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Koh, H K

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Boston University
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Howard K. Koh

Cancer Prevention and Control Center, Boston University Schools of Medicine and Public Health, Boston, Massachusetts

Ultraviolet (UV)-associated cancer is the most common cancer in the United States. Approximately 90% of nonmelanoma skin cancer and 65% of melanoma are attributable to UV exposure and theoretically could be eliminated by primary prevention measures. Safe sun strategy includes use of sunscreens, use of protective clothing, minimization of exposure from 10 A.M. to 3 P.M., and avoidance of tanning parlors. Although more definitive data in human populations on the effectiveness of sunscreens to prevent melanoma and skin cancer are needed, sunscreens are thought to reduce risk. Safe sun prevention must start in childhood and adolescence when people receive most of their UV exposure. Secondary prevention through professional and public education and early detection may further reduce melanoma mortality. — Environ Health Perspect 103(Suppl 8):255–257 (1995)

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Introduction

Ultraviolet (UV)-associated cancer (i.e., skin cancer) is the most common cancer in the United States. In theory, we should be able to improve skin cancer control through both primary and secondary prevention (1). An estimated 90% of nonmelanoma skin cancers (squamous cell carcinoma and basal cell carcinoma) are attributable to cumulative UV sun exposure (2). Hence, effective primary prevention measures (safe sun strategy) theoretically should be able to eliminate most of these cancers. For malignant melanoma, recent estimates suggest that perhaps 65% (worldwide) are attributable to UV exposure. Therefore, primary prevention has a possible role for this malignancy as well (3).

In addition, early, thin, stage I melanoma has a very high 5-year survival rate and is mostly curable. In contrast, late-stage metastatic melanoma generally is incurable (1), causing 7000 deaths a year in this country (4). Hence, secondary prevention through education, early detection, and possibly screening could complement primary prevention to reduce melanoma mortality (1,5,6).

Based on current knowledge, we can make recommendations for primary prevention through a safe sun strategy. Safe sun currently entails at least three elements for persons at risk: a) use of sunscreens; b) personal behavior changes to include use of natural shade, protective clothing and hats, and minimization of exposure between 10 A.M. to 3 P.M. [the peak ultraviolet B (UVB) time]; and c) avoidance of tanning parlors (7). In addition, environmental strategies to preserve atmospheric ozone are also important primary prevention measures. This presentation focuses mainly on the first two items: use of sunscreens and personal behavior changes.

Primary Prevention—Safe Sun Strategy

Use of sunscreens has increased in the United States over the past three decades. Sunscreens are graded according to their solar protection factor (SPF), which ranges from 2 to 50 or more. Sunscreens protect against UVB and, more recently, ultraviolet A (UVA). Experts distinguish between sunblocks (physical blockers of UV light, such as titanium dioxide) and sunscreens (chemical agents that absorb UV light, such as para-aminobenzoic acid [PABA] esters) (7). Sunscreens prevent erythema and sunburn in animal models and in humans (8) and prevent squamous cell carcinomas in animal models (9). In addition, in a recent randomized study in humans, sunscreens appeared to prevent actinic keratoses, which are precursors to squamous cell carcinomas (10,11).

Despite these data, many questions still remain about proper sunscreen use within a safe sun strategy. We encourage people to avoid sunburns to protect against skin cancer (and possibly, melanoma) years later. But, if more subtle sun damage causes substantial immune aberrations in humans, we may require even more comprehensive sun protection to improve public health.

We also need definitive data in human populations on the ability of sunscreens to prevent melanoma and skin cancer. Currently, the evidence that sunscreens prevent skin cancer is largely restricted to squamous cell carcinoma models in animals (9). Obtaining such human data prospectively would require decades of monitoring and follow-up, so understandably such data are lacking. Available case-control studies on sunscreens and melanoma generate mixed conclusions and may be complicated by confounding (12–14).

How should we advise the public until these answers are available? A U.S. Food and Drug Administration monograph has established conditions by which over-the-counter sunscreens are recognized as safe and effective (15). First published in the Federal Register in 1978, these conditions were reviewed and updated in the 1980s and were undergoing revision again in 1994. Suggestions from scientific groups, consumer groups, industry officials, and concerned citizens shaped the content of this monograph. Hence, this very public process has attempted to fashion a consensus about what sunscreens can do and the conditions under which they can be marketed as safe and effective products. For example, the monograph offers a suggested label for sunscreens—"Sun Alert: The sun..."
causes skin damage. Regular use of sunscreens over the years may reduce the chance of skin damage, some types of skin cancer, and other harmful effects due to the sun" (15).

Comprehensive, safe sun education must start in childhood and adolescence when people receive most of their UV exposure (16). This raises many public health challenges. First, children (and adults) may find sunscreens messy and inconvenient, which lowers compliance. Also, sunscreens can occasionally cause side effects such as dermatitis and other irritative problems. We need a better understanding of the effects these problems have on compliance and must consider methods for improvement (17).

