also occur in the setting of clonal evolution for tumor cells that have a compensatory amplification of genes downstream from SMO such as GLI.⁴,⁵

In individuals with multiple resistant BCCs, the iso-
genic background of a single individual may facilitate mo-
lecular studies of these resistant BCCs because some of
the tumors may become resistant through multiple mecha-
nisms. Future efforts to attack or prevent resistance in
BCCs may involve the use of more than 1 drug at a time
to target multiple pathways that contribute to abnormal
basal cell growth.⁴,⁵

We were surprised that our case series did not show sec-
ondary resistance in the 8 patients with mBCC. It is pos-
sible that with longer follow-up times, mBCCs may be ob-
served to acquire resistance while the patient is undergoing
vismodegib treatment. In addition, larger sample sizes may
be needed to observe this phenomenon: the regrowth rate
we observed was only 1 in 5 in patients with laBCC.

Because of the risk of regrowth, frequent skin examina-
tions of patients undergoing treatment with vismodegib are essential to monitor for acquired resistance, even
if the original tumor appears to be gone on clinical ex-
amination. When identified and biopsied early, these sec-
ondarily resistant BCCs are more likely to be treated ef-
effectively. Non-SMO inhibitor treatments such as surgical
excision can be essential to optimize patient outcomes.

With increased vismodegib usage, it is likely that tu-
mor regrowth may be an increasing phenomenon. Fu-
ture studies with larger numbers of patients observed for
longer periods are needed confirm our observations, iden-
tify factors associated with regrowth, and characterize the
molecular mechanisms by which regrowth occurs.

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Accepted for Publication: May 25, 2012.
Published Online: August 20, 2012. doi:10.1001
/archdermatol.2012.2354

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Author Contributions: Both authors 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 analy-
sis. Study concept and design: Chang and Oro. Acquisi-
tion of data: Chang and Oro. Analysis and interpretation of data:
Chang and Oro. Drafting of the manuscript: Chang and
Oro. Critical revision of the manuscript for important intel-
tlectual content: Chang and Oro. Obtained funding: and
Oro. Administrative, technical, and material support: Chang
and Oro. Study supervision: Chang and Oro.

Financial Disclosure: Drs Chang and Oro are clinical in-
vestigators in studies sponsored by Genentech, Infinity,
and Novartis.

Funding/Support: Research for this article was funded
by National Institutes of Health grant R01AR046786
(OrO).

Role of the Sponsors: The sponsor had no role in the
design and conduct of the study; in the collection, analy-
sis, and interpretation of data; or in the preparation,
review or approval of the manuscript.

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Computerized Interactive Educational Tools
Used to Improve Use of Sun-Protective
Clothing and Sunscreen: A Randomized
Controlled Study

Skinsafe¹ is a computer-assisted learning (CAL) program
developed to educate patients on melanoma risk factors,
melanoma symptoms, and the importance of sun-
protective behavior. The program asks users to complete
in a single sitting (<30 minutes) computerized modules
containing a combination of interactive and didactic seg-
ments. We sought to determine if interactive CAL patient education delivered through Skinsafe, used as a part of a multimodal patient education program, could influence use of sun-protective clothing and sunscreen.

Methods. This interventional study was approved by the institutional review board and conducted at University Hospitals Case Medical Center. Any individuals presenting to the dermatology clinic lobby, spoke English, and were at least 18 years old were eligible. At enrollment, participants were randomized into the control or intervention arm using permuted block randomization. The intervention group completed a multimodal education program that included the following components: (1) the CAL Skinsafe tutorial; (2) a skin self-examination tutorial while clothed, under the guidance of clinicians; and (3) a self-selected telecommunication reminder (phone call, text message, e-mail, or letter) to receive monthly for 12 weeks, which reminded the participant to perform skin self-examinations. All participants received a melanoma brochure, a common form of patient education distributed in dermatology clinics.

