

## Ding dong dell, arsenic in the well

New Hampshire's municipal water supplies are carefully monitored for arsenic and other toxins. But Granite Staters who get their drinking water from a private well—as do 40% of residents—might be less safe. A recent analysis of several thousand private wells in the state found that one in four have naturally occurring arsenic at levels that Joshua Hamilton, Ph.D., director of DMS's Center for Environmental Health Sciences, considers potentially dangerous. The highest levels found in the study were 100 parts per billion (ppb). That's not much—the equivalent of just one large mouthful of food out of all the food 10 people would eat in their lifetimes. Even those who drink water from a 100 ppb well their whole lives wouldn't consume enough to cause clinical signs of poisoning like those in the murder mystery *Arsenic and Old Lace*. But, says Dartmouth epidemiologist Margaret Karagas, Ph.D., 100 ppb is enough to put people at greater risk of developing skin or bladder cancer.

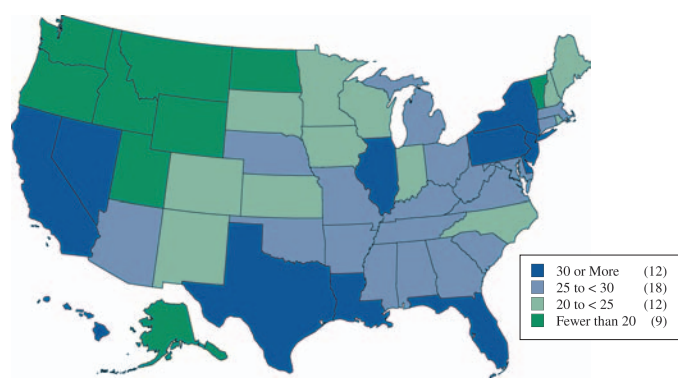
Scientists have been divided for many years on the question of whether or not arsenic causes cancer. Cancers are now believed to pass through a number of obligatory precancerous stages before they become malignant tumors, and there are opportunities at each stage to reverse or prevent the tumor's progression. DMS toxicologist Angeline Andrew, Ph.D., was the lead author of a recent paper in *Environmental Health Perspectives* examining arsenic's role in this process.

**Repair:** Tumor progression begins with the initiation phase, when a carcinogen—such as a highly reactive chemical or radiation—damages DNA. Then comes the promotion phase, when exposure to other chemicals facilitates progression of the lesion toward cancer. In most people, enzymes can repair damaged DNA and reverse the cancer progression. But when Andrew looked at DNA repair enzymes in the lymphocytes of New Hampshire residents, she found a strong correlation between arsenic levels in their urine and toenails—which correlated closely with levels in their well water—and levels of a key enzyme, ERCC1. In those exposed to the most arsenic, ERCC1 was almost totally suppressed.

The researchers hypothesize that arsenic is not a true carcinogen, or initiator, but a promoter. So in people exposed to a carcinogen that can damage DNA, such as cigarette smoke or the sun's ultraviolet radiation, arsenic promotes the damaged cells' progression to cancer by suppressing their DNA-repair mechanism.

DMS's Center for Environmental Health Sciences is doing more than studying the science behind such processes. Dartmouth officials are also working with state agencies to make sure that Granite Staters are informed on the subject of arsenic in well water. Information about testing private wells is available from the Department of Environmental Services' Water Supply Engineering Bureau at 603-271-3445. And information about remediation options and prices is available at <http://www.des.state.nh.us/factsheets/ws/inc/2-11.html>. ROGER P. SMITH, Ph.D.

Physician visits per person during the last six months of life, 2000-2003



Dartmouth Atlas maps, like this one from a recent study, show variations in care.

## Less is more for the chronically ill

Dartmouth's Center for the Evaluative Clinical Sciences (CECS) is at it again. Known for its *Dartmouth Atlas of Health Care* and study after study showing that more care does not necessarily yield better outcomes, CECS has now revealed startling variations in spending on chronically ill, elderly people. The study documented potential savings of \$40 billion over four years if all U.S. hospitals followed practices used in Salt Lake City, Utah; Rochester, Minn.; and Portland, Ore.—cities where patients get high-quality, low-cost care. Patients there are admitted to hospitals less often, spend less time in intensive care units (ICUs), and see fewer specialists.

The variations in spending—according to researchers John Wennberg, M.D., M.P.H., and Elliott Fisher, M.D., M.P.H.—are due to an unmanaged supply of resources, limited evidence about what care is best for the chronically ill, overdependence on acute-care hospitals, and overoptimism about the benefits of more aggressive treatment. In fact, chronically ill people can be cared for better and less expensively in home-health and hospice-care settings.

**Claims:** The researchers based their findings on Medicare claims data from more than 4,300 hospitals in 306 regions. They examined the records of 4.7 million Medicare enrollees who died from 2000 to 2003 and had at least one of 12 chronic illnesses, including cancer, congestive heart failure, and/or chronic lung disease. Average Medicare spending during the last two years of life for these patients ranged from about \$24,000 in Idaho to nearly \$40,000 in New Jersey. And during their last six months of life, average hospital stays ranged from seven days (Utah) to about 16 (Hawaii, New York, and others); ICU stays from fewer than two days (New Hampshire, Vermont, and others) to almost five (Florida and New Jersey); and physician visits from fewer than 20 (Vermont, Mountain States, and the Pacific Northwest) to more than 40 (New Jersey). Patients in high-spending regions had slightly shorter life expectancies and less satisfaction with their care than those in areas with lower rates of spending.

The report, funded by the Robert Wood Johnson Foundation, calls for an overhaul of the way chronic illness is managed and for a reimbursement system that rewards, rather than penalizes, organizations that reduce excessive use of services. LAURA STEPHENSON CARTER