Filling the Gap

New Data on Safety of Dental Amalgams

Controversy about the safety of dental amalgams—blends of mercury and other metals used in fillings—has been simmering for at least 150 years. An association between mercury vapor exposure and neurologic and neuropsychological deficits (such as decreased memory and attention, lowered response time, and tremor) has been documented among dentists and dental workers, who, in the course of their work, may be exposed to mercury vapor from amalgams. However, little research has been conducted on dentists' patients, who may not face occupationally elevated exposures but who have had varying numbers of dental fillings installed over the course of their lives. Could dental fillings leach mercury into people's bodies over time, eventually causing neurotoxic effects? According to a study by Pam Factor-Litvak of Columbia University and her colleagues, there is little cause for concern [***EHP* 111:719–723**].

The researchers examined 550 healthy working adults aged 30–49 years to investigate whether having fillings was associated with reduced cognitive functioning, including verbal and nonverbal memory, attention, and fine motor coordination. The subjects participated in an evaluation that included collection of urine samples to assess urinary mercury (UHg) concentrations, an oral examination to determine the type and number of fillings in each individual's teeth, a battery of standard neuropsychological tests, and a questionnaire designed to collect information about lifestyle, demographics, health history, and other pertinent characteristics.

The investigators used linear regression analyses to estimate whether there was an association between each exposure measure (UHg, total number of amalgam restorations, and number of occlusal amalgam restorations to align the upper and lower jaw) and neuropsychological test scores. The tests they administered were chosen to assess specific cognitive domains based upon reports of mercury-related neuropsychological impairments in occupational studies.

Say "ahh!" New data show that adverse effects from mercury in dental fillings are not a cause for concern.

UHg concentrations were low among the participants, ranging from 0.09 to 17.8 micrograms per gram of the waste product creatinine (compared to a typical occupational exposure range of 2.0–60 micrograms per gram creatinine). The scores of the neuropsychological tests were within the norms for the ages studied and showed the expected relationships between factors such as age, sex, education level, and employment strata. The researchers found that neither UHg itself nor counts of either total or occlusal amalgams were associated with any measure of neuropsychological deficit.

According to the literature, impairment of function may be cumulative, occurring 20–35 years after exposure, and the researchers did consider the temporal relationship between the placement of amalgams and neuropsychological performance. Although they did not collect data about the age of the amalgams, they presumed that most of the fillings were placed 10–20 years prior to the study, because most fillings are first placed in the teenage years, with relatively few installed after age 25. This conjecture seems reasonable, although the authors acknowledge that the absence of those data is a limitation of the study.

This study may not lay the issue to rest once and for all, but as the authors conclude, their results "are reassuring in that exposure to amalgam-derived Hg is not associated with detectable subtle neuropsychological deficits." **–Ernie Hood**

Septic Suburbia

Too Many Tanks Increases Disease

Throughout the U.S. countryside and in many suburban subdivisions—in fact, in one-quarter of U.S. households—septic systems are used for wastewater disposal. Mark A. Borchardt and colleagues from the Marshfield Medical Research Foundation and the Marshfield Clinic now report that septic system density is associated with acute infectious diarrhea in children in a central, rural area of Wisconsin [***EHP* 111:742–748**]. Acute infectious diarrhea remains a common illness in the United States, particularly among young children, the age group most susceptible to gastrointestinal infections.

About one-third of all private septic tanks in the study area—14 contiguous ZIP codes around the town of Marshfield—included holding tanks. Holding tanks are used on sites where the soil is unsuitable for a septic drain field. Unlike a conventional septic system, a holding tank is a sealed concrete vault that stores wastewater until it is removed by a licensed waste hauler. But in central Wisconsin, many homeowners improperly discharge wastewater from holding tanks into nearby open ditches. County officials in central Wisconsin estimate that up to 40% of all holding tanks have some illegal surface discharge. Plus, septic systems can leak if not properly maintained.

The investigators selected 153 case children with a median age of 2.2 years who were seeking medical treatment for acute diarrhea, and 274 randomly selected control children with a median age of 3.7 years. Similar proportions of case and control subjects lived in rural households with private wells and septic systems.

The children's parents answered questions on demographic information, disease symptoms, and potential risk factors or confounders for acute diarrhea. Household wells were sampled for bacterial pathogens and indicators of water sanitary quality. (The investigators did not test well water for viral pathogens during this study.)

