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# Skin Cancer Screening

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## 1. Introduction

This chapter reviews 1) the incidence, mortality, and risk factors for skin cancer, 2) the efficacy, cost-effectiveness, and frequency of skin cancer screening, 3) behavioral interventions to improve engagement in skin cancer screening, and 4) issues related to screening of special populations.

## 2. Melanoma and non-melanoma incidence, mortality and risk factors

Skin cancer is the most common cancer in the US, with almost three million individuals being diagnosed annually [1]. Both melanoma and non-melanoma (or keratinocyte) skin cancer (NMSC) incidence rates have been increasing in recent decades [2]-[4]. In 2012, melanoma is predicted to be the fifth most common cancer among US men and the sixth most common cancer among women [2]. Risk factors for melanoma and NMSC include male sex, age over 50 years, personal or family history of melanoma or NMSC, red hair, blue or green eyes, Fitzpatrick skin type I (very fair skin sensitive to ultraviolet radiation [UV]) with freckles, actinic keratosis on the head, familial atypical mole-melanoma syndrome, or numerous (i.e., > 100) moles [2], [5]-[15]. Additionally, many melanomas and NMSCs can be attributed to UV exposure such as via outdoor occupations, one blistering sunburn prior to age 18, multiple sunburns at any age, or indoor tanning [15]-[21].

### 3. Efficacy of skin cancer screening

During a total cutaneous examination (TCE), the healthcare professional uses observation by sight, sometimes augmented by serial photography and/or dermoscopy to detect not only skin cancer but also risk factors for skin cancer (e.g., actinic keratoses) [22]. Suspicious lesions may then be biopsied and examined histologically. TCE also allows the healthcare professional the opportunity to educate the patient regarding their risk of skin cancer [22]-[24]. Screening of those at high risk for skin cancer detects tumors at an earlier stage when tumors are thinner, resulting in lower mortality rates [25]-[31]. Due to their clinical training and expertise, dermatologists are able to detect melanoma tumors during an early stage of growth, whereas patients may not notice a tumor until it is noticeably thick [32]-[34]. To date there are no major randomized controlled trials assessing the efficacy of TCE, but a case-control study found that melanoma patients who had a TCE in the three years prior to their diagnosis were 14% less likely to have thick melanoma, resulting in 26% fewer deaths [25]. Specificity for detection of melanoma through TCE is comparable to that of other cancer screening tests [35]. Most professional organizations recommend total cutaneous examination (TCE) for high risk individuals [1], [36]-[38], and some recommend population screening [39]; although, in 2009 the US Preventive Services Task Force concluded that there was insufficient evidence to recommend skin cancer screening for the general adult population [40].

Patients and their family/friends are the first to spot half to three quarters of all melanomas [41]-[45]. To perform SSE, individuals are instructed to carefully examine all of their skin for abnormal spots following the "ABCDE" criteria: asymmetry, irregular borders, variation in color, large diameter (i.e., >6mm or a pencil eraser), and evolving (i.e., a changing spot) [46]. Skin self-examination (SSE) is associated with thinner tumors [47], may shorten the time to diagnosis [48], and may reduce melanoma mortality by up to 63% [49]. Both the National Cancer Institute [38] and the American Cancer Society [36] recommend monthly SSE.

### 4. Cost-effectiveness and frequency of skin cancer screening

Because of its high prevalence, NMSC is among the mostly costly cancers to treat among the Medicare population [50]. SSEs are cost-effective in that people can perform them on their own; however, there is the potential for otherwise unnecessary medical visits. Screening programs with cost ratios less than \$50K per year of life saved are said to be cost-effective [51]-[54]. Two studies found that dermatologist skin cancer screening for individuals 50 years of age or older is cost-effective with costs of \$10-\$16K per quality-adjusted life year [QALY] saved overall and \$35K per QALY for biennial screening of siblings of melanoma patients; whereas, annual screening of the general population is not cost-effective [52], [53]. A 1996 Australian study of the cost-effectiveness of every five-year screenings by family practice physicians of men over 50 years of age found a cost-effectiveness of \$6.9K per QALY [55]. In comparison, the cost-effectiveness ratios for biennial mammography for women ages 50-69 years and for colorectal cancer screening every five years after age 50 are \$30.5K and \$47.4K per QALY saved,

respectively [51], [54]. With the introduction of the Patient Protection and Affordable Care Act, those previously without health insurance will have access to medical care [56]. In addition, this law will increase the focus on prevention of chronic illnesses such as cancer [57].

