



Aboard the Mobile Nutrition Research Laboratory, nutritionist Fariba Roughead (right) and nurse Ruth Christianson (middle) prepare volunteer Sue Cherette (on table) for measurement of her body composition with a dual x-ray absorptiometer. Roughead is conducting a study to determine whether supplements containing calcium, copper, and zinc are more effective than those containing only calcium in maintaining bone density of premenopausal women.

Driving Nutrition Research to the Consumer

In North Dakota last fall, along with the yellow school buses, members of the Grand Forks Public School District also greeted a big, white bus—a laboratory on wheels from the Grand Forks Human Nutrition Research Center.

The Mobile Nutrition Research Laboratory, its formal name, brought testing facilities to seventh-graders who agreed to help scientists learn how zinc fortification affects their development. The study is one of four projects currently under way in the center's new field-studies program.

Research has shown that improved nutrition may be effective in preventing or treating major health problems such as diabetes, osteoporosis, cancer, cardiovascular disease, and depression. The costs of these problems—both human and economic—are high, so evaluating the relationship between sound nutrition and health is important.

But many nutrition studies fall short of including at-risk segments of the population because of logistical problems. Individuals who are immobile, who live at a distance, or who are too young to visit a research facility rarely get involved. “The real advantage of this mobile unit is that by bringing the lab to people, we can involve underserved individuals in nutrition research,” says psychologist James G. Penland, who is with the center's Mineral Nutrient Functions Research Unit.

The 40-foot, \$400,000 mobile research lab is custom-equipped to evaluate the nutrition and health of volunteers in home, work, school, and other institutional settings, allowing

the center to study nutritional problems and benefits in underserved and at-risk populations. It has proved an excellent environment in which scientists can evaluate volunteers' dietary intake, nutritional status, physical health, body composition, and psychological function.

Last year—its first in operation—the lab was mobilized to bring nutrition research and its benefits to the Grand Forks community and outlying regions.

STEPHEN AUSMUS (K10108-1)



In the mobile nutrition lab, technician Kay Williams collects a blood sample from a 7th grader participating in a zinc-fortification study.

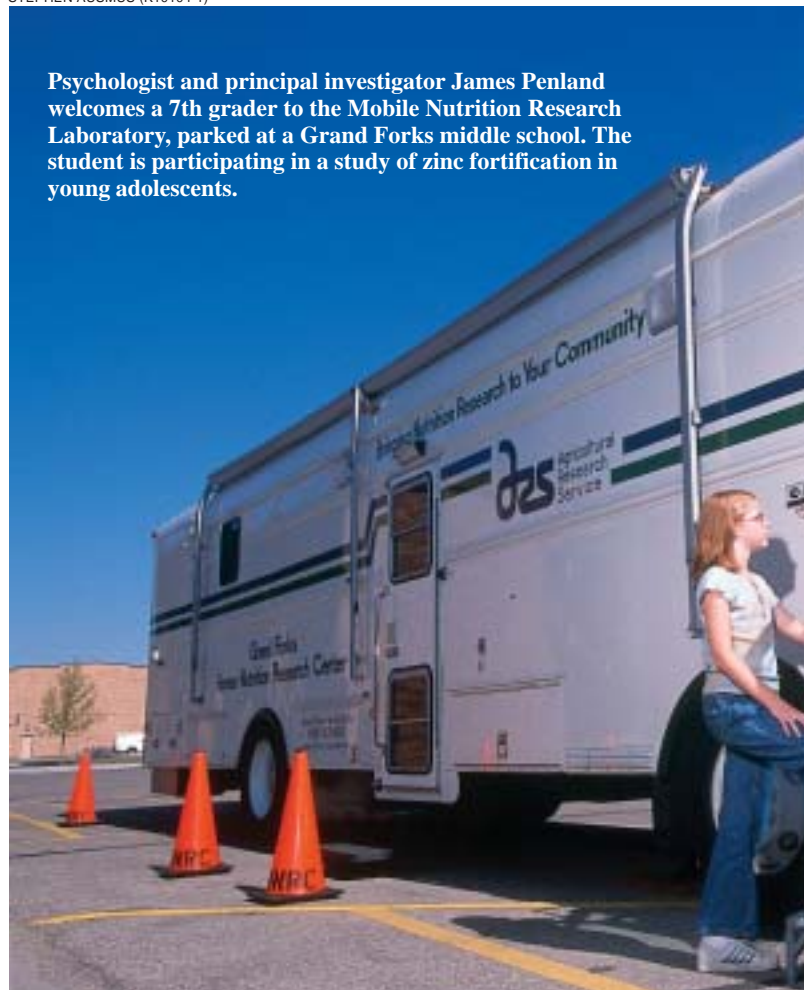
Lab on the Run

A multiyear study began in 2001 to determine the benefits of improved zinc nutrition for the mental, physical, and social functions of adolescent boys and girls.

