“Prevention is better than cure”: this advice guides dermatologists and other health care professionals who promote the use of sun protection to prevent melanoma and other skin cancers. However, primary prevention, such as attempts to educate the population about the link between ultraviolet radiation (UVR) and melanoma, is not the only instrument that can reduce the burden of the disease. Early diagnosis (also known as secondary prevention) of skin lesions that have not yet spread to other organs is also of overwhelming importance. If treated early, the chance of curing melanoma is very high in most cases; the overall five-year survival rate for patients whose melanoma is detected early, before the tumor has spread to regional lymph nodes or other organs, is about 98 percent in the US. The survival rate falls to 15 percent when the disease metastasizes to distant organs.1

Therefore, secondary prevention is an extremely promising tool. Early detection and screening programs were set up in the past in locales such as the US, Australia, and Europe. The American Academy of Dermatology...
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(AAD) has been offering free visual skin examinations throughout the US since 1985,2 and The Skin Cancer Foundation has sent a mobile van around the US offering free total-body skin exams since 2008. In Australia, a large community-based randomized trial of melanoma screening was piloted, but the plan for a full-scale trial was abandoned due to financial reasons.3 Although no population-based skin cancer screening (SCS) has been implemented yet in Australia, a lot of opportunistic screening occurs through skin cancer clinics. In Europe, the Euromelanoma Day was established in 1999 in Belgium and soon spread to nearly all other European countries, offering a free skin examination to the population every first day of May.4 In 2008, Germany was the first country to implement a nationwide population-based skin cancer screening (SCS) after conducting a pilot project in Schleswig-Holstein, the northernmost federal state of Germany, showing promising results.5

The SCREEN Project

The SCREEN project6 (Skin Cancer Research to Provide Evidence for Effectiveness of Screening in Northern Germany) was a one-year pilot project in Schleswig-Holstein carried out from July 2003 to June 2004. All residents who were policyholders of statutory health insurance (approximately 85 percent of all inhabitants) and age 20 or older were eligible for a whole-body screening. People receiving skin cancer aftercare or in active treatment were excluded. In total, 1.88 million of the 2.8 million inhabitants met the eligibility criteria.

The skin cancer screening consisted of a visual total-body skin examination by a physician who had undergone an eight-hour training program. Nearly all of the 118 dermatologists (98 percent) and about two thirds of all 2,614 non-dermatologists (64 percent) with practices in Schleswig-Holstein participated in the training course. In the SCREEN project, the skin of a participant was first examined by a general physician (non-dermatologist). If a suspicious lesion was detected, the patient was referred to a dermatologist, who conducted a second whole-body examination. If necessary, the patient underwent a biopsy. Alternatively, screenees were free to consult a dermatologist for initial screening, but only 22.6 percent chose this path.

Melanoma Findings

The population was recruited to the screening by physicians, health insurers, and different mass media campaigns.7 A total of 360,288 inhabitants (19.2 percent) participated in the SCS, with three times as many women as men. Skin biopsies were taken from 15,983 screenees (one out of every 23 screenees). This yielded 3,103 skin tumors, including 585 melanomas, 1,961 basal cell carcinomas (BCCs), 392 squamous cell tumors (SCCs), and 165 other malignant skin tumors.8 Thus, one malignant tumor was found for every 116 persons screened (3,103 of 360,288). This came to one melanoma in every 620 people screened, one BCC in every 184 people screened, and one SCC in every 920 people screened. Although SCCs are more common in the general population than melanoma, more melanomas were found than SCCs. This may be due to the younger screening population (compared to the general population) and the pre-screening publicity that
targeted moles and melanoma more than non-melanoma skin cancer.\textsuperscript{8} Overall, one melanoma was found for every 28 excisions done. Large differences by age group were observed: 20 excisions were performed to find one melanoma in men 65 years and older, whereas more than 50 excisions were required to find one melanoma in men between the ages of 20 and 49.

This intensified screening resulted in a melanoma incidence increase during the SCREEN period, followed by a decline after the end of the project.\textsuperscript{3} The trend was more pronounced in women than in men, owing to their greater participation rates. No such rise was observed in Germany as a whole (Figure 1). Training programs and campaigns to increase public awareness preceding the screening period may explain the incidence peak in women in 2001 as well as the elevated incidence in the pre-SCREEN period compared to the incidence in the post-SCREEN period.

**Mortality Reduction**

The main objective of melanoma screening is to prevent melanoma deaths by early detection of suspicious lesions that might otherwise be discovered only once they became large or symptomatic, often at a late stage when the risk of death is much higher. Depending on the case fatality rate, an intervention effect on mortality may take several years or even decades to become visible. Since melanoma is quite lethal when diagnosed at a late stage,\textsuperscript{10} five years were deemed a sufficient time period after implementation of the SCREEN project to assess the trends in melanoma mortality in Schleswig-Holstein. The official mortality statistics provided information on melanoma deaths from 1990 to 2009.

