It has been more than six years since COEH faculty member Brenda Eskenazi, researcher Asa Bradman, and their UC Berkeley colleagues established the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS), one of 11 national centers for research into children’s health and the environment. In that time, they have not only conducted pioneering research exploring the health effects of pesticide exposure on the children of farmworkers in California’s Salinas Valley, they have also lived and breathed a commitment to making the community they are studying an active partner in their research.

“Everywhere you go in occupational and environmental health, you hear stories about communities that were experimented on and never heard the results,” Eskenazi said. “When we started, we vowed that the community would hear from us in a timely fashion and be included in a respectful way.”

The CHAMACOS team has sought to engage everyone who has a stake in its research, in many cases bringing together adversaries who do not typically sit down with each other to share perspectives.

“Making that happen has been a challenge,” Eskenazi said, “but I believe that if everybody is at the table and involved, they are more likely to buy into the results, and the research will have a better chance to influence policy changes.”

The researchers work with representatives of the various constituencies to develop their studies. They regularly provide research updates to their community advisory board, and they ask stakeholders for advice at virtually every step of the way. This process takes a great deal of time and effort—and can be frustrating—but Eskenazi wouldn’t have it any other way.

When the Community Says No

Last year, just before her study of the effects of pesticide exposure on fetal growth and premature deliveries was to be published (see sidebar, page 6), Eskenazi began getting calls from reporters about a similar study that was to appear in the same journal. The other researchers had released their results to the press. Her CHAMACOS team had not.

“As an editor of that journal, I knew that the other researchers had different results,” Eskenazi said. “I was concerned that people might read about those results and confuse them with ours. We hadn’t yet had a meeting to inform our community. If we did a release, people might read about our study in the paper before they’d heard from us.”

Torn, she called her advisory board members, sounded them out about sending out a press release, and found them to be solidly opposed—with one group arguing that the press release would give the findings more attention than they deserved and another arguing that the community needed to hear the results first.

“Stakeholders,” continued on page 6
Letter from the Director
Planning for the Future with Prevention, Environmental Health in Mind

In our continuing effort to improve California’s workers’ compensation system by focusing on preventing workplace injuries and illnesses, we have engaged Glenn Shor, policy researcher at the California Division of Workers’ Compensation, to help us explore ways to improve incentives for prevention and to bring this approach to the attention of policymakers.

In the environmental health arena, we are taking steps to help policymakers understand the impact of future development on environmental health in California. A colloquium series, “California at 50 Million,” launched by Professor David Dowall, director of the Institute of Urban & Regional Development, in collaboration with COEH faculty member Robert Spear, is bringing together experts in fields as wide-ranging as urban planning and ecology to explore the health challenges the state will face as we build an infrastructure to accommodate population growth. (http://www-iurd.ced.berkeley.edu/)

In collaboration with UC Irvine, Spear and Dowall will guide research to gather new information and develop new approaches that will illuminate the potential effects of land use on the environmental health of Californians. The first of these projects is in partnership with COEH alumnus Rajiv Bhatia, director of environmental and occupational health, and Thomas Rivard, senior environmental health inspector at the San Francisco Department of Health. The study will be exploring whether or not there is a correlation between noise, traffic, and air pollution. Researchers will be analyzing noise levels and traffic density through vehicle counts, in combination with existing air pollution data. Neighborhood focus groups will also be asked about their daily experience of environmental quality in study areas. If noise levels are found to correlate with air pollution, then noise could be used as a less expensive indicator for health and quality-of-life zoning and land-use decision making.

This research meshes with work that other COEH faculty members are doing in environmental health tracking. Ultimately, we hope to reduce the burden of environmentally-related disease in communities by informing land-use and development decisions with the data we get from tracking. For example, my research with the Environmental Health Tracking Center seeks to learn more about the potential impact of environmental factors on asthma. If we find that living near freeways is associated with worse asthma outcomes, we can provide this information to decision makers, who may choose not to build schools near freeways.

