Screening, early detection, and trends for melanoma: Current status (2000-2006) and future directions

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In the past 5 years, there have been notable strides toward the earlier recognition and discovery of melanoma, including new technologies to complement and augment the clinical examination and new insights to help clinicians recognize early melanoma. However, incidence and mortality rates throughout most of the developed world have risen over the past 25 years, while education and screening, potentially the best means for reducing the disease, continue to be severely underutilized. Much progress needs to be made to reach middle-aged and older men and persons of lower socioeconomic status who suffer a disproportionate burden of death from melanoma. Worldwide melanoma control must also be a priority, and comprehensive educational and screening programs should be directed to Northern Ireland and a number of Eastern European nations, whose 5-year survival rates range between 53% and 60%, mirroring those of the United States and Australia more than 40 years ago.

Learning objective: After completing this learning activity, participants should be aware of the most recent melanoma epidemiologic data, both in the United States and internationally; worldwide early detection and screening programs; clinical strategies to recognize and improve the detection of early melanoma; the latest technologies for early detection of melanoma; and public and professional education programs designed to enhance early detection. (J Am Acad Dermatol 2007;57:555-72.)

Melanoma is an increasingly common cancer in the United States and elsewhere. Screening and early detection programs can ideally detect nearly all melanoma at a curable and early stage. In this review, we highlight emerging national and international incidence and mortality trends, advances in clinical strategies for the detection of early melanoma, worldwide screening and educational programs, new technologies for early identification of lesions, and public and professional education to promote early detection of disease.

We reviewed MEDLINE and national and international registries and databases using search terms such as melanoma, incidence, mortality, early detection, screening, physical exam, sensitivity, specificity, screening, self-screening, identification, recognition, and dermoscopy/dermatoscopy. We identified additional studies by reviewing the reference lists of all studies included herein and consulted

Abbreviations used:

AAD:	American Academy of Dermatology
ABCD:	asymmetry, border irregularity, color, and diameter
ACS:	American Cancer Society
BSCT:	Basic Skin Cancer Triage
CAMS:	classic atypical mole syndrome
CNMD:	Consensus Net Meeting on Dermoscopy
CI:	confidence interval
DN:	dysplastic nevi
FDR:	first-degree relatives
GP:	general practitioner
HRNCAMS:	high-risk non-CAMS
IOM:	Institute of Medicine
LMM:	lentigo maligna melanoma
NM:	nodular melanoma
NMSC:	nonmelanoma skin cancer
OR:	odds ratio
PCP:	primary care provider
PLC:	pigmented lesion clinic
QALY:	quality-adjusted life year
SEER:	Surveillance, Epidemiology, and End Results
SES:	socioeconomic status
SSE:	skin self-examination
SSM:	superficial spreading melanoma

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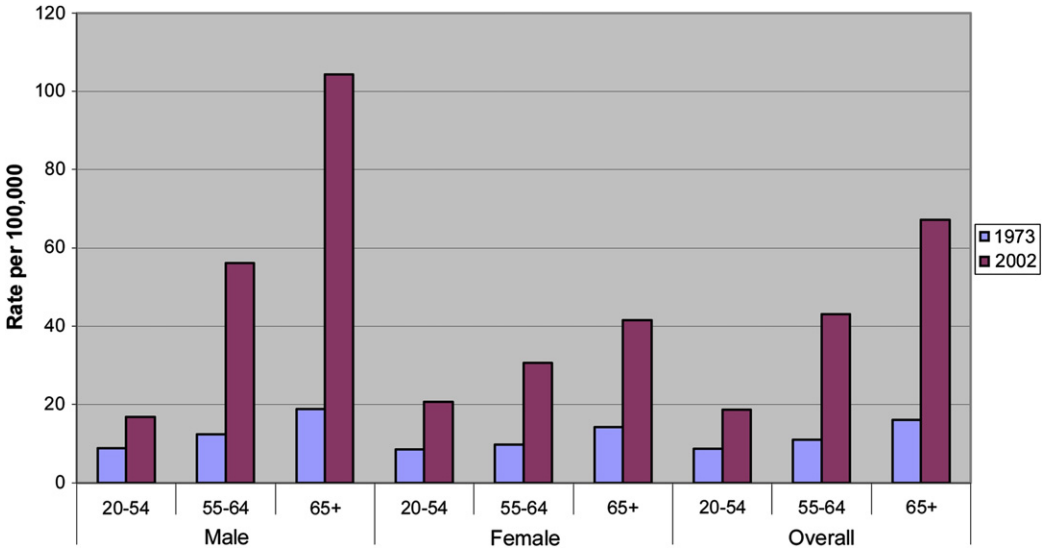

Fig 1. Melanoma incidence among non-Hispanic whites, 1973 and 2002, by age and gender. (Data taken from the Surveillance, Epidemiology, and End Results [SEER] Program SEER*Stat Database. Incidence - SEER 9 Regs Public Use [1973-2002], National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2005, based on the November 2004 submission. Available from www.seer.cancer.gov).

with experts to ensure that all relevant studies were covered. Every effort was made to use only the most recently published studies (2000-2006); in some cases, key studies before 2000 were included.

INCIDENCE AND MORTALITY TRENDS IN THE UNITED STATES AND INTERNATIONALLY

The American Cancer Society (ACS) estimates that there will be 59,940 cases of melanoma in the United States in 2007 (33,910 cases in males, and 26,030 cases in females). Estimates also indicate that there will be 8110 melanoma deaths (5220 in males; 2890 females).[1]

Incidence trends

Both in the United States and throughout most of the world, the incidence of melanoma has been increasing steadily over the past few decades. In fact, in the United States, the overall age-adjusted incidence among non-Hispanic whites has increased from 7.5 cases per 100,000 in 1973 to 21.9 cases per 100,000 in 2002, an increase of nearly 200%, with disproportionate increases in persons over the age of 55 years.[2] Two-thirds of all melanomas diagnosed in the United States between 1988 and 1999 were <1 mm, while the proportion of ≥2 mm lesions (14.4% to 15.5%) has remained the same.[3]

Incidence rates between 1973 and 2002 have risen in all age groups and in both men and women; however, men between the ages of 55 and 64 years have experienced more than a 4-fold increase (12.4 to 56.1 per 100,000), and rates have risen more than 5-fold in men aged 65 years and older (18.8 to 104.4 per 100,000; Fig 1). One study contended that the higher numbers of biopsies among the Medicare population in recent years are the cause for these rates, rather than true increases in incidence.[4] Recent data from New South Wales (Australia)[5] indicates stabilizing incidence rates in younger men and declining rates in younger women. In this data, only men aged 75 years and older show increasing incidence rates (7.2% per year). In Sweden, the overall incidence rates remained stable for 1990 through 1999, with declining rates in younger and female patients offset by lack of progress for older patients, men, and individuals with truncal lesions and nodular melanoma.[6]

In the United States, the incidence of melanoma among African Americans and Hispanics is dramatically lower than that among whites; however, rates are slowly increasing in these groups as well. From 1992 to 2002, incidence among black males increased from 0.58 to 1.00, and in black females increased from 0.58 to 0.95. Among Hispanic males, incidence increased from 3.11 in 1992 to 4.68 in 2002. Melanoma incidence among Hispanic women increased from 3.38 to 4.05 during this same period.[2]

