
Skin-Cancer Screening: A Three-Year Experience That Paid for Itself

George H. Limpert, MD

West Chester, Pennsylvania

Background. The incidence of cutaneous malignant melanoma is steadily rising. Although cancer screening guidelines seek to increase the frequency of curative early excision of melanomas, it is unclear how these guidelines can be economically incorporated into clinical practice.

Methods. A free skin-cancer screening clinic, which used a brief undressed skin examination, was held annually for 3 successive years at a private, rural, family physician's office. The goal was to identify undiagnosed melanomas with the expectation of finding other skin cancers as well. Data were collected on marginal costs to the practice, confirmatory follow-up examinations, and marginal revenue received from follow-up treatment with the author.

Results. Of 247 persons screened, 70 (28%) sought a follow-up examination with either the author (38 pa-

tients) or their primary or other consulting physicians (32 patients). Fifty-four percent of the 70 patients who followed up (15% of the total screened) were found on biopsy or repeat physical examination to have malignant or premalignant lesions, including one melanoma. The 38 participants seen in follow-up by the author generated 114 patient encounters with the billing of 151 procedures and office visits. Marginal revenues generated by the follow-up procedures and office visits with the author following this free skin-cancer screening exceeded by 3.6 times the marginal cost of the screening.

Conclusions. A free mass skin-cancer screening in a rural setting by a family physician can identify melanoma and other previously undiagnosed skin cancers and pay for itself as well.

Key words. Melanoma; skin diseases; screening; primary health care; rural. (*J Fam Pract* 1995; 40:471-475)

The incidence of cutaneous malignant melanoma is rising worldwide.^{1,2} It was estimated that there were 32,000 new cases and 6900 deaths resulting from melanoma in the United States during 1994.³ The lifetime incidence of melanoma in the United States is approaching 1 in 90 persons.⁴

Extensive debate has focused on the most effective way to detect this highly malignant cancer in its early asymptomatic stages when surgical excision is curative.⁵⁻¹⁰ Awaiting the presentation of the symptomatic patient is unacceptable because of the high rate of metastases at this stage; physician skin screening at episodic sick

visits may be impractical because of time constraints; screening at well follow-up visits or complete physical examinations is ideal but inefficient; mass screening has not been proven cost-effective at the societal level, and therefore has not been endorsed¹¹⁻¹³; primary prevention and public education for early detection have been proven effective in other countries but require an organized political effort at the national level.^{14,15}

This study was developed in response to the high perceived rate of malignant melanoma in the author's community. No attempt was made to address the cost-effectiveness to society of skin-cancer screening. Instead, the study focused on the marginal cost and revenue associated with sponsoring a skin-cancer screening by a solo family practice.

The hypotheses were that (1) a free, high-volume skin-cancer screening could be performed inexpensively in a private family physician's office, (2) the screening

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would detect at least one asymptomatic melanoma for every 300 to 500 individuals screened, and (3) the screening would pay for itself as a result of the numerous skin cancers detected and treated.

Previously published efforts at mass skin-cancer screening in the United States have failed to combine the following attributes: a 100% undressed skin examination, arranged by appointment and conducted by a board-certified family physician in a private office in a rural area setting; accurate follow-up data; and a cost and revenue analysis.¹⁶⁻²¹ These desirable features were incorporated into the current project.

The cost and revenue analysis was crucial to this study to determine whether it would be economically feasible for physicians in solo or small group practices in rural areas to conduct mass skin-cancer screening in their communities.

Methods

A free skin-cancer screening clinic was held annually in each of 3 successive years (August 1991, August 1992, June 1993). Participants were self-selected persons predominantly representing two counties in northeastern Pennsylvania (Susquehanna and Wyoming counties) who responded to screening clinic advertisements and made appointments to be seen.

Publicity began 1 month before the screening by means of flyers distributed from the author's office and from local businesses, free public service announcements on the local radio station, paid advertisements in the local newspapers and shopping guides, and a feature article in the community hospital's quarterly health bulletin, which is mailed to the community (Tyler Memorial Hospital, Tunkhannock, Pennsylvania).

