

many parts of the country, local groups are engaged in taking action designed to limit the sale of alcohol in their communities (10), and research in the alcohol field is most likely to influence policy when coupled with such grass roots initiatives (11). The strategy described in this study can potentially be used to monitor and support these community efforts to limit the availability of alcohol to young people (12).

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Public Health Applications of Hansen's Disease Research and Treatment

ROBERT JACOBSON, MD
 J.L. KRAHENBUHL, PhD
 CHARLES PATOUT, JR., MD
 CORINNE AXELROD, MPH

All the authors are with the Bureau of Primary Health Care, Health Resources and Services Administration, Public Health Service. Dr. Jacobson is Director, Division of National Hansen's Disease Programs (NHDP). Dr. Krahenbuhl is Chief, Laboratory Research Branch, NHDP. Dr. Patout is Chief, Rehabilitation Branch, NHDP. Ms. Axelrod is a Special Assistant, Office of the Director, Bureau of Primary Health Care.

Tearsheet requests to Corinne Axelrod, Bureau of Primary Health Care, 4350 East West Highway, Bethesda, MD 20814; tel. 301-594-4110; FAX 301-594-4072.

Synopsis

Because of the similarities in causative agents of Hansen's disease and tuberculosis, Hansen's disease research is now being used in the identification, treatment, and prevention of tuberculosis. Numerous

studies are under way to screen and develop new drugs to combat the threat of multiple drug-resistant tuberculosis. Additional studies focus on factors to reduce the transmission of tuberculosis and on the development of techniques for early diagnosis and identification of drug resistance.

Advances in Hansen's disease research and treatment also are being applied to the prevention of ulcers and amputations in diabetics and others without protective sensation in their feet.

The Lower Extremity Amputation Prevention Program, developed at the Gillis W. Long Hansen's Disease Center in Carville, LA, is a multi-disciplinary approach that includes screening, risk assessment, and the development of a treatment plan with an emphasis on patient involvement. Expected to prevent up to 90 percent of diabetes-related amputations, the program is being implemented in Jackson, MS, in a community-based diabetic foot program and will be replicated throughout the United States.

In the 100 years since the first Hansen's disease (HD) patients arrived in Carville, LA, to receive humane and effective treatment, the biomedical advances in research and the clinical achievements in controlling the disease have become well known. They are described in the accompanying PHS Chronicles (page 000). Less known are the public health applications of Hansen's disease research and treatment, particularly in tuberculosis (TB) and diabetes.

The Gillis W. Long Hansen's Disease Center, often referred to as "Carville," is a Public Health Service facility that is part of the Bureau of Primary Health Care in the Health Resources and Services Administration, an agency of the Public Health Service.

The Laboratory Research Branch of this facility, now housed at the Louisiana State University School of Veterinary Medicine in Baton Rouge, LA, is known as a world center of excellence in Hansen's disease research. Its work continues despite the low prevalence of this disease in the United States, because HD remains endemic in parts of the world, it continues to affect immigrants to the United States from these areas, and it may relapse after long periods of dormancy.

In recent years, Hansen's researchers have been called upon to help confront the renewed public health threat of TB, which has had a 20-percent annual increase in the United States between 1985 and 1992, in large part due to the AIDS epidemic, drug abuse, increased homelessness, and crowded prison conditions. Of great concern is the increase in both the rate of new TB cases resistant to at least one standard drug (23 percent in 1991) and in multiple drug resistance.

In the erroneous belief that TB was virtually eradicated, funding and support for research dwindled. Because the causative agents of Hansen's disease (*Mycobacterium leprae*) and tuberculosis (*Mycobacterium tuberculosis*) are closely related, researchers in the Carville laboratory research branch have been called upon to extend their Hansen's disease expertise to TB. Studies are currently underway in areas such as drug screening to search for new TB therapies, early diagnosis and detection of drug resistance, prevention of TB transmission, and basic studies of TB pathogenesis.

Although multiple drug resistance indicates that new drugs are urgently needed, the TB bacillus is not among the panel of pathogens routinely screened by pharmaceutical houses searching for new antibiotics. Screening and development of drugs are therefore the focus of studies by Carville's researchers to combat the threat of multiple drug resistant TB. Comparison of the efficacy of 2- and 3-drug combinations of

existing anti-TB drugs using in vitro and in vivo models (infected mice) is funded by interagency agreement with the Centers for Disease Control and Prevention.

Funding from the National Institutes of Health (NIH) Division of AIDS has supported the Carville laboratory's screening of more than 4,000 compounds for anti-TB activity, including novel synthetic and natural products under investigation by the National Cancer Institute as anti-cancer agents.

In a separate project, NIH will provide funds for the laboratory to collaborate with four other institutions to screen Latin American bioreactive plant products for anti-TB effects. The laboratory also has been selected recently by the NIH Division of AIDS for support of a prospective 5-year study to screen the anti-TB activity of 50,000 additional compounds.

Rapid, accurate diagnosis of TB cases and detection of drug resistance are essential. The latest molecular biology techniques are being employed by laboratory workers to detect low numbers of *M. tuberculosis* in patients' sputum samples. These studies include investigation of the basis of drug resistance in TB, focusing on rifampin and INH, the two major drugs used to treat this infection. This work will yield rapid tests for detecting rifampin and INH resistance in newly diagnosed cases of TB and may provide the basis for designing improved chemical forms of rifampin as well.