In Scotland (1979-1998), the incidence rate rose more sharply in men than women, reversing earlier trends, and occurred in melanomas of all thicknesses in men. In women, only melanomas thinner than

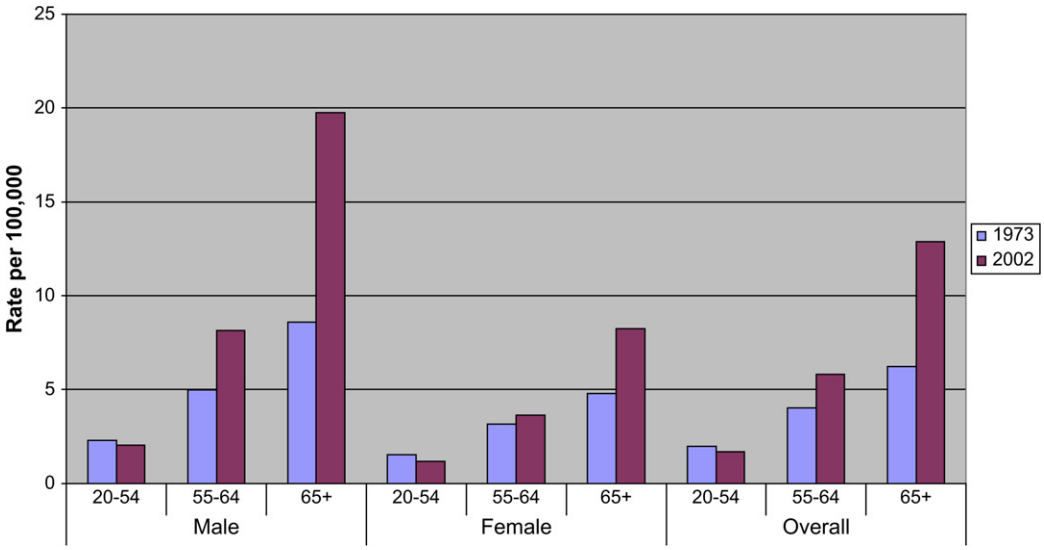

Fig 2. Melanoma mortality among non-Hispanic whites, 1973 and 2002, by age and gender. (Data taken from the Surveillance, Epidemiology, and End Results [SEER] Program SEER*Stat Database. Mortality - All COD, Public-Use with State, Total U.S. [1969-2002], National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2005. Underlying mortality data provided by NCHS [www.cdc.gov/nchs].)

1.5 mm increased in incidence. The most frequent body sites for melanoma include the trunk, head, and neck in men and the legs in females.[7]

De Vries et al[8,9] analyzed 211,557 incident cases of melanoma recorded during from 1953 to 1998 from 63 European cancer registries. Incidence rates vary significantly depending on the geographic location, with higher rates in northern European countries (such as Norway and Sweden) and lower rates in southern and eastern Europe (such as Poland and Italy). It has been hypothesized that this latitudinal gradient may be related to sun exposure behaviors, and in particular to the tendency for Northern Europeans to vacation in sunny climates, resulting in intense, intermittent sun exposure. Encouragingly, the rate of increase has begun to subside, and in some cases has actually decreased in younger age groups in northern Europe (ie, Denmark, Norway, and Sweden). However, incidence rates continue to rise in older men and women. In addition, in most of the western, eastern, and southern European countries (ie, France, Slovakia, and Slovenia) melanoma incidence continues to increase.

Mortality

In 1973, the mortality rate among non-Hispanic whites in the United States was 2.1 per 100,000; in 2002, this number increased to 2.9 per 100,000.[2] Since 1992, however, there has been no change in mortality among men and a reduction in mortality among women.

With regard to specific age groups, between 1973 and 2002, melanoma mortality decreased by 23% in women aged 20 to 54 years and by 11% in men in the same age range. In contrast, mortality rates rose 15% in women aged 55 to 64 years and 64% in men of the same age range. Mortality rates increased 130% (8.6 to 19.8 per 100,000) in men aged 65 years or older, and 73% in women of the same age group (Fig 2).[2]

American states with the highest rates of death from melanoma are New Hampshire, Oklahoma, Maine, Utah, and Idaho (Table I).[2] Specific information on factors that may be associated with state-by-state rates of mortality, such as incidence, dermatology care, social class, rural versus urban residence, and surgical care, are unavailable. Therefore, new attention should be given to developing such databases. It is worth noting that nearly all of the 10 states with highest melanoma mortality are in the bottom third of US population ranking, and only one is among the most populous 25 states.

Worldwide, mortality rates are highest in New Zealand, Australia, Norway, Denmark, and South Africa (Table II), among others.[10-16] Mortality rates are uniformly higher in males than females. Rates are rising worldwide, most precipitously in older men, with women of the same age experiencing smaller increases. Mortality rates are decreasing or stabilizing for younger women, and rates among younger men vary by country. For example, mortality has leveled off in Sweden since the mid-1980s, and in particular

Table I. States with top ten highest rates of mortality related to melanoma (all races)*

State	Annual death rate	Dermatologist/ capita rank	Population rank
New Hampshire	3.9 (2.9, 5.2)	22	41
Oklahoma	3.5 (2.9, 4.1)	45	27
Maine	3.5 (2.6, 4.6)	47	40
Utah	3.4 (2.6, 4.4)	16	34
Idaho	3.4 (2.4, 4.6)	29	39
Oregon	3.3 (2.7, 3.9)	10	28
Vermont	3.3 (2.1, 5.1)	30	49
Wyoming	3.2 (1.8, 5.3)	48	51
Kentucky	3.1 (2.6, 3.7)	27	25
Nebraska	3.1 (2.3, 4.0)	38	38

Death data provided by the National Vital Statistics System public use data file. Death rates calculated by the National Cancer Institute using SEER*Stat. Death rates are age-adjusted to the 2000 United States standard population by 5-year age groups. Population counts for denominators are based on Census populations as modified by the National Cancer Institute. (Available from: http://statecancerprofiles.cancer.gov)
The number of dermatologists per state was taken from personal correspondence with Barbara Paez, the Member Services Coordinator of the American Academy of Dermatology, on December 6, 2005.
Population data were taken from the 2000 United States Census (www.census.gov).
*States are shown with their ranking of number of dermatologists per capita in the state (including Washington, DC; 1 = the most dermatologists/capita, 51 = the fewest dermatologists/capita) and with their population size rank (1 = most populous, 51 = least populous).

a statistically significant downward trend was observed in females.[16]

Survival

Remarkably, 5-year survival rates now exceed 90% in certain countries, including the United States, Australia, and Sweden. The overall 5-year relative survival rate between 1995 and 2001 from nine US Surveillance, Epidemiology, and End Results (SEER) geographic areas was 91.6% (90.3% for white men; 93.5% for white women).[2] In Scotland, survival rates that were as low as 58% in men in 1978 jumped to 80% in 1993 ($P < .001$).[7] Case-fatality rates, an important indicator for survival, have improved dramatically in South Australia in only 20 years, and the case-fatality rate for the 1994 to 2000 diagnostic period was 0.79 (95% CI 0.63-0.99) when compared with the 1980 to 1986 baseline.[17]

However, it appears that many nations have not benefitted from early detection and educational programs. Low rates of 5-year survival have been found among men in Northern Ireland (53.5), Cracow (55.8), the Czech Republic (60.3), and Slovenia (60.6), equaling survival rates in the United States and Australia from more than 40 years ago. Survival rates for women generally fared no better in these four countries, and women had surprisingly high rates of truncal melanoma.[10]

Table II. Mortality rates for melanoma 2002: Top ten in the world (among those with at least 100 deaths)

Country	Adjusted mortality rate, males	Adjusted mortality rate, females
New Zealand	6.1	3.6
Australia	5.1	2.6
Norway	3.8	2.1
Denmark	3.3	2.2
South Africa	3.1	2.4
Sweden	2.9	1.6
Switzerland	2.7	1.6
Kazakhstan	2.7	2.0
Czech Republic	2.6	1.6
United States	2.6	1.3

Data from Ferlay J et al[15] (available from: http://www-dep.iarc.fr/globocan/downloads.htm).