The free screening clinic was held in the author's solo office in a rural township of 1300 inhabitants, located in a county with a population of 40,400 (Susquehanna County, Dimock, Pa, 15 miles north of Tunkhannock).²² The screening hours were from 5:30 PM to 8:30 PM to encourage participation by working men and women. Six to seven patients were scheduled for each 15-minute time slot. Neither participants nor insurance companies were charged for the examinations. Participants completed a demographic and background medical information form on arrival. Illustrated brochures about melanoma published by the American Cancer Society were distributed to the participants at registration.

Each examination was performed by the author chaperoned by a nurse. Ceiling-mounted fluorescent lighting was used, with handheld incandescent lighting used for close examination of suspect lesions. During the

2- to 3-minute examination, each participant's entire body surface was scanned (including the scalp, hands, and feet), and the preprepared documentation and patient instruction, education, and follow-up sheet completed. The female vulva was excluded from a significant number of examinations on patient request.

The intake patient demographic and background sheets requested patient's name, address, telephone number, birth date, and occupation; personal physician's name, address, and telephone number; and the number of months since the patient's last physician visit. Medical history questions included frequency of sunscreen use, personal history of skin cancer, and number of blistering sunburns. Social history related to living or vacationing in southern states; family history of melanoma was also requested. A release-of-information statement on the form, allowing communication with each participant's personal physician, was signed and dated by each participant.

The patient education sheet described the rationale for the skin-cancer screening, the nature of the examination to be provided, and the necessity of follow-up. The most common benign, premalignant, and malignant lesions found on the skin were described: dermatitis, psoriasis, warts, skin tags, benign moles, seborrheic keratosis, actinic keratosis, squamous cell carcinoma, basal cell carcinoma, dysplastic nevus, and malignant melanoma. Follow-up recommendations were listed along with the significance of the skin lesions identified.

Participants suspected of having a cutaneous malignancy were specifically and emphatically instructed to have a skin biopsy within 1 month. Those with suspected precancerous lesions or with lesions difficult for the author to identify were told to follow up in 1 to 3 months. All others were told to follow up routinely in 1 year.

Participants were instructed by the receptionist at their departure to follow up with the author, with their personal physician, or with a dermatologist in the nearest city (45 to 60 minutes away). Three months after the skin-cancer screening clinic, letters were sent to the participants who had been asked to follow up and to their personal physicians. These letters reiterated the suspect nature of their skin lesions, recommended follow-up, requested information on whether the participant followed up with a physician, and requested a confirmatory diagnosis on the suspect lesions.

Follow-up data and confirmation of lesion diagnoses were obtained from the author's office charts, and from letters and telephone calls with participants or their physicians. In all cases, a verbal report of a diagnosis from a physician or a copy of a pathology report was used as the definitive diagnosis of a suspect lesion.

Patients returning in subsequent years for repeat visits to the skin-cancer screening were credited with follow-

ing up as recommended, even if their initial recommendation had been for a biopsy or 1- to 3-month follow-up. If, however, their subsequent screening visit led to a non-screening follow-up office visit or procedure confirming a suspected diagnosis, data for the confirmed diagnosis was registered only in the most recent year of their screening, rather than in the first. Doing so eliminated duplication of confirmed diagnoses.

Advertising expense data for the screening were supplied by the public relations manager at Tyler Memorial Hospital, who arranged for the news advertisements and articles, public service radio announcements, and other promotions. Some costs were estimated if exact values were unavailable owing to their being bundled with other bulk advertising activities.

Office expense data were supplied by the manager of Tyler Family Practice, Tyler Memorial Hospital, Tunkhannock, Pa. The marginal cost of conducting the skin-cancer screening clinic was considered to be the difference between the expense of conducting the screening and the expense of running the office during usual hours for the study period. The cost of the screening program was calculated by summing the cost of advertising, marginal staff wages during the screening, food for the community hospital volunteers who assisted, and follow-up mailings.

The actual wages incurred during the screening were higher than normal wages incurred because a second nurse was used to manage the high volume of patients during the screening. Marginal staff wages were calculated by subtracting normal staff wages that would have been incurred during routine office hours from the actual staff wages incurred during the screening.

