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An Approach to a Prevention Plan For Malignant Melanoma For the State of Connecticut

Ellen Ann Falvey

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AN APPROACH TO A PREVENTION PLAN FOR

MALIGNANT MELANOMA FOR THE STATE OF CONNECTICUT

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Master of Public Health Thesis

AN APPROACH TO A PREVENTION PLAN
FOR MALIGNANT MELANOMA FOR
THE STATE OF CONNECTICUT

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2001
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INTRODUCTION

In 1930, the risk of an American developing malignant melanoma was one in 1500.\(^1\) Today, the lifetime risk of an American male developing melanoma is 1 in 60, and that of an American female is 1 in 80.\(^2\) The American Cancer Society’s Department of Epidemiology and Surveillance Research estimated that there would be 47,700 new cases of melanoma and 7,700 melanoma cancer deaths in the year 2000.\(^3\) For the year 2001, their prediction is for 51,400 new cases of melanoma in the United States – 29,000 male and 22,400 female.\(^2\) Although there is a rise in incidence, the estimates for melanoma cancer deaths have not changed notably. The estimated total for 2001 is 7,800 – 5000 male and 2800 female.\(^2\) Not only is malignant melanoma the eighth most common cancer in the United States, but the incidence of melanoma has also doubled in the last decade.\(^4\)

The steadily increasing incidence is thought to reflect lifestyle changes. Especially since World War II, clothing styles have changed, as have recreational behaviors. There has been an increase in intermittent, intense exposure to the sun by indoor workers of higher socioeconomic status.\(^5\) Upward trends in skin cancer incidence may also be affected by increasing ultraviolet exposure due to depletion of the ozone layer.\(^6\)

In order to develop optimal prevention approaches, there must be knowledge of etiology. Based on animal experiments and epidemiological studies, ultraviolet radiation (UVR) exposure has been identified as the primary causative factor and most important environmental risk in the development of melanoma. The association between ultraviolet radiation and melanoma is somewhat controversial. However, many studies have
indicated that melanoma is related to intense, intermittent exposures, and to incidents of blistering sunburns during childhood and adolescence, as well as to more chronic exposures.\textsuperscript{7,8,9}

Years of research have led to a greater understanding of the epidemiology, risk factors, and natural history of melanoma. This should be the foundation upon which a public health program for prevention and control should be built. Because there is a definite scientific base for the harmful effects of ultraviolet light, there is good reason to believe that a public health educational approach would be effective, because early detection and primary protection have the potential to be successful.

Melanoma could decline through effective primary and secondary prevention measures. By reducing excessive sun exposure, primary prevention could reduce incidence, because two-thirds of all melanomas are attributed to excessive sun exposure.\textsuperscript{10} Therefore, programs that stress prevention must occur. Secondary prevention (early detection) could increase melanoma cure rates because long-term survival figures are over 95\% for Stage I melanoma. These cure rates decline sharply to fewer than 5\% for metastatic disease.\textsuperscript{11} This makes early detection and treatment strategies the key to survival, and should therefore be another central point upon which public health approaches are considered and undertaken in order to reduce the incidence of this disease.

The \textit{American College of Preventive Medicine} published its practice policy statements on skin cancer prevention and screening recommendations in a 1998 issue of the American Journal of Preventive Medicine. These policy statements are intended to be
guidelines for physicians and public health practitioners who provide health care and implement preventive health programs for individuals and society.\textsuperscript{12}

The \textit{American Cancer Society} (ACS) also has published guidelines for the early detection of cancer. The ACS began recommending guidelines in 1980, and continues to update them, as new data becomes available.\textsuperscript{13}

These guidelines will be further defined in this paper, and issues will be identified that need to be addressed in the development of a melanoma prevention program for the State of Connecticut.
DEFINITION

Melanoma is a malignant tumor that is derived from melanocytes through a malignant transformation. Melanocytes are derivative cells that originate from the neuro-ectodermal crest, which is the tissue matrix for the brain and medullary spine. These cells migrate during the early fetal period into the skin, where they settle within the epidermis and become part of the complex skin structure. However, these cells are not skin cells since they have a neuro-ectodermal origin, the potential for migrating, and the functional capacity of nerve cell units. One of the prominent functional features of melanocytes is to produce the melanin pigment as a response to ultraviolet radiation in order to protect the skin structures from sunburn damage. When one is exposed to sunlight, the melanin in the skin increases and the skin darkens.

Melanoma consists of melanocytes that have been transformed into cancer cells that grow uncontrollably. While melanoma can suddenly appear in the skin without warning, most studies suggest that one-third of melanomas begin from a precursor nevus, or mole. Patients themselves report that in 70% to 85% of primary melanoma cases there have been pre-existing lesions. However, these have not been confirmed histologically. Melanoma has a high potential for metastasis and, although the disease accounts for only 1% of all types of skin cancer, 60% of all skin cancer deaths are attributed to melanoma.

Cutaneous malignant melanoma is divided into four major pathologic subtypes. See Table 1. Superficial spreading melanoma (SMM) is the most common form of melanoma, accounting for approximately 70% of all cases. It often occurs on the upper back of men and women, and on the lower extremities of women. When diagnosed, the
patient usually reports a gradual or recent change in a pre-existing lesion. Nodular melanoma is the second most common subtype, accounting for 15% to 30% of all melanoma cases. The most frequent occurrence sites are the legs and trunk. Nodular melanoma is characterized by rapid growth, with a lack of an identifiable radial growth phase.

Lentigo maligna melanoma (LMM) generally appears on the faces or other sun-exposed areas of the elderly, with a mean age of 70. It accounts for about 4% to 10% of melanomas that affect Caucasians. LMM is linked to cumulative sun exposure, as are the non-melanoma skin cancers. The pre-existing lesion is usually present for 10 to 15 years. Acral lentiginous melanoma is the least common subtype to affect Caucasians, affecting 2% to 8%. However, it accounts for 35% to 90% of melanoma in African Americans, Hispanics, and Asian populations in the United States. This lesion is usually located on the palms, soles, or beneath the nail plate.

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<tr>
<td>Superficial Spreading Melanoma</td>
<td>Upper back of men and women Lower extremities of women</td>
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<tr>
<td>Nodular Melanoma</td>
<td>Legs and trunk</td>
</tr>
<tr>
<td>Lentigo Maligna Melanoma</td>
<td>Head, neck, and arms of elderly</td>
</tr>
<tr>
<td>Acral Lentiginous Melanoma</td>
<td>In Caucasians In African Americans, Asians, Hispanics - on palms, soles or beneath nail plates</td>
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Melanoma has two growth phases – radial and vertical. During the radial phase, the tumor spreads laterally along the skin surface. Removal of the melanoma during this phase is almost always curable by surgery alone. During the vertical phase, the
melanoma extends downward through the layers of the epidermis and dermis into the subcutaneous tissue. As it continues to grow downward, it invades lymphatic and vascular systems, resulting in local, regional, and distant lymph node or visceral organ involvement.\textsuperscript{17,21}

It is critical to have a uniformly accepted cancer staging system in order to guide physicians in treatment decision making, to allow comparisons of results of treatments from different health care centers, and to determine prognosis. The staging system should be simple, practical, and reflect the prognosis of patients.\textsuperscript{22} Since 80\% of melanoma patients present with Stage I disease, the American Joint Committee on Cancer (AJCC) has recommended the following four-stage system. Early recognition can lead to the detection and excision of thin, highly curable lesions. In this system, melanomas are classified primarily by how deeply the cancer cells have penetrated the skin and whether or not they have metastasized.\textsuperscript{21,22}

- Stage I is a localized melanoma and involves a mole or growth on the top layer of the skin.
- Stage II indicates that the growth is deeper but has not spread anywhere else in the body.
- Stage III is when the melanoma has limited spread to a nearby regional lymph basin or other nearby tissues.
- Stage IV indicates advanced metastasis with involvement of more than one regional lymph basin.\textsuperscript{21,22}

In late 1999, the AJCC Melanoma Staging Committee recommended major revisions in the staging system. The AJCC proposed to include many of the factors that
are routinely used now to predict prognosis, make treatment decisions, and report outcomes of clinical trials.\textsuperscript{23}

Survival from melanomas is inversely proportional to the thickness of the tumor. Within Stages I and II, the five-year survival depends on the level of microinvasion according to Clark levels or the measured tumor thickness as defined by Breslow. Once the diagnosis has been made an important criterion for predicting metastasis and patient survival is the Breslow tumor thickness measurement in millimeters (mm). Breslow thickness gives insight into the biology of melanoma that can guide clinical treatment. It is not 100\% predictive due to anatomic limitations of some tumors. Clark and others have developed parameters other than thickness to help predict clinical outcome. It is then possible to estimate the likelihood of metastatic disease as well as mortality.\textsuperscript{17,19} Tumors excised before a microscopic thickness of 0.76 mm has been attained have a 10-year survival rate of 92\%. Tumors of patients, which are excised after a thickness of 4.00 mm, have a 10-year survival rate of 42\%.\textsuperscript{20}
DIAGNOSIS AND TREATMENT

There is little doubt that the decreasing fatality rates are due to early detection and surgical excision of melanomas. It is important to diagnose the tumor in its primary stage, when it can easily be treated before secondary dissemination occurs. After a tumor has metastasized, it is more difficult to treat effectively and likely to be fatal.

There is scarce data on the natural history of how melanomas grow. However, data does exist which suggests that tumors grow slowly over months to years in the thin or lateral phase before becoming deeply invasive in the vertical phase. This is especially true of the superficial spreading melanomas and the lentigo maligna melanomas. Both of these can effectively use the ABCs of early melanoma for detection at the earliest phase, keeping in mind that this is only a guideline. This acronym is defined as:

A = Asymmetry – most early lesions grow at an uneven rate resulting in one half being unlike the other;
B = Border - irregular, notched, or poorly defined;
C = Color – irregular pigmentation, shades of black, grey, brown, blue, red, or white;
D = Diameter - greater than 6 mm, greater than the size of a pencil eraser;
E = Elevation – change in height from flat or non-palpable, or recent enlargement;
F = Feeling – presence of sensation, as itching, tenderness or pain.