Economics serves as another measure of the human toll of melanoma. In the United States, the annual direct cost of treating newly diagnosed melanoma in 1997 was estimated to be $563 million. Stage I and II disease each comprised about 5% of the total cost; stage III and IV disease consumed 34% and 55% of the total cost, respectively. About 90% of the total annual direct cost of treating melanoma in 1997 was attributable to <20% of patients, primarily those with stage III and IV disease.[18]

Summary

Incidence and mortality rates rose precipitously throughout most of the developed and industrialized world from the 1960s through the 1990s. While it may take decades for the effect of primary prevention on melanoma incidence to become evident, public health efforts to promote sun protection and tanning bed avoidance must be vigilantly implemented and maintained. Early detection efforts (secondary prevention) may result in reductions in mortality more quickly than sun protection campaigns, and interventions will be most successful if they target those at greatest risk of disease (see the section on early detection below). Web sites for exploring national and international incidence and mortality trends include Globo Can (http://www-dep.iarc.fr/globocan/downloads.html) and SEER (http://seer.cancer.gov/).

CLINICAL STRATEGIES FOR EARLIER RECOGNITION AND IDENTIFICATION

Recent advances have heightened our understanding of recognition patterns, the descriptive epidemiology of "melanoma histogenetic type

epidemiology," the relationship between moles and melanoma, and risk factors for melanoma.

Recognition patterns

Abbasi et al[19] conducted a Cochrane Library and PubMed search to re-evaluate the so-called ABCD and to assess literature on evolving lesions. Current data did not support the revision in small diameter lesions, but the review led to a new recommendation for the addition of E for "evolving" to the current ABCD mnemonic.[20]

Many melanomas do not commonly meet the ABCD criteria. For example, early melanoma is frequently <5 mm in diameter, and nodular and desmoplastic melanomas do not commonly meet the A, B, and C criteria. Conversely, many seborrheic keratoses and atypical nevi fulfill most of the ABCD criteria. Testing the practical utility of the ABCD rule in physician practice, Gachon et al[21] investigated the practice of 135 volunteer dermatologists and recorded the immediate perceptions and intuitive diagnostic opinion about 4036 consecutive nevi and melanoma. They found that dermatologists generally rely more on the overall pattern and "ugly duckling sign"[22] rather than more well-known algorithms such as the ABCD rule. In a multivariate model attempting to predict what "clues" a physician uses for diagnosing melanoma, overall irregularity, the ugly duckling sign, and recent change according to the patient stood out. Further studies are required to see if this recognition process can be used for teaching to the lay public or non-dermatologist physician. Likewise, in dermoscopy (see dermoscopy section), overall pattern recognition has been shown to be more accurate than specific ABCD criteria.[23]

Melanoma histogenetic type epidemiology

During the last few decades, the incidence of thick melanoma has remained stable in most of Australia, the United States, and Western Europe, with little progress in detecting "early" nodular melanoma.

In an analysis of more than 35,000 invasive melanomas from the US SEER Registry (1988-1999), nodular melanoma comprised only 9% of all lesions but accounted for nearly 50% of melanomas 2 mm or deeper when melanomas not otherwise specified were excluded. Median thickness of nodular melanoma changed little from 1988 to 1991 (2.14 mm) to 1995 to 1999 (2.16 mm), and nodular melanoma were nearly 4 times thicker than superficial spreading melanoma (SSM; 0.54 mm, median thickness).[3] The world's only outlier appears to be in the South Australia population-based registry, where the proportion of nodular melanoma/all invasive melanoma dropped from 18.5% (1980-1986) to 10.7% (1994-2000).[17] In Italy, nodular melanoma also comprised a higher percentage of $\geq$2 mm lesions than SSM (65% vs 10%).[24] More than 60% of melanomas $\geq$3.5 mm accessioned by the Scottish Melanoma Group were nodular disease, with a trend toward older cases in more recent years (>65% of the thickest cases were in individuals $\geq$65 years of age).[25]

Because thick melanoma is often nodular disease, there is a strong interest in the clinical presentation and biologic factors of this tumor subtype. Few studies have examined differences between early/late nodular melanoma (NM) or nodular/SSM of similar thickness. Among 54 patients in Sweden, NM patients generally reported that their melanoma was a new lesion, while patients with SSM generally reported a previous pigmented lesion at the site of the melanoma. Thin NM appeared to be smaller in diameter than thick NM.[26] Telltale signs of early SSMs do not appear to be uniformly present in NM. NMs were found more often than SSMs to be symmetric (80%), elevated, uniform in color, and nonpigmented (50% were amelanotic [red or pink]), strikingly different from SSMs, which were primarily brown or black.[27] Color change among NM was uncommon. Patients with NM were 10 years older, and their tumors were nearly 3 mm thicker. Liu et al[28] found that male sex, older age, and fewer melanocytic nevi were associated with rapid tumor growth. Rapidly growing melanomas were frequently symmetric, amelanotic, elevated, had regular borders, and were symptomatic.[28]

In a recent population-based study in Queensland, for nearly all melanoma cases, the time between recognition of an abnormality and diagnosis of melanoma apparently does not influence the thickness of the lesion, with the exception of NM, for which there was a positive association with melanoma thickness. The thickness of these lesions was nearly 3% greater per month for each extra month between initial physician identification and diagnosis.[29] Likewise, Liu et al[28] recently reported that nodular melanoma grows at 4 times the rate of either SSM or lentigo maligna melanoma (LMM), with an increase of nearly half a millimeter per month.

There are important lessons for melanoma discovery. NMs were self-detected more frequently than SSMs, leading authors to speculate that quickly growing tumors are more likely to draw the attention of the patient, while slow-growing types are more likely to go unnoticed.[29] Unfortunately, the reduced "patient delay" in this instance is not associated with thin NM. Moreover, the shorter period of evolution of NM appears to limit the opportunity for detection by physicians. Demierre[30] commented that the

association of NMs with solar/actinic keratosis reported by Chamberlain et al and other investigators suggested distinct pathways of melanoma susceptibility. Indeed, a proposed dual pathway hypothesis supported by recent genetic data provides a foundation to develop a risk prediction tool for melanoma.[31]

Invasive LMM has also increased in individuals aged 65 and older, and in a study of the Northern California SEER site, LMM comprises 27% of all invasive melanoma in men 65 years and older. Swetter et al[32] concluded that health care providers should be particularly vigilant about screening chronically sun-exposed skin in older, fair-complexioned males.