Survey data were collected on the day of enrollment and 3 months after enrollment, at the conclusion of the study. The data collected included demographic information and self-reported use of sun-protective clothing (ie, wide-brimmed hat, long-sleeved shirts) and sunscreen.

A logistic regression was used to analyze the data. We constructed 2 models controlling for sex, age, race, education, and family history of melanoma.

Results. A total of 132 participants completed the study. At baseline, participants in the control and intervention groups were similar in terms of sex, age, race, and education level. There was no significant difference in response rate in the intervention and control groups (P=.77).

At baseline, 34.7% reported “always” or “frequently” using sun-protective clothing, and 39.1% reported “always” or “frequently” using sunscreen. Those in the intervention group were 2.4 times more likely to wear sun-protective clothing as well as sunscreen. Many dermatologists frequently remind patients of the importance of sunscreen use—our findings suggest that perhaps sun-protection education in the office can be improved by encouraging patients to regularly use sun-protective clothing as well as sunscreen.

There are several limitations to our study. Primarily, all outcomes measured relied on self-reported behavior. In addition, we have to consider the Hawthorne effect, whereby subjects modify their behavior in response to being studied. Alternatively, participants might have been dishonest in follow-up surveys because they knew the aim of our intervention. Furthermore, all of the subjects in the intervention group received all 3 aspects of the multimodal educational program (CAL Skinsafe program, skin self-examination tutorial, and telecommunication reminders to perform skin self-examinations), but only the CAL Skinsafe program emphasized the use of sun-protective clothing and sunscreen. Therefore, it is not clear whether the use of sun-protective clothing and sunscreen was not statistically significant in our analysis (OR, 1.26 [95% CI, 0.58-2.77]). Men were less likely to use sunscreen (OR, 0.32 [95% CI, 0.14-0.72]) (Table).

Use of Sunscreen at 3-mo Follow-up

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Odds Ratio (95% CI) (SE)</th>
<th>Z-Score</th>
<th>P Value &gt; Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention group</td>
<td>1.26 (0.58-2.77) (0.51)</td>
<td>0.58</td>
<td>.56</td>
</tr>
<tr>
<td>Male sex</td>
<td>0.32 (0.14-0.72) (0.13)</td>
<td>−2.76</td>
<td>.01</td>
</tr>
<tr>
<td>Age</td>
<td>0.10 (0.97-1.02) (0.01)</td>
<td>−0.36</td>
<td>.72</td>
</tr>
<tr>
<td>Family history of melanoma</td>
<td>0.60 (0.21-1.71) (0.32)</td>
<td>−0.95</td>
<td>.34</td>
</tr>
<tr>
<td>White race</td>
<td>0.39 (0.12-1.28) (0.24)</td>
<td>−1.55</td>
<td>.12</td>
</tr>
<tr>
<td>College education</td>
<td>1.88 (0.83-4.269) (0.78)</td>
<td>1.52</td>
<td>.13</td>
</tr>
</tbody>
</table>

Comment. The CAL Skinsafe education system, when used as a part of a multimodal patient education program, was successful at increasing sun-protective clothing use. We suspect that this is attributable to the education supplied during the CAL Skinsafe tutorial, which emphasizes the importance of UV protection in 2 separate modules. Of note, moderate increases in performance in sunscreen use occurred in both groups at the 3-month follow-up, and we believe that subjects may have been more inclined to engage in sun-protective behaviors in the months after visiting a dermatologist’s office. Men were less likely to use sunscreen—perhaps because they do not use topical products as frequently as women. Other studies have also noted sunscreen use and other sun-protective behaviors to be greater in women.

It is unclear why the intervention had a greater effect on sun-protective clothing use rather than sunscreen use. We hypothesize that purchasing and applying sunscreen at least 20 minutes before engaging in outdoor activities (as directed in the Skinsafe modules) is more cumbersome than donning sun-protective clothing. Many dermatologists frequently remind patients of the importance of sunscreen use—our findings suggest that perhaps sun-protection education in the office can be improved by encouraging patients to regularly use sun-protective clothing as well as sunscreen.