The lab's previous zinc studies showed young children's attention, memory, and reasoning improved with only 20 milligrams (mg) of supplemental zinc daily. Mean intake for children is about 12 mg for boys and 9 mg for girls. Similar results were found in adults with about 50 mg of supplemental zinc daily. "But the relationship between zinc nutrition and behavior has not been studied in adolescents," says Penland. Indeed, dietary recommendations for young adolescents aged 9 through 13 are based solely on data from zinc studies involving adults. "We wanted to study kids while they're in peak growth," says physiologist Henry C. Lukaski, a principal investigator along with Penland.

As of last fall, 200 seventh-grade boys and girls attending local middle schools have been tested. Students drank fruit juice for 10 weeks that had been fortified with either 10 mg or 20 mg of zinc or that had not been fortified at all. At the beginning and end of the study, the team of researchers drew students' blood, recorded their dietary intakes, and measured their growth and body composition. The student volunteers performed tasks on a microcomputer so that their cognitive function could be measured. They completed questionnaires so that their social and emotional adjustment could be assessed. And they underwent physical fitness tests to measure strength, endurance, and flexibility. Scientists at the center are now analyzing the results, but preliminary data indicates that increased zinc is likely to benefit memory in this age group.

STEPHEN AUSMUS (K10104-1)



Psychologist and principal investigator James Penland welcomes a 7th grader to the Mobile Nutrition Research Laboratory, parked at a Grand Forks middle school. The student is participating in a study of zinc fortification in young adolescents.

STEPHEN AUSMUS (K10107-1)



Aided by food models, Fariba Roughead and psychology technician Becky Stadstad enter information for a dietary recall into a nutrient composition database. The data is used in field studies that evaluate the impact of dietary intakes on the relationships among nutrition, health, and function.

Driving Inclusiveness

In the last year, the mobile lab was also driven to three of the four American Indian reservations in North Dakota. The U.S. Indian Health Service estimates that nationwide, nearly half of all American Indians suffer from heart disease, diabetes, or depression or a combination of these. But there is little information about the relationship between these major health problems and actual dietary and physical activity patterns, especially in North Dakota American Indians.

Postdoctoral research psychologist Jacqueline S. Gray, Penland, and Lukaski surveyed dietary intakes and conducted nutritional, fitness, and mental health assessments. Their goal is to implement effective interventions to improve health and quality of life among American Indians. The data from that outreach study is now undergoing analysis.

Earlier last year, nutritionist Fariba K. Roughead and Lukaski began recruiting 220 healthy postmenopausal women for a 3-year study. Roughead and Lukaski will use the mobile lab to give recruitment presentations to groups of women in various



STEPHEN AUSMUS (K10105-1)



At a study station inside the mobile lab, James Penland teaches a student how to perform a computerized test of visual memory for the zinc-fortification study.

settings, such as senior centers. Roughead will study the benefits of long-term mineral supplementation on bone metabolism. Reduced bone mineral density is strongly associated with fractures and the onset of osteoporosis. The researchers will provide women with supplements containing calcium alone or calcium plus copper and zinc for 2 years. Volunteers will be evaluated through blood tests and bone density measurements at the beginning of the study and every 6 months thereafter. A follow-up evaluation will be conducted 12 months after supplementation ends.

The Toll of Stress

Also last year, University of North Dakota psychology graduate student Robyn Drach and Penland recruited a group of female student volunteers from the University—some who suffer from dysmenorrhea, or painful menstruation (cramps), and some who do not. “There may well be nutritional factors that are involved in the experience of various menstrual-related problems,” says Penland. Drach examined volunteers’ dietary

intakes; their blood levels of calcium, magnesium, copper, and zinc; and their responsiveness to stress.

Both groups were subjected to the physiological stress of having their hand immersed in ice water for 5 minutes. They were also subjected to the psychological stress of reading a script in front of a camera. “Public speaking is an intimidating experience for almost everyone, so it serves as an effective psychological stressor,” says Penland. Drach then measured blood pressure, skin temperature, and other autonomic responses common to stress.

“For college-age women, it helps that the mobile unit was parked right outside their dormitories,” says Penland. “Volunteers can get up in the morning before they’ve eaten, have their blood drawn, and then go back to their rooms.” After conducting statistical analyses, the researchers found that the women with dysmenorrhea had lower concentrations of calcium and magnesium in their blood than the women without dysmenorrhea. During the ice-water test, women with dysmenorrhea were more sensitive to the cold than those with normal menstrual periods. These results confirm Penland’s original work, which showed that calcium and magnesium might be important factors for women who experience painful menstrual periods.

For each of these projects, the mobile lab’s accessibility proved key. “Such studies would be difficult, if not impossible, to conduct if participants were required to travel to our center,” says Penland.—By **Rosalie Marion Bliss, ARS.**

This research is part of Human Nutrition, an ARS National Program (#107) described on the World Wide Web at <http://www.nps.ars.usda.gov>.

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