Amelanotic melanoma in itself is often associated with a delay in diagnosis because of a lack of visible pigment and clinical features which may simulate nonmelanoma skin cancer or benign processes, such as dermatofibroma, verruca vulgaris, or pyogenic granuloma. While amelanotic/hypomelanotic melanoma accounts for an estimated 2% to 8% of all melanomas,[33,34] it frequently defies early clinical detection, fails to meet the ABCD criteria, and poses a challenge for dermoscopic evaluation, which utilizes color and pigmented structures to differentiate pigmented skin lesions from nonmelanocytic neoplasms.[35]

The influence of age on the association between moles and melanoma

Three recent studies have found similar associations between age and the detection of moles and melanoma. In an analysis of the American Academy of Dermatology (AAD) national screening programs (n = 363 confirmed melanomas), the overall yield of melanoma (the number of confirmed diagnoses per number of screenees) was 1.5 per 1000 screenings, compared with a yield of 2.6 per 1000 screenings among men aged $\geq$50 years. More than 4 melanomas per 1000 screenees were found in men aged $\geq$50 years who reported a changing mole.[36]

Using baseline total body photography and dermoscopy, Banky et al[37] followed 309 patients with at least one of the following risk factors for melanoma: personal history of melanoma, family history of melanoma, more than 100 nevi, or more than 4 atypical nevi. In a follow-up of patients (an average of 3 visits spanning 34 months), younger patients (aged <50) developed new moles more so than older patients (aged >50), but were less likely to develop melanoma. The predictive value for a new mole being a melanoma was greater in patients >50 years of age. Among 311 changing nevi, size was by far the most common type of change (67%). Changing nevi were slightly more common than new nevi (n = 262) and far more common than regressed nevi (n = 86). Eighteen melanomas were detected in 309 patients; of these, 14 were in patients with changing lesions and 4 were in patients with new lesions. Notably, in patients <50 years of age, <1% of all new lesions were melanomas, whereas in patients >50 years of age, 30% were melanoma.[37]

While the estimated annual rate of transformation of any single mole into melanoma was very low (about 1 per 200,000), the lifetime risk of a mole on a 20-year-old male transforming into melanoma by age 80 was 1 per 3164, compared with 1 per 10,800 for women. Cutaneous melanomas were associated with precursors at least 50% of the time for patients <30 years of age. In contrast, for patients over the age of 60, the prevalence of melanoma being associated with a precursor nevus was only 20%.[38]

Risk factors

Whiteman and Green[39] developed hypothetical tables for absolute risks for melanoma among white patients, combining information on environmental, phenotypic, and genotypic causal factors. The 10-year risk of cutaneous melanoma appeared to be highest for older persons residing in southern Australia and the southern United States with $\geq$21 nevi on their arms.[39]

Cho et al[40] examined risk factors for melanoma in 3 large cohorts of men and women in the United States. Among the nearly 180,000 subjects free of cancer followed for up to 14 years, 535 histologically-proven melanomas were included. Males had a higher risk for head or neck and trunk lesions. Individuals with >10 sunburns had nearly a 7-fold higher risk of upper extremity melanoma compared with those with no burns. The number of moles was most strongly related to melanoma of the trunk; the relative risk of melanoma for subjects having >10 moles was 4.67 compared with having no moles.[40] Overall, the association between melanoma and gender, number of nevi, and history of sunburn differed significantly by anatomic site, lending support to the divergent pathway hypothesis of melanoma.[31] Siskind et al[41] sought to determine whether melanomas arising in the head and neck that are not LMM had different phenotypic and environmental associations than those on other sites. Participants with melanomas of the head and neck were significantly older than patients with melanomas of the trunk, and patients with head and neck melanoma also had fewer nevi.

To explore variables associated with either thin, intermediate, or thick melanoma, Negin et al[42] prospectively evaluated 369 patients regarding their signs and symptoms at the time of their initial visit.

Gender, age, and primary site were not significantly associated with an increasing category of Breslow depth. In a multivariate analysis, the signs and symptoms most strongly associated with an increased category of Breslow depth were bleeding (odds ratio [OR], 7.5), followed by pain (OR, 3.3), lump (OR, 2.2), itching (OR, 1.9), and change in size (OR, 1.7). Change in color and skin breakdown were not independently associated with an increasing category of Breslow depth. In a recent large, population-based Queensland study of 3772 melanomas, the most commonly reported signs and symptoms in patient-detected cases were changes in color, size, and shape, or irritation or itch at the melanoma site.[43] In fact, persistent lesional itching has been suggested as perhaps the earliest symptom of melanoma in a small percentage of cases.[44]

EARLY IDENTIFICATION, SCREENING, AND EARLY DETECTION

The early identification of melanoma can be potentially enhanced in multiple venues, such as community-wide screenings, dermatology-led mass screenings, non-dermatologist physician or healthcare professional surveillance, by skin-self examination (SSE), specialized pigmented lesion clinics, and education targeted to patients and the public at greatest risk of disease.[45]

Community-wide and mass screening

Because of a relatively low prevalence of mortality and the high costs for mounting such a study, no community-based randomized trial has provided definitive information to determine whether screening asymptomatic persons with whole-body exams by physicians reduces mortality from skin cancer. With the absence of any national or international randomized screening trial, there was insufficient evidence for an expert group such as the US Institute of Medicine (IOM) to provide screening recommendations for melanoma.[46]

Researchers in Australia (where such a study is more feasible because of higher rates of melanoma) planned and began to implement a randomized trial of population screening.[47-50] While the plan called for eventually randomizing 44 Queensland communities, 18 were initially randomized to intervention (n = 9) and control (n = 9) towns. The trial's three components included: (1) a community education component, which aimed to provide accurate information about melanoma and screening to residents; (2) an education and support component for medical practitioners, which aimed to increase awareness of the program and to improve doctors' skills in screening for and diagnosing melanoma; and (3) the provision of free skin screening services.[48-50] Uptake of the whole-body skin cancer examination was measured by surveys of residents in intervention and control towns. Baseline rates were similar in intervention and control towns (11.2% and 11.3%); however, rates jumped 2 years later to 34.8% in intervention towns compared to 13.9% in control communities.[49] Screenings were typically performed by general practitioners (GPs) and special screening services. More than 16,000 whole-body examinations in 18 communities had been conducted, with the following confirmed diagnoses: 33 melanomas, 259 basal cell carcinomas, and 97 squamous cell carcinomas, with the probability of detecting any type of skin cancer of 2.4%.[50] The overall specificity of the skin examination for melanoma was 86.1%. Unfortunately, the study was not expanded to the 44 communities and was recently disbanded because of a lack of governmental funding.

Dermatology-led mass screening programs

Mass, population-wide screening programs are now commonplace in many countries, including Australia, Belgium, Denmark, Italy, the Netherlands, Sweden, Switzerland, the United States, and the United Kingdom.[51-58] Programs are uniformly promoted by local media in advance of a screening day, week, or month. Evaluations have generally centered on the results of the screening event, and only in Belgium has the widespread effect on the broader community been reported.[55]

Analysis of the AAD National Skin Cancer Screening Programs (1986-2001) noted that 65% of screenees had at least one risk factor for melanoma, and 33% reported a changing mole. Among all screenees, nearly 80% did not have a regular dermatologist, 78% reported no previous AAD skin cancer screening, 60% had never had their skin checked by any doctor, and 51% reported that they would not have seen a doctor for skin cancer without the free screening. AAD national screening and educational programs have expanded to all 50 states and provided educational messages about sun protection and early detection to millions.[52] Among nearly 250,000 screenees, 363 melanomas were diagnosed; 98% were stage I melanomas.