There are several limitations to our study. Primarily, all outcomes measured relied on self-reported behavior. In addition, we have to consider the Hawthorne effect, whereby subjects modify their behavior in response to being studied. Alternatively, participants might have been dishonest in follow-up surveys because they knew the aim of our intervention. Furthermore, all of the subjects in the intervention group received all 3 aspects of the multimodal educational program (CAL Skinsafe program, skin self-examination tutorial, and telecommunication reminders to perform skin self-examinations), but only the CAL Skinsafe program emphasized the use of sun-protective clothing and sunscreen. Therefore, it is not clear whether the use of sun-protective clothing and sunscreen was not statistically significant in our analysis (OR, 1.26 [95% CI, 0.58-2.77]). Men were less likely to use sunscreen (OR, 0.32 [95% CI, 0.14-0.72]) (Table).
Accepted for Publication: June 12, 2012.

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Financial Disclosure: Dr Bordeaux is supported by the Dermatology Foundation Clinical Career Development Award in Dermatologic Surgery.

Funding/Support: Dr Bordeaux is supported by the Dermatology Foundation Clinical Career Development Award in Dermatologic Surgery. This publication was made possible by the Case Western Reserve University Skin Diseases Research Center Grant Number P30AR039750 from National Institute of Arthritis and Musculoskeletal and Skin Diseases.

Additional Information: Study No.: Case 1610. The trial protocol is available through the Case Western Reserve Cancer Center Institutional Review Board office.


Impact of Bar-Code Labeling of Clinical Photographs on Patient Care and Practice Workflow

Dermatologists rely on clinical photographs to observe lesions over time and to identify surgical sites. Studies have shown that without photographs at the time of surgery, patients could not identify 17% to 29% of biopsy sites, and surgeons could not identify 5% to 12% of biopsy sites. With photographs, all biopsy sites were identified.1,2 Accurate labeling and secure storage of clinical photographs is a universal problem within dermatology. From 2008 through 2011, our department used prints of clinical photographs stored in the patients’ physical medical charts. Photographs were sometimes missing or unavailable at the various clinic sites, so we stored digital images on a secure server. Authorized users could access and print images at any site (2011). These methods were time intensive, error prone, and had less security than our online medical record.

Our practice uses demographic labels with a Code-39 bar code to identify patient specimens. Bar codes are a validated tool for error reduction in many areas of health care.3 We developed software (in C# for Windows Desktop) that uses photographs of these Code-39 bar-code labels to identify and upload clinical photographs into the patient’s online medical record, enabling all providers to view these images. To format images for this software, we photograph the patient’s demographic label prior to photographing the patient (the label with identifiers are not in the clinical photograph) (Figure).

Methods. At our academic medical center, for two 1-month periods, before (January 2010) and after (January 2012) implementation of the bar-code system, we assessed the proportion of Mohs surgery referrals with a photograph present in the medical record. To quantify the effort required under both our prior systems and the current bar-code system, we measured time for associated activities. We measured the time to log and process clinical photographs using our bar-code software to calculate the total administrative time per photograph. We compared this time to 2 prior systems that our practice used: (1) printing (Epson Photolab Personal) and labeling 2 copies of the digital photograph (for the medical chart and dermatologic surgeons); and (2) manually moving digital photographs onto a secure drive.

To determine the electronic readability of Code-39 barcode images obtained in our practice, we examined the demographic data extracted from 200 sequentially barcode images obtained during clinic visits. The Fischer exact test was used to determine P values for 2 × 2 frequency tables; the t test was used to compare group means. Institutional review board approval was waived.

Results. With our bar-code system, the percentage of patients with photographs available at the time of surgery increased from 84% (54 of 64) to 95% (73 of 77) (P = .049). Under the bar-code system, an average of 20 seconds of administrative time was required per clinical photograph, significantly faster than the 50 seconds per photograph needed.