Additional studies to curtail transmission of TB to HIV-positive persons and health care workers include studying the effect of ultraviolet light on the inactivation and drug resistance of *M. tuberculosis*, the relationship between *M. tuberculosis* and the immune system, down regulation of host microbicidal activity, and the effects of the microenvironment on overall resistance to disease.

Although leprosy research remains the central mission of the Carville laboratory branch, technology transfer from Hansen's disease to TB research has enabled the laboratory to respond to the urgent needs of the TB epidemic.

In the area of diabetes, researchers in the Rehabilitation Branch at the Carville facility have developed techniques to prevent foot wounds, heal chronic ulcers, and prevent amputations among HD patients with lower extremity sensory loss. These same techniques can be applied directly to millions of patients in the United States with diabetes and others who have lost protective sensation in their feet.

"Insensitive foot" in diabetes or HD results from progressive loss of peripheral nerve function. The loss of protective sensation in the foot can lead to recurrent injury (with failure to heal), progressive

deformity, paralysis, and ultimately amputation.

Approximately 60,000 diagnosed diabetics in the United States undergo lower extremity amputation each year, at a cost of about \$25,000 each. It is estimated up to 90 percent of these amputations could be prevented by use of the Lower Extremity Amputation Prevention (LEAP) Program developed at Carville.

The LEAP Program utilizes a multidisciplinary team consisting of a physician, podiatrist, physical therapist, nurse, and orthotist. An initial foot screen is conducted to evaluate the condition of the foot, determine the patient's risk category, and develop a treatment plan. Patients with active infection receive appropriate antibiotics and are confined to bed with the leg splinted. Ulcers are treated with a total contact walking cast. Once the ulcer is closed, protective footwear is provided and walking is carefully monitored. In some cases, custom made shoes are necessary.

Patient education is an essential part of the "Carville approach." Throughout all stages of the treatment, members of the team work closely with the patients who are taught to inspect their feet daily.

The LEAP Program is being adapted at the Jackson-Hinds Community Health Center, a federally-funded community health center in Jackson, MS. Members of the Carville team have worked with the Jackson-Hinds Diabetic Foot Clinic to establish a community-based diabetic foot program. The program

is focused on prevention and trains low income adults from the community to serve as Diabetes Educator Assistants. They provide outreach services to other low income, medically underserved, elderly persons in senior residences and public housing facilities in Jackson.

The partnership between Carville and Jackson-Hinds has led to the establishment of a regional training center in Jackson to certify registered nurses and other health care providers as Diabetic Foot Care Specialists. The training program consists of at least 400 hours of instruction as well as training and practical experience, including assessment of risk factors, proper foot care (skin, nail, callous), and footwear selection. They will be taught techniques to reduce risk factors and improve foot care. The training program has been approved by the Mississippi State Nursing Association.

HRSA's Bureau of Primary Health Care funds programs to increase access to primary and preventive health care for low income, underserved, and vulnerable populations. Hansen's disease has been one of the most stigmatized conditions in history, and the advances made at Carville have enabled people with HD to lead healthy and productive lives. The application of research and treatment developed for HD patients to other vulnerable populations such as those with TB and diabetes is an exciting, new opportunity that is a model for public health practice.

Behavioral Risk Factors of Chippewa Indians Living on Wisconsin Reservations

DAN E. PETERSON, MD, MPH
PATRICK L. REMINGTON, MD, MPH
MARIE A. KUYKENDALL
MARTY S. KANAREK, PhD, MPH
JOSEPHINE M. DIEDRICH, RN, MS
HENRY A. ANDERSON, MD

Dr. Peterson, a Medical Epidemiologist with the Centers for Disease Control and Prevention (CDC), is currently on assignment in Harare, Zimbabwe. At the time of the study, he was a CDC Epidemic Intelligence Officer with the Bureau of Public Health, Wisconsin Department of Health and Social Services. Dr. Remington, Ms. Diedrich, and Dr. Anderson are currently with Wisconsin's Bureau of Public Health. Dr. Remington is the State Chronic Disease Epidemiologist, Ms. Diedrich was a Master's

Degree Candidate at the time of the study, and Dr. Anderson is State Environment Health Epidemiologist. Ms. Kuykendall is with the Lac Courte Oreille Tribal Office, Hayward, WI. Dr. Kanarek is an Associate Professor in the Department of Preventive Medicine and Institute for Environmental Studies, University of Wisconsin, Madison.

Tribal study coordinators were Vicki Doud (Lac du Flambeau), Becky Lewis (Lac Courte Oreilles), Joan Slack (Red Cliff), Doris Emery (St. Croix), and Mary Bigboy (Bad River). Meg Ziarnik, Dee Higgins, and Beth Fiore, all of Wisconsin Division of Health, helped with the survey in the field. Dan Sosin, Centers for Disease Control and Prevention, contributed to study design, analysis, and the presentation of results.

Tearsheet requests to Dr. Patrick Remington, Wisconsin Department of Health and Social Services, 1414 E. Washington Avenue, Room 96, Madison, WI 53703-0304; tel. 608-267-3835; FAX 608-267-3696.