The investigators used public property tax records to find the parcel identification number (PIN) for each case and control household. This geographic coding system specifies the location of property by section (640 acres, which is also one square mile), quarter section (160 acres), and quarter–quarter section (40 acres). These

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square land survey units are defined by fixed lines established under the federal Public Land Survey System used in 30 states.

The county sanitary permit programs for septic systems use the same PIN, so the investigators were able to match household locations with sanitary permits to determine the number and type of septic systems surrounding each household. Septic systems were classified as holding tanks, nonholding tanks (including septic field systems) less than 20 years old, and nonholding tanks more than 20 years old. Twenty years is the functional life of a septic drain field.

The researchers found that diarrheal illness correlated with higher densities of all types of septic systems surrounding homes. Viral diarrhea was associated with holding tank density per section—the largest scale—with the risk increasing by 8% with every additional tank. Bacterial diarrhea was associated with holding tank density only at the quarter–quarter section level, with the risk increasing by 22% with each additional tank. The reason for the geographic scale difference between viral and bacterial diarrhea likely lies in previous research findings showing that viruses move farther than bacteria through the environment.

Yet, surprisingly, bacterial pathogens were not found in the wells of case households. It therefore seems likely that the case children were not infected through contaminated well water, the investigators say. Instead, children in case households could have been exposed to pathogens directly released from septic tanks to the land surface surrounding their homes.

This study is important because it is the first to assess residential proximity to septic systems as a risk factor for intestinal pathogens. The U.S. Environmental Protection Agency is preparing to promulgate the Groundwater Rule, a set of measures intended to reduce disease transmission from the more than 158,000 public groundwater systems in the nation. **–John Tibbetts**

Preventing Pill Pollution

Keeping Drugs and Toiletries out of the Environment

For two decades, evidence has been growing that residues from pharmaceuticals and personal care products (PPCPs) are continually contaminating the environment. Although details of the environmental health impacts are likely to remain sketchy for some time, it's not too early to begin minimizing the potential for damage, says Christian Daughton of the U.S. Environmental Protection Agency National Exposure Research Laboratory in Las Vegas, Nevada, in a mini-monograph [***EHP*** **111:757–774; 775–785**]. Daughton hopes this first comprehensive overview of the issue will spur discussion among the many disparate players involved in PPCPs' life cycle—manufacturers, health care professionals, hazardous waste managers, drug enforcement officials, sewage treatment plant operators, water utility managers, funeral directors, veterinarians, homeland security officials, consumers, and many more. Many of these players historically have considered neither the ramifications of PPCP use nor opportunities for improvement in their production and consumption.

Daughton sets the stage for his arguments by outlining the problem, as revealed by research in the past two decades, and concluding that the myriad possible biological actions of PPCPs in air, soil, water, and groundwater are simply too complex to accurately predict. Furthermore, because some adverse health effects from PPCPs (particularly hormonally active drugs) appear to be quite possible, actions to minimize these effects should be considered. Doing so not only might reduce environmental health impacts, but also could lead to substantial cost reductions for industry and consumers, and could reduce medical problems, he says.

Daughton suggests dozens of reasonable technological, marketplace, and policy changes that could begin to steer industry, consumers, and government in a more beneficial direction. For example, he says, improved packaging could extend shelf life and reduce the amount of a product that expires and must be discarded unused. Studies could focus on improving drug absorption so that smaller doses are needed and less is excreted. And sewage overflows into storm sewers and surface waters also could be curbed. Answers to pollution from personal care products are less clear, because there has been so little research on them. But lotions, shampoos, fragrances, mouthwashes, sunscreens, and other products likely play a critical role in environmental contamination, Daughton says, because they are used in such large quantities and they readily wash off.

The pharmaceutical field also could benefit from more basic knowledge about PPCPs. For instance, basic data such as the amount of PPCPs manufactured and used is unknown, as are some of the basic facts regarding how much is metabolized, excreted, washed off, or otherwise directly disposed and leached into the environment—and possibly back into our bodies—in an altered form.

Despite such information gaps, several countries have already implemented programs that contain portions of Daughton's suggestions. Canada, Australia, France, and Italy allow consumers to return unused drugs, for instance, which reduces the load on sewage treatment systems and landfills.

If problems are to be headed off, the process should begin soon, says Daughton. He notes that the Institute of Medicine has documented a 17-year gap from the time new medical knowledge and practices are developed to the time they are widely assimiliated into practice. **–Bob Weinhold**

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Flushing away the environment? Drugs and toiletries containing hormonally active chemicals need to be kept out of sewage systems.