Revenue data were extracted periodically during the 3 years from the hospital-based office billing system at Tyler Memorial Hospital, which handled the billing and collections for all of the services provided by the author. By tracking the exact dates and Current Procedural Terminology (CPT) codes of the services provided by the author to the participants seen by him in follow-up, exact dollar amounts billed and received from those participants and their insurers were cumulated.

The marginal revenue from the screening clinic was considered to be the income received by the author as a result of office visits and procedures to reevaluate or treat a participant's suspect skin lesion. No revenue was generated at the time of the screening clinic, as it was a free service. Some of the lesions were determined at follow-up not to be cancers or precancers. The income from these visits and procedures, which would not have been generated had the skin-cancer screening not been held, was included in the marginal revenue.

The dollar amounts received by other physicians who treated participants as a result of the screening were not

solicited because they were not relevant to this study. Revenue figures do not include fees received by other physicians from participants who did not follow up with the author.

For personal interest, estimates of lost potential revenue were calculated using the approximate office time devoted to the screenings multiplied by the average hourly income collected in the office. This figure was not included in either the marginal cost or the marginal revenue summations.

Results

Free skin-screening examinations were provided to 235 individuals over a 3-year period. Twelve persons returned in subsequent years for repeat screening examinations, resulting in 247 encounters. For statistical purposes, a total number of 247 was used.

Sixty-two percent of the patients screened were female and all were white. They ranged in age from 4.5 to 84 years, with a mean of 53.5 years. Sixty-one percent had a history of blistering sunburn; 9%, a personal history of cancer; 20%, a family history of melanoma; and 31% usually used sunscreen. The author was the primary care physician for 11% of the patients screened. Eighty-one percent were affiliated with other primary care physicians; 9% had no primary care physician.

Follow-up information was received on 82 participants (33%) by auditing the author's charts or by telephone or mail contact with the participants or with their primary care physicians. Seventy (28%) patients followed up for examination or biopsy with a physician as a result of the screening, and 12 (5%) reported they had no further evaluation. No follow-up information was received on the remaining 165.

Biopsy of a suspect lesion was emphatically recommended for 51 participants. Forty (78%) of these followed up with a physician, 33 (83%) of whom received a biopsy. A repeat examination in 1 to 3 months to reevaluate a less worrisome type of lesion was recommended for 61; 21 (34%) followed up, 9 (43%) of whom received a biopsy. A routine repeat skin screening in 1 year was recommended for the remaining 135 participants, 9 (7%) of whom followed up with a physician for a repeat skin examination.

Either the clinical diagnosis after a careful repeat examination of a suspect lesion found at screening or a biopsy-proven diagnosis was accepted as the confirmed diagnosis of a lesion. Malignant melanoma (MM) was confirmed in 1 participant (biopsy-proven); dysplastic nevi were confirmed in 5 (4 by biopsy), Bowenoid actinic keratosis was confirmed in 1 (by biopsy); actinic keratosis was confirmed in 18 (12 by biopsy); and basal cell carcinoma

Table 1. Skin Cancer Screening Clinic Cost Data

Item	Amount (\$)
Advertising	
Radio (public service announcements)	0
News articles	0
Newspaper advertising	207
Hospital public relations newsletters	1000
Fliers, posters	50
Office expense	
Marginal staff wages*	143
Food for volunteers	50
Letters, postage, copies	110
Total†	1560

*Indicates staff wages greater than those that would have been incurred during normal office hours for the days the clinic was conducted. Actual staff wages were \$407; normal staff wages would have been \$264.

†In computing the total cost of the screening clinic, the author excluded the \$850 of lost office revenue for the days the clinic was held.

noma (BCE) was confirmed in 13 (all by biopsy). No squamous cell carcinomas (SCC) were confirmed by biopsy or repeat examination. Two lesions suspected on screening to be SCC were found to be actinic keratosis on biopsy; 1 suspected SCC was found on biopsy to be a BCE; 1 participant with a lesion highly suspect for SCC (a smoker with a chronic scaling lip lesion) was lost to follow-up.

The marginal cost for holding the skin-cancer screening clinic was approximately \$1560. The breakdown of the marginal cost is detailed in Table 1. Calculations for lost potential revenue and total staff wages also were included.