The most common features of early melanoma are change of color and increased size. A changing nevus, or mole, is also an important risk factor for melanoma.
Variation in size, shape or color of the pre-existing lesion, or an onset of bleeding or itching have been reported by more than 80% of patients with melanoma at the time of diagnosis.\textsuperscript{15,16} Melanoma may not present in the classic manner and may appear to be an ingrown nail or a chronic ulcer. Many lack pigment and present as pink, red, or neutral nodules. Advanced melanomas are more easily identified and typically may be nodular or ulcerated.\textsuperscript{26}

Because melanoma often affects otherwise healthy young people in their most productive years, and can lead to metastasis and death, surgeons in the past have attempted to treat them radically in the hopes of increasing their chances for survival. Many retrospective studies have shown that the width of the surgical incision did not affect the patients' survivals, recurrence rates, or the likelihood of lymph node metastasis.\textsuperscript{19,25} Over the past twenty-five years, physicians have come to recognize how important certain prognostic factors are, such as tumor thickness and depth. These now indicate the appropriate surgical treatment as well as any follow-up chemotherapy or radiation.\textsuperscript{19}

The majority of melanomas can be diagnosed by purely clinical criteria. However, there are many smaller lesions that are difficult or impossible to distinguish between benign or malignant. Epiluminescence microscopy (ELM) is a noninvasive technique that can provide additional criteria for diagnosis in early melanoma. It makes subsurface structures of the skin accessible to provide criteria for clinical diagnosis of pigmented skin lesions. Its effectiveness in early diagnosis is not yet proven,\textsuperscript{21} but it appears that ELM increases the diagnostic sensitivity only in those who are formally trained in its technique.\textsuperscript{27}
It is not possible to biopsy each lesion in some patients, such as those diagnosed with atypical mole syndrome and those who present with several lesions. In these cases full body photography is a helpful tool in assisting in the identification of changes in these lesions. Serial photographs and measurements can then follow suspicious lesions.\textsuperscript{28}

A significant recent development to help define the outcome of patients with melanoma is the sentinel node biopsy technique followed by lymphoscintigraphy. A sentinel lymph node is the first lymph node to receive lymphatic drainage from a tumor. Biopsies of a sentinel lymph node can reveal whether there is lymphatic metastases, thereby avoiding unnecessary dissection of the regional lymph node basin.\textsuperscript{29}

Early diagnosis and adequate surgical treatment make the ten-year survival rate 90\% for primary melanomas that measure less than 1.5 mm in thickness. However, there is still no effective treatment for disseminated or Stage IV melanomas.\textsuperscript{28} As yet, no regimen of chemotherapy has successfully improved cure rates for patients with advanced melanoma. Many advances have been made in the fields of immunology and molecular biology, and a large number of melanoma vaccines are in the stages of clinical development. These may be a promising option in the future treatment of melanoma.\textsuperscript{1}
EPIDEMIOLOGY

Cutaneous malignant melanoma is one of the most rapidly increasing and highly fatal cancers in the world today. In 1935, the lifetime risk of an American developing melanoma was 1 per 1500,\(^1\) and its incidence has doubled in the last decade.\(^4\) It is now estimated that there will be 51,400 new cases diagnosed in the year 2001, as well as 7,800 deaths in the United States alone.\(^2\) Figures compiled by the Connecticut Tumor Registry placed the incidence of melanoma in Connecticut for 1996 to be 365 males and 303 females.\(^3\) The National Cancer Institute’s Surveillance, Epidemiology, and End Results (SEER) program estimates 700 new cases of melanoma for Connecticut in 2001.\(^2\)

Cutaneous melanoma is a more common cause of death than non-malignant skin cancer (NMSC). Malignant melanoma is responsible for six out of every seven deaths caused by skin cancer.\(^26\) Melanoma affects a younger population than many other cancers, and usually arises in the third decade of life, with the median age at the time of diagnosis seen in the mid-forties to early fifties. Those who die from melanoma tend to do so at an earlier age than from most other cancers.\(^11,31\) Therefore, melanoma represents one of the leading adult-onset cancers in terms of average years of life lost per person and years of income lost per death.\(^32,33,34\)

The risk for developing melanoma increases with age. The rise in melanoma rates has been observed in adults as well as adolescents. The incidence of melanoma in children younger than fourteen has not changed.\(^26\) When melanoma does occur in childhood and adolescence, it usually arises in giant congenital nevi. The overall incidence of melanoma is greater in men, but rates are higher in women under the age of
The annual age-adjusted incidence of melanomas was 5.7 per 100,000 in 1973, and 11.5 per 100,000 in 1991. This was an estimated annual increase of 3.9%. There was an increase of 82.7% in the population less than age 65, which was second only to prostate cancer. For the population aged 65 and over, there was an increase of 127.8%. This increase was second only to that of female lung cancer. The melanoma incidence increased 117.2% in males, and 74.6% in females.

Mortality is reduced when lesions are found early and promptly removed. There has been an improvement in the fatality rate over the past seven decades. The overall survival rate was less than 13% in 1925, compared with a rate greater than 80% in 1990. According to the National Cancer Institute’s Surveillance, Epidemiology, and End Results (SEER) program’s statistics, the five-year relative survival rates for all stages of melanomas diagnosed in the US from 1974 to 1976 was 80% for Caucasians and 67% for African Americans. From 1980 to 1982, the five-year relative survival rate was 83% for Caucasians and 61% for African Americans, and from 1989 to 1996, the survival rate was 89% for Caucasians and 70% for African Americans. Part of the difference in survival between the two racial groups is due to the difference in the stage of the disease at the time of diagnosis. During the 1989 to 1995 period, the localized stage at the time of diagnosis was 82% for Caucasians and 56% in African Americans. These survival rates have been adjusted for normal life expectancy and are based on follow-up of patients through 1996. The African American population has repeatedly shown poorer survival rates in other studies.

There is much variation in melanoma incidence among nations but increases have been noted worldwide. Numbers compiled by the International Agency for Research on
Cancer (IARC) have documented an increase in melanoma incidence and mortality universally in predominantly white populations. The incidence of melanoma in white populations of Australia, New Zealand, Hawaii, and California had the highest rates in both male and female populations. The lowest rates of incidence were found in Asian populations in Hong Kong, Singapore, China, India, and Japan. Rates in European countries fell between these two extremes. Melanoma incidence has been found to be higher in persons residing closer to the Equator, which is a positive indicator for sun exposure as a causative factor in melanoma.

Because malignant melanoma is a common tumor in white-skinned populations who live in sunny climates, high incidence rates are seen in Australia and New Zealand. The incidence of melanoma has doubled in Australia since the late 1980s, reaching epidemic proportions with 1 in every 17 women and 1 in every 14 men acquiring melanoma over her or his lifetime. The age-standardized incidence rate of 27.9 in men and 25.0 in women is seen in Australia and New Zealand, as compared to 10.9 in men and 7.7 in women in North America.

Skin melanoma has a high survival rate in developed areas of the world, with the best rates in Australia and New Zealand, 85%. This is attributed to successful education campaigns that have resulted in early diagnosis. Survival rates for persons diagnosed with Stage I melanoma have increased from approximately 50% in the 1950s to approximately 90% today.

Despite this, the overall population’s death rates from melanoma have continued to rise approximately 2% annually since 1950. According to SEER statistics, the
mortality rate for melanoma has increased faster than for any other tumor except prostate cancer. This increase is attributed to the rapidly rising incidence of melanoma.  

The survival rates in developing countries of the world tend to be poorer (40%). Developing countries for these statistics include Central and South America, Africa, and Asia. The poorer survival rates are attributed to later diagnosis, and limited access to treatment. In addition, many of the tumors are acral melanomas, located on the soles of the feet, which carry a poorer prognosis than other melanomas. The mortality rates worldwide are much less than the incidence rates.
ETIOLOGY AND ENVIRONMENTAL ISSUES

In order to develop prevention approaches, knowledge of causation must be addressed. Many factors that affect the development of melanoma are being investigated. Up until this time, exposure to sunlight by persons who are constitutionally at risk of melanoma is the only environmental factor that has been consistently linked to melanoma in most studies. There is epidemiologic evidence for a direct link between melanoma and sun exposure, but the pathophysiology of this relationship is not known. Sunburn is a person-specific measure of the degree to which target tissue, the melanocyte, has been exposed to biologically active ultraviolet radiation.4

The exact cause for the increase in melanoma incidence is not known. Most likely, it is due to a combination of effects. Because the increase is worldwide, global factors need to be considered. Stratospheric ozone depletion which allows more intense ultraviolet light to reach the earth's surface could be partially responsible.38 The changes in lifestyle of populations could also be responsible. There has been a progressive change over the past decades from predominantly occupational to predominantly recreational sun exposure.6 Other factors that might be involved in causation need to be determined.

Many case-control studies link sun exposures that are intense and intermittent to cutaneous melanoma.39 Consequently, melanoma is more likely to occur in office workers who have recreational and vacation exposures to the sun.40 Other major arguments for the intermittent exposure hypothesis include latitude and migration studies that indicate that high exposure to sunlight during childhood increases the risk of
developing melanoma as an adult. Studies have implicated sunburn because it is a memorable experience, but other lesser exposures could also be responsible. A history of sunburn in the first fifteen years of life is a major risk factor. It is not clear if this is a global indication of very large exposures at that age, or that there is a particularly high sensitivity of childhood skin to excessive sunlight. 40,41

The risk for melanoma is related to latitude in Australia and also in the US, where white populations living near the Equator are at higher risk than those living near the poles. Melanoma incidence and mortality rates increase according to the proximity of residence to the Equator.28,41 The high incidence in Australia reflects the intensity of the solar radiation as well as the Celtic background of the population. The incidence rates of melanoma in Australia are the highest in the world. The age-standardized incidence rate of melanoma of the skin exceeds 30 per 100,000 person-years in the state of Queensland. In Australia, melanoma ranks fifth among cancers as a source of incident cases and tenth as a cause of death at any age. Presently, there is concern over the dramatic increase in incidence of melanoma in Australia as well as in light-skinned populations all over the world.42,43,44

ULTRAVIOLET RADIATION (UVR)

The most common factor associated with the development of skin cancer is related to ultraviolet radiation acquired through exposure to the sun. Ultraviolet radiation consists of a spectrum of light ranging in wavelengths between 200-400 nm (nanometers). The strengths of light wavelengths vary and are divided into three categories: ultraviolet A (UVA), ultraviolet B (UVB), and ultraviolet C (UVC). UVC is the strongest form of ultraviolet radiation measuring 200-280 nm, but because of the
earth’s atmosphere it does not reach the surface of the earth. UVB, which measures 280-
320 nm, is considered to be the most harmful to humans. UVA measures 320-400 nm. The division into various wavelengths is based on biologic activity, with a UVR above 320 nm having much less activity.

