

CONCLUSION

Melanoma is a serious public health concern in the United States and recent decades have seen alarming increases in its incidence and resulting mortality. Screening for melanoma is thought by many to be an effective way to detect the malignancy at an earlier and more favorable stage and thus reduce the mortality from this disease. In fact, this is assumed in the practice of dermatology today. However, recommendations for or against melanoma screening by cancer societies and preventive health care organizations are mixed. Given the scope of the melanoma problem it is surprising that few studies are available to help guide such screening recommendations. In the absence of solid research, it is understandable why the public health messages being sent are mixed. This is in sharp contrast to many other cancers such as those of the breast, cervix, colon, and prostate where much more research on both effectiveness and cost-effectiveness of screening interventions is available. Unfortunately, mixed public health messages may discourage people in need of screening and encourage screening among those who do not need screening. However, until better research is available on melanoma screening it will be impossible to achieve a rational approach to screening or a consensus on recommendations.

The primary focus of this dissertation has been to examine the effectiveness and cost-effectiveness of screening for melanoma. As part of this process, several previously

unanalyzed or minimally analyzed aspects of melanoma epidemiology have been investigated including differences in melanoma incidence and survival due to stage at diagnosis, decade of life, and gender of the patient. Though there were no prospective, randomized controlled clinical trials, data were available in the form of implemented screening programs initiated by the American Academy of Dermatology. Using these data and data from SEER and other cancer registries, a decision analysis was used to simulate a clinical trial of melanoma screening. The results of these analyses should be seen as attempting to use the best available data to estimate cost-effectiveness and suggest factors impacting such screening programs.

Our decision analysis can help to determine the value of performing an actual trial of melanoma screening. It is interesting to speculate on the value of obtaining better information on the effectiveness and cost-effectiveness of melanoma screening by funding a clinical trial of screening. The value of a definitive, successful screening trial could be determined by estimating the changes in practice that would occur if various guidelines for screening were implemented after such a study. Suppose screening was not cost-effective for a percentage of the population, but was cost-effective for another group of the population. First, one could assume a certain screening criterion might be implemented based on that information. Then, one could determine how many people are currently being screened inappropriately and appropriately, given this assumed criterion. Thus, one could estimate what resources are currently being used inappropriately on screening those people not meeting the criterion and what resources are being lost by not screening those people who do meet the assumed criterion.

Estimating the value currently lost by not screening appropriate individuals is more difficult and would most likely involve setting a monetary value for a year-of-life-saved. For instance, if one assumed that every year-of-life-saved is valued at \$100,000, and also assumed screening costs \$50,000 per year-of-life-saved for the appropriately screened group, then a value could be arrived at for the amount currently being lost by current screening practices. Thus, the value of obtaining better information on screening for melanoma, depends on what screening criterion is likely to be found in a melanoma screening study as well as the current practices. Additionally, one might include how likely it is that a study would actually change the current practices of screening, since recommendations for screening are not always practiced, even once made. The results of this thesis aid in determining what criteria are likely to be recommended after such a study. Hypothetically, if the result of a melanoma screening study suggested 20% of the population that is not currently screened should be screened every three years, the value of performing such a trial would likely be very high given a few reasonable assumptions and the trial would likely pay for itself after only a few screenings⁸. This “back-of-the-envelope” calculation though obviously limited, suggests that a trial of melanoma screening if funded may well pay for itself in relatively short order.

⁸ Assume 20% of the US population is screened every three years and the prevalence of melanoma in this group is 200 per 100,000 population. Further assume each screening of a melanoma patient results in 0.5 years of life saved (YLS) and costs \$50,000 per YLS and that each YLS is worth \$100,000 (appropriately discounted). Then, each round of US screening would result in a savings of approximately \$12.5 million without accounting for additional savings from not screening those currently being screened inappropriately. Elwood² in 1994 estimated a screening trial for melanoma would cost approximately \$11 million for a study with several years of follow up. Even if this estimate of the cost of a trial is doubled to \$22 million one can see that a trial would likely pay for itself after two screenings, more or less.

The results of these analyses could also be used to help design a study of melanoma screening by helping to determine which groups to target in an initial study. Often, first screening trials are performed on high-risk individuals with the belief that if screening this population were not particularly cost-effective, that screening an even less at-risk population would certainly not be as cost-effective or worth investigating. Such a study would yield initial results at less cost than screening of the general population. These analyses suggest that using age and possibly gender would be an easy way of targeting a higher risk population with a lower study cost and a more favorable cost-effectiveness ratio than the general population. Another way to enroll higher than average risk individuals would be to have people self-select themselves for screening as was done in the AAD screening programs. By “self-select” in this context I am referring to a screening program that is set up and advertised, possibly takes place in a public arena such as a shopping mall, and in which people passing by or seeing the ads then self-select themselves for screening. It appears from the results in this thesis that a combination approach of self-selection and age-specific criteria could be used to achieve a lower cost-effectiveness ratio than screening the general population. In the results presented here, the screening of a self-selected group of men and women 50 years or older was more than five times more cost-effective than screening the general population.

