Skills Training to Learn Discrimination of ABCDE Criteria by Those at Risk of Developing Melanoma

June K. Robinson, MD; Rob Turrisi, PhD

Objective: To develop skin self-examination skills by improving the use of the ABCDE criteria by those at risk of developing melanoma.

Main Outcome Measure: Recognition of A, B, C, D, and E traits.

Results: The subjects preferred the bookmark (87% of subjects), opaque ruler (94% of subjects), and lighted magnifying lens (81% of subjects) to reading the brochure, which was felt to take too long. Recognition of border irregularity, color variation, and diameter improved significantly after the intervention. Women recognized color variation more often than men (94% vs 62%; odds ratio [OR], 23.7; 95% confidence interval [CI], 16.1-50.5). Men identified irregular borders more often than women (91% vs 75%; OR, 16.8; 95% CI, 4.5-22.6). Women appropriately decided to see a physician more often than men (81% vs 57%; OR, 13.5; 95% CI, 7.1-28.4).

Conclusions: Determining the presence of the A, B, C, and E criteria is challenging for the novice. Skills training aided performance of skin self-examination. Differences in proclivities according to sex suggest that if men and women form partnerships for skin checks, they may learn from each other, and their combined strengths will promote detection of early melanomas.

Arch Dermatol. 2006;142:447-452

HE ABCD (ASYMMETRY, BORDER IRREGULARITY, COLOR VARIATION, DIAMETER >6 MM) acronym was created in 1985 to help primary care physicians and laypersons recognize early melanomas that might be confused with benign pigmented lesions.1 Over the last 20 years, dermatologists have advocated the use of the ABCD screening criteria in skin self-examination (SSE) and provided educational materials to teach people to perform SSE. These materials, which included pictorial instructions, achieved wide distribution in the media. As patients and physicians used the static diagnostic criteria defined by A, B, C, and D to examine moles, awareness of change (evolution) in moles increased.2 In 2004, the importance of change in shape, size, symptoms (eg, itching and tenderness), surface, and shades of color of a mole was recognized by adding an E (for evolution) to the acronym of the screening criteria for visual examination of pigmented skin lesions (ABCDE).3 Although the diagnostic accuracy of the ABCD criteria has been verified in clinical practice, no randomized controlled trial has been performed to demonstrate that using the criteria improves the ability to perform early detection.4-6 Laypersons have used photographs illustrating the criteria to enhance discrimination of pigmented skin lesions.7-8 Although written materials represent the minimal intervention needed for teaching adults how to perform SSE,9 passive knowledge-based learning by reading a brochure has not been shown to improve the ability to discriminate between benign and malignant pigmented lesions.10 This study examined the use of the ABCDE criteria by men and women at risk for developing melanoma and skills training with tools such

Author Affiliations:
Northwestern University Feinberg School of Medicine, Chicago, Ill (Dr Robinson); and Biobehavioral Health and Prevention Research Center, The Pennsylvania State University, University Park (Dr Turrisi).
as a magnifying lens, rulers, and a pencil eraser to facilitate identification of the features. The focus of examining differences according to sex was to assess preferences for different information sources as well as differences in skills following the interventions as a function of sex.

**METHODS**

**SUBJECT RECRUITMENT**

A sample of 100 men and women was recruited from a registry of 652 people with either a personal or family history of melanoma who agreed to participate in research. The subjects were randomly selected from those who met the inclusion criteria of having no previous history of counseling about performing SSE, being able to see to read a newspaper, and understanding English. People contacted by telephone were given a choice between mixed- or single-sex groups. The institutional review board of Loyola University Medical Center, Chicago, Ill, approved the research protocol. The subjects were offered nominal payment in appreciation of their participation.

**INTERVENTION AND ASSESSMENT**

Ten single-sex groups of 10 unrelated adult men or women, aged 18 to 80 years, met once in a classroom. All participants were exposed to knowledge-based interventions and skills-training interventions sequentially.

