The Diarrhea Dilemma

Managing Illness in Mexico

Although preventing a water supply from becoming polluted is critical, it may be even more critical to properly manage water along its path to the consumer, according to a study out of Mexico's Instituto Nacional de Salud Pública [***EHP* 110:A619–A624**]. Each year, unsafe sewage disposal and fecal–oral transmission of pathogens are responsible for 3.2 million premature deaths from otherwise preventable enteric diseases, including diarrheal diseases, says the World Health Organization. However, Enrique Cifuentes and colleagues say that water quality indicators such as microbial counts may not always accurately predict health risks. Instead, housing deficiencies, hygiene-related behavior, water storage practices, and risk perceptions must also be considered to adequately manage enteric diseases.

Pieces to the puzzle. Housing deficiencies, hygiene-related behavior, water storage practices, and risk perceptions all play a role in whether children contract diarrheal diseases.

The study focused on the community of Xochimilco, in a water reclamation area on the outskirts of Mexico City. The researchers evaluated a wide range of factors that might be linked with enteric diseases. Using self-reported data from guardians of children younger than 5 years old, the team evaluated 761 children during one wet season (November 1999–May 2000) and 732 during one dry season (June–October 2000), with 75% overlap in the children studied.

Diarrhea prevalence was 11.8% in the wet season and 10.7% in the dry season. During the dry season, children aged 1–2 years were most likely to suffer from diarrheal diseases, and children of all ages were most vulnerable when vegetables were washed only with water or with water and soap, not disinfected with chlorine; when drinking water was stored in an unprotected cistern or bucket or had a bad taste; and when children lived in crowded conditions.

They were least vulnerable during the dry season when water was available for toilet flushing; when drinking water was stored in a covered jar or protected cistern or bucket; when an inside shower was available; and when a piped water supply was available all day (which occurred in about 35% of the houses), rather than shutting down intermittently.

During the wet season, the only age distinction was that children older than 2 were less likely to suffer from diarrheal diseases, just as they were in the dry season. Children of all ages were most vulnerable when they ate food from street vendors and when drinking water had a perceptible color to it.

The researchers also found that cultural beliefs played an important role in disease incidence. Children who lived in households where the inhabitants believed that diarrhea is caused by forces such as the evil eye were more at risk than those in households that linked diarrhea with hygiene practices or contaminated food and water.

The study findings are based on households within 500 meters of five wells sampled for fecal coliform contamination, but showed no correlation between disease incidence and use of the two wells that were found to be contaminated. The neighborhoods are in an area where water reuse projects involving wastewater treatment and application as irrigation water are common and expanding, and have the potential to introduce contaminants into the water supply.

While the results of this study are consistent with similar studies conducted around the world, they are limited by a number of factors in the study design. For instance, the health, housing, and water supply data are self-reported. Data on water contamination are based on samples taken before chlorination and distribution, and do not represent the water actually consumed by the children, especially as about one-fifth to just over one-fourth (depending on the season) consumed bottled water. The researchers also assumed that the children did not drink from wells outside the study area. Despite these limitations, Cifuentes says this study provides good baseline data for assessing any future impacts of water reuse projects. **–Bob Weinhold**

Pollutants Alter Play

Another Way PCBs Affect Children

A prospective Dutch study that has tracked various health consequences of perinatal exposure to polychlorinated biphenyls (PCBs) and dioxins since 1990 continues to offer new insights into children's health [***EHP* 110:A593–A598**]. The latest assessment by the team, headed by Hestien J. I. Vreugdenhil of Erasmus University Rotterdam and Sophia Children's Hospital, finds that prenatal exposure to these pollutants can influence play behaviors that reflect sex differences.

In this latest stage of the study, 189 children, average age 7.5 years, were evaluated using the Pre-School Activities Inventory, a questionnaire asking parents about their children's play behaviors. The inventory consists of 24 questions that distinguish play behavior between the sexes by focusing on three key aspects of play—type of toys, activities, and child characteristics. Representative questions include whether a child prefers playing with tools versus playing with dolls, taking care of babies versus climbing, and avoiding dirt versus taking risks. Three scales are derived from the inventory: a feminine scale, a masculine scale, and a composite scale integrating both masculine and feminine behaviors.