Sixty-five percent of Belgian dermatologists participated in a nationwide "Melanoma Monday" campaign. Twenty-five melanomas were confirmed in 2767 screenees.[55] Follow-up analysis of the national media campaign led to detection of 141 new melanomas, more than doubling the typical monthly rate of new cases.[55] Screening programs in Padova, Italy also found high yield (13 melanomas per 2050 screenees) and generally thin melanoma (92%

<1.50 mm).[53] Three melanomas were detected among more than 1000 screenees in four Italian open access clinic sessions.[51]

Few programs have used prescreening publicity to reach high-risk persons who have minimal dermatologic care. Swetter et al[59] found higher rates of confirmed skin cancer when targeting screening to elderly white men with minimal to no previous dermatologic care, and television, radio messages, and personal history of skin cancer were found to be motivating factors for older men in Utah.[60]

From a survey conducted within the first phase of the Queensland randomized screening trial, factors such as history of a clinical skin examination, concern about skin cancer, personal history of skin cancer, and high susceptibility toward skin cancer were important determinants of screening intention.[61]

In a cost-effectiveness model, Losina et al[62] found that one-time melanoma screening of the general population was cost-effective compared to other cancer screening programs in the United States. Every 2-year screening in siblings of melanoma patients was also cost-effective. In the general population, one-time, every 2-year, and annual screening saved 2.5, 8.8, and 10.2 quality-adjusted life years (QALYs) per 1000 people screened, with incremental cost-effectiveness ratios of $7300/QALY, $58,000/QALY, and $450,500/QALY. In siblings of melanoma patients (relative risk [RR] = 2.24 compared to the general population), one-time, every 2-year, and annual screening saved 5.7, 19.2, and 22.6 QALYs per 1000 people screened, with incremental cost-effectiveness ratios of $3400/QALY, $24,500/QALY, and $196,500/QALY, respectively.[62]

Specialized pigmented lesion clinics

Mackie et al[63] popularized the use of specialized pigmented lesion clinics (PLCs) in Scotland to provide expert and timely referral services for local physicians and patients. Delay in patient diagnosis was reduced in 2001; 67% of patients visited their physician within 3 months of seeing a worrisome pigmented lesion, compared with only 16% in 1986.[63] To date, only one study has compared the diagnostic performance of a PLC with cancer registry data. Among 1741 PLC patients seen in a clinic in Italy, 15 melanomas were later recorded in the local registry. Excisions had been performed for all but two of the cases: a missed in situ lesion and a 0.60-mm melanoma. The PLC exam had a sensitivity of 87% and a specificity of 95%, with a rate of 5.1:1 for excision of benign lesions that were considered melanoma.[64]

Skin self-examinations

Because lesions on the skin are often visible, the patient should notice suspicious changes. In addition, patients have the most opportunities to examine their skin.[65] Although physicians detect thinner lesions than patients, it is the patient who most often discovers the melanotic lesion, accounting for about half of all melanomas.[66]

Only one study has tested mortality reduction associated with skin self-examinations (SSEs). Berwick et al[67] conducted a case-control study and found that SSE could potentially reduce mortality related to melanoma by 63%. More recently, SSE was found to be a key predictor for melanoma <1 mm in thickness.[68]

Only a minority of individuals actually practice regular SSEs. In a study conducted among residents 30 years and older in Queensland, only 26% reported performing a full-body SSE in the past 12 months.[69] Among high-risk patients attending a cancer clinic, 27% reported practicing at least one SSE in the past 4 months.[70] Carli[68] found SSE rates of 21% (at least once every 3 months) among more than 800 melanoma patients in Italy.

SSE rates also differ depending on how one defines the skin self-exam. In a random-digit-dial survey of adults in Rhode Island, 58% reported examining their skin. However, when further probed on how often and what parts of the body were examined, only 9% were considered to thoroughly examine their skin.[71] Further describing barriers for SSE, Weinstock et al[71] found that 29% stated that they do not think about it, 22% believed that they had no reason to, and 15% said that there was nothing there before. Arnold et al[72] found even stronger barriers among a sample of Boston area young adults in whom more than half did not know what to look for or never thought about performing a SSE.[72] In a later survey of 2126 Rhode Island and Massachusetts adults, Weinstock et al[73] found that 19% of men and 17% of women performed a comprehensive SSE. Having a partner and using a wall mirror were key predictors for SSE performance. Notably, respondents with less than a high school degree were less than one-third as likely as college-educated respondents to pay close attention to their skin, look at a particular mole, do casual exams, or perform thorough exams.

Other studies have examined barriers and promoters for performance of SSE. A survey of 549 Connecticut residents found that family history of cancer and past physician examination predicted SSE in men, and that previous benign biopsy or an abnormal mole were individual predictors for both men and women.[74] In a multivariate model designed

to identify predictors of SSE performance, Robinson et al[75] found modifiable predictors to be attitudes, knowledge, and confidence in performance. These combined with nonmodifiable variables, such as having dermatology visits with skin biopsies, at least one NM skin cancer nonmelanoma skin cancer (NMSC) in the past 3 years, and younger age to account for 61% of the variability in SSE performance.[75] Of note, patients with >1 atypical nevus (compared with none) were less likely to detect their melanoma and this held constant after adjustment for all other variables. Carli et al[76] speculated that patients with many moles may find it difficult to spot suspicious lesions amidst other atypical lesions.

Few studies have sought to test the patient's accuracy in performing a SSE. In a study of high-risk patients (many moles, personal or family history of melanoma, and/or multiple dysplastic nevi) who had practiced SSE regularly for at least a year, Muhn et al[77] tested whether an artificial increase in size of a mole on the back could be detected by participants conducting SSEs. This controlled trial had 3 phases; first, one mole was changed by 2 mm, then one was changed by 4 mm, and finally there was no change. The sensitivities for self-detecting increases of 2 mm and 4 mm were 58% and 75%; however, the specificity (likelihood of detecting no change when no change occurred) was 62%.[77]

At least three studies have attempted to boost performance of the SSE. Weinstock et al[78] used mole-mapping imaging, and nearly all participants were satisfied with the training to assist in SSE; almost half began to perform SSE for the first time after use of the program. After receiving images, spouses and friends were also more frequently participating in skin examinations.[78] Phelan et al[79] led a study of patient responses to the use of photo books to augment SSE performance. Patients with skin cancer used them most frequently, followed by patients with many moles. In addition, 34% of patients requested a CD in addition to their photo book.[79] A randomized trial provided the first evidence of efficacy for involving partners (compared with solo learning) of skills training for the SSE.[80]

Physician offices

Full-body examinations by either dermatologists or nondermatologist physicians have both shown the potential to save lives that otherwise would have been lost to melanoma. Of the five major "early detectable" cancers (melanoma, breast, colorectal, prostate, and cervical), only skin cancer requires an initial visual, nontechnological skill. Dermatologist examination of the skin has been shown to have relatively high sensitivity and specificity. Carli et al[68] recommended that dermatologists perform a total body skin examination to identify suspect lesions, particularly during consultations for other reasons. However, Fisher et al[81] suggested that the absence of a standard protocol for skin exams made screening a difficult goal to achieve in all dermatology practices. A survey of US dermatologists[82] finds that only 30% routinely perform a total skin examination on all of their patients.