Preassessment and postassessment questionnaires were administered before and after the knowledge intervention and then before and after the skills intervention. In addition, following a 20-minute break after the skills intervention, another postassessment test was conducted. Demographic information about age, sex, ethnic background, education, and household income was obtained from all participants.

**KNOWLEDGE-BASED INTERVENTIONS**

During a 10-minute program, the dermatologist (J.K.R.) projected 8 images at original magnification ×20 to demonstrate the A, B, C, and D features. The dermatologist made a recommendation to see a physician if a lesion had a diameter equal to or greater than 6 mm and if the lesion was also high scoring for 2 other features. The gradations of the ruler in the image were explained. She pointed to representative areas of color photographs of pigmented lesions to show the abnormal feature and a contrasting area that did not show the feature. Monitoring moles for change was demonstrated with side-by-side examples of 2 moles by pointing to the changed area and describing it. After the dermatologist gave the presentation, she left the room without inviting questions or interacting with the group.

Each participant was then given a Skin Self-Examination bookmark by an educational facilitator (who was not a physician) followed by the brochure, "Skin Cancer: Early Detection" (American Academy of Dermatology, Schaumburg, Ill). As the facilitator distributed each item, she asked the participants to read it and turn it over when they were finished. They were told that they could keep the bookmark and the brochure for reference and were referred to those items for help in completing the questions at the postintervention assessment. Two independent observers kept a log of the time needed to review the bookmark and brochure. Interactions among the participants during the session were also logged.

The following variables were measured.

First intervention:

- **Knowledge-based.** A dermatologist used pigmented lesions projected onto a screen (original magnification ×20) to present information; subjects reviewed a bookmark and a brochure.
  - ABCD scores of 5 pigmented lesions printed with a ruler in the picture (original magnification ×2) (preintervention and postintervention assessment) and 2 opportunities to select the changing mole among 4 examples
  - Preference for printed reference material

Second intervention:

- **Skills training by group discussion of ABCD scoring of photographs of pigmented lesions, interactive demonstration of measuring with a ruler and a pencil eraser, and using a handheld magnifying lens.**
  - ABCD scores of 3 pigmented lesions, each on a separate transparency (preintervention and postintervention assessment)
  - Duration of the skills training session
  - ABCD scores of 3 pigmented lesions, each on a separate transparency, after a 20-minute break
  - Decision to seek a physician’s care on 3 pigmented lesions used in the preintervention and postintervention assessments and 3 other pigmented lesions after the break (6 different pigmented lesions)
  - Preference of measuring device and magnifying lens
  - Attitude and beliefs about using the magnifying lens

**ASSESSMENTS OF KNOWLEDGE-BASED INTERVENTIONS**

Before and after the knowledge interventions, each subject received 5 separate pages with a photograph of a single pigmented lesion printed on each page at twice the original magnification (with a ruler in the photograph). For each single pigmented lesion, subjects used a scale to score the asymmetry, border irregularity, and color variation present. A score of 1 represented symmetry, regular border, or even color; a score of 5 indicated asymmetry, irregular border, and uneven color. In addition, the diameter was measured using the ruler in the photograph. The order of the images used in the preintervention and postintervention assessments changed, and the images used in the presentations were different from the moles used in both intervention assessments. The subjects received 2 additional pages showing the before and after appearances of 4 pigmented lesions. They selected the moles that had changed.

Ratings of 1 to 2 on asymmetry, border irregularity, and color variation were categorized as symmetric, smooth border, and even color. A rating of 3 was categorized as undecided. Ratings of 4 to 5 were categorized as asymmetric, irregular border, and uneven color. Diameters scored as 1 to 6 mm were categorized as small, 7 to 10 mm or bigger as large. All ratings (symmetry, border, color, and diameter and selections of changing moles) were then scored as correct if they were in agreement with those made by a dermatologist.
SKILLS TRAINING INTERVENTION

The skills training intervention was designed to personalize the subjects’ decisions by having the pigmented lesions appear as if they were on their own skin. Three images of pigmented lesions were individually reproduced at life size on separate clear transparencies and placed on the forearm. Clear and opaque plastic rulers with both millimeter and inch units were distributed, with instructions to measure the diameter in millimeters. Then, the facilitator led a group discussion about scoring the features of the printed pigmented lesions. She asked about the ease of making a decision and comfort with the decision. Projected digital alterations of moles demonstrated the range of scores for A, B, and C. The group discussed whether a physician should see the pigmented lesion. During the skills training session, the gradations on the clear and opaque rulers were demonstrated.

