal history of blistering sunburns as a child, a personal history of “atypical” or “dysplastic” mole, more than 100 moles, green or blue eyes, or a history of burning instead of tanning after sun exposure.\textsuperscript{27-32} Those who did not meet these criteria of high risk were placed in the low-risk group. All participants were contacted for follow-up phone surveys to collect information on self-reported behavior 3 months after enrollment (eFigure 2). Every effort was made to collect follow-up
data, as participants were called a minimum of 5 times before they were removed from the final analysis because follow-up data could not be collected. If the participant was not contacted, a message was left when possible with the principal investigator's contact information so that participant could contact the study team to complete the follow-up questionnaire.

STATISTICAL ANALYSIS

The target sample size was 200 participants. With equal numbers in the treatment and control groups, a total of 200 individuals is needed to achieve at least 80% power, at a .05 level of significance, to observe a standardized effect size of 0.4.

A logistic regression was used to analyze the data because it is nonparametric and the distribution of our data set was not normal. We constructed 2 models to evaluate the effectiveness of our intervention on the outcomes of interest, controlling for sex, age, race, education, and family history to adjust for variations between the groups.

RESULTS

CHARACTERISTICS OF PARTICIPANTS

A total of 390 clinic visitors were offered study participation (Figure 1): 112 participants were randomized to the control group, of whom 14 did not complete the survey, and 115 were randomized to the intervention group, of whom 3 did not complete the survey. Enrollment was completed for 98 in the control group and 112 in the intervention group. The overall response rate for the 3-month follow-up was 62.9% (132 of 210). There was no significant difference in response rate in the intervention group. The overall response rate for the intervention group was completed for 98 in the control group and 112 in the intervention group, of whom 3 did not complete the survey. Enrollment was completed for 98 in the control group and 112 in the intervention group, of whom 3 did not complete the survey.

TELECOMMUNICATION REMINDER SELECTION

Most individuals in the intervention group selected to receive e-mail telecommunication reminders (50%). Of the remaining participants in the intervention group, 18% selected letters, 17% selected phone calls, and 15% selected text messages.

PERFORMANCE OF SSEs

At baseline, 43.3% reported performing SSEs (Table 2). At the 3-month follow-up, a greater percentage in the intervention group reported performing SSEs, compared with the control group (78.9% vs 60.7%; P ≤ .05) (Figure 2). Those in the intervention group were 2.36 times more likely to do SSEs at the end of the study (P ≤ .05) (Table 3). The subgroup that received text message reminders had greatest improvement in performance in SSEs from 31.3% at baseline to 76.9% at follow-up (Table 4).

RISK ASSESSMENT FOR DEVELOPING MELANOMA

Prior to the intervention, approximately one-third (34.5%) of participants in the intervention group perceived their risk for melanoma to be “higher than average,” another third in this cohort perceived their risk to be “average,” and the remaining third perceived their risk to be “less than average” (Figure 3). At the time of enrollment, the Skinsafe program calculated the risk for these same participants based on responses to 10 standardized questions (addressing history of sun exposure and blistering sunburns, family history, skin type, etc) and found that 56.7% were at a higher than average risk for melanoma, 37.1% had an average risk, and only 6.2% had a less than average risk. At the 3-month follow-up, 47% of participants reported perceiving their risk for melanoma to be higher than average, 30% reported their perceived risk to be average, and 22% reported less than average perceived risk. Of the patients who reported performing SSEs at the end of the study, 47% of those perceived their risk for melanoma to be higher than average, and only 18% perceived their risk to be less than average.
CONFIDENCE IN IDENTIFYING MELANOMA DURING AN SSE

At baseline, more individuals in the intervention group reported being “not very confident” or “not at all confident” in their ability to identify melanoma compared with the control group (44.6% vs 20.4%; *P < .001). At the 3-month follow-up, more in the control group reported being not very confident or not at all confident about their ability to identify melanoma compared with the intervention group (32.8% vs 14%; *P = .01). In addition, those in the intervention group were 2.72 times more likely to feel “very confident” or “somewhat confident” in their ability to identify melanoma during an SSE at the end of the study (Table 3). Age was inversely correlated with confidence in ability to identify melanoma (odds ratio [OR], 0.97; *P ≤ .05) (Table 3).