Although efficacious and cost-effective, rates of *ever* having had a TCE are low at approximately 15-17% among US adults [58], [59]. Despite the recommendation from some organizations for monthly SSE, SSE rates are also suboptimal. US and Australian studies conducted from 1991 to 2004 found that only 23-61% of individuals performed SSE at least annually [60]-[66]. A study of Scottish patients also noted that approximately one third of patients did not seek medical attention until more than three months after noticing a worrisome pigmented lesion, potentially contributing to thicker melanomas [67]. Due to the relatively low rates of skin cancer screening, it is important to identify efficacious and cost-effective interventions to increase engagement in screening behavior, particularly among high risk groups such as men 50 years of age and older.

## 5. Psychosocial barriers to skin cancer screening

Several psychosocial variables have been found to be associated with skin cancer screening. Dermatologists' main reason for not conducting TCE is patients' perceived embarrassment or reluctance [68]. An Australian study found that having a TCE in the past three years was associated with having a positive attitude toward skin cancer screening [69]. TCE intentions were higher among first-degree relatives of melanoma patients reporting greater physician and family support and perceiving greater benefits (e.g., to prevent cancer) of and lesser barriers (e.g., not enough time, anxiety) to TCE [70]. Barriers to TCE reported by Australian employees included fear of being diagnosed and difficulty attending appointments during work hours [71]. SSE has been found to be associated with higher SSE self-efficacy (i.e., SSE-related confidence) [72] and perceived benefits of and barriers to SSE [73] among melanoma patients/survivors. Intentions to receive SSE were higher among individuals with higher family support and higher benefits and lower barriers to self-examination [70]. SSE-related benefits were the strongest predictor of SSE among individuals from families with familial atypical multiple mole melanoma [74]. Other barriers to self-detection include limited ability to recall the skin's appearance and undercounting the number of moles on the skin [75]. Physicians, family, and media may serve as cues to action in skin cancer prevention and detection [76].

## 6. Prior interventions to increase skin cancer screening

Community and mass media campaigns (e.g., SkinWatch) that have increased TCE have been conducted mostly in Australia [35], [77]. For example, SkinWatch, a three-year Australian rural and regional community-based randomized controlled trial, involved community education ("self-help guide" to skin examination and melanoma risk factors, available in physicians'

waiting rooms), a media campaign (press regarding the program and advertisements), and volunteer recruitment and activities (training of a “Volunteer SkinWatch Coordinator” in each community to serve as liaison between the community and research team). More than 16,000 people attended SkinWatch screening clinics conducted by general practitioners and special screening services [78], [79]. By two years, screening rates almost tripled in intervention communities [35]. Screening attendance was associated with age 40-49 years, fair skin, personal history of skin cancer, concern about a spot or mole, and not having had a recent TCE [80]. Reasons endorsed for failing to attend screening services included a lack of knowledge regarding services, not having time to attend services, and having had a TCE recently [80]. A few studies assessing interventions to increase TCE have found low (2-19%) uptake rates even among high risk populations [28], [81]. On the other hand, a more recent Australian study found that 71% of employees attended a free workplace skin cancer screening [71]. Finally, Manne and colleagues [82] found that a tailored print intervention increased TCE intentions and performance among first degree relatives of melanoma patients.