UVR is considered to be a complete carcinogen that initiates and promotes the growth of malignancies. UVR causes melanocytes to multiply leading to a series of biochemical reactions. These reactions may induce the production of growth factors that alter cellular growth and lead to precancerous changes. UVB is known to have a number of qualities that could make it a carcinogen. It may alter the immune system’s ability to function effectively in recognizing and clearing of abnormal cells. UVB has been shown to decrease the ratio of T-helper cells to T-supressor cells, but how this leads to the development of melanoma is unclear at this time. Although it was initially believed that UVA seemed to promote tanning and appeared not to contribute to burning, recent studies suggest that UVA may also contribute to the risk of skin cancer, as well as suppression of the immune system.

Both UVA and UVB lead to skin damage either by tanning, burning, or every day cumulative UVR exposure. By activating melanocytes, UVB causes a suntan, and in fair-skinned individuals, causes sunburn due to an inadequate amount of melanin. The cumulative effects of UVA and UVB radiation lead to wrinkles and decreased skin elasticity, and also to cataracts. UVB rays are linked to non-melanoma skin cancers and certain forms of melanoma.

The ratio of UVA/UVB varies very little throughout the day except close to sunrise and sunset, and significant levels of ultraviolet light still reach the earth’s surface.
on cloudy and rainy days. It is also important to note that the exposure to the whole of sunlight has created the high incidence rate of melanoma that is occurring now. Protection should be from the whole of sunlight until the relationship of the various components of sunlight to the etiology of skin cancers is better understood.  

UVB intensity also varies with latitude. In the United States, there is a 2.5 to 3 fold difference in melanoma incidence rates between Massachusetts and southern Arizona. UVB exposure increases fifteen percent every 3000 meters of altitude. This is a problem in areas that have cooler summer temperatures when many people are outdoors during mid-day hours.  

Solar radiation exposure is increasing worldwide because the protective ozone layer is thinning. Tremendous attention has been given to the depletion of the ozone layer, since it was first noted to be decreasing in the 1970s. There has been a 3% worldwide average decrease in the ozone layer since 1978, with a 50% decrease over Antarctica since 1983. Most of the loss in global ozone has occurred over the north and south poles, although there is evidence that ozone is being lost at nearly all latitudes outside the tropics. The ozone layer is more effective in blocking UVA radiation than UVB radiation. Therefore, depletion of the ozone layer increases the amount of UVB contacting the surface of the earth, and may be related to the rising incidence of melanoma. The US Environmental Protection Agency (EPA) has estimated that for every 1% decrease in the ozone layer, the incidence of melanoma mortality worldwide increases 1-3%. Future changes in ozone, especially over the mid-latitude regions, may have further damaging effects on melanoma incidence.
OZONE DEPLETION

The ozone layer, located in the stratosphere, is that part of the earth’s atmosphere which extends from 10 to 30 miles above the earth’s surface. Ozone, which is the triplet molecule form of oxygen, is scattered throughout the stratosphere’s twenty-mile width, and absorbs the vast majority of dangerous ultraviolet radiation that is transmitted to earth. It blocks all UVC, and 90% of UVB from reaching the earth’s surface, but does not affect UVA.45

During the past half-century, human activities have threatened the ozone layer. Mankind has polluted the air with chemicals that are destroying this life-protecting ozone shield. The cause and effects of ozone depletion are not completely understood by scientists. Some of the decline can be attributed to a natural ozone cycle. The sun’s energy produces new ozone. At the same time these gases are being destroyed by natural compounds that contain hydrogen, nitrogen, and chlorine. All of these chemicals have been present naturally in the stratosphere in small amounts for billions of years.45

The concentration of ozone in the stratosphere is fairly constant. It varies slightly from natural processes, such as increased UVR from the sun, change in seasons, and volcanic eruptions. The greatest decrease in ozone occurs during the winter months when less UVR is transmitted. This ozone depletion has been most prominent at the poles because the ozone column is thinner there. The ozone column is thicker at the Equator and during the summer months.45

As ozone depletion increases, most of the increased transmission of UVR will be the dangerous short-wave UVB. Some of the serious worldwide effects of this depletion
include decreased crop production, and damage to marine life and many species of animals, as well as an increase in human skin tumors and cataracts.\textsuperscript{45}

Other more recently studied causes of ozone depletion are chlorofluorocarbons (CFCs), and bromide compounds. CFCs were developed in the 1930s and were most commonly known for their use as aerosol propellants in spray cans. They contain chlorine, fluorine, and carbon atoms, present in a very stable structure, and were ideal compounds for many purposes in an array of home, automobile, and industrial products. However, they have been shown to have a destructive impact on the ozone layer.\textsuperscript{48}

Scientists also identified bromine-containing compounds called Halons as being destructive to the ozone layer. Bromines and CFCs together are called halocarbons. Halocarbons are a danger for the future because they can survive in the atmosphere for decades and several can last for centuries. Therefore, if production of such compounds ceased worldwide, halocarbons that are already in the atmosphere would continue to damage the ozone layer for the next 100 years.\textsuperscript{45}

By 1976, civic leaders in the United States advocated boycotts on items using CFCs, and some companies even eliminated these compounds from their products. However, because the atmosphere of the earth belongs to everyone, all countries of the world must address the problem. In 1985, scientists were dismayed to note that there were dramatic declines in ozone values over Antarctica each spring. Since they had no suitable explanation for these changes, they began intense investigations. By 1987, scientists discovered that ozone concentrations above Antarctica had fallen to half their normal levels. They reported that the ozone loss over the Antarctic region was due to the combination of it being the coldest as well as the most isolated area on Earth. The
stratosphere over the Antarctic contains icy cloud particles that are not normally found in warmer climates. Normally, chlorine and bromine are locked in safe compounds that will not harm ozone, but the ice particles in the Antarctic change them into dangerous chemicals that cause them to break apart ozone molecules. This destructive action begins when the sun returns to the Antarctic in the spring and provides energy to the chemical cycle that destroys ozone.

In 1987, environmental and political leaders from twenty-four nations met in Montreal and agreed to set limits on the use of CFCs and Halons. The treaty became known as the Montreal Protocol, and demonstrated a new agreement among nations regarding environmental responsibility.

The policy makers and scientists who drew up the treaty were concerned about further ozone loss. They included an agreement to reconvene in the future to study any new scientific information that might change their timetables to end CFC production. According to the original treaty, countries were to freeze production and use of halocarbons at their 1986 levels by mid-1989, and, over the next ten years, they would cut CFC production in half.

Because somewhat similar weather conditions exist in the Arctic region as in the Antarctic, scientists began to gather data there also. In the late 1980s, they began investigations in Greenland, Canada, and Norway. They discovered that the stratosphere there also contained chlorine and bromine compounds as in the Antarctic, but because the atmosphere of the Arctic was not as isolated as the Antarctic, the ozone depletion was not as great at that time.
In 1988, the researchers clearly stated that ozone levels worldwide had declined over the past seventeen years, and that this decline could not have been caused solely by natural processes. They further reported that ozone levels had also dropped by measurable amounts, not only in the winter and spring, but also in the summer months. The ozone loss at this time of the year poses the greatest health risk to humans, because more people are out of doors.\(^4^9\)

This latest scientific information caused the members of the Montreal Protocol to strengthen their efforts in stopping the use of halocarbons. The treaty was amended and called for a complete phase out of all ozone-depleting chemicals by the year 2000. It also called for a rapid phase out of other ozone-destroying chlorine compounds.

In order to be fair to developing nations, who could not catch up to the more technologically advanced countries in research and training, and could not afford the higher-priced substitutes for the banned chemicals, the treaty established an environmental fund that provided subsidies to help them financially make the change.\(^4^5\)

The ozone hole has grown steadily over the past two decades, and NOAA (National Oceanic and Atmospheric Administration) monitors the progression of the ozone hole from space and on the ground in Antarctica. Many questions still remain unanswered and scientists are unsure of what further ozone problems might develop in the future. The Montreal Protocol was a critical step in protecting the ozone layer. World leaders will need continued information and research findings from the scientific community in order to continue the international responsibility of protecting the earth for the future.
RISK FACTORS FOR MELANOMA

A number of factors have been indicated for the increased incidence of melanoma. The greatest impact is due to acute sun exposure. Blistering sunburns occurring during childhood and adolescence is an almost universal risk factor for Caucasian populations. A number of other key risk factors have also been cited, and include genetic, phenotypic, and behavioral or environmental predispositions.

A family history of melanoma confers a substantially increased risk for melanoma, as does a personal history of non-melanoma skin cancer. Certain families tend to develop atypical mole syndrome or congenital melanocytic nevi that place them at greater risk for developing melanoma. Familial melanoma has been seen in approximately 8-12% of melanoma patients. This population tends also to develop primary lesions at a younger age, and have an increased frequency of clinically atypical nevi. Recently, a familial melanoma gene has been identified in genetic studies. Genetic factors play a large part in the development of melanoma, since hair and skin color, the host’s response to UVR, and the ability to repair damage to DNA are all genetically determined.