The facilitator then demonstrated how to place a No. 2 pencil eraser over the mole and check to see if any part of the mole extended beyond the pencil eraser. She distributed pencils and helped small groups of 2 or 3 participants place the eraser on the mole on the transparency. The participants indicated if the top of the eraser covered the mole.

A magnifying lens (original magnification ×2) in a metal frame and a magnifying lens in a plastic frame with a battery-operated light were given to each participant to examine the mole. The facilitator demonstrated how to turn on the light and how to focus on the mole. At the conclusion of the skills training session, subjects commented on whether they felt that they could find a changing mole, if they thought that the ABCDE criteria would help them check their moles, and whether the ruler and magnifying lens would be useful. Both observers recorded the duration of the skills training session.

ASSESSMENTS OF SKILLS TRAINING INTERVENTIONS

In the preintervention and postintervention assessments, the participants evaluated 3 separate pigmented lesions by scoring the amount of asymmetry, border irregularity, and color variation present on similar 1 to 5 scales as described in the “Knowledge-Based Interventions” subsection. Participants also used clear and opaque plastic rulers with both millimeter and inch units to measure the diameter in millimeters. Finally, the participants made decisions about seeking a physician’s care for each lesion (yes or no). As with the knowledge-based assessments, all pre–skills training and post–skills training interventions ratings (symmetry, border, color, and diameter) were scored as correct if they were in agreement with those made by a dermatologist.

Posttest Preference of Reference Materials

Participants were asked whether they preferred using the pencil or the ruler. In addition, participants were asked to use their preferred magnifying lens to score 3 pigmented lesions and make a decision about seeking a physician’s care for each (yes or no). The participants were given the lens that they preferred. Their attitudes about using the magnifying lens were elicited by the following 8 questions with 5-point Likert scale responses (strongly disagree, moderately disagree, neutral, moderately agree, strongly agree):

1. The magnifying glass helped me to see.
2. Using the magnifying glass was confusing.
3. The magnifying glass made it easier to see the symmetry.
4. The magnifying glass made it easier to see the borders.
5. The magnifying glass made it easier to see the colors.
6. The magnifying glass made it easier to measure the diameter with a ruler.
7. I can learn to use the magnifying glass.
8. I will use the magnifying glass.

High internal consistency was observed for these items (α coefficient, 0.83); therefore, items were scaled so that higher scores represented more positive attitudes about using the magnifying lens and then summed to create a single attitudinal variable.

Extended Posttest Assessment

After a 20-minute break, each participant separately scored (using the 1 to 5 rating scales) 3 different moles on transparencies using the bookmark, brochure, ruler, and magnifying lens as reference materials and decided if a doctor needed to see each mole (yes or no). These ratings were then assessed in relation to those made by the dermatologist as described in the “Assessments of Skills Training Interventions” subsection.

STATISTICAL ANALYSIS

For statistical analysis, we used SPSS statistical software (release 10.0.06; SPSS Inc, Chicago, Ill). Descriptive statistics were used to characterize patterns on all demographic, background variables, and preferences for reference materials (eg, means, standard deviations, and frequencies in percentages). Participants’ scores on each evaluative dimension were compared with the dermatologist’s scores using paired t tests. Multivariate regressions were used to test for associations between the independent variables of age and sex and the dependent variables of the ABCD features. Analysis is presented herein with odds ratios (ORs) and 95% confidence intervals (CIs).