Interventions that have increased SSE through 1-year follow up among the general population have included in person and telephone approaches, videos, pamphlets, and free TCE [83]-[87]. For high risk populations such as melanoma patients and their family members, two UK and US groups have found success at 3-6 months using Skinsafe, an interactive multimedia intervention including characteristics of skin at risk, early signs of melanoma, personalized risk feedback, and SSE instruction [88], [89]. Other interventions have included the approaches used for general populations as well as personalized risk feedback, diaries and body maps, tailored recommendations and reminders, workbooks, a couple-based approach, guided imagery, and the use of photos of moles [75], [88], [90]-[99]. In general, interventions that have significantly increased skin cancer screening have tended to target high risk populations and be interactive and individually tailored based on personal characteristics, attitudes, and behaviors [92], [94].

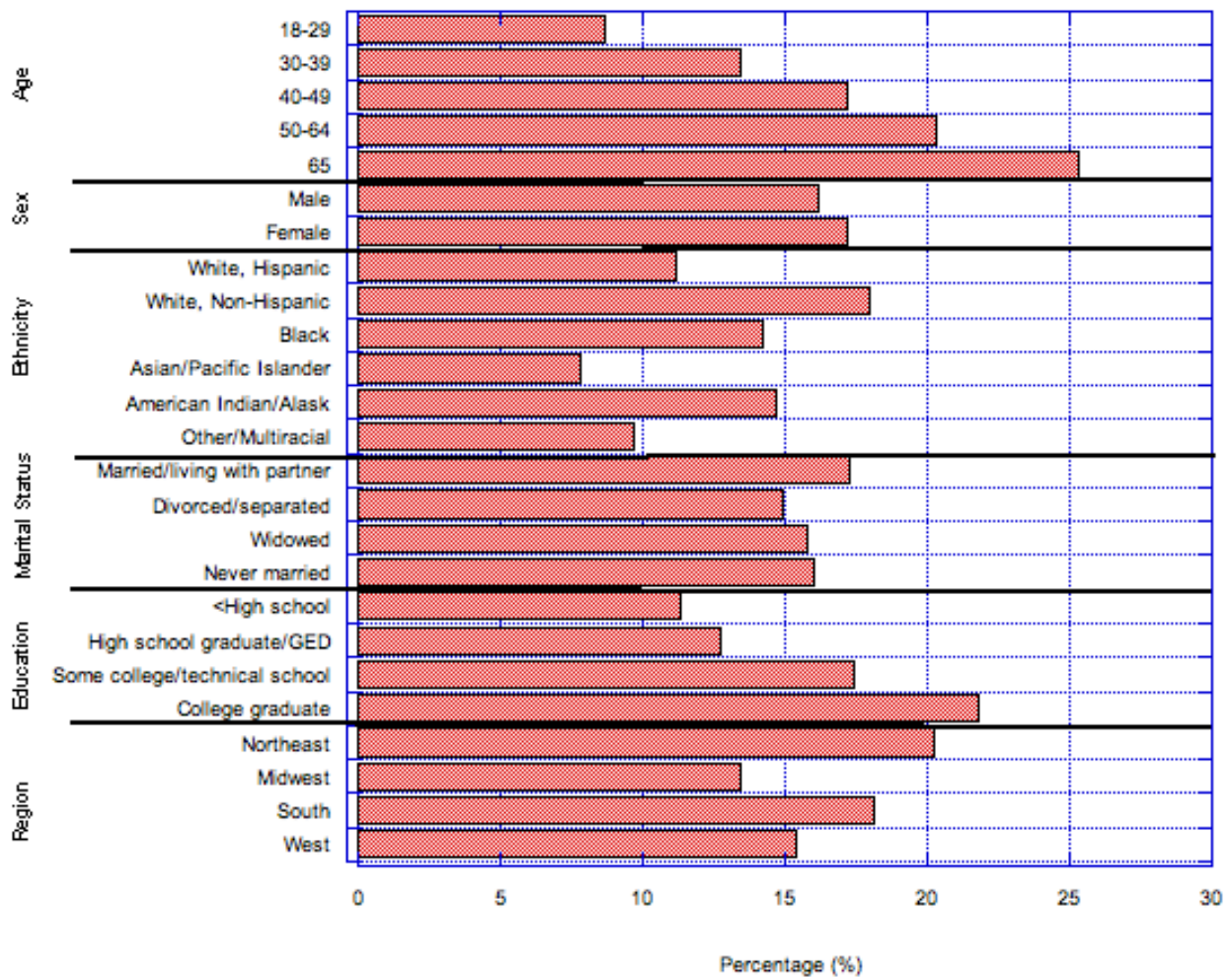
## 7. Special populations

### 7.1. Older men

It is well-documented that men, particularly those aged 50 years and older, have higher incidence of, as well as morbidity and mortality from melanoma than other demographic groups [1], [100]-[103]. During the past decade, the incidence of thick melanomas (i.e., 4 mm) in the US increased significantly only in men 60 years of age and older [1]. A recent analysis of four phase III trials found that women had a consistent 30% advantage in all aspects of localized melanoma progression, which they attribute to a variety of potential tumor- and host-related biologic sex difference [100]. Studies have found that women are also more likely than men to do SSE [48], [60], [61], [63], [65], [66], [104]-[107], intend to do TCE [108], and detect melanomas [42], [44]. Figure 1 shows US TCE rates in 2005 among various demographic groups.



Health interventions targeted specifically to men may benefit from a consideration of masculinity [109]-[117]. For example, one study found that more masculine college students were more likely to intend to do SSE if they received a worry control versus a response-efficacy (i.e., screening can detect skin cancer when it's most treatable) message [115]. Studies have found barriers to healthcare utilization and prevention among men that may be related to a stereotypical masculine identity including discomfort with communication, feelings of vulnerability or invincibility, and even homophobia [111]. Thus, interventions for men should emphasize "masculine norms" such as self-reliance, emotional control, and power [109]. A few European and Australian interventions targeting middle-aged and older men included male celebrity modeling, use of photos, a website, free exams, and education and were successful in increasing SSE [114], [118], [119] and TCE [120]-[122]. Geller and colleagues (2006) also recommend a national survey to assess men for risk factors, perceived susceptibility, attitudes toward TCE and SSE, perceived barriers, and potential social supports [113].



Adapted from [59]

**Figure 1.** Adjusted predicted value (%) for having total-body skin examination among US adults, National Health Interview Survey, 2005

## 7.2. Young adults

Melanoma is the second most common cancer (after lymphomas) in adolescents and adults younger than age 30 in the US [123]. The high rates of melanoma in this age group can likely be explained by high ultraviolet (UV) radiation exposure and low sun protection rates early in life [124], [125]. About one in three adolescents and young adults report intentional sunbathing [126]-[128], and 40-60% of college students have used indoor tanning booths, with higher rates among women [129]-[131]. In addition, sunscreen use is poor in this age group, with 50-85% failing to routinely wear sunscreen when outdoors [132], [133].

Some organizations recommend regular skin cancer screening beginning at 20 years of age [36], [38]. However, results of the 2000 National Health Interview Surveys showed that only 7% of young adults aged 18-29 years had ever received a TCE, down from 11% in 1998 [134]. Physicians tend to neglect young adults as a group that does not need skin cancer detection counseling [135], [136]. In addition, few studies have examined skin exam rates in young adults. Routine skin exams are largely recommended for those at high risk of skin cancer (usually older adults) [8], but the increasing rates of skin cancer in young adults indicates a potential need for culturally-appropriate interventions to increase skin exams in this age group, particularly among high risk populations such as individuals with a family history of skin cancer or indoor tanners. Skin cancer prevention interventions for young adults benefit from a focus on the negative effects on appearance stemming from UV exposure [137], [138]. Similar appearance-oriented interventions to increase skin cancer screening could focus on the effects of biopsies and skin surgeries if skin cancer is not detected early.

