The U.S. is losing its war on cancer, according to a long article in the January, 1994 SCIENTIFIC AMERICAN.[1] The basic measure of success or failure -- the age-adjusted cancer death rate -- continues to climb slowly year after year, despite $25 billion spent to find a cure since 1971 when Richard Nixon declared a national "war on cancer."

The cancer establishment--the largely male, largely white and largely elderly group of researchers who act as gatekeepers for cancer research dollars--try to put a good face on it. They point to reductions in deaths from childhood cancers, reductions in cancer deaths among young adults, and reductions in deaths from some specific cancers. Still the fact remains that the total age-adjusted death rate for cancer continues to climb year after year. The rise in the cancer death rate is particularly steep among people 65 and over.

The cancer establishment tends to blame cancer on individual lifestyles, such as diets high in fat and low in fiber. There is one major problem with this argument. Heart disease is known to be associated with cigarette smoking, heavy use of alcohol, and diets high in fat and low in fiber and low in antioxidants [beta-carotene, vitamin E and selenium, for example]. In several countries heart disease rates are decreasing. In the U.S., heart disease is down 40% from its peak in the 1960s. It therefore seems unlikely that recent increases in cancer are caused by the same factors that cause heart disease.

Now a group of younger cancer researchers is advocating a return to the fundamental principles of public health developed during the 19th century, based on prevention. Much of cancer is thought to be preventable because rates of occurrence and death vary substantially from one population to another. Environmental factors are likely to account for much of this variation.

Between 1969 and 1986, several cancers increased significantly among persons aged 64 to 84 in six industrial countries.[2] Multiple myeloma [cancer that starts in the bone marrow and spreads to various bones, especially the skull], melanoma of the skin, and cancers of the prostate, bladder, brain, lung and breast are increasing in the general population of many industrial countries. Except in the case of lung cancer, these increases remain largely unexplained.

In the last two years, cancer prevention researchers have focused new attention on environmental chemicals. Devra Lee Davis and others have developed a hypothesis about the cause of breast cancer in women. For a long time researchers have known that exposure to estrogen (the female hormone) increases a woman's risk of breast cancer. Now Davis has shown that many fat-soluble industrial chemicals, widely distributed in the environment, mimic or amplify the biological effects of estrogen.[3] [See RHWN #369.] The National Cancer Institute is now planning to establish a laboratory to study "hormonal carcinogenesis" (hormones as causes of cancer).

Now a second hypothesis has been developed by Devra Davis, Aaron Blair, Sheila Hoar Zahm, Neil Pearce, Joseph Fraumeni, and others at the National Cancer Institute, asking about the role of pesticides in certain cancers. The hypothesis begins by examining the health of farmers.

Two million farm workers, and three million farmers and their families, form a large occupational group exposed to toxic chemicals.[4] Farmers are a relatively healthy group. For any given age, farmers have a low overall mortality rate, indicating general good health. Compared to the general public, farmers have lower risk for ischemic heart disease [narrowing of the coronary arteries], and for all causes of cancer combined.[5] Farmers also have lower risks for cancers of the lung, esophagus, bladder, colon, liver, and kidney.

Low rates of cancer for lung, esophagus, and bladder, and low rates of heart disease, can be explained by low prevalence of smoking among farmers, which has been noted in numerous studies.

In addition, farmers have a low percentage of body fat, and a high measure of physical fitness, probably because they perform hard physical labor that keeps them in good shape. This good physical condition probably contributes to lower risks for heart disease and colon cancer, both of which are associated with a sedentary lifestyle.

Farmers also eat a relatively large amount of fruits and vegetables, compared to the average American, and relatively small amounts of processed foods. As a consequence, farmers' diets are most likely higher in fiber than the average diet. Furthermore, in general, farmers reside in areas with little air pollution.

However, despite their generally good health, farmers have higher-than-average-population risks for certain cancers: non-Hodgkin's lymphoma, skin melanomas, multiple myeloma, leukemia [cancer of the blood-forming organs], and cancers of the lip, stomach, prostate, and brain.

These high rates of a few select cancers among farmers, against a background of low risks for most cancers and for non-cancer diseases, suggests that work-related exposures may be causing specific cancers among farmers.

These patterns may have broad public health implications since several of the high-rate tumors among farmers are the same cancers that appear to be increasing in the general population of many developed countries: multiple myeloma, non-Hodgkin's lymphoma, melanoma of the skin, and cancers of the prostate and brain.

There are several factors that could be causing these cancers among farmers: farmers are out in the sun a lot, and ultraviolet sunlight is associated with melanoma and cancer of the lip. Exposure to phenoxy herbicides (2,4-D, 2,4,5-T, acifluorfen, CNP, erbon, mecoprop, and others) has been linked to non-Hodgkin's lymphoma, and to soft tissue sarcoma.[6] Exposure to insecticides has been associated with leukemia, multiple myeloma, and brain cancer. It is possible that animal viruses may play a role in some farmers' cancers because elevated risks of leukemia, soft tissue sarcoma, and non-Hodgkin's lymphoma have been seen in slaughterhouse workers and veterinarians.

But there is also another possibility. Perhaps something in the environment damages the immune systems of farmers, who then fall prey to cancers that healthy immune systems would have been able to ward off.

It is noteworthy that the same cancers that affect farmers also affect people whose immune systems have been damaged by disease, or by medical intervention. Patients with AIDS (acquired immune deficiency syndrome) experience striking excesses in non-Hodgkin's lymphoma. (However, the AIDS epidemic does not provide a complete explanation for the increase in non-Hodgkin's lymphoma among the general population. The general increase started before the AIDS epidemic began. In the U.S., the greatest increases in non-Hodgkin's lymphoma, multiple myeloma, and leukemia have occurred in rural agricultural areas of the central region of the country.)

People who have organ transplants are given drugs to suppress their immune systems because the immune system would normally reject a foreign organ; these people, too, have high rates of non-Hodgkin's lymphoma. Brain and skin cancers occur among bone marrow transplant recipients; soft-tissue sarcomas, skin melanomas, and squamous cell carcinomas of the skin and lip occur in kidney transplant patients; leukemia and stomach cancers occur in people with immunodeficiency diseases.

This similarity between cancers associated with immunosuppression and cancers among farmers suggests that farmers' cancers may be
caused by environmental factors that damage the immune system.

There is a large and convincing body of evidence showing that pesticides harm the immune systems of laboratory animals.[7] However, the number of human studies is very small. In humans, pesticide exposures have been linked to a variety of immune system effects including decreased host resistance to disease; suppressed T-cell activity; enhanced B- and T-cell immune response; and contact hypersensitivity. T- and B-cells are particular kinds of cells that circulate in the blood and protect the body by fighting off bacteria, viruses and cancer cells.

Increasingly, the general public is exposed to the same chemicals that farmers are exposed to. And, as we saw last week, there is evidence that immune disorders are increasing in the general population. The hypothesis of Davis and her colleagues, that chemicals (or other factors) on farms are increasing the cancer rates among farmers, could have important consequences for us all. It represents a new kind of tough, creative thinking that has been missing from the war on cancer up until now.

--Peter Montague


Descriptor terms: cancer statistics; mortality; morbidity; diet; fat; fiber; antioxidants; heart disease; prevention; multiple myeloma; melanoma; skin cancer; prostate cancer; bladder cancer; brain cancer; lung cancer; breast cancer; estrogen; agriculture; farm workers; smokers; air pollution; sunlight; phenoxy herbicides; viruses; soft tissue sarcoma; non-Hodgkin's lymphoma; aids; organ transplants; immune system; studies;