Few studies have compared differences in tumor thickness between physicians (either dermatologists or nondermatologist physicians) versus self or family detection. A multivariate analysis led by the Italian Multidisciplinary Group on Melanoma found melanoma detection by a dermatologist to be the strongest predictor of melanoma <1 mm (OR, 0.45; 95% confidence interval [CI], 0.28-0.73).[68] Likewise, a study of Connecticut patients found that initial melanomas discovered by dermatologists were more likely to be detected below 0.75 mm than those found by nondermatologist physicians.[81] Earlier recognition of melanoma by dermatologists may be partly explained by a recent study comparing dermatologist and primary care physician assessment of lesions. Photographs of randomly chosen lesions were used to evaluate the accuracy of melanoma diagnosis and management of pigmented lesions between 101 dermatologists and 115 primary care physicians. Dermatologists outscored primary care physicians in both domains; however, primary care physicians who routinely biopsied lesions outscored counterparts who did not tend to do so.[83]

Physicians also detect melanoma at earlier stages compared to patients, spouses or family friends.[44,66,84] Epstein et al[84] found differences of nearly 0.7 mm, and Schwartz et al[44] found physician-detected melanoma (0.40 mm) to be significantly thinner than patient (1.17 mm) or spouse-detected melanoma (1.00 mm).

Because dermatologists have specialized training, their practice setting is the ideal place for screening; however, most Americans will never see a dermatologist without a referral from their primary care physician. Melanoma patients typically have contact with their physicians in the year before diagnosis, suggesting that many lesions may be diagnosed earlier with the assistance of primary care providers (PCPs).[46] In fact, middle-aged and older men make at least 3 to 4 visits per year to a physician or medical care facility.[85] A single survey of patients in waiting rooms found that 82% reported that it would be appropriate for their PCP to conduct regular full-body skin examinations, and 87% stated that they would like their PCP to perform a full-body skin exam regularly.[86] Using a computer simulation

model to simulate the effects of a hypothetical melanoma screening program, Girgis[87] suggested that an every 5-year screening by family physicians for men over the age of 50 would be cost-effective.

Much remains unknown about melanoma discovery patterns and the differences between dermatologist and PCP biopsy and referral practices. Chen et al[88] performed a systematic review of 32 studies of melanoma discovery patterns conducted before 2001 and found numerous information gaps, including lack of consistent sensitivity and specificity data, inadequate sample sizes, and data derived primarily from residents rather than attending physicians.

Populations at high risk

Before launching an effective educational or early detection program, it is necessary to identify patients at moderate-to-high risk for developing melanoma. Selective education and screening could be considered for individuals with the following high-risk characteristics: middle-aged and older men, family members of melanoma patients, personal history of melanoma, nonmelanoma skin cancer patients, transplant patients, low socioeconomic status (SES), many moles/atypical moles, fair skin, and blue/green eyes, blonde/red hair.

Middle-aged and older men. It is well documented that men, particularly those aged 50 years or older, have higher incidence and mortality rates for melanoma. Of particular relevance to mortality rates, during the past decade, the US incidence of thick tumors (>4 mm) increased significantly only in men aged 60 years and older.[89] For this demographic, the IOM report noted that evidence does support benefits of early melanoma detection and treatment as part of usual medical care and that clinicians and patients should continue to be alert to the common signs of skin cancer, with a particular emphasis on older white males and on melanoma.[46] A crucial step in reducing melanoma mortality is first discovering, then improving the sources that influence awareness of early detection among this high-risk group. Special efforts to reach men aged 50 years and up led to increased screening as part of the Queensland community-based trial. Men at the age of 50 or older comprised 21% of all participants but accounted for 49% of all melanoma diagnoses.[90] Likewise, persons of varying educational levels increased screening rates, likely resulting from well-designed promotional materials.[91]

Family members of melanoma patients. A randomized trial testing an intervention that provided personalized telephone counseling and individually tailored materials for siblings of recently-diagnosed melanoma patients resulted in greater performance of SSE (OR, 1.81; 95% CI, 1.04-3.71) at 12 months for intervention siblings compared with controls (receiving standard dermatologist education). The number of participants in both groups that received a skin cancer examination more than doubled, with no differences between intervention and control subjects.[92] Earlier surveys on beliefs and practices regarding skin cancer prevention and detection among 404 siblings of recently diagnosed patients with melanoma found that only 27% had received a skin cancer examination by a dermatologist during the past year; 47% had never received a dermatologic examination. Multivariate analysis found modifiable positive predictors for SSE and dermatologist examinations, including having a clinician with whom to talk about melanoma and believing in the importance of regular skin examinations by a physician.[93] Manne et al[94] found similar skin cancer risk reduction practices of 229 first-degree relatives (FDRs) of recently diagnosed melanoma patients. Forty-five percent of FDRs had received a physician recommendation to perform SSE but only 24% were ever instructed on how to perform the exam.

Personal history of melanoma. It is well documented that personal history of melanoma is one of the strongest risk factors for melanoma. Risk of multiple primary melanoma was recently examined among 4484 patients with primary melanoma (follow-up of 7 years). Nearly 9% had a second primary melanoma diagnosis; 21% of these patients had a family history of melanoma compared with 12% of patients with a single primary melanoma. DN was twice as common (38% v. 18%) in multiple primary melanoma patients.[95] In a study of melanoma patients at the John Wayne Cancer Institute who received routine education on the performance of the SSE and clinical warning signs, tumor thickness decreased from a mean of 1.32 for the initial melanoma to 0.63 mm for the second primary melanoma.[96]

Non-melanoma skin cancer patients and actinic keratoses. Numerous studies have found that individuals who have a history of either basal cell carcinoma or squamous cell carcinoma are at significantly increased risk of developing a subsequent primary melanoma as compared to the general population. Although the studies vary with regard to the level of risk (ranges from 2.5 to 10.0), all report that NMSC is a significant risk factor for melanoma.[97-106] In a retrospective observational study from the 1992-1998 Medicare Current Beneficiary Study, the OR of developing NMSC or melanoma was increased more than sixfold in patients with actinic keratoses.[107]

Transplant patients. Kasiske et al[108] examined rates of malignancies among first-time recipients of

deceased or living donor kidney transplantations in 1995-2001 (n = 35,765) using Medicare billing claims. Compared with patients on the waiting list, several tumors were more common after transplantation including: NMSCs (2.6-fold), melanoma (2.2-fold), Kaposi's sarcoma (9.0-fold), non-Hodgkin's lymphoma (3.3-fold), cancer of the mouth (2.2-fold), and cancer of the kidney (39% higher).[108] An analysis (1988-1998) of the US Renal Data System (89,786 patients) found 246 melanomas in kidney transplant patients, or a 3.6 fold difference when compared with the general population.[109]