Xeroderma pigmentosum, a genetic disorder, carries an increased risk for the development of melanoma. Patients with xeroderma pigmentosum demonstrate defectiveness in their DNA repair mechanism following ultraviolet exposure. These patients exhibit an extremely high relative risk of developing skin cancer, and up to 22% of them develop melanoma, many of them in the first decades of life.
In addition, persons in immunosuppressive states, and those psoriasis patients who have had prior therapy with oral psoralen combined with ultraviolet A treatments are also at a greater risk for melanoma.\textsuperscript{26, 50} There is an increased risk with the use of sun beds and sunlamps. Recent published articles and research on the risks of artificial tanning are scarce and the results are inconsistent with earlier studies. Contrary to the claims of tanning parlors, UVA rays have a suspected link to malignant melanoma and, like UVB rays, they also may be linked to immune system damage. This information is of interest, since the use of tanning beds has increased substantially, especially by women and adolescents.\textsuperscript{6, 47}

A change in a preexisting mole is an important risk factor for melanoma. More than 80\% of patients presenting with melanoma state there is a change in the size, shape, or color of a previously stable lesion, or that bleeding or itching has been noted.\textsuperscript{20, 50}

Among whites, melanoma incidence is inversely related to their distance from the equator. The migration of light skinned people to areas of intense sun exposure, for which they were poorly adapted, has left their descendants at high risk for melanoma. For example, people of Celtic descent from Scotland, England, and Ireland largely populate Australia. These predominantly white Anglo-Saxons, are predisposed to freckles and moles, and are a perfect population to develop melanoma. Although darker skinned people do acquire melanoma, whites are at a much greater risk.\textsuperscript{26}

The age at which exposure to intense UV radiation occurs also seems significant. Many studies indicate that exposure during teenage years conveyed the greatest risk. Another study showed that people who migrated to sunny climates at a younger age have
a higher risk for development of melanoma than do people who migrated after the age of twenty.\(^{52}\)

Risk is also greater for areas of intense intermittent exposure. This would explain the much higher incidence of melanoma on legs of women and backs of men rather than on the continually exposed skin of neck and head. It would also explain the higher incidence of melanoma in white-collar workers of higher socioeconomic status or office workers who go to the beach every weekend. These persons tend to vacation in warmer climates and to experience intense, periodic exposure to ultraviolet radiation on an intermittent basis.\(^{26}\)

By multiple analysis, six factors were identified that were most likely to influence the emergence of melanoma. Those included:

- history of three or more years in an outdoor summer job as a teenager,
- history of actinic keratosis,
- blond or red hair,
- family history of melanoma,
- three or more blistering sunburns before the age of twenty, and
- higher than average freckling on the upper back.

If one had one or two risk factors, there was a 3.5-fold increased risk of developing melanoma over the general population. If three or more risk factors were present, there was an approximated 20-fold increased risk.\(^{24,53}\)

Melanoma affects both sexes, and hormonal factors do not appear to have any influence in its development. Presently, in Australia, 75% of all fatal melanomas are diagnosed in adults over the age of fifty, and of these two-thirds occur in men.\(^{50}\)
The phenotypic risk factors are similar for melanoma and non-melanoma skin cancers. Individuals with fair skin, blue or green eyes, blond or red hair, ability to freckle, sun sensitivity or inability to tan are at the highest risk for developing skin cancer.20,26,44

Several phototypes have been defined based on the burning or tanning reaction of the skin from UVR exposure. Skin types I and II, that have an inability to tan, are at greatest risk for skin cancer. See Table 2.

Table 2.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Always burns, never tans; sensitive, (Celtic)</td>
</tr>
<tr>
<td>Type II</td>
<td>Always burns, tans minimally</td>
</tr>
<tr>
<td>Type III</td>
<td>Burns slightly, tans gradually to light brown; (average Caucasian)</td>
</tr>
<tr>
<td>Type IV</td>
<td>Burns minimally, always tans well to moderately brown; (olive skin)</td>
</tr>
<tr>
<td>Type V</td>
<td>Rarely burns, tans profusely to dark; (brown skin)</td>
</tr>
<tr>
<td>Type VI</td>
<td>Never burns, deeply pigmented, not sensitive, (black skin)</td>
</tr>
</tbody>
</table>

There is some data to support the theory that a tan is protective against melanoma. A few recent studies have shown that sun exposure during childhood, that causes tanning but not burning, may reduce melanoma risk. It appears that this only applies to those who were able to tan, and needs more research before this becomes an accepted theory.54
PREVENTION PROGRAMS

Prevention programs are formulated by using the facts and figures compiled by epidemiologists, and with the results of an assessment of the needs of the community involved. Behavioral scientists assist in the formulation of prevention programs, because understanding of behavior and behavior change can lead to more effective interventions and new questions for epidemiologists to address.

The goal of any educational prevention program is to provide information to the public in order to increase their knowledge base, and change their attitudes, motivation, and behavior. To develop appropriate risk reduction strategies, prevention programs need to be guided by social-behavioral models from social psychology, which are integrated with medical and educational models. These models emphasize social influences, skill-building, and behavioral competencies related to particular health-related behavior. Social learning theory has been effectively applied by educators in schools in such areas as the prevention of smoking, and alcohol and drug-abuse behavior.6

Most health promotion specialists realize that knowing a hazard does not necessarily translate into behavioral compliance with the recommended precautions. Nevertheless, campaigns should be grounded in the facts as understood and prepared by experts. Information on levels of public knowledge is essential in formulating messages designed to influence behavior.

Health promotion relies heavily on cognitive models of behavior, models that theorize links between what people know and feel about the consequences of behaviors
and the behaviors they exhibit. These models require us to devise programs that persuade people that the recommendations are worth following.55

In order for information to be effective, it must be targeted at the right audience and in a way that communicates appropriately to that particular population. Because of the difficulty in persuading adolescents to change their behavior, it is important to teach children while they are still receptive to knowledge given to them by adults. Attitudes and behavior patterns are laid down during childhood. In addition, for young people, it is important to start at their level of knowledge and to use language they understand and relate to.6

There is evidence that humans behave rationally on the basis of their expectations about the consequences of the actions they contemplate, the positive and negative value they place on those consequences, and the social approval or disapproval they expect from their actions. This expectancy-value model and others like it provide psychological concepts that connect the educational input from a melanoma prevention program and behavior change. We assume these messages work by changing people’s beliefs about the consequence of their behaviors, which leads to an intention to change their behavior. Early detection behavior is multi-faceted and includes a variety of behaviors by doctors and members of the public, including periodic exams, heightened awareness, and attendance at screening facilities.6

In order for health education interventions to be effective, members of the targeted population need to be included for their perceptions and recommendations. The National Institute of Health (NIH) program “Healthy Communities 2000”, specifically stresses that the recipients of health interventions should be involved in developing the
program’s priorities. Programs will be more likely to succeed if they make maximal use of information about the needs of the target population and on the strength of the interventions.\textsuperscript{56}
MELANOMA CONTROL PROGRAMS

Despite the extensive work of physicians, oncologists, and researchers, there have been few advances in finding a cure for melanoma once it has reached the advanced stages of the disease. However, the visible nature of skin cancer presents a strong argument for prevention programs that make early diagnosis and treatment possible.

The long-term goal of any primary disease prevention program is to reduce the incidence and mortality rates of that disease. Because of the latency period for developing melanoma, this could be a twenty-five to thirty year plan. Since epidemiological studies incriminate exposure to UVR as a major risk factor, primary prevention campaigns encouraging sensible sun exposure become increasingly important. Some effect could be seen from secondary prevention campaigns within a three to five year period. However, even with major changes in people’s behaviors, it would be unlikely to see any effect from primary prevention campaigns for ten to twenty years. Therefore, it is necessary to put good evaluation tools into place at the start of these campaigns.

Melanoma prevention efforts have been started in several nations over the past few decades. Although these programs vary in scope and intensity, they can be categorized into four different approaches to melanoma control.

1. One major approach concentrates on media-led public awareness campaigns as seen in Australia, New Zealand, United Kingdom, and the United States.
2. Australia, New Zealand, Switzerland, the Netherlands, and the United States have also developed education and early detection programs.
3. Another approach involves screening and surveillance of persons who are at greatest risk of developing melanoma, and the Netherlands, the United Kingdom, and the United States have used this approach.

4. Lastly, a program involving professional education has begun in Australia, Austria, Italy, and the United Kingdom.7

**Australia**

Australia has the highest incidence of skin cancer in the world. In Queensland, where the problem was the greatest, a program to educate the population and detect early tumors began in the 1970s. By the late 1970s, comprehensive public health education programs were being designed. There has been a national primary prevention program in place for several years, but, despite a high level of appropriate community response to the educational programs, melanoma incidence continues to rise. More recently, Australia has been placing increasing emphasis on secondary prevention programs for skin cancer.58

Each year, one national program is undertaken in November and is known as “National Skin Cancer Awareness Week”. Many agencies are involved in developing the policies and programs and each year a different theme is promoted. In addition to this national campaign, each state organization conducts its own secondary prevention programs intermittently throughout the year. The country has been successful in its public health efforts over the past 20 years with two specific campaigns developed in the 1980s by the Anti-Cancer Council of Victoria: *Slip! Slop! Slap!* (Slip on a shirt, Slop on sunscreen, and Slap on a hat) and *SunSmart*. These campaigns have reported that the public has adopted more protective sun behaviors as a result of their public health efforts
to increase public awareness. The *Slip! Slop! Slap!* campaign was associated with an increase in sunscreen use over a one-year period that included multimedia advertising and community awareness.\textsuperscript{28,58}

After one year of the *SunSmart* campaign, 48\% of those surveyed reported using more sun-protective measures than during the previous year, with approximately 24\% attributing their changed habits to the campaign. Of the respondents, 66\% reported that they had encouraged others to increase their level of sun protection.\textsuperscript{46} Also, there has been a marked decrease in the incidence of melanoma in females who were born after 1950, as well as the overall age-standardized mortality. There was also a decrease in the incidence of non-melanoma skin cancers in those under fifty years of age.\textsuperscript{58}

Australia has a large variety of organizations and individuals that take a strong interest in intervention programs for the prevention and early detection of skin cancer. The cure rate in Australia for melanoma is greater than 80\% and the presenting tumor thickness, which is the best predictor of prognosis, has decreased over the last 20 years. According to statistics and surveys, there are more consultations for skin lesions each year and the sale of sunscreens, hats, and sun protection clothing has shown increases over the last decade.\textsuperscript{59}

Australia has made great progress in changing the knowledge base of its citizens. The effort has included public education programs aimed at all ages but particularly concentrated on the young. There have been substantial changes in knowledge, attitudes, and beliefs regarding melanoma, sunlight, and tanning.\textsuperscript{6}

In Australia, 90\% of people had heard about melanoma and 95\% believed that it was a serious problem. However, there still was a steady increase in the incidence of
melanoma. Since the people knew the facts about melanoma and were aware of what to do to protect themselves, the government decided to help them do it more easily. This involved structural changes that included standards for sunscreens, sunglasses, and sun protective cloth. It also allowed a tax exemption for sunscreen products that complied with the standard. Schools planted trees and built canopies for sun protection, and shade was provided for spectators at sporting events, parks, pools, and other open public places. A standard was written to ensure that workers were protected from excessive sun exposure in the workplace, and the government has been active in limiting the manufacture, distribution, and use of ozone depleting substances.  