Population-based age-standardized mortality rates (European standard population) for women in Schleswig-Holstein were at relatively constant rates of 1.4 per 100,000 between 1990 and 2003. These rates began to drop during and immediately after the implementation of the statewide SCREEN project. In 2009, mortality rates were almost 50 percent lower than they were during the 1990 to 2003 period. Mortality rates for men in Schleswig-Holstein ranged between 1.8 and 2.1 per 100,000 from 1990 to 2006 and also dropped by almost 50 percent, to 1.0 per 100,000 during the most recent period.\textsuperscript{11} The onset of mortality reduction after an SCS is generally expected some years later, so the observed immediate mortality reduction would seem very early to be attributed to the screening. However, again, the training programs, the public awareness campaign, and a consecutive incidence increase before the SCREEN period may have resulted in such an early effect.

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Ten-year mortality trends for the most recent period (2000-2009), expressed as annual percentage changes (APCs), were assessed by log-linear regression. They revealed a significant decline in melanoma mortality for the last 10 years (overall -7.4 percent per year: women -7.1 percent and men -7.5 percent). This decline was also consistently observed in young, middle-aged, and older individuals.

**Comparison to Adjacent Regions**

It could not be ruled out that the observed mortality reduction in Schleswig-Holstein was only a one-time anomalous trend. Therefore, the melanoma mortality trend in 2000-2009 was compared to the time trends in four regions adjacent to Schleswig-Holstein, i.e., regions without a comparable screening project. Denmark, which has a population of 5.6 million and is located north of Schleswig-Holstein, has never had a systematic skin cancer screening program like the SCREEN project. The other three regions were the following German federal states: Mecklenburg-Vorpommern in the east (population 1.6 million), Hamburg in the south (population 1.78 million), and Lower Saxony in the southwest (population 7.9 million). In these regions, national German systematic skin cancer screening was launched in 2008, after the early success in Schleswig-Holstein. As a fifth region, the entire country of Germany (excluding Schleswig-Holstein) was used for comparison.

None of the four adjacent regions or Germany (excluding Schleswig-Holstein) has had a clear change in melanoma mortality during the last 20 years or the last 10 years (Figure 2). Statistical tests of the annual percentage changes revealed a statistically significant difference between the overall mortality trend in Schleswig-Holstein and the mortality rates in each of the other regions. The decline in melanoma mortality was consistent in Schleswig-Holstein for both sexes and much greater for both men and women than in any of the five comparison regions.

**Conclusions and Future Prospects**

The nationwide skin cancer screening program was implemented in Germany in July 2008 based on the early findings of the SCREEN project. The current nationwide SCS is going to run until 2013. Then, the national health authorities will decide whether to continue the program. The decline in melanoma mortality—observed in the region of the SCS but not in any of the surrounding regions without population-based SCS—is a cornerstone of evidence towards proving the effectiveness of melanoma screening.

We strongly believe that the preliminary evidence provided by the SCREEN project justifies continuation of the German SCS. However, additional evidence is necessary. Currently, screening data is being linked to cancer registry data,
enabling further analysis of five-year survival and a comparison of expected and observed mortality for screened and unscreened melanoma patients. When more time has passed, data from the nationwide SCS could be used to repeat a comparison of mortality trends, this time comparing trends in the screening region to those in other European countries without SCS. A further step would be to conduct a case-control study of deceased melanoma patients and controls who either participated or did not participate in the SCS. It could then be explored whether persons who died of melanoma were less likely to have undergone a skin examination. After carrying out further studies on the basis of the whole German program, stable evidence should be available to implement SCS in other regions of the world.

What Can Patients and Physicians Learn from This Study?

Our data suggesting reduced melanoma mortality resulting from total-body skin examinations support the established recommendation to check
the human body regularly for suspicious skin lesions, including skin not normally exposed to the sun, and to consult a physician when indicated.

The education of physicians is crucial. Both the benefit and harm of screening need to be considered by the physician.\(^2\) Harm can be caused by the diagnostic procedure itself—for example through psychological distress, problems in wound healing, or scar formation after tumor excision. In younger men, more than 50 excisions were required to find one melanoma, compared to one found in 20 excisions in older men. These numbers are high even for older men: in German mammography screening need to be considered by consulting a physician when indicated.

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5. van der Leest RJ, de Vries E, Bulliard JL, et al. The role of routine excision for pigmented skin lesions in younger men: in German mammography screening campaigns will also likely serve as an important yardstick for others looking to implement broad-based melanoma screening programs.

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