Persons of low socioeconomic status/poor health access. While it is well known that persons with higher education or income are more likely to be diagnosed with melanoma, less is known about the disproportionate burden of mortality for low SES individuals or for minority populations. Latest examination of the US SEER registry found that overall five-year survival was demonstrably less for minorities (72%-81%) than for whites (89.6%).[110]

Reyes-Ortiz[111] summarized the studies related to the effect of SES on melanoma stage at diagnosis. Of the 12 studies analyzed (8 population-based), all found increased rates of advanced stage melanoma or decreased survival in lower SES individuals. Various indices of social class were used including occupation, education, social class areas, physician supply, and poverty rates. SEER data from records (1988-99) of more than 23,000 melanoma patients were reviewed to assess 5-year melanoma survival. Older patients living in lower SES areas had worse melanoma survival than those from high SES areas.[112]

Thicker melanomas (>1.5 mm) were also three times more common in patients with low levels of education or unemployment in Italy.[113] In a study of incident cases of melanoma, colorectal cancer, breast cancer, and prostate cancers diagnosed in Florida, patients who were uninsured were most likely to be diagnosed with a later stage cancer. In fact, lack of insurance was more commonly associated with later-stage melanoma than for other cancers.[114] A merge of Florida state tumor registry data with state physician manpower data revealed that each additional dermatologist per 10,000 residents was associated with a 39% increased likelihood of earlier diagnosis. Roetzheim et al[115] suggested that AAD screenings branch out to areas with the shortest supply of dermatologists. In a US National Health Interview Study, having health insurance and a usual source of health care were important predictors for skin cancer screening with few differences between men and women.[116] A UK study found reluctance to seek advice for a suspect lesion was most pronounced among persons from socially deprived districts, suggesting that there could be significant attitudinal barriers to screening among certain groups.[117]

A Behavioral Risk Factor Surveillance Study in Massachusetts conducted in 2002 found the lack of education to be the strongest predictor for unawareness of melanoma as being a cancer of the skin. Only 59% of persons with less than a high school degree correctly defined melanoman compared to more than 90% for people with a college degree.[118]

Many moles/atypical moles. Oliveria et al conducted a randomized trial of patients with five or more dysplastic nevi; half of patients received a teaching intervention (physician and nurse education module) with a photo book (personal whole-body photographs compiled in the form of a booklet, with nurse instruction on how to use the photographs), and the remainder received only the teaching intervention. Four months later, 61% patients in the photo book intervention reported skin examination three or more times (P = .039 for paired comparison) compared with 37% in the group receiving the teaching intervention alone.[119]

NEW TECHNOLOGIES: DERMOSCOPY AND PHOTOGRAPHY

We highlight the dermoscopy studies from meta-analyses, randomized trials, links with other outcome data (eg, cancer registries), and comparisons with naked-eye examinations.

Annual total cutaneous examination, total cutaneous photography, and dermoscopy were employed for patients with classic atypical mole syndrome (CAMS) and a heterogeneous group of patients at high risk (ie, those with high-risk non-CAMS [HRNCAMS]). A total of 258 patients (160 CAMS and 98 HRNCAMS) were studied. In the CAMS cohort, 28 new MMs developed in 19 patients resulting in a cumulative 10-year risk of 14% (95% CI; 7-20). In the HRNCAMS cohort, 10 new MMs developed in 9 patients, and the cumulative 10-year risk was 10% (95% confidence interval: 2-17). The MMs diagnosed in both cohorts were either in situ or <1 mm in Breslow thickness.[120]

Carli et al[121] has conducted the only randomized trial to test differences in the management of equivocal lesions between the naked-eye examination, naked-eye examination plus dermoscopy (with mandatory excisions), and the possibility of digital follow-up according to the clinician's decision. Patients in the combined arm had significantly fewer lesions referred for surgery. However, the authors expressed concern that the digital follow-up of equivocal lesions was associated with a small occurrence of initial melanomas left unexcised.

Meta-analysis of all studies performed before 2001 found that dermoscopy, when performed by trained examiners, had greater discriminating power for melanoma than clinical examination alone. Bafounta et al[122] called for improved technology to reduce the proportion of false-negative findings. Kittler[123] conducted a meta-analysis of 27 studies that compared the accuracy of melanoma diagnosis with and without dermoscopy. Dermoscopy yielded an improvement of 49% compared to naked eye exams; however, dermoscopy by untrained or less experienced examiners showed no improvements compared with the clinical examination.

Four algorithms (the Menzies method, the 7-point checklist, the ABCD rule, and pattern analysis) were tested for diagnostic accuracy by 61 "nonexpert" physicians in Australia (35 GPs). More than half of the physicians diagnosed 5 or fewer melanomas annually. Clinical and dermoscopic image assessment of 40 melanocytic skin lesions revealed high rates of diagnostic accuracy (73-81%) following self-guided training with all four algorithms. However, the Menzies method showed the highest diagnostic accuracy and sensitivity, and was most widely well-accepted by study participants.[124]

In a study of 100 pigmented lesions for which no agreement was reached, Carli et al[125] found that an examination of lesions based on morphologic features (including dermoscopy), without any contact with the patient, was associated with the risk of incorrect classification in as many as 60% of early melanomas, and as many as 30% of lesions were left unexcised. The authors asserted that for equivocal, hard-to-diagnose lesions, physicians should be aware of potential risks associated with teleconsultation or with automated melanoma derived from using only digital instruments.

Massone et al[126] noted that the accuracy of traditional clinical diagnosis of melanoma ranges between 65% and 80%, and concluded that the naked-eye examination with the ABCD system may fail to detect the so-called "small melanoma" as well as melanomas regular in shape or color. Recognition and prompt removal of lesions that are clinically or dermoscopically suspicious for melanoma should be the main aim of dermoscopy, as well as avoiding unnecessary excision of benign lesions. Important moves toward standardizing the dermoscopic diagnosis have been made via the development of the Consensus Net Meeting on Dermoscopy (CNMD). Forty trained dermoscopists from many countries evaluated 108 lesions via the Internet using a 2-step process that discriminated between melanocytic and nonmelanocytic lesions. The most specific dermoscopic criteria for early melanoma detection were asymmetry, atypical pigment network, and blue–white structures. These criteria achieved a sensitivity approaching 97%.[127]

Feit et al[128] also found that follow-up photography added to the detection of evolving, thin melanoma. Among all new melanomas, change in baseline photos resulted in detection of 74% melanomas;19% were new lesions. Many of the changing lesions did not correspond with the clinical criteria for melanoma but were most evident with careful review of baseline and follow-up photographs. Lucas et al[129] found that lesions categorized as both nonuniform and changed (by dermoscopy) were more than four times as likely to be melanoma compared with other categories: uniform and changed, nonuniform and unchanged and uniform and unchanged. Of the 16 melanomas found in the study, none developed from an obvious dysplastic nevus, 5 evolved from lesions that appeared to be small nevi, 4 evolved in an area where a small pinpoint focus of pigment could be identified, and 7 evolved in skin with no previous identifiable lesion.[129]

Oliveria et al[130] reviewed the emerging technologies and examined the many factors needed for more broad-scale implementation including physician training, low-cost equipment, and research into patient, physician, and health care system uptake of new technologies.

PROFESSIONAL AND PUBLIC EDUCATION

We describe the prevalence of screening by physicians, medical students, and nurses, and report on most recent professional training programs.