Future Directions

Screening as evaluated in this thesis only considered dermatologists performing the screen; however, screening for melanoma need not be so narrowly defined. Significant

improvements in melanoma screening might be accomplished by having non-dermatologists perform screenings in parallel or serially with dermatologists. For instance, these results showed that the cost of the initial screening examination is the primary determinant of the total costs of the program. Table 5.1 shows the range of C-E ratios from the cost-effectiveness analysis if the screen cost is varied from \$20-\$60. One can see that the screen cost has a significant impact on these estimates. The simplest way to reduce the screen cost would be to have a less-expensive person performing the screen such a nurse or nurse practitioner. Our results also showed that this less expensive screener could have a significantly lower sensitivity while still maintaining or reducing the cost-effectiveness ratio (see Figure 4.5). One screening strategy would be to have professionals other than dermatologists perform an initial screening exam and either perform necessary biopsies or refer all positives screens to a dermatologist for further evaluation. These non-dermatologist professionals would preferably be highly trained for screening exams to enhance accuracy. It is possible that such professionals could achieve a sensitivity equal to or even greater that of many dermatologists without any decrease in specificity of the examination.

Another way to decrease costs would be to have general practitioners perform the examination as part of an annual visit. This would decrease the marginal cost of such a screening examination and also reduce the patients' opportunity costs, since they would presumably already be visiting the physician for other reasons. The problem with this strategy is that primary care physicians already are burdened with performing so many tasks that it simply may not be practical to add more while maintaining the accuracy of

Table 5.1. Range of cost-effectiveness estimates, varying screen cost from \$20-\$60.

Screen Scenario	Screen cost \$43	Screen cost \$20-\$60
Reference Case	\$51,481	\$23,015 - \$71,558
Ref Case + NMSCA	\$64,646	\$36,692 - \$84,361
50+ year old men and women	\$22,368	\$7,227- \$33,045
50+ year old women	\$30,888	\$11,981- \$44,223
50+ year old men	\$18,904	\$4,394- \$29,136
All Caucasians	\$172,276	\$84,633- \$234,089

the screening examination. Also, such a strategy would only include screening of people who visit their primary care physician. Another way to decrease opportunity costs of the patient is to have the screens take place at points of convenience such as malls, and this is done in practice in many screenings. Another type of screening protocol that could be performed involves the addition of recent technology for screening pigmented lesions such as digital epiluminescent microscopy (DEM), which can be performed by a technician and the results can be interpreted later by a dermatologist or immediately by a computer program. We have recently completed a pilot study of such a computer-assisted digital epiluminescent microscopy (CADEM) and preliminary results show CADEM has an accuracy approximately equal to that of dermatologists. Other studies have found DEM when performed interpreted by dermatologists to improve the accuracy of their evaluation of pigmented lesions. If CADEM was shown to be accurate, technicians could be trained to screen all or most pigmented lesions on patients and only those with positive screens would be referred to a dermatologist for further evaluation and likely biopsy. Such a program might be ideal for screening if one's goal was to screen a significant proportion of the population and

maintain a low cost-effectiveness ratio. In fact, it turns out that the number of practicing dermatologists precludes their screening the entire US population each year, even if all dermatologists spent all their time screening for melanoma and did no other work.

Research on melanoma screening is lacking and much is needed in order to make informed decisions on how best to reduce the mortality from this disease. Recently, a research group has started a randomized trial of a community-based population screening for melanoma in Queensland, Australia ¹. Forty-four communities with a population 560,000 adults aged 30 years or more will be randomized to receive either a community-based screening program for 3 years or normal practice. The screening program involves whole body skin examination by a physician, provides open access to skin cancer screening clinics, and promotes thorough skin self-examination with many years of follow-up. This trial should provide not only a great deal of information on screening for melanoma but also because recurrent screens will be performed, it should provide data on the natural history of melanoma. Because medical practices and costs are different in the US and Australia and there is greater heterogeneity of the US population and environment, an argument for such a trial in this country in the near future can be made. If such a trial is not performed it is likely that decisions regarding screening will be made based on a person's socioeconomic or educational level, the patterns of referral of an individual's primary care physician, practice patterns of an individual's insurance carrier, or simply personal preferences regarding health care. Such determinants of whether an individual is screened for melanoma do not necessarily maximize public welfare or correlate well with cost-effectiveness. Further

work is needed on the impact of targeting screening. The development of a “risk score” for melanoma could help individuals determine their risk of melanoma and guidelines for screening could be made based on such risk scores. Such a risk score might logically include skin type and ability to tan, environmental exposures, family history of melanoma, personal history of melanoma and other skin cancers, and in the future possibly even genetic markers. It is important to remember that while targeted screening does lower the cost-effectiveness ratio, highly-targeted screening programs can result in a significant number of people with melanoma not being screened.

A logical and consistent approach to melanoma screening will only be achieved after the necessary foundation of research has been performed. Such research appears clearly warranted based on the results presented here.

References

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