RESULTS

PARTICIPANTS

The mean (SD) age of the 100 subjects was 56 (2.5) years. There was no significant difference in the mean ages of men and women. The median education level of the participants was some college, and the mean (SD) annual family income was $45 000 ($5000). There was no significant difference in education or family income associated with sex. All participants were white, and none were Hispanic.

During the initial recruitment, 10 men and 5 women declined to participate. During the telephone interview, 96% of women and 65% of men desired single-sex groups because they were more comfortable seeking assistance with skin examinations from a stranger of the same sex. Qualitative results independently summarized by 2 observers are reported only when both observers reported that more than 75% of the participants in a session expressed the opinion.

EVALUATION OF THE KNOWLEDGE-BASED INTERVENTION

Using the pigmented lesions printed at original magnification ×2, the identification of border irregularity, color variation, and diameter improved significantly after the intervention (Table 1). Asymmetry was not a
trait that was intuitively recognized, and identification did not improve with education. Education about the gradations of the ruler in the image significantly improved the subjects' ability to measure the diameter accurately, with a smaller diameter reported after the intervention (Table 1). Education did not improve recognition of a changing mole.

In the preintervention and postintervention assessments, women recognized color variation more often than men (94% vs 74%; OR, 12.7; 95% CI, 6.2-20.5).

Table 1. Recognition of ABCDE Criteria on Photographs of Pigmented Lesions Before and After Knowledge-Based Intervention by 100 Subjects∗

<table>
<thead>
<tr>
<th>Feature</th>
<th>Before Intervention</th>
<th>After Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct</td>
<td>Undecided</td>
</tr>
<tr>
<td>Asymmetry</td>
<td>12 (3)</td>
<td>48 (9)</td>
</tr>
<tr>
<td>Border irregularity†</td>
<td>65 (15)</td>
<td>14 (1)</td>
</tr>
<tr>
<td>Color variation†</td>
<td>51 (5)</td>
<td>15 (2)</td>
</tr>
<tr>
<td>Diameter†</td>
<td>27 (16)</td>
<td>33 (12)</td>
</tr>
<tr>
<td>Evolution</td>
<td>10 (4)</td>
<td>65 (12)</td>
</tr>
</tbody>
</table>

*Data are given as mean (SD) percentages.
†Recognition improved with knowledge-based intervention; P<.05, paired t test.

In the preintervention and postintervention assessments, women recognized color variation more often than men (94% vs 74%; OR, 12.7; 95% CI, 6.2-20.5).

In the preintervention and postintervention assessments, women recognized color variation more often than men (94% vs 74%; OR, 12.7; 95% CI, 6.2-20.5).

EVALUATION OF THE KNOWLEDGE-BASED INTERVENTION REFERENCE MATERIAL

The mean (SD) allotted time to review the bookmark was less than 5 (1) minutes and to read the brochure was 20 (4) minutes. Ninety-two percent of participants preferred to have a reference, although 87% felt that the brochure was too long and that the bookmark was more helpful.

No sex differences were observed in the evaluation of the knowledge-based intervention reference materials.

EVALUATION OF THE SKILLS TRAINING INTERVENTION

Scoring of border and color and the decision to see a physician improved significantly after skills training (Table 2). When participants were retested after the 20-minute break, there was no significant difference from the results prior to the break.

Differences according to sex

Women recognized color variation more often than men (94% vs 62%; OR, 23.7; 95% CI, 16.1-50.5). Men identified irregular borders more often than women (91% vs 75%; OR, 16.8; 95% CI, 4.5-22.6). Women appropriately decided to see a doctor more often than men (81% vs 57%; OR, 13.5; 95% CI, 7.1-28.4).

EVALUATION OF THE SKILLS TRAINING REFERENCE MATERIAL

Ninety-four percent of participants preferred the opaque ruler because it was easier to see the units. Sixty-eight percent correctly observed that the pencil eraser did not cover all aspects of the mole, and 32% erroneously observed that the eraser covered the mole.