The marginal revenue generated by the skin-cancer screening clinic was calculated as the total payments received by the author from participants who returned for office visits or surgical procedures to treat lesions discovered through the skin-cancer screening clinic.

Of the 247 participants, 38 (15%; 54% of the 70 who followed up) returned to the author for a follow-up examination (Table 2). These follow-ups resulted in 114 patient encounters with the billing of 151 office visits and procedures; many single encounters resulted in the performance and billing of more than one procedure. Twenty-seven different CPTs for office visits and procedures were used in billing.

Billings for follow-up examinations and procedures on the skin-cancer screening participants totaled \$8428, of which \$5577 (66%) was collected. Therefore, the marginal revenue generated by the author was approximately 3.6 times the marginal cost (\$1560) of the skin-cancer screening clinic.

The marginal cost to the author's office for the melanoma found was \$1560. The marginal cost for each confirmed malignancy (MM, BCE; n=14) was \$111, and

Table 2. Follow-up Procedures Performed by the Author

Type of Procedure	No. of Procedures
Biopsy	34
Excision	
Benign	14
Malignant	5
Destruction	
Benign	24
Malignant	4
Office visits	17
Surgical follow-up (no charge)	53
Total patient encounters	114
Total procedures and office visits	151*

*Many patient encounters included more than one procedure.

for each confirmed malignancy or premalignancy (n=38), \$41.

Discussion

This study demonstrates the economic feasibility of sponsoring a free skin-cancer screening clinic by a solo family physician in a rural setting.

For family physicians already possessing an interest in dermatology and the skills to distinguish the characteristics of benign from malignant pigmented nevi, the effort involved in holding such a screening should be negligible. With foresight and planning, 15 to 25 participants can be thoroughly screened each hour. Soliciting the support of a local community hospital for assistance with advertising may be invaluable.

The cost of holding a skin-cancer screening can be calculated from various points of view: society's, the patient's, or the physician's. Calculating costs from the point of view of society and of individuals is very complex, requiring consideration of such factors as all parties' time, the effect of false-positive and false-negative screening diagnoses, and the risk of unnecessary procedures. This type of data gathering and analysis far exceeds the capability of this study.

Calculating the costs at the level of the individual physician, however, is simpler, requiring only analysis of marginal office and advertising costs. In this study, the bulk of the \$1560 marginal cost consisted of advertising expense.

The value of the lost potential revenue during the screening may constitute one of the larger "costs" associated with holding a screening. If one viewed the cost of the screening as including the lost potential revenue plus the *actual* staff wages during the screening, even then the

cost of the screening would have been only \$2674, a figure the marginal revenue still exceeded by approximately 2.1 times.

Much of the follow-up treatment after a screening is likely to fall to the physician who initiated the screening, enabling the costs to be recouped. In this study, the marginal revenues from the follow-up visits and procedures totaled \$5577, exceeding by 3.6 times the marginal cost of the screening.

The goal of definitively diagnosing at least one melanoma was achieved in this sample, but the reproducibility of that result in screening such a relatively small number of people is yet to be demonstrated in a primary care setting. Whether this success resulted from self-selection among participants or simply from random variation cannot be determined on the basis of this study.

The rate of 1 melanoma found in the 247 screening encounters does, however, approximate the rates observed in other screening efforts: 1 *presumed* melanoma per 130 screening participants through the American Academy of Dermatology's National Melanoma/Skin Cancer Prevention Program, ie, 3578 presumed melanomas in 461,290 persons screened over 7 years²³; and 1 *confirmed* melanoma per 280 screening participants in a subset of that program, specifically, 9 confirmed melanomas in 2560 individuals screened in 2 years in Massachusetts.¹⁸

Whether any lives will be saved as a result of this screening project cannot be determined. The patient education sheets and the brochures about melanoma that were distributed at the screening are likely to have been of as much benefit as the skin examination itself.²⁴⁻²⁶

Gaining satisfaction from the early diagnosis of previously undiagnosed cutaneous malignancies and adding to the variety and scope of one's practice may be the factors that support the conclusion that the skin-cancer screening in this study paid for itself.

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