Each child's perinatal exposure to 4 environmentally important PCBs was estimated from levels of the pollutants in the mother's blood, umbilical cord blood, and breast milk. Breast milk assessments also measured 17 dioxins. About half the children were breastfed for at least six weeks, which increased their exposure to the pollutants, because these pollutants are passed through breastmilk. The other half were fed formula containing no PCBs and dioxins from birth.

Boys with higher prenatal exposure to PCBs scored significantly lower on the masculine scale of play behavior, whereas girls with higher prenatal exposure to PCBs scored higher on the masculine scale. Prenatal exposure to dioxins was associated with higher scores on the feminine scale of play behavior in both boys and girls. Breastfeeding was not associated with behavioral changes, suggesting that PCBs and dioxins probably disrupt hormones related to childhood play behavior early in fetal development. However, the children's levels of steroid hormones were not measured at birth. At some later time in the study, the children will be re-evaluated to observe their sex-related behavioral development.

The authors propose that the alterations in play behavior may be due to steroid hormone imbalances caused early in development, but just how PCBs and dioxins influence steroid hormones remains unknown. The authors recommend following up with this cohort to assess potential implications of these results on later development. **–Carol Potera**

New Bone Drug Benefit

Less Skeletal Lead Released

Alendronate (trade name Fosamax) is a potent biphosphonate drug commonly prescribed to reduce or reverse the loss of bone density in postmenopausal women. In postmenopausal osteoporosis, the hormonal changes associated with menopause cause the normal balance between bone resorption (loss) and formation to be thrown off, with increased resorption resulting in less dense bones that are more prone to fracture. Biphosphonates inhibit bone resorption, allowing bones to maintain their density. Now, according to the results of a two-year pilot study conducted by a team of Australian researchers led by Brian Gulson of Macquarie University, antiresorptive therapy may also be useful in warding off the deleterious health effects of elevated blood lead levels by inhibiting lead's release from the skeleton into the bloodstream [***EHP* 110:1017–1023**].

The skeleton is the main reservoir of lead within the body. Times of physiologic stress such as menopause can result in the release of stored lead into the blood through demineralization, the same process that causes calcium to be released from bone. Previous studies have shown that menopausal and postmenopausal women tend to have higher blood lead levels than premenopausal women. This is an issue of concern because elevated blood lead levels in adults have been correlated with hypertension, decreased renal function, impaired neurocognitive function, and Alzheimer disease.

The subjects consisted of 3 premenopausal women, 2 perimenopausal women (perimenopause being the years before menopause begins when estrogen levels begin to fall), 2 postmenopausal woman, and 3 men. Each of the 10 subjects was given alendronate for 6 months. Blood and urine samples were collected monthly for 7–9 months before, 3 months during, and up to 6 months after the treatment. These samples were analyzed for markers of bone turnover (which increases during menopause) and for lead isotopes, allowing the researchers to assess the effects of the antiresorptive therapy on blood lead levels.

The subjects were recent immigrants to Australia. They were chosen to take advantage of the fact that the lead isotopic composition, or "signature," in multigenerational Australian residents is different from that of people from other countries. Thus, the migrant subjects would be expected to have blood lead signatures characteristic of their countries of origin (due to the release of stored lead from bone) as well as the Australian lead isotopes (due to environmental exposure since their arrival). By tracking changes in the ratio of these lead isotopes, the researchers were able to specifically monitor the level of blood lead coming from bone sources and thus trace the effects of alendronate on bone lead release.

As the authors had predicted, there were significant decreases in the lead isotopic ratio in the migrant subjects during the treatment period—that is, the subjects' blood lead was increasingly composed more of Australian lead—indicating that the inhibition of bone resorption by the drug was in fact reducing the release of skeletal lead. Further, the average overall blood lead levels in the migrant subjects decreased by about 20% during the treatment.

Although the number of subjects studied was small, this pilot study is still the most extensive to date of the effect of antiresorptive agents on blood lead that apparently comes from bone sources. It raises the tantalizing possibility that antiresorptive therapy, in addition to its proven effectiveness in preventing osteoporosis, could also be used in older women and men to prevent the adverse health effects associated with elevated concentrations of lead in the blood. **–Ernie Hood**

PhotoDisc

Good to the bone. Besides preventing osteoporosis, antiresorptive drug therapy may offer older patients an added benefit: lower blood lead levels.