Europe

In the 1980s, European nations began to recognize that the incidence and mortality from malignant melanoma were rising steadily. It was also noted that patients in Europe were being diagnosed with a higher proportion of thick primary lesions as compared to those patients in Australia, and were therefore more likely to have a poorer prognosis. This led to an evaluation of the Queensland Melanoma Project that was begun in Australia in the 1960s. Queensland is Australia’s “Sunshine State” and has the highest incidence of melanoma in the world. After studying the measures taken by that country, it was decided that Australia’s campaigns might have contributed to a greater public understanding of malignant melanoma and a greater self-awareness leading to earlier diagnosis and treatment of tumors. Surveys of the public in different European communities demonstrated that there was a lack of knowledge and awareness of skin cancer in general and particularly of the risk factors and fatal quality of melanoma. This led to the development of public education programs in many European countries that
also included education for primary care physicians and dermatologists. Only some of these programs made any attempt to evaluate the effect of their activities. 

Presently, in Europe, activities mainly concern early detection and education exercises. However, there is a movement towards primary prevention, with governments, public health departments, national dermatological associations, and others initiating campaigns to encourage a cautious approach and advocate sensible sun exposure. In the United Kingdom, skin cancer has been targeted in the *Health of the Nation Document*, with the stated aim of reducing the yearly rise in the incidence of skin cancer by the year 2005.

**United States**

There has been no formalized program of education in the United States except for the annual project co-sponsored by the American Academy of Dermatology (AAD) and the American Cancer Society (ACS), which began in 1985. Each spring, national and local media promote educational messages regarding the risk factors and warning signs of skin cancer, and the value of early detection and sun protective measures. It is estimated that over 50 million Americans are reached in this manner. These announcements are also presented in parents and women’s magazines and disseminated as public service announcements in all the 50 states.

Free screenings are performed by dermatologists, who recommend further evaluation for suspect tumors and periodic surveillance for those persons at high risk. Participants are offered education in primary prevention and early detection by experienced dermatologists. During the first nine years that the national screening program had been conducted in the United States, more than 650,000 people have been
examined. A suspected diagnosis of melanoma has been made in greater than 7000 cases, of basal cell carcinoma (BCC) in more than 49,000 cases, and of squamous cell carcinoma (SCC) in more than 6700 cases. The sensitivity attributed to the visual examination by trained dermatologists was estimated to be 89-97%, with a specificity of 99% to detect melanoma. These percentages are close to other screening efforts such as the Papanicolaou test (Pap Smear) for cervical cancer, and the occult blood tests for colon cancer.

Over the past decade other organizations have contributed to melanoma prevention, education and early detection efforts. They include the Center for Disease Control (CDC), and the Skin Cancer Foundation. Recently, the CDC began collaborating with the AAD to develop a national skin cancer agenda and to develop state programs for primary prevention in children.

Because of the attention drawn to skin cancer awareness by the AAD, several positive factors have evolved. Surveys of the fashion industry in the US have indicated that tans are out of fashion and that top models are not required to develop tans for work. Legislation has been passed in many states regulating the operation of tanning booths, as well as providing warnings to the public. In 1994, the National Weather Service began to publish and broadcast the UV Index in 58 major cities in order to alert the public of ultraviolet exposure levels on particular days. The ultra-violet index report by meteorologists offers a daily report of UV light levels on a scale of 1-10+, or minimal to very high exposure.

In an effort to prevent cancer, it is important to give accurate information to children. The ACS has been most active in preparing programs on general cancer
education specifically written for children. Most cancer education in United States schools has been based on ACS programs. Two major programs used recently are the “School Health Curriculum Project” and the “Know Your Body Program”. Both programs are prevention-oriented and geared toward modifying student’s knowledge, attitudes, and behaviors.

Schools are an ideal setting to present cancer education and prevention programs since most of the nations’ youth attend schools. Children are at a stage in life when their health attitudes are being formed. In an analysis of cancers and causes, it was observed that several risk factors were within the scope of personal control. They include alcohol, diet, tobacco use, sexual behavior, pollution, and sunlight. Cancer education should demonstrate personal responsibility in developing healthy habits that will benefit now and throughout life. Adolescents, as a group, are difficult to reach. By the time children reach adolescence, they may resist the practice of sun-protective behaviors. Thus, special attention is needed for programs that address peer pressure and social norms that influence the voluntary use of sun protective behaviors.

An intervention with teenagers that resulted in a reported increase use of sunscreen, used digital photographs of the teens and altered them on the computer to indicate the aging and disfiguring effects of the sun on the skin. Another intervention used an instant camera that had an ultraviolet filter designed to take a full frontal black and white photograph of the face. Using this system, damage to the epidermal pigmentation was demonstrated. This method can be quite dramatic in demonstrating the extent of sun-damage already present and the further consequences of chronic sun exposure on the face. Photographs were given to participants to take home as
reminders of the extent of sun-damage and photoaging effects of chronic sun exposure.

A positive aspect of this type of intervention is that it allows for direct communication,
the opportunity for individualized assessment of risk, and for feedback.

Behavioral change is a complex process. In order to be effective, any campaign
must deal with motivations for sunbathing. The obsession for tanning has been ingrained
in our society for some fifty years and is a difficult concept to change. Attitudes toward
tanning and sunbathing changed in the earlier part of this century. Before the 1920s, it
was fashionable to have a pale complexion, and people wore clothing that protected their
skin from sun exposure. Fair skin was associated with an aristocratic upbringing and
lifestyle, while a tanned skin was associated with outdoor labor. Then, attitudes began to
change, and a tan became a status symbol, associated with a wealthy lifestyle and
frequent trips to sunny climates. By the mid-1940s, more people could afford to vacation
in warmer climates. Fashion changed so that more skin was exposed to the sun and it
became essential to be tanned. Great amounts of money and time were then spent in
acquiring a tan.

Our society still has many who purposely seek sun exposure because they believe
that a tan makes them look and feel good. In one national health survey of the American
people, 61% felt that people looked better with a tan, and 55% actually attempted to
achieve a tan. This demonstrates that the relationship between knowledge and behavior
has been inconsistent, and that education does not necessarily translate into compliance
with sun-protective behaviors.

*Healthy People 2010* is a national health program and disease prevention
initiative. The initiative is frequently used to determine priorities for state and local
health departments, including Connecticut. It has a target of 2.5 deaths per 100,000 population with a baseline of 2.8 melanoma cancer deaths in 1998. Its short-term goal is to reduce melanoma deaths and reduce sun exposure and skin cancer and encourage statewide cancer registries to include melanoma in their statistics. In addition, it hopes to encourage the proportion of persons who use at least one of the following protective measures to reduce the risk of skin cancer: avoiding sun between 10 AM and 4 PM; wearing protective clothing; using sunscreen with an SPF of 15 or greater; and avoiding artificial sources of UVR. Another objective is that an increased proportion of adults, aged eighteen and older, who follow protective measures, may reduce their risk of skin cancer. The target is for 75% of adults to use at least one of the identified protective measures.

The Internet now offers a variety of information on malignant melanoma. A tutorial on recognition of melanoma designed for physicians can be found there as well as information on available treatments and support help.

Recently, the CDC developed a national skin cancer control plan. It included the development of a skin cancer agenda for the United States, and a national skin cancer awareness month. Additionally, it funded skin cancer prevention programs in Arizona, Georgia, California, Hawaii, and Massachusetts directed at caregivers of children under the age of thirteen.

In 1994, the AAD and the CDC piloted a program called “Melanoma Monday” in Dallas, to promote skin awareness. After reviewing national surveys, it was determined that only one-third of Americans knew that melanoma is a kind of skin cancer, and that most do not know the warning signs of melanoma. A national program was developed
and instituted in 1996, and was targeted at adults to encourage skin awareness and self-examination. The program will be repeated annually reinforcing the practice of self-examination.\textsuperscript{6}

Presently, melanoma is diagnosed much earlier than in previous decades with increased survivability. Because the United States does not have a nationwide cancer registry, the exact number of new cases of cancer diagnosed each year in the US and in the individual states is not known. Most statistics in the US come from the cancer registries of the Surveillance Epidemiology and End Results (SEER) program of the National Cancer Institute. At present, only a few states, including Texas, Connecticut, and California, make malignant melanoma a reportable tumor. Many state and international cancer registries have expressed concern that the incidence of melanoma is under-reported. A National Tumor Registry would allow for more accurate statistics to effectively assess the magnitude and impact of future incidence, as well as a means to accurately evaluate the success of prevention program efforts.\textsuperscript{37,61}

In Connecticut, various efforts are being made toward the prevention of skin cancer. The American Cancer Society and The American Academy of Dermatology sponsor “Melanoma Monday” on the first Monday of May, and offer several skin cancer screenings at different sites throughout the state during the month of May. According to Dr. Caron Grin, a dermatologist at the University of Connecticut Health Center, the screenings in recent years have been directed at persons at high risk or who have a familial melanoma history. (Personal Communication, C. Grin, M.D., 2/6/01) Dr. Grin also stated that the medical schools in the state have included skin cancer prevention and
diagnosis in their curriculum for many years now. Residency programs at the universities also require a rotation through the specialty of dermatology.

In addition, the ACS has a program that provides individual counseling sessions to primary care providers and their staffs. These sessions are presented in the individual physicians’ offices and outline preventive tests and guidelines for several cancers, including skin. Recommendations on measures to best incorporate these guidelines in physical exams are given, along with instructional pamphlets and videos to be used by patients, and suggestions for follow-up. (Personal Communication, Mary Hampton, Program Coordinator, American Cancer Society, 10/2000)

During the past two summers, the St. Francis Hospital and Medical Center has sponsored a screening and education intervention program at local beaches and parks, in an attempt to teach sun protection measures at an opportune moment. This year, the State Department of Public Health has received grant funding to initiate education programs aimed at providers of day care in three separate communities. This is a positive initiative in that behavioral and cancer specialists recommend that the very young be taught personal health habits that will become part of their routine for a lifetime. (Personal Communication, Susan Major, CT Department of Public Health, Jan. 2001)

Cost-Effect

The Department of Dermatology at Massachusetts General Hospital and the Department of Surgery at Boston University School of Medicine attempted to estimate the annual direct cost for diagnosing and treating malignant melanoma. They developed a model for cost analysis using cost estimates in the Boston area and projected numbers of patients with melanoma disease in 1997. The result was an estimated $563 million to
treat newly diagnosed melanoma disease. Stage I and Stage II disease each comprised about 5% of the total cost, and Stage III and Stage IV comprised 34% and 55% of the total cost, respectively. Less than 20% of the melanoma patients in this country (those with Stage III and IV) accounted for 90% of the direct cost.\textsuperscript{34}

One benefit of developing intensive screening practices is the survival advantage of tumors being diagnosed in their early stages. The economic implications could be a tremendous incentive for developing prevention programs, since the cost of treating a patient with Stage III or Stage IV melanoma disease is about 40 times the cost of treating one patient with Stage I disease. Because of the increasing incidence of melanoma in this country, the economic impact to the health care system could be significant.