I hope and intend that COEH will continue to expand our interdisciplinary program to prepare students for work in this exciting and important intersection of environmental health research and policy. By giving policymakers data about possible health consequences and methods for predicting the impact of decisions about land use and development, COEH can contribute to the future quality of life in California.

John Balmes

The interrelations among pollution, noise, traffic, and neighborhood will be explored in a pilot study in San Francisco.
Researchers Test Alternative Way to Assess Environmental Risks

Is 50 degree weather cold or mild? Is 45 years of age old or young? If you scored 85 on a test, did you do well, O.K., or poorly? If you agreed to meet at 11:00 a.m. and arrived at 11:15 a.m., was that acceptable or rude?

Your frame of reference can make a big difference, says COEH faculty member Tom McKone of UC Berkeley. Language can be imprecise, and perceptions vary. So when researchers and government officials attempt to assess environmental risks and set policy, they often find themselves dealing with uncertainty and ambiguity about what constitutes a situation that is “hazardous,” “acceptable,” or “safe.”

Seeking a way to characterize more clearly the uncertainties involved in assessing environmental risks, McKone and colleague Ashok Deshpande, now retired from India’s National Environmental Engineering Research Institute, have borrowed a methodology used in engineering that takes into account the extent to which something fits into sets of defined categories.

For example, McKone says, many people would call a Fuji apple red. But it has yellow in it as well. How can we account for the fact that the apple can be categorized as red and, to some extent, not red (yellow)? Fuzzy logic, the name given the methodology by its inventor, Lotfi Zadeh of UC Berkeley, provides a way to express the apple’s “degree of membership” in both color categories.

Deshpande and his colleagues in India applied fuzzy logic to an assessment of water quality in the Ganges River. McKone worked with Deshpande to interpret the general applicability of this work to risk assessment. Tens of thousands of people bathe in the Ganges each day for religious reasons, yet the quality of the water in the river has deteriorated over the years as sewage and industrial wastes have been discharged into it. To help the government assess the effectiveness of measures it had introduced to control the effluent, the researchers used fuzzy logic methodology to study the water at two bathing places, Varanasi, where pollution has been severe, and Rishikesh. By considering both water quality measurements and expert opinions about what measurements are acceptable, they were able to characterize the water quality at Rishikesh as “acceptable” and to demonstrate an urgent need to intensify pollution control efforts at Varanasi, where the water quality was “not acceptable.”

“But Are We Safe?”

“A lot of the things we do in public health or environmental decision-making really involve these fuzzy sets,” McKone says. “We don’t know what ‘safe’ is. You can’t draw a straight line and say everything on this side is safe and everything on that side is dangerous. We like to have crisp lines, but that gives us a false sense of

Fuzzy logic is particularly useful for situations with lesser degrees of certainty. While it is clear that the situation at Varanasi, at right, is not acceptable, at Rishikesh things are more complex. Assessing degree of membership allows us to see, however, that while the highest degree of certainty is for “acceptable,” the next highest is for “just acceptable” so efforts to improve water quality must continue to push it over towards highly acceptable.

“Risk Assessment,” continued on page 7
Workers’ Compensation Pays Only a Fraction of Real Disease Costs, Study Finds

The most comprehensive study to date of work-related deaths and disease in the U.S. has revealed that workers’ compensation systems throughout the nation have failed dramatically to pay for the medical costs and the deaths they are set up to cover.

As a result, said COEH faculty member Paul Leigh of UC Davis, enormous costs—80 percent or more of what workers’ compensation should cover—get shifted from workers’ compensation systems to individual workers, their families, private medical insurance, and taxpayers, through Medicare and Medicaid.

Working with colleague John Robbins, Leigh first estimated the deaths and costs for all occupational disease in 1999, using epidemiological studies. He then estimated the number of workers’ compensation cases, costs, and deaths in the same year. Comparing these two estimates, he found that workers’ compensation missed roughly 46,000 to 93,000 deaths from disease and $8 billion to $23 billion in medical expenses.