## 7.3. Racial and ethnic minorities

While white individuals are at higher risk for melanoma, non-white individuals tend to be diagnosed at later stages and have poorer survival [139], [140]. Specifically, ethnic minorities are 1.96 to 3.01 times more likely to die of melanoma, as compared to Whites of the same age and sex [139], [141], [142]. There are likely biological factors that play a role in this disparity [140]. However, another reason for later detection may be that race/ethnicity may be a proxy for some other demographic factors such as poorer SES, lower education, poorer access to healthcare, linguistic barriers, medical distrust, and occupational hazards such as UV exposure [140]. Though skin cancer rates are lower in racial and ethnic minority groups, they are not immune from this disease. Therefore, efforts should be made by healthcare professionals to educate these groups regarding their risk and signs of skin cancer.

Few studies have been conducted to determine the prevalence of TCE and SSE among racial and ethnic minority groups. One study found the rate for ever having had a TCE in Hispanic Whites was 3.7%, compared to 8.9% in non-Hispanic Whites [134]. Another study found rates of 16.2% in Blacks and 17.1% in Hispanics for regularly receiving TCE, compared to 25.5% of Whites [14]<sup>3</sup>. A study of US university students found that 7.7% of Asian, 12.5% of Black, and 14.3% of Hispanic students reported ever having performed SSE (compared to 39.5% of White students) [144]. A study conducted by Pipitone and colleagues (2002) compared SSE in 27 Hispanic and 113 White individuals, finding that none of the 27 Hispanics reported ever being

taught SSE [145]. In addition, the Hispanics reported not being told to perform SSE as often as non-Hispanics were.

#### **7.4. Other underserved populations**

Particular attention to underserved populations (e.g., based on education, older age, rural/urban status, etc.) is needed. Demographic variables found to increase prevalence and/or severity of melanoma include urban residence in some cases, lower educational level, not being married, and being retired [31], [47], [146], [147]. TCE rates have been found to be lower among some demographic groups such as non-whites [59], individuals with high occupational UV exposure or lack of health insurance [148], lower educational levels [70], [148], unmarried men [70], and men living in metropolitan areas [114]. Rates of SSE have also been found to be higher among dermatology clinic patients and in younger adults as opposed to adults older than 50 [48], [60], [106]. Skin examination behaviors are influenced by factors such as skin cancer awareness, socio-economic status, and sociocultural values. Perceived risk for and knowledge regarding skin cancer is poor, especially among blacks and those with lower education levels [149]-[153]. Analysis of results from the Health Information National Trends Survey also showed that Blacks, the elderly, and people with less education all perceived themselves as being at reduced risk for skin cancer [149]. Furthermore, these groups, along with Hispanics, tended to believe that they could not reduce their skin cancer risk or that recommendations for risk reduction were too unclear for them to adopt appropriate strategies [149]. Interventions designed to address health disparities should be culturally appropriate, inexpensive, easy to use, be appropriate for low health literacy levels, easily disseminated, address access to care, utilize tailoring, and involve the community when possible [113], [154]-[158]. Additionally, when developing interventions for an older population, it is important to keep in mind declines in cognitive abilities and a reliance on affective decision making as a result of such declines [159], [160].

## **8. Conclusion**

Skin cancer is common and increasing in incidence. Skin cancer screening is efficacious and cost-effective in detecting more curable skin cancers. However, engagement in skin cancer screening is relatively low, even among high risk populations. Thus, research indicates a need for improved skin cancer screening interventions especially among high risk populations such as individuals with a personal or family history of skin cancer and older men. Several behavioral interventions have been developed and have demonstrated some promise in increasing skin cancer exams. However, health disparities in melanoma incidence, morbidity, and mortality exist as well as disparities in engagement in skin cancer detection. These disparities indicate a need for sensitive and culturally-appropriate behavioral interventions. Researchers should attend to individuals with low health literacy levels when designing these interventions. Young adults should also be educated regarding their risk for skin cancer and how to do skin exams, given the increasing rates of skin cancer in this age group. Future research on



skin exams might benefit from the incorporation of new technology, such as use of smart-phones and other wireless devices. Such approaches might enhance needed dissemination of efficacious interventions to the public.

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