Skin cancer screening rates

While skin screening by PCPs may be an effective tool in reducing advanced stage melanoma, in practice, the rates of screening (whether reported by the public or professionals) are low. In a random survey of the US adult population in 1998, only 21% had ever had a full head-to-toe skin examination.[131] Reports from 784 primary care visits to 109 family practitioners and 61 internists as part of the 1997 National Ambulatory Care Survey revealed that skin examinations were reported at only 16% of visits, much lower than reported rates for other cancer screenings.[132] In a survey of patients in dermatology and primary care clinic waiting rooms at a Veterans Affairs medical center, 32% reported undergoing regular full body skin examinations by their PCP.[82] This rate did not differ between respondents in the primary care or in the dermatology clinic.

Physicians report higher rates of screening than the public. Altman et al[133] surveyed almost 1400

PCPs throughout the United States regarding their cancer screening practices. Approximately 37% of physicians reported screening most of their patients for skin cancer.[133] A more recent survey of family medicine physicians, internists, and GPs sought to determine the national rates of melanoma screening. Sixty percent of eligible physicians responded, and of these, nearly 60% physicians routinely performed full-body examinations with their high-risk patients. In the regression analysis of factors influencing physician examination of high-risk patients, lack of time was the strongest barrier [odds ratio (OR) 0.3 (95% confidence interval (CI) 0.2 to 0.6)]. Physicians using the most information sources [OR 2.5 (95% CI 1.3 to 4.8)] were the most likely to examine their high-risk patients. Physicians whose patients requested a skin examination were more likely to examine their patients compared with physicians whose patients did not request such an examination ($P < .01$).[134]

While screening by PCPs has the potential of being an effective screening tool, physicians and medical students have noted various barriers to doing skin screenings. Physicians and medical students have noted a lack of time, skill, and confidence as barriers to skin examinations.[135,136] In a survey of nearly 500 PCPs, Kirsner et al[135] noted that 50% felt that their lack of confidence in screening for skin cancer was an important obstacle.

Physician interventions

Forty-one family physicians in Tuscany received a 4-hour training session on the diagnosis, management, and decision plans for dermatology referrals. Training led to a marked increase in melanoma diagnosis (using slides) with a concomitant improvement in specificity (55-73%) for a dermatology referral.[137] Harris et al[138] demonstrated increased confidence in identifying suspicious lesions through the use on an Internet Continuing Medical Education program to 354 US physicians. Satisfaction among physician users was nearly 90%. In a controlled study of an Internet-based skin cancer triage intervention for physicians, Gerbert et al[139] found intervention effects for physician skin cancer diagnosis and evaluation planning. Although the study was limited by questions asked immediately after a lecture, a study of Belgian GPs found improvements in the proportion of pigmented lesions correctly identified.[140] A 2-hour Basic Skin Cancer Triage (BSCT) curriculum was designed to improve the skills, knowledge, confidence, and attitudes of 28 PCPs in Rhode Island. Significant changes from pretest to posttest were made in provider ability to accurately diagnose and triage lesions, provide reassurance about lesions, and improve knowledge of skin cancer control practices.[141] Successful utilization of the BSCT curriculum in broader settings awaits further study. An educational video shown to randomly selected family physicians did not result in significant differences in the proportion of malignant lesions biopsied.[142]

Medical school training

In a 2004 study of more than 650 fourth-year students at seven US medical schools, Moore et al[143] found that 43% had never performed a skin cancer screening exam. However, students performing at least one examination were nearly 3 times more likely to report being moderately skilled in the skin cancer exam. Brandling-Bennett et al[144] conducted focus groups with New England medical students to discover optimal venues within the medical school curriculum to insert skin cancer education. Lee et al[136] reported that third year medical students at UCLA felt least competent in performing skin cancer examinations compared to clinical breast, Pap smear, and digital rectal exams.

Nurses

A 1997 survey of 457 Texas nurses found that 61% believed that skin cancer detection was part of their practice; more than 60%, however, noted that lack of national guidelines and low priority of skin screening by doctors served as key barriers.[145] Using the consensus clinical diagnosis of the dermatologists as the gold standard, the nurse practitioner's sensitivity for detecting significant skin cancer lesions ranged from 50% to 100% and the detection specificity was 99% to 100%.[146]

Public and patient education

In the past 5 years, numerous organizations and foundations have launched melanoma Web sites replete with photographs of normal and abnormal lesions and techniques to perform SSE.[147-149] One study found that the majority of Web sites failed to include complete information on general information, risk factors, diagnosis, treatment, prevention, and prognosis. Medical information retrieved with the search term melanoma was likely to lack complete basic melanoma information and contained inaccuracies in 14% of sites.[150] Bichakjian et al[150] noted that health care providers can help patients by recommending comprehensive and accurate Web sites, by working to create accurate and thorough Web-based health information material, and by educating patients and the public about the variability in completeness and accuracy. Bhavnani[151] investigated the way that facts on melanoma were

distributed across high-quality Web pages using inter-rater experiments with skin cancer physicians. In-person training of the public and teaching about the ABCD criteria resulted in better assessments of common moles and dysplastic nevi (DN). Branstrom et al[152] conducted a study of 120 Swedish residents (30 each with pigmented lesions, DNs, melanoma, and from a healthy population) and found reasonably good ability to identify malignant changes but less ability to recognize common moles and DN.

Two randomized trials have tested different methods of patient education. One found that knowledge of melanoma improved with the use of a videotape compared with a clinic visit; however, physician encounters were more effective in reducing patient anxiety or distress.[153] A second study used different methods to engage patients in recognition of early melanoma and found photographs to be far superior to use of only the ABCD rule.[154]

CONCLUSIONS

With the recent, abrupt cessation of the population-based, randomized screening trial in Queensland, randomized studies of large cohorts with many years of follow-up, as required to rigorously demonstrate that early detection of melanoma is desirable, may never be funded. Thus, there is the possibility that we will never have the evidence required to conclude that screening effectively reduces melanoma mortality.

Disturbingly low screening rates in the presence of persistent and avoidable mortality prompt a call for new and far-reaching approaches, including ways to make screening more available to underserved individuals, targeted education to the high-risk public, and "early" professional education to health professional students in all disciplines.[155] In Australia, where early detection (or screening) campaigns were initiated earlier than in Europe, a shift toward thinner lesions, more SSM melanomas, and fewer NMs has been observed over time, and has been accompanied by improvements in melanoma survival. In most industrialized nations, much progress has been made in detecting earlier lesions, reducing case-fatality, and improving survival. Dramatic progress at the population level, as evident in Australia, hopefully foreshadows subsequent efforts in the United States and elsewhere.

We are left with a number of questions derived from the summary review above: (1) Can new technologies and advances in vigilant surveillance of persons with key risk factors for melanoma be extended more broadly to persons with less access to expert dermatologic care? (2) Can we deepen our understanding of the biologic, clinical, and behavioral antecedents of NM that now comprises a disproportionate burden of late-stage melanoma? (3) Can the widespread proliferation of Internet information for physicians and the public alike be harnessed to identify early curable melanoma among our most at-risk Americans? (4) Can randomized trials testing some or all of the strategies described earlier-public education, physician screening, and skin self-examination be conducted to gather most relevant information for planning large-scale programs?

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