“Occupational diseases kill 50,000 to 70,000 people each year in the U.S.—that’s more than many other non-work-related deaths, such as from leukemia or AIDS,” Leigh said. “This is a significant problem, and it is supposed to be paid for by the workers’ compensation system. It turns out, however, that the great majority of these deaths go uncompensated, because very few diseases are recorded [by the worker’s compensation system].”

The occupational diseases that cause the greatest numbers of deaths are, in order, cancer, chronic respiratory disease, and circulatory disease, Leigh said. Diseases like these take a long time to exact their fatal toll, and it is challenging to design a system that takes this latency factor into account. But ignoring this problem results in cost-shifting, which takes the burden away from those responsible for unsafe or unhealthy conditions in the workplace and moves it to innocent third parties, he said. For example, chronic respiratory disease doesn’t usually cause death until the retirement years, so the spillover costs are likely to be absorbed by Medicare—that is, by taxpayers.

“If a company pollutes the air, a natural resource, we expect the company to eliminate the pollution or pay to clean it up,” Leigh said. “Similarly, if the workplace ‘pollutes’ workers, a human resource, the company should prevent the problem. If it doesn’t, it should pay for it, not pass on the cost to someone else.”

Leigh points to several models that have been developed to deal with the problem of compensating workers for job-related diseases that manifest themselves later in life, including the Black Lung Trust and programs to compensate workers for cancer and other diseases contracted while working on nuclear weapons and uranium mines during the Cold War.

“Let’s take arrangements like these and apply them to other occupational diseases,” he said.

Leigh would also like to see a model program that finds a way for workers’ compensation insurers to hold reserves to pay for medical care for workers with osteoarthritis caused by work-related injuries. Osteoarthritis is a painful disease that is not fatal but is the primary cause of disability in the U.S. It can occur as many as 30 years after a worker injures a hip or a knee on the job.

Leigh acknowledges that solving the problem his research has raised will not be easy, but he urged, “Debate should begin on these issues.”

Leigh’s findings corroborate those of other studies over the years, including one by Glenn Shor, who recently joined COEH to help address workers’ compensation issues. Leigh’s study is based on data gathered in the course of 12 months from 48 of the 50 states.

Progress in the expanded use of improved stoves was recently highlighted at a high level workshop in China. The workshop brought together experts from universities, non-governmental organizations, governmental agencies, and international organizations. Participants gathered to discuss the findings of the first independent evaluation of China’s pioneering effort to distribute 180 million fuel-efficient stoves to the majority of its 220 million rural households.

The National Improved Stove Program (NISP) was initiated in the 1980s by the Chinese Ministry of Agriculture with a main goal of improving the efficiency of biomass (crop residues and wood) fuel use in rural areas. Over the course of the program, which continued into the ‘90s, the issue of indoor air pollution gained prominence. Due to certain core requirements of Ministry-approved stoves, the fuel-focused program also had a significant impact on indoor air quality. The workshop’s consensus statement notes that nearly a billion Chinese citizens have benefited from lowered indoor air pollution due to the program.

The workshop was a forum to recognize the achievements of NISP, based on an independent evaluation headed by COEH’s Kirk Smith, and carried out by researchers from UC Berkeley, the Institute for Global Health of UCSF, Tsinghua University, Renmin University, and the Chinese Centers for Disease Control, and funded by the Shell Foundation.

More importantly, organizers sought to publicize the method and results of the program to other developing countries in need of effective indoor air pollution interventions, and also to other ministries within the Chinese government.

The workshop’s statement urges the Chinese government to improve on the results of NISP, noting that many serious problems remain in rural Chinese households. For example, the collection and use of poisonous coal containing fluorine and arsenic from local deposits is a growing problem. The coal is often used even in households equipped with improved biomass stoves, to fuel secondary stoves to keep water heated or warm the house. Even with normal coals, however, indoor pollution levels are often high because the use of coal stoves with chimneys is not widespread in rural areas. A concerted national program is needed to address the problems due to rural coal use, just as NISP did for biomass fuels.