The combination of CAL Skinsafe education, hands-on SSE tutorial, and telecommunication reminders was successful at increasing the performance of SSEs. We hypothesize that this is due to the complex interplay of psychosocial factors involved in modifying patient behavior. Patients often exhibit distinctive learning styles that may be restricted to visual, aural, reading/writing, kinesthetic styles, or a multimodal combination of these patterns. As such, each patient possesses a unique learning fingerprint that is most likely to be accessed through multiple and often diverse mechanisms. A unique aspect of our intervention involved kinesthetic teaching, which gives the patient an opportunity to gain “hands-on” experience that builds confidence, an important motivator in performing health protective behavior. This has been used successfully for patients with diabetes mellitus who must perform precise health protective behaviors to control their disease.

Glazebrook et al19 studied the efficacy of Skinsafe software to educate high-risk patients in a primary care setting and found that those who participated in the intervention were 1.67 times more likely to perform SSEs or “mole checks” after the intervention. In our study, those in the intervention group were 2.36 times more likely to perform SSEs after the intervention. We hypothesize that our greater success rate is due to the multimodal approach used in our intervention, whereas the previous work conducted by Glazebrook et al19 used only the Skinsafe program. Furthermore, we hypothesize that our greater success may be partial attributable to setting—the participants in our study were recruited at dermatology outpatient clinics and may have been more interested in sun protective behavior and SSEs than patients recruited from primary care offices. The success of multiple interventions is well established in trials of smoking cessation and coronary risk minimization that routinely demonstrate higher efficacy for patients receiving multimodal interventions.

Notable increases in the performance of SSEs were observed in the subset of participants in the intervention group that elected to receive text message telecommunication reminders. In recent studies, text message reminders linked to local weather information were used successfully to increase the use of sunscreen in patients presenting to the dermatology clinic.38 We hypothesize that telecommunication reminders, such as text message and e-mail, are more closely associated with behavior modification because of greater personalization. In our study participants were able to select a day and time that would be most convenient to receive the reminder, which likely made our reminders most effective. In addition, these methods of contact are usually directed specifically at the participant, whereas it is more difficult to
ensure that letters and phone calls reach the intended recipient.

As demonstrated in a prior study, the participants in our study tended to underestimate their risk for developing MM prior to the intervention. Those in our intervention group were given a “computer-calculated” risk—and most perceived their risk to be lower than what was calculated by the software program, despite reporting well-known risk factors, such as history of melanoma in a first-degree relative or a personal history of atypical or dysplastic moles. At the end of the study, more participants reported perceiving their risk for melanoma to be higher than average, which is more consistent with the computer-generated risk assessment. Yet, 22% perceived their risk to be less than average, despite having received a computer-generated risk profile during the intervention on the day of enrollment, which indicated that only 6.2% of this population had a less than average risk. These data suggest that informing patients that they are at a greater risk for melanoma does not always change self-perceived risk. Of note, only 18% of participants who perceived their risk to be less than average reported performing SSEs at the end of the study, a rate that is well below the baseline performance of SSEs—perhaps an indication that perceived risk is a motivator for adapting new behaviors.

Improved self-reported confidence in ability to identify melanoma was observed in the intervention group. We hypothesize that the tutorial within the Skinsafe program that allows participants to identify suspicious lesions in a “quiz format” was helpful in raising confidence. In addition, because more participants in the intervention group reported performing SSEs, confidence may have increased as individuals became more acclimatized to closely examining their skin. Of note, our logistic regression suggested that age is inversely correlated with confidence in an ability to identify melanoma, which suggests that perhaps additional interventions are needed to improve confidence in self-detection

### Table 3. Logistic Regression Follow-up Assessment

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>OR (SE)</th>
<th>Z Score</th>
<th>P &gt; z</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance of SSE at 3-mo Follow-up</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention group</td>
<td>2.36 (1.03)</td>
<td>1.96</td>
<td>.05</td>
<td>(1.00-5.57)</td>
</tr>
<tr>
<td>Male sex</td>
<td>0.93 (0.40)</td>
<td>-0.18</td>
<td>.86</td>
<td>(0.39-2.18)</td>
</tr>
<tr>
<td>Age</td>
<td>1.01 (0.01)</td>
<td>0.67</td>
<td>.50</td>
<td>(0.98-1.03)</td>
</tr>
<tr>
<td>Family history of melanoma</td>
<td>1.35 (0.79)</td>
<td>0.51</td>
<td>.61</td>
<td>(0.42-4.28)</td>
</tr>
<tr>
<td>White race</td>
<td>1.40 (0.91)</td>
<td>0.51</td>
<td>.61</td>
<td>(0.39-5.04)</td>
</tr>
<tr>
<td>College education</td>
<td>1.60 (0.71)</td>
<td>1.05</td>
<td>.29</td>
<td>(0.67-3.83)</td>
</tr>
</tbody>
</table>