\textbf{Diagnostic Health Care Professionals}

Our health care system has placed an increased responsibility on primary care physicians to initially evaluate most health-related problems. Because the majority of melanomas present to primary care providers, including obstetricians, gynecologists, and pediatricians, there is a need for these physicians to improve their skin cancer diagnostic skills, as well as health education skills. At present, dermatologists seem to be the best at diagnosing malignant melanoma. A recent study has shown that non-dermatologists may be three times as likely to misdiagnose melanoma compared to dermatologists.\textsuperscript{37}

Seminars need to be developed, with the cooperation of medical schools and medical organizations, that will improve the ability of internists and other primary care physicians to recognize skin tumors. These workshops should teach diagnostic techniques for skin cancer and the rationale for including dermatological exams and skin cancer prevention in regular physicals.\textsuperscript{37,53} This could more effectively begin in medical
schools and during residency programs, where specific training in diagnosis of skin cancers could be given to enhance early diagnosis.57

**Sunscreen Protection**

The SPF classification for sunscreens is an index of protection against skin erythema, or redness and burning. SPF ranges from 1-45 or greater and quantifies UVB protection. An SPF of 15 filters 92% of the UVB, SPF32 filters out about 96%, and SPF64 filters out around 97%. In Australia, legislation requires labeling for any SPF over 15 to read SPF15+. SPF is determined by using a light spectrum indoors that is meant to imitate the noonday sun. Currently, there is no uniform measure of UVA absorption.63

Many health authorities feel that SPF numbers and protection factors are misleading and confusing to the public. The Australian recommendation for sunscreen is that of SPF15 or above for all its citizens, regardless of skin type, since it is considered that all of the population is at risk for skin cancer.60

There are conflicting reports on the effectiveness of sunscreens and the prevention of melanoma. The regular use of sunscreen products is thought to potentially reduce photodamage to the skin, decrease the incidence of non-melanoma skin cancers, and possibly reduce the incidence of melanoma. Sunscreen and the wearing of protective clothing have been associated with a reduced risk of both melanoma and non-melanoma skin cancers in several animal, cohort, and case-control studies. On the other hand, some studies have not shown this effect.63 Although most studies did adjust for skin type and sun exposure, confounding variables could still have been a problem. Study results could also be affected by recall bias, excessive sun exposure to persons who are protected
against sunburn through the use of sunscreen, the improper application of sunscreen, or use of sunscreen not potent enough. Some of the older studies involved less potent sunscreen preparations that offered little or no UVA protection, and recent studies have suggested that exposure to UVA also increase the risk of melanoma. Commonly used chemical sunscreens block UVB but are virtually transparent to UVA, which makes up 90% to 95% of ultraviolet energy in the solar spectrum. Therefore, sunscreen use may permit excessive exposure of the skin to portions of the solar radiation other than UVB and may increase the risk of melanoma.\textsuperscript{12}

Sunscreen itself may be associated with adverse effects. The hypothesis is that sunscreen offers a false sense of security to users who may increase their time spent in the sun, avoiding sunburn, but exposing them to harmful solar radiation, which may be carcinogenic or decrease immune function. Some think that certain ingredients in sunscreen are capable of altering cell structure and can be carcinogenic. Presently, little is known about potential long-term effects of sunscreen use.\textsuperscript{63}

Some recent retrospective studies reported a protective effect of sunscreens on malignant melanoma. Melanoma incidence and mortality rates have been seen to be falling in the past few years in Australia. Because seventy-four percent of the Australian population reports regular usage of sunscreen, those studies have concluded that sunscreens have played a major role in these decreasing rates. Incidence rates have also been decreasing among Caucasians in Hawaii.\textsuperscript{53}

Although these findings demonstrate strong evidence that sunscreen use is an effective means of preventing melanoma, data from prospective studies would certainly be more definitive.\textsuperscript{53} Until more conclusive evidence is available, the safest rule to
follow would be to use sunscreens in combination with other measures of sun protection, and not rely on it as the sole measure of protection. This agrees with the current recommendation of the American Cancer Society and the American Academy of Dermatology.

To date, no one has been able to demonstrate that the regular use of sunscreen will reduce the risk of melanoma. Therefore, sunscreen products should be used as an adjunct to other sun-protective measures not as a substitute for them. From all the existing data, the most likely conclusion that can be drawn is that a combination of sun protection habits, that include protective clothing, sunscreen use, and avoiding the midday sun, may be the cause for the falling rates in the incidence of melanoma that have been noted.\(^5\)

**Screening**

Melanoma is an ideal tumor for screening because it is common, and visible to the naked eye. The natural history of the disease is also known, including the fact that early diagnosis and treatment can reduce morbidity and mortality. There is also a safe and relatively inexpensive screening tool available in the form of physical examination. Total cutaneous examination is a noninvasive, relatively quick, and reasonably sensitive screening procedure when performed by a physician who is qualified in the identification of skin cancers.\(^6\)

Presently, the early detection of cancer and precursor lesions is opportunistic in the United States, because there is an absence of a well-organized approach to screening, counseling, and follow-up. There is a great potential toward prevention and early diagnosis because of our current knowledge and technology. Morbidity and mortality from malignancies could be greatly reduced, if our health care system would realize the
cost-effective benefits of preventive care and dedicate itself to achieving a standardized, 
precise approach to early cancer detection. The United States has a unique problem with 
payment for skin cancer examinations due to not having a universal type health care 
system. Health Maintenance Organizations and many insurance carriers do not cover 
skin examinations. A skin cancer exam is not usually a covered billing diagnosis, for 
patients with traditional fee-for-service coverage. If there were more convincing data 
that skin cancer exams by primary care physicians are not only lifesaving but eventually 
cost effective, all HMOs and insurers might be persuaded, or required, to include skin 
cancer examinations as covered practices. If all companies were required to pay for total 
skin examinations, then all insurance carriers would be on an equal footing to benefit 
eventually from this prevention practice.

Most experts believe that physical screening and patient self-examination can lead 
to earlier detection of precursor lesions and thin non-invasive melanoma. A few believe 
that all persons should have an annual total skin-examination performed by a person 
experienced in the detection of skin cancer. However, it is unrealistic to expect that 
everyone can be examined, and the cost for every American to have yearly skin 
examinations by a dermatologist could be prohibitive. A more effective policy would be 
to focus screening efforts in order to reach those persons at highest risk for developing 
tumors. For example, in Massachusetts in 1987, 86% of those screened had at least 
one risk factor, and 78% had at least two. Total skin examinations that include a 
personal risk assessment are a means of providing patient education, individualized sun 
protection practice recommendations, and instruction on how to perform a monthly self-
examination.
PREVENTION RECOMMENDATIONS

I. RECOMMENDATIONS OF THE AMERICAN COLLEGE OF PREVENTIVE MEDICINE

1. Sun avoidance and other sun-protective measures as hats, clothing, and sunglasses are probably effective in reducing skin cancer.

2. There is insufficient evidence to recommend for or against the use of chemical sunscreens as a protection against melanoma. Presently, the available data indicates that sunscreen may increase the risk.

3. The College does not believe that discussion of sunscreen and sun protection should be carried on with every patient. Physicians should be educated regarding skin cancer issues and discuss sun protection with patients who have questions or who are at particular risk, such as those with a family history of melanoma or precursor lesions or those who have increased sun exposure.

4. The College recommends that discussion of sun protection occur during routine examinations for children and adolescents, because of the importance of preventing sunburn in childhood.

5. The College recommends periodic total cutaneous examinations be performed on populations at high risk for melanoma. Those at high risk include those with a family history or personal history of skin cancer, phenotypic predispositions, and those with increased UVR exposure due to occupational or recreational exposure.
6. The College recommends that physicians who perform total skin examinations be trained in its performance to assure high-quality exams and also to prevent unnecessary biopsies.

7. The College recommends increasing research efforts:
   - into the association of UVR and malignant melanoma,
   - the preventive ability of sunscreens in reducing UVA exposure,
   - the possibility of carcinogenic effects of components of sunscreens, and
   - well-conducted observational or case-controlled studies, or randomized clinical trials into learning more about the interval and the risk-benefit ratio of screening skin examinations for various populations.

8. The College supports studies on the effectiveness of community health promotion campaigns to educate the public about the dangers of ultraviolet radiation.

II. RECOMMENDATIONS OF THE AMERICAN CANCER SOCIETY

   These guidelines are for asymptomatic persons of average risk.

1. ACS recommends that cancer check-ups that include skin examinations be performed every three years for those aged 20-39, and then annually after the age of 40.

2. Examinations should include patient education regarding sun avoidance and sunscreen use.
AN APPROACH TO A CONNECTICUT MELANOMA PREVENTION PLAN

Elements to this program are at both the national and state levels. Participants are included in Table 3. This plan involves the expertise of public health officials, policymakers, medical professionals, educators, behavioral scientists, environmental officials, insurers, HMOs, and retailers.

Table 3. Players Involved in Skin Cancer Prevention

<table>
<thead>
<tr>
<th>Players Involved in Skin Cancer Prevention</th>
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<tbody>
<tr>
<td>Federal, state, and local public health departments</td>
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<tr>
<td>National public, private, and voluntary organizations</td>
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<tr>
<td>National, and state physicians’ groups as American Medical Society, American College of Surgeons, and American Academy of Dermatology</td>
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<tr>
<td>Local hospitals, professional associations, schools, agencies, etc.</td>
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<tr>
<td>Volunteers – high school and college students, seniors, and parents</td>
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<tr>
<td>Media – radio, television, newspapers, and magazines</td>
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<tr>
<td>Insurers and HMOs</td>
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<tr>
<td>Manufacturers and Retailers of sunscreen, sun-protective clothing and recreational equipment</td>
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</table>

NATIONAL LEVEL ISSUES AND NEEDS

In order to put a prevention program together, national support is necessary. Work already begun at the national level by government and private agencies should be continued, including funding for research projects and grants.