Smith noted that one hopeful development in this direction has been the development of a flourishing private industry in China that is designing and producing improved stoves for coal. This entrepreneurial activity holds promise for increasing the distribution of these critical elements of an improved public health picture in China and beyond.

Smith expressed excitement, despite flaws in the stove program, about the increasingly high standards the Chinese government is establishing for indoor air quality. The workshop statement emphasized that these standards need to be met, urging that the higher standard of living evident in Chinese cities be shared with its rural inhabitants.


Children’s Health Study Findings

The Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) conducted research on the effects of pesticide exposure \textit{in utero} on the growth and gestational development of nearly 500 newborns in California’s agricultural Salinas Valley. The study had two key findings:

- There was no adverse relationship between the mothers’ exposure to organophosphate pesticides (typically used in agricultural settings) during their pregnancy and the growth of their unborn children.
- Exposure to certain pesticides, especially in the latter part of pregnancy, was associated with shorter gestational duration.

The study was one of many that CHAMACOS is doing to assess the impact of environmental exposures on children’s health in this part of California, known as the “nation’s salad bowl.”

Reporting in \textit{Environmental Health Perspectives} last July, Center Director Eskenazi, Associate Director Bradman, Kim Harley and other team members said they had “failed to demonstrate an adverse relationship between fetal growth and any measure of \textit{in utero} organophosphate exposure,” but they had found decreases in gestational duration associated with pesticide exposure. Premature births can cause serious health problems and are a leading cause of infant mortality in the U.S.

The researchers’ findings were different from those of a New York study published in the same journal that showed decreased birth weight and length among babies exposed \textit{in utero} to insecticides containing chlorpyrifos.

“Stakeholders,” continued from page 1

“I reflected on what they had said, and, as much as I wanted to tell our story, I decided that we had to tell the community first,” she said.

As a result of this exchange, CHAMACOS organized town hall meetings that drew people from throughout the valley. “Based on a questionnaire we did after the presentations, we know that people were happy to hear the results from us,” Eskenazi said.

While the reaction of her advisory board had put her in a difficult situation, she did not feel it had compromised her academic freedom. “I weigh what the board has to say, but it is advisory,” she said. “If our research team felt the concerns about a press release were not valid, we would have sent one out. But we needed to honor what was right for them and felt that informing the community first was ethically correct. In the long run, I believe the decision gave CHAMACOS more credibility in the community.”

To avoid similar dilemmas in the future, Eskenazi and her colleagues have since developed a protocol for sharing summaries of new research findings and providing advance notice when they feel that a press release may be in order.

Benefits of Participatory Research

While focusing intensely on interaction with stakeholders may seem to be at odds with research productivity, Eskenazi points to the benefits derived from this participatory approach.

“One day we were talking to growers about preventing pesticides from coming into the homes of farmworkers,” she said. “We asked them if they could have workers wash their hands in the fields at the end of the day. They said they want their workers to wash their hands, but the workers won’t do it. Then one of our community partners, a doctor who grew up in a farmworker family in the valley and had worked in the fields, told the group that, as a child, he’d been told not to wash with cold water, because cold water would give him arthritis. We could see light bulbs going off all around the table!”

CHAMACOS has since begun work with the community to introduce warm water to the fields, select the best soap for removing pesticide residues, and design clothing that workers can shed before entering their homes. The results of these interventions are not yet available, but Eskenazi argues that involving the community has provided new insights and focused the interventions so that they will be more acceptable and sustainable.

Since community-based research is very costly, she is grateful that the National Institute of Environmental Health Sciences and the U.S. Environmental Protection Agency, which fund CHAMACOS, support and advocate community outreach. “This is a growing process,” she said. “It takes years to build trust, rapport, and respect, but I really believe the effort pays off in better research.”