Eighty-one percent of people preferred the lighted magnifying lens to the one without a light. Some had difficulty focusing on the mole on the transparency. Participants agreed that for self-examination, the magnifying lens could only be used to see the front of the extremities and was not useful for the face, neck, scalp, or back. People spontaneously turned to use the magnifying lens on the person beside them to look at moles on the face, neck, and ears. This behavior occurred in all groups and involved 80% of the participants.

All groups expressed concern about finding a changing mole because they doubted they could remember what it looked like. Most agreed that the ABCDE criteria helped focus their attention on the types of change that were cause
for alarm. Several suggested that writing down the diameter of a mole and the letters for the feature they found would help them to remember what they needed to check again.

DIFFERENCES ACCORDING TO SEX AND AGE

Men were more likely than women to use a magnifying lens (82% vs 47%; OR, 29.3; 95% CI, 8.4-44.5). Men aged 40 to 59 years reported a significant improvement and willingness to use the lens (87% vs 64%; OR, 12.7; 95% CI, 8.2-26.5). The older male participants (aged 60-80 years) expressed problems focusing on the pigmented lesion with the magnifying lens (94% vs 54%; OR, 30.2; 95% CI, 8.2-107). The mean (SD) duration of the skills training intervention for a group was 25 (8) minutes. We found no significant difference in duration between the men's and women's groups.

COMMENT

Despite technologic advances such as detecting melanomas with dermoscopy and observing patients with lesions by reexamining them for change with digital epiluminescence microscopy, early recognition of cutaneous melanoma remains for most people a matter of visual inspection by the physician and the patient or their partner.11-13 Because patients initially discover approximately 50% of melanomas,13 the best opportunity for early detection may be SSE by those at risk of developing melanoma. Those with a history of a melanoma have an 11.4% risk of recurrence in the first year after diagnosis.16 The challenge is to create consistent, simple SSE messages that enable learning and performance by the patient and their family within that first year.

The addition of E, for evolution, to the acronym ABCD is intended to heighten awareness of the diagnostic importance of change, which has been recognized for many years.17-21 Education in SSE and skills training that builds on the commonly recognized changes in a mole may improve the ability of laypersons to detect evolving lesions. Change in size and/or color and very dark colors are the features most commonly reported by patients.22-26

In this study, people preferred to measure the diameter of moles with a ruler. They believed that this method is more useful for finding changes than the pencil eraser method. Some older people may benefit from the use of illuminated magnification to see the gradations of the ruler. Recognition of border irregularity and color variation improved using the printed images after the knowledge-based intervention; however, before skills training, participants did not correctly score the mole on the transparency on their forearm. The smaller size of the pigmented lesion on the transparency may have made it difficult to apply their knowledge. Perhaps seeing the pigmented lesion on their forearm increased their anxiety and impaired their perception. Individuals spontaneously sought a partner with whom to use the magnifying lens on their own moles. Scoring the moles on the transparency improved after skills training, and this knowledge was retained after a short break; however, there may be less retention after a longer delay. Future research is needed to evaluate this.

This study identified differences in proclivities according to sex, with men showing better border discrimination in small lesions and women having better color detection. The willingness of men to use a magnifying lens may account for their improved discrimination of borders in small lesions. The motion of focusing up and down on the mole with the magnifying lens during the skills training exercise probably improved visual learning, which is enhanced by gesture associations, such as pointing to the area of concern.27 Shifting or changing scale, as happens with magnification, enhances detection of edges, such as the border of the lesion.28

A possible confounding variable is the interactions between the female facilitator and the respondent of the same or opposite sex. In all groups, linking the auditory discussion of the measuring units with looking at the ruler reinforced the elements of the skills training. Visual perception of color and border irregularity was linked with the motion of the hand on the magnifying lens. Because the duration of the skills training session was similar for men and women, and the observers did not notice a qualitative difference in the discussions, the results do not seem to have been influenced by the sex of the facilitator.