Educational activities that are designed to prevent melanoma can be related to activities that lead to structural change. Structural change refers to changes in the social, political, and economic structure of society. These changes can then lead to a change in behavior and provide other positive outcomes in a cancer prevention program. See Table 4.
Table 4.

<table>
<thead>
<tr>
<th>Federal Role in Skin Cancer Prevention</th>
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<tbody>
<tr>
<td>Regulation of development, manufacture, and labeling of sunscreen products</td>
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<tr>
<td>Legislation to preserve ozone</td>
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<tr>
<td>Research on ozone depletion, sunscreen, and cancer research</td>
</tr>
<tr>
<td>Continue research and evaluation by national federal and health organizations</td>
</tr>
<tr>
<td>Institution of National Tumor Registry</td>
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</tbody>
</table>

Structural change includes legislation that prohibits the manufacture and use of ozone-depleting substances. Education programs that teach skills for assuming personal responsibility for disease prevention and control are significant. However, the role of world governments in the area of reducing ozone depletion is high and continued efforts need to be continued by all countries in order to protect the world and environment around us. Efforts need to be continued by the United States and other world leaders to eliminate further use of ozone-depleting products as well as to monitor the progression of the ozone hole. Because the ozone loss poses a health risk to humans that is beyond their personal control, leaders need to continually evaluate and protect their citizens.

Other structural changes include setting standards for testing and labeling of sunscreens, and the Food and Drug Administration (FDA) is presently reviewing labeling of sunscreens to help the public from confusing information about sun-protection. It is also recommended that OSHA (Occupational Safety and Health Administration) introduce regulations that would lead to a sun-protective policy for outdoor workers. It is impractical to prohibit outdoor workers from laboring in the sun during peak hours. However, it is possible to require employers to provide sunscreen, and sun-protection clothing such as hats and long-sleeved shirts, and plan the day’s work activities so that
shady areas are used advantageously during peak sun hours, whenever possible.

Employers could also be required to have a written plan to minimize sun exposure.

The NIH (National Institutes of Health) and CDC (Center for Disease Control) both have important functions in relation to structuring, funding, and evaluating cancer prevention programs that need to continue. A concerted effort by interested groups and individuals (such as melanoma patients, American Cancer Society, American Medical Association, and American Public Health Association) to inform legislators of the importance of voting for funding and research into ozone preservation, etiology of cancer, and other areas pertaining to skin cancer would be very beneficial. Further research is recommended into the association of ultraviolet light and malignant melanoma, preventive ability of sunscreens in reducing UVA exposure, and into the possible carcinogenic effects of sunscreen products.

Further, the institution of a National Tumor Registry that required melanoma to be reportable would allow for more accurate statistics on skin cancer incidence and prevalence in order to assess the magnitude and impact of future incidence. It has been suggested that melanoma incidence figures in the United States presently underestimate the true incidence rates to a significant degree, possibly 15%. Figures from a national registry would also demonstrate the true effectiveness of prevention efforts for evaluation purposes.

**STATE LEVEL ISSUES AND NEEDS**

The identification of issues that need to be addressed is a first step in the development of a prevention plan. The author believes that to be successful a multidisciplinary approach coordinated by the State Department of Public Health is
necessary. Such a program takes advantage of many resources currently available. The
goal of this program is to promote skin awareness and self-assessment for early evolving
tumors, as well as for potential risk factors. All skin cancers would be recognized in this
program. Ultimately, it would be beneficial to have a Cancer Control Program that
would develop a plan for the control of all cancers and coordinate prevention and
education efforts throughout the state.

The identification of issues to be addressed in a plan for the melanoma prevention
portion of a cancer control program for the state of Connecticut follows, and is outlined
in Table 5. The multidisciplinary approach involves the expertise of many, and all
groups need to cooperate to develop an educational and screening program that has the
best potential of being successful. If the program is to succeed, it needs to be developed
by all interested parties working together so that resources are allocated in a non-partisan
manner to achieve collective goals. The program would be funded by contributions from
the state, grants, and solicited private donations.

The multidisciplinary approach has been observed to work in the fight against
breast cancer in this country. Regular clinical examinations, mammography, and
frequent self-examinations have facilitated early detection of breast cancer. The
extensive involvement and efforts of health care professionals, the media, and federal,
state and private organizations has made an enormous impact on the early detection and
treatment of breast cancer. The plan could be implemented and coordinated by the State
Department of Public Health. The Commissioner should call together leaders of agencies
who are already committed to the fight against skin cancer and together they should set
up a task force to evaluate the specific needs of the state, including education and funding
issues. The American Cancer Society and the American Academy of Dermatology should be considered to be cosponsors of this program, because of their previous and very capable and effective involvement.

Table 5.

<table>
<thead>
<tr>
<th>Primary Prevention</th>
<th>Secondary Prevention</th>
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<tr>
<td>Needs Assessment – for those at risk and communities</td>
<td>Screening Programs</td>
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<td>Education</td>
<td>Self Examination</td>
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<tr>
<td>Parents and early care-givers</td>
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<td>School-based</td>
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<td>Day-care centers</td>
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<td>Pre-schools</td>
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<td>Elementary schools</td>
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<td>High schools</td>
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<td>Recreation</td>
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<td>Beaches</td>
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<td>Camps</td>
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<td>Pools</td>
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<td>Other sites in community</td>
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<tr>
<td>Professional education</td>
<td></td>
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<td>Medical schools</td>
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<td>Physicians</td>
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<td>Nurses and others</td>
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<td>Structural Change/Legislation</td>
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<td>Publicity</td>
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<td>Evaluation</td>
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**Needs Assessment**

Before program development is possible, an overview of the current status of cancer control in the state of Connecticut and an outline for developing strategies that will encourage government representatives, health care providers, voluntary health organizations, and the community to improve collaboration among cancer programs needs to be developed. Data collected by epidemiologists, including estimates of skin
cancer incidence and mortality rates, needs to be utilized. Although it is generally accepted that skin cancers, and melanoma in particular, are under-reported, melanoma is a reportable tumor in the state of Connecticut. The increased incidence will be an incentive to initiate the prevention program as well as to obtain needed funding.

Community leaders should be polled to obtain their input into the program. This could be accomplished through local health departments. These estimates and information will help the continuing efforts to reduce the public health burden of cancer by providing information that can be used to prepare public health education programs for communities and for those at high risk of developing skin cancers.

**Education**

*Parents and caretakers of children*

Health education campaigns need to be specifically tailored to different age groups and audiences. Because excessive sun exposure and sunburn in the first fifteen years of life has been shown to be a determinant risk factor for melanoma, this group needs serious consideration. Children may receive as much as three times the annual sun exposure of adults. It has been estimated that fifty to eighty percent of a person’s lifetime sun exposure occurs by the ages 18-21.  

Parents are the first caretakers and teachers of children, and the value of their example represents a most important social influence on children. Parents and other adults in children’s lives are role models, who help to determine their future behaviors. It is imperative that parents and other caregivers have the necessary information in order to protect these children. Hospital nurseries should begin to teach sun-protection behaviors
to new parents. Pediatricians and their office personnel also have a large responsibility in health education.

Day-care agencies and pre-schools need to become more involved with teaching prevention and helping to incorporate preventive behaviors in children’s daily routines. It is hoped that prevention behaviors that are learned early in life may be less resistant to change than those acquired later in adulthood. Because day care centers and nursery schools are regulated by the state, employees in these agencies could easily be provided skin cancer prevention information. This could be accomplished by inservices to managers, who would then be supplied with training materials such as videos and teaching packets for their employees. This instructional material should be reviewed, as new information became available. Updated information could then be made available to all agencies either by newsletters or through a web-site.

Elementary schools

Beginning in the elementary grades, the health curriculum should annually include formal skin-cancer prevention education, with the goals of increasing children’s knowledge and promoting favorable attitudes toward sun protection. There is definitely a place for a national, comprehensive school health program that would incorporate cancer education, prevention, and early detection into the science curriculum of all health classes throughout the nation. Programs would be directed at the development and practice of positive health habits aimed at protecting and taking care of one’s own body. Any education program that is chosen should be developmentally based, age appropriate, and meet the educational standards of our area. Most importantly, it must be evaluated on an ongoing basis.
**High Schools**

Not only is it important to target education to younger children, but it is also important to reinforce that information with teenagers and young adults. The risk of mortality is perceived as low for skin cancers and seen as occurring in the very distant future. Warnings about skin cancer may not encourage sun-protective behavior in individuals, especially adolescents. However, individuals could more readily accept intervention efforts that are designed to impact appearance and anti-aging concerns. See page 36 for further information. This could lead to the desired behavior change. It is the challenge of public health education in skin cancer prevention to transmit the appropriate message to high-risk groups, beginning early in childhood, in such a manner as to make the acquired knowledge translate into immediate and positive constructive behaviors.

**Recreational areas**

Beaches and recreation areas, where persons are exposed to the sun, appear to be ideal settings for presenting intervention programs. In addition, cancer prevention programs that already exist could be expanded and offered to swim instructors, camp counselors and lifeguards throughout the state. This could be most beneficial because these persons are in positions to teach large numbers of children each year.60

Programs need to be developed using a peer leader, such as a lifeguard or counselor, to model appropriate sun-protective measures. In addition, information pamphlets, motivational strategies, goals and feedback, and free sunscreen are all positive interventions to be used in these programs. Financial support for these programs would
optimally come from businesses solicited for donations, including producers and distributors of sunscreen products, and retailers of recreation products and clothing. Volunteers, both professional and non-professional, could be used to conduct these programs. Local radio, television, and newspapers could help by publicizing the screening locations.