Joint Degree Program Blends Nursing, Public Health

UC San Francisco and UC Berkeley have established a graduate degree program combining nursing and public health. The joint MS-MPH program is designed for nurses seeking to link their clinical, administrative and research interests with public health to improve health care in the community.

Candidates for the joint degree will earn an MS degree at UC San Francisco. They will then complete an MPH at UC Berkeley’s School of Public Health. Nursing students now enrolled in fields related to MPH specialties (e.g., community and cross cultural nursing, occupational and environmental health, maternal child health, health policy) may apply in fall 2005 to enter the MPH program in September 2006. As the program matures, it is expected that candidates will be able to apply to both schools simultaneously.

“Graduate work in nursing provides advanced theory and practice in clinically-based care with a focus on the health of the individual,” said Marion Gillen, director of COEH’s Occupational and Environmental Health Nursing program.

“The new program will enable students to broaden their clinical base with a population-based, multidisciplinary perspective so that they can lead the way in meeting health care needs in community, workplace and international settings.”

Gillen, who is spearheading the new program, credits her colleagues—COEH faculty member Julia Fauccett, chair of the Department of Community and Health Systems, Mary White, professor of nursing, and Dorrie Fontaine, associate dean for academic programs—and their colleagues across the Bay—Barbara Abrams, associate dean for student affairs, Zak Sabry, professor of public health nutrition, and Dean Stephen Shortell of the School of Public Health—with the vision to create this new learning opportunity for students.

For information about the new program involving occupational, environmental and community health, contact Gillen (415-476-1382; marion.gillen@nursing.ucsf.edu). For other specialties, contact Abbey Alkon (415-476-4695; abbey.alkon@nursing.ucsf.edu).

“Risk Assessment,” continued from page 3

safety—‘Oh, drink all you want, because your water is at .8 parts per million and the standard is 1.’”

The traditional numerical approach to risk assessment is hard for the public to understand, McKone says: “I’ve been to so many meetings where somebody gives a long presentation and concludes, ‘... and your risk is 10^{-3},’ and everyone is scratching his head and asking, ‘But are we safe?’ I think it would be a very interesting experiment in risk communication if we came into a community and said, ‘We looked at what makes water unsafe, what makes water acceptable, what makes water good and what makes water very good. Your water has a high degree of match with good but not with very good.’ So people can think about what they want to do. People don’t understand the numbers—all they hear is the word, risk. If you can keep the assessment process in the domain of lay-language and away from mathematical terminology, it may be easier for people to digest.”

McKone says regulation is moving in that direction: “Many regulatory agencies are now putting a lot more narrative discussion into the risk assessment and are talking about margins of safety rather than risk. Our methodology provides yet another alternative. It allows us to articulate a range of uncertainties by putting them in categories.”

In public health, McKone says, the way you communicate information can influence the decisions you get. He doesn’t think fuzzy logic leads to radically different scientific outcomes, but he believes it can help scientists and regulators explain complex environmental challenges in a way that makes the uncertainties and the trade-offs more transparent.

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Protecting workers and communities from environmental health hazards through teaching, research, and service

The Northern California Center for Occupational and Environmental Health (COEH), a multidisciplinary program of the University of California at Berkeley, Davis, and San Francisco, promotes health and safety in workplaces and communities by:

- Educating health professionals in epidemiology, ergonomics, industrial hygiene, medicine, nursing, toxicology, and related fields to be leaders in occupational and environmental health.
- Developing new knowledge through an interdisciplinary research agenda focused on preventing illness and injury.
- Responding to the needs of people affected by hazards in their workplaces or communities, with special attention to vulnerable populations.

Through these activities COEH supports federal, state, and local agencies, health and safety professionals, industry, labor, and community-based organizations in their efforts to prevent occupational and environmental disease and injury.

COEH is an Education and Research Center (ERC) of the National Institute for Occupational Safety and Health (NIOSH).

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