Almost all colors perceived by the human eye are a combination of 3 primary colors: red, green, and blue. Because men have a greater chance of having partial red-green color blindness, they may perceive color differently from women and may have difficulty interpreting very small color differences within a mole. This color perception deficiency is especially problematic because blue, red, and white are more often present in melanomas than in nevi.10 The importance and subjectivity of color perception in making the diagnosis cannot be underestimated. When dermatologists use dermoscopy to examine lesions, the number of colors contributes to the final score (ABCD of dermoscopy),11 and the presence of 5 to 6 colors represents a positive feature in Menzies’ classification system.12 The interpretation of color variation is subjective to the perception of color, which is flexible and in the mind of the beholder.

Another potential color recognition problem is that recognition depends on lighting conditions.29 Although participants in this study did not feel that the illuminated magnifying lens improved color discrimination, there was a preference according to age for the use of the magnifying lens, which may reflect enhanced perception by illuminated magnification. Men, who preferred to use magnification, apparently used the additional benefit of brighter illumination to discern borders.

Although dermatologists who are highly skilled in the art of clinical detection of melanoma seem to unconsciously rely on overall pattern recognition,30 the novice needs a framework and the repetition of skills training. The ABCDE criteria provide a helpful framework to examine nevi, but discrimination of A, B, C, and E is challenging because they are continuous not discrete variables and have a subjective reference range. By focusing the learner’s attention on scoring the criteria, discuss-
ing the decision process with the group, and showing ex-
amples from across the spectrum, the ability to discern vari-
ations improved. The criterion D is a discrete vari-
able that is objectively measured. In this study, once sub-
jects understood the gradations of the ruler, they were comfortable measuring with it.

Recognizing evolution requires the ability to com-
pare a pigmented lesion’s current appearance with its former appearance. In this study, people were con-
cerned that they could not remember the previous ap-
pearance of the lesion. Hanrahan et al13 found that the main difficulty people had in performing SSE is their lim-
ited ability to recall the appearance of the moles. Based
on our experience with knowledge-based interventions and skills training, recognition of evolution will be im-
proved by training in how to compare the current ap-
pearance of a lesion with its former appearance. Proclivi-
ties in recognition of color and border, the 2 most com-
monly identified changes, suggest that partnerships
of men and women in learning and performing skin checks will promote detection of early melanomas.

Accepted for Publication: December 21, 2005.
Correspondence: June K. Robinson, MD, Northwestern
University Feinberg School of Medicine, 132 E Dela-
ware Pl, No. 5806, Chicago, IL 60611 (archdermatol
@jama-archives.org).

Author Contributions: Study concept and design: Robinson.
Drafting of the manuscript: Robinson. Critical revision of
the manuscript for important intellectual content: Turrisi.
Dr Robinson takes responsibility for the data and the accuracy of the data analysis.

Financial Disclosure: None.
Funding/Sponsor: This study was supported by grant
5R21 CA-103833-02 (Dr Robinson) from the National Cancer Institute.

Disclaimer: Dr Robinson is the Editor of the Archives of
Dermatology. She was not involved in the editorial evaluation or decision to accept this article for publication.

REFERENCES


7. Branstrom R, Heidblad MA, Kraka u, I llen H. Laypersons’ perceptual discrimi-


9. Mickler TJ, Rodriguez JR, Lescano GM. A comparison of three methods of teach-


11. Argenziano G, Soyer HP, Chimenti S, et al. Dermoscopy of pigmented skin les-


14. Robinson JK, Nickoloff BJ. Long-term digital epiluminescence surface micros-


16. Ferrone CR, Porat LB, Berwick M, Halpern AC, Coit DG. Clinicoepidemi-


19. Lucas CR, Sanders LL, Murray JC, Myers SA, Hall RP, Grichnik JM. Early mela-


25. Elwood JM, Gallagher RP. The first signs and symptoms of melanoma: a population-


29. Tarr MJ, Kerstene D, Bulthoff HH. Why the visual recognition system might en-


31. Hanrahan PF, Hersey P, Menzies SW, Watson AB, D’Este CA. Examination of the ability of people to identify early changes of melanoma in computer-altered pig-