Second, although a single bottle of sunscreen may be relatively inexpensive, over a long, hot summer a family could find mounting costs prohibitive. If this is a major problem, we need to make sunscreens more accessible to low-income families.

Third, to promote safe sun and ultimately prevent UV-associated skin cancer, we must alter attitudes about tanning, particularly in adolescence. One U.S. survey indicates that two-thirds of respondents still believe that people look more healthy with a tan—this cultural norm may have to be changed before we can possibly observe improved safe sun behavior (unpublished data). Finally, we must teach children in an understandable way. For example, astronomer Leith Holloway has published the so-called shadow rule in the photobiology literature (18)—if your shadow is shorter than you are, it is time to seek shade and put on sunscreen. The American Academy of Dermatology has started to publicize this rule through public service announcements featuring their official spokesperson Joel Mole.

It is difficult to accurately estimate the number of people currently using sunscreens in the United States. A Boston University School of Public Health national random-digit dial survey found that about half the respondents who had sunbathed on the previous day also reported using sunscreen (Koh et al., unpublished data). Of these, only about one-half of users (hence, about one-quarter overall) used SPF 15 or greater, the level currently advocated by most policy groups. Men and those of lower socioeconomic status reported lower rates of sunscreen use. Hence, gender and social class differences need further clarification.

Secondary Prevention Strategies
Strategies for early detection and secondary prevention must recognize that most melanomas are asymptomatic and usually do not cause pain, itching, or other discomfort to the patient (1,19). Hence, only recognition by visual examination will detect these lesions early. The potential for professional and public education (20) in melanoma is high—the media can help improve recognition of this uniquely visible and external tumor. All primary care practitioners should be taught how to distinguish between ordinary moles (melanocytic nevi) and malignant melanoma (19,21). Since 1985, we have promulgated the ABCD rule which states that a mole with A, asymmetry; B, border irregularity; C, varied or intensely black color; and D, greater than 6 mm (the diameter of a pencil eraser) may signify melanoma (1,19,20). Many patients now seek medical advice for suspect moles (after noting ABCD qualities) that indeed are melanomas, demonstrating that patients can be empowered to improve their own health. Since about half of all melanoma patients discover their own lesions, patients have critical roles in early detection (22).

The American Academy of Dermatology has led national educational and early detection efforts annually every spring since 1985. The educational campaign involves disseminating warning signs and risk factors for skin cancers and melanoma through the media. Articles in newspapers and magazines and on radio and television penetrate all the top 30 television markets throughout all 50 states each year (23). To date, these messages have been carried as free public service announcements by the media and incur little cost. We must evaluate such public education to see how much these efforts have changed skin cancer knowledge, attitudes, and behaviors in this country.

Screening for skin cancer has attracted interest in recent years. Screening for any cancer is an inherently challenging area and in the skin cancer arena, many questions arise. There is theoretical appeal for this approach to cancer control. Melanoma is a rising public health problem, early detection is associated with cure, and the screening tool—a visual examination by a qualified observer (1,5,6)—requires no special technology, is noninvasive, is acceptable to the public, and takes only a few minutes.

The ideal study design for screening for skin cancer would be a randomized trial (as in breast cancer and some other cancers) (5). However, because of logistical and funding challenges and for many other reasons, no randomized trial for screening for skin cancer exists or indeed is planned anywhere in the world (5,6). Data should soon be emerging from an ongoing case-control study investigating whether self-screening is associated with lower rates of lethal melanoma in Connecticut (24). Short of this, a demonstration project by the American Academy of Dermatology has been coordinating free skin cancer screenings by volunteer dermatologists. Each spring, the media advertises these sessions and some among the general public choose to attend to have their skin checked. These sessions have screened over 700,000 people since 1985 (23). Of the first 400 pathology-confirmed melanomas found through this effort, 90% of invasive lesions have been thin, stage I tumors usually associated with 5-year survivals of 87% or more (23). However, this is not a randomized trial and lacks an appropriate control group. In addition, because of self-selection bias and many other biases, we cannot be certain of its impact on melanoma mortality.

In the meantime, policy groups differ about whether skin cancer screening should be part of general health policy. Clearly, these recommendations will change over time as new data come forward. The United States Preventive Services Task Force currently recommends skin cancer screening for high-risk persons. In that regard, investigators from the Netherlands and the University of Pennsylvania focus screening on families with atypical nevi or dysplastic nevi (25,26). These efforts for screening, surveillance, and education have found thinner melanomas in these groups.

Another early detection strategy may be to target those at high risk of dying from melanoma. Melanoma mortality is higher in men than in women, particularly men over age 50, who currently comprise almost half of all melanoma deaths in the United States (27,28). It is not known if these gender differences are due to a different biology of melanoma in older men, different behavioral factors, or a combination. Some hypothesize that older men are less aware of skin lesions and moles than other subpopulations. Until further data are available, it may be reasonable to focus some of our early detection and educational efforts to men over 50 (27,29).

With more research and better evaluation of primary and secondary preventive strategies for UV-associated cancer, we hope that ultimately these preventive approaches will decrease melanoma and skin cancer incidence and mortality.
REFERENCES