### Table 4. Reminder Type and Performance of SSEs in the Intervention Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline</th>
<th>Follow-up</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total intervention group who performed SSEs</td>
<td>44.6</td>
<td>78.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Patients in intervention group that received text message reminders who performed SSEs</td>
<td>31.3</td>
<td>76.9</td>
<td>.03</td>
</tr>
<tr>
<td>Patients in intervention group that received e-mail reminders who performed SSEs</td>
<td>50.0</td>
<td>82.9</td>
<td>.003</td>
</tr>
<tr>
<td>Patients in intervention group that received letter reminders who performed SSEs</td>
<td>31.6</td>
<td>72.7</td>
<td>.06</td>
</tr>
<tr>
<td>Patients in intervention group that received phone call reminders who performed SSEs</td>
<td>50.0</td>
<td>75.0</td>
<td>.26</td>
</tr>
</tbody>
</table>

Abbreviations: OR, odds ratio; SSE, skin self-examination.

Table 3. Logistic Regression Follow-up Assessment

Table 4. Reminder Type and Performance of SSEs in the Intervention Group

Figure 3. Risk assessment for melanoma as perceived by participants in the intervention group compared with the risk calculated by the Skinsafe software program. The graph shows a bar chart with two sets of bars: one for participants' perceived risk at baseline (open bars) and the other for the risk calculated by the Skinsafe software program (closed bars). The x-axis represents the risk levels as follows: Less Than Average, About Average, Higher Than Average. The y-axis represents the percentage of participants. The bars are color-coded: participants' perceived risk is shown in white, and the Skinsafe calculated risk is shown in black. The chart illustrates the difference in perceived risk compared to the calculated risk.
in elderly populations. There are a variety of mechanisms that could account for this finding, and we hypothesize that perhaps older patients may have more benign skin changes (seborrheic keratosis and pigmented macules) appearing at a faster rate and therefore may have greater difficulty keeping track of changes. Furthermore, older patients may have comorbidities, such as impaired vision, that could compromise their ability to detect subtle changes in color or border pattern.

There are several limitations to this analysis. For example, neither the researchers nor the participants were blinded in this study. The slightly lower recruitment and follow-up rates in the control group may be a source of selection bias. However, the control and intervention groups were well matched at enrollment, and there were fair response rates in both groups. A further limitation was that change in performance in SSes and all other variables measured in our analysis relied entirely on self-reported behavior, and it was not possible to reach all of the participants for follow-up data at the end of the study period. Every effort was made to contact all the participants via a minimum of 5 phone calls, and consequently, most participants (62.9%) provided follow-up data. Because nearly half of the participants in our analysis held a college or advanced degree, it is not clear if our findings could be generalized by the level of education. In our analysis, all of the participants followed in the intervention group received all 3 aspects of the intervention (CAL, SSE tutorial, and telecommunication reminder), but it is not clear if our findings are attributable to synergism or if 1 modality was primarily responsible for the changes we observed. Future research could be aimed at determining the efficacy of other combinations of multimodal interventions that can modify patient behavior.

Dermatologists may use these findings to implement multiple modalities for teaching and reminding patients to perform SSE to increase patient autonomy and ultimately reduce the morbidity and mortality of MM.

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Author Contributions: Drs Aneja and Brimhall contributed equally to this study. Drs Aneja, Brimhall, Kast, Carlson, Cooper, and Bordeaux had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Brimhall, Cooper, and Bordeaux. Acquisition of data: Savina Aneja, Brimhall, Kast, and Carlson. Analysis and interpretation of data: Savina Aneja, Brimhall, Kast, Sanjay Aneja, Cooper, and Bordeaux. Drafting of the manuscript: Savina Aneja, Brimhall, and Kast. Critical revision of the manuscript for important intellectual content: Savina Aneja, Brimhall, Kast, Sanjay Aneja, Carlson, Cooper, and Bordeaux. Statistical analysis: Savina Aneja and Sanjay Aneja. Obtained funding: Cooper. Administrative, technical, and material support: Savina Aneja, Brimhall, Kast, Cooper, and Bordeaux. Study supervision: Cooper and Bordeaux.

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Additional Information: This is study case No. 1610. The trial protocol is available through Case Western Reserve Center institutional review board office.

Correction: In the Evidence-Based Dermatology Review article titled “Measurement Properties of Outcome Measures for Vitiligo: A Systematic Review” (2012; 148[11]:1302-1309), published online first on September 17, 2012, an error occurred in the byline. The full name for Dr Linthorst Homan should read “May W. Linthorst Homan, MD.”