*Professional*

Professional education could improve melanoma case-finding in the United States if patients seeking health care for disorders unrelated to skin care were examined by physicians trained in the diagnosis of skin cancers. The opportunities for primary care providers to diagnose melanoma far outnumber those of dermatologists. More research is needed on the performance quality of skin examination practice during routine medical visits, on the teaching of skin cancer education in medical schools, on the proportion of high-risk patients who ask for screening, and on the proportion of physicians who assess risk factors. It becomes increasingly important to educate all health care professionals, who examine patients, in the signs of early melanoma in order to increase early detection and have a positive impact on decreased mortality.⁶,⁶⁰

Insurance companies reimburse many specific preventive services to primary care providers, such as sigmoidoscopy, Pap smears, and mammography. However, the time spent on a total skin evaluation in a routine physical examination is not usually reimbursed to the physician. Health care reimbursement, HMOs, and changing systems of health care have a large impact on time spent on prevention practices by primary providers of health care. Since there is no specific code for total skin examination for
physicians to use to bill insurance companies, health care reform may need to include requirements for paying for this prevention service.6

*Community*

Primary prevention is aimed at preventing disease based on the knowledge of etiology. Since it has been estimated that 65% of melanomas in the white population worldwide are attributable to sun exposure, primary prevention should focus on encouraging sun-sensible behaviors, especially for those populations at high risk. Any prevention program should include the following recommendations for sun safety:12,50

- Limiting exposure to the sun – Offer ways to enjoy healthy outdoor activity, while reducing exposure to UVR.
- Covering up the exposed skin areas – Encourage the use of protective clothing with long sleeves, long pants, and wide-brimmed hats as well as fabrics made of newer sun-resistant fabrics.
- Sunscreens – Advise the use of broad-spectrum sunscreens with a sun protection factor (SPF) of at least 15 to be used in conjunction with, not instead of, other sun-protection measures.
- Skin self-examination.

Specific programs need to be aimed at other select groups, such as senior citizens, parks and recreation workers, and outdoor workers, making special efforts at addressing their individual concerns and risks. All allied health professionals, such as physiotherapists, and massage therapists, who come into close personal contact with the public, should be given information about skin cancer and its risk factors, so that they will be alerted to early signs of skin cancer in their clients. Others interested in providing
health education such as physicians, hospitals, nurses, and educators could present many of these programs. Pamphlets with information about causation and high-risk individuals should be supplied by the sponsoring agencies and made available in waiting rooms of physicians’ offices, clinics and hospitals.

Special attention should be paid toward darkly pigmented people and non-white races to promote awareness and early diagnosis in order to reduce mortality. Information should include mention of their risk potential that is smaller but still significant. Statistics continue to show that individuals in lower socioeconomic groups of society and among members of some ethnic and minority populations have higher incidences and mortality rates of cancer, as well as a poorer access to optimal health care in general.\(^3,^{35}\) Blacks are more likely than whites to be diagnosed with cancer at a regional or distant stage of the disease, rather than at a local stage when it can be more successfully treated. Blacks have a lower survival rate than whites at each stage of diagnosis, for every type of cancer.\(^2\)

The use of volunteers should not be overlooked as an ideal resource. Volunteers can be used in many capacities, from registration and set-up to presentation of programs in schools and community settings. Volunteers can include high school, college, nursing, and medical students as well as senior citizens, parents, and physicians. These groups should be tapped for their knowledge and enthusiasm, as well as for cost-effectiveness.

*Tanning beds*

A largely overlooked source of UV radiation is the use of commercial tanning beds, that are primarily used by adolescents and younger women. The dangers of tanning
salon usage needs to be better presented to the public, so there will be no misunderstanding that tanning parlors and sunlamps do not offer a safe way to tan.\(^6\)

Studies of both adults and adolescents have shown the perception that a tan is physically attractive, and an indicator of good health. Efforts to change this perception are a key to a successful prevention program. In retrospect, it has taken some thirty years to convince the public that there is a causal relationship between cigarette smoking and lung cancer. There are also some similarities regarding risky behaviors and HIV infection. Public education should promote personal responsibility in the prevention and early detection process. In order to achieve the goal of this plan, strategies need to be included to reduce sun exposure while still allowing people to enjoy healthy, outdoor activity.\(^2\)

**Structural Change/Legislation**

It is important to find representatives who are favorable to the program and will promote legislation in the areas of cancer prevention, and funding. They can be helpful in instituting legislation to require the introduction of a sun protection policy and education programs into the school system. They also can be useful in the communities for providing for shade in the form of trees, canopies, or shelters in schoolyards, parks and other public areas. Recreation events and work activities should be scheduled with sun protection in mind, whenever possible to avoid the midday sun.\(^63\)

A cost-benefit analysis of early detection programs could be utilized to procure funds. The cost of a life saved, of person years of life saved, or the cost of surgical and medical management and terminal care avoided are all means of eventually saving money.\(^60\)
Publicity

Public health education currently is the major means of achieving primary prevention of skin cancer and melanoma, and is accomplished by media-led public awareness campaigns. The public is presented with the safe tanning index in connection with the ozone and ultraviolet radiation-monitoring program of the US National Weather Service, along with spotlighting of instructive material. Likewise, many HMOs and hospitals send newsletters to their clients that highlight important health information. A prevention program that uses the media and other educators in an organized fashion can be most effective. Media coverage includes radio, television, newspapers, periodicals and posters. It is recommended that the state program begin in May to coincide with the annual program of the American Academy of Dermatology and then follow with monthly spotlights throughout the summer months. This could include special programs at the beaches, community fairs and other appropriate outdoor gatherings where a booth would be appropriate.

The preparation of press packets, sample video clips, public service announcements, and connecting the media to experts and skin cancer patients by program participants would be useful in maximizing public information.

Evaluation

Many countries are currently carrying out prevention and early detection exercises. It is very important that these activities be audited to determine their true worth and to identify the areas of public health education that are the most valuable, as well as the most effective approaches. Continuing evaluation leads to updating and changing programs for effectiveness.
The public’s level of knowledge regarding risk factors for melanoma, as well as their attitudes and behaviors regarding UV radiation and its potential hazard to the human body, needs to be continually assessed. The early diagnosis and treatment of melanoma is likely to continue to depend on the clinical expertise of physicians to whom the patient presents along with the experience and skills of the pathologist reviewing the specimen. It will become increasingly important to educate all health care personnel in the signs of early melanoma in order to enhance early detection and have a positive impact on decreasing the mortality rate. This also demonstrates that a population-based tumor registry would be helpful in monitoring the effect of a program on the whole community.

**Secondary Prevention**

Survival from melanoma is directly related to early detection. Secondary prevention refers to early diagnosis in order to reduce morbidity and mortality. The benefits of cancer screening must be promoted in the community by health care providers and cancer control professionals so that everyone is provided with the needed information about tests that are available for the early detection of specific cancers.

The American Cancer Society has recommended a cancer-related check-up that includes a total cutaneous skin examination every three years for those aged 20 to 39, and then annually after the age of 40. This is a reasonable practice for those persons who are not at high risk. The American College of Preventive Medicine recommends that persons at high risk for melanoma have periodic total skin examinations by physicians who are trained in performing high-quality exams.

Therefore, it is highly recommended that a skin cancer examination be integrated in routine physical exams with primary care providers. Because primary care physicians
have routinely screened for hypertension, a positive impact has been made in its control. Likewise, if screening for skin cancer were a part of every routine physical examination, more lesions would be identified earlier and excised. A total skin exam can be sensitive and quick if done by a physician well trained in the identification of skin cancer. When coupled with patient education on sun avoidance and cancer prevention, it can help to reduce the incidence and mortality from melanoma. No invasive instruments or techniques are needed to screen for melanoma. During a routine examination, a physician needs only to examine the skin surrounding the areas he is examining. For example, the face can be examined while at the same time eyes, ears, and noise are evaluated; the chest and back can be observed while listening to heart and lungs, and the legs can be observed while tendon reflexes are checked.

Until the time that total skin examination is included as a routine practice in the majority of visits to primary providers, it is recommended that screening programs be expanded in the state, and that their effectiveness be evaluated. Screenings are important venues for reaching persons who might not have primary providers, never visit a provider, or have no insurance. Programs can be conducted by the local dermatologic society in conjunction with other organizations, such as churches, insurance agencies, or clubs. Physicians and nurses need to be enlisted to participate. It is valuable to have organizations sponsor screenings that can get good publicity coverage and funding. Many large organizations have physicians, nurses, and others available to help direct, organize, and coordinate the screening function. Many hospitals are also willing to coordinate screening efforts and they also have many resources available to run a program. All of these areas need to be investigated for involvement.
The American Academy of Dermatology has prepared a form that is widely used in screenings at the present time. The form includes a release from liability, a drawing that indicates the type and location of all suspicious lesions and recommendations given to the patient for follow-up. It is a record for statistical comparison as well as for evaluation of the program. (Personal communication, C. Grin, M.D., 2/01) Finally, screening programs offer a perfect time for personal education of the participants in risk factors, self-examination, and in sun protection safety.

One barrier to physician involvement in screening programs has been a liability issue. Most programs do not provide liability insurance to professionals who are involved in them. Therefore, it is up to the individuals to cover their own level of responsibility with personal liability insurance. Most states, including Connecticut, do have “Good Samaritan” laws that exempt physicians from liability, if they have not entered into a doctor-patient contract and have not charged a fee. Many physicians are still sensitive to this issue, even though no physician has been sued nationally at a screening clinic.

All persons should be educated about sun protection, how to perform self-examinations, and on the warning signs of melanoma. This is a priority of the media education campaign. The American College of Preventive Medicine finds that there is insufficient evidence to recommend for or against sunscreen use, but does encourage physicians to discuss sunscreen use with patients who have questions and with those who are at high risk for skin cancers. The College also recommends that discussion regarding the importance of avoiding sunburn in childhood occur during regular pediatric check-ups.
CONCLUSION

Malignant melanoma is a potentially lethal neoplasm that has a strong tendency for distant metastasis. It is essentially preventable by incorporating behavioral changes. Emphasis on prevention in professional and public education is increasingly important.

It is important to promote awareness of the dangers of ultraviolet radiation and to provide information on the prevention and early detection of skin cancer. A major focus to a primary prevention program is the combined efforts of state and federal associations working toward a common goal of reducing the incidence of melanoma. Keeping in mind that health promotion requires a sustained change in behavior of individuals, a national program should continue to evaluate the knowledge, attitudes, and behavior of its citizens regarding sun-sensible attitudes.

There is a great potential for the early detection of cancer if our health care system will dedicate itself to achieving an organized and systematic approach to prevention and early cancer detection. Early detection of cancer and precursor lesions offers a largely unmet potential to reduce morbidity and mortality from malignancies.

In order to be successful, a melanoma prevention program needs to include public health education regarding skin awareness and protection. Media programming needs to be targeted so that all persons are educated about the warning signs of skin cancer with special emphasis aimed at caregivers of children and adolescents. Ideally, a melanoma prevention program should be part of a well-coordinated national cancer control program that is aimed at prevention and early diagnosis of all cancers in order to reduce the public health burden in the twenty-first century.
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