

Dirty diapers help researchers pinpoint fetal health risks

June 1, 2003

KALAMAZOO -- A team of researchers, up to their elbows in more than 800 sets of dirty diapers, have turned the experience into what may be some of the first conclusive evidence that environmental pollutants can impact the health and future prospects of children, even before they're born.

Western Michigan University researchers, working in cooperation with Kalamazoo's two major hospitals and Michigan State University's Kalamazoo Center for Medical Studies, have determined that a startling 50 percent of children born in the area during a 10-month period in 2002 were exposed to lead while still in the womb, and about 5 percent of babies born had already suffered lead exposure at levels typically associated with neurological problems.

Exposure in the womb to lead and other toxic chemicals was analyzed by collecting blood from umbilical cords as well as meconium samples from the first sets of diapers soiled by newborns. Meconium is the bowel discharge from infants during their first 24 to 48 hours of life and reflects the accumulation of bile secreted during the last five months of gestation.

"What we've done is develop a way to look at the earliest potential impact of substances on fetal development," says Dr. Jay Means, WMU's Gwen Frostic Professor of Environmental Chemistry and Toxicology and the lead researcher. "We know that many of these substances have their most profound effects on the developing child, but so little is known about the exposure of a significant percentage of the population to these substances. This gives us a snapshot of that exposure."

Means says the selection of meconium as a sample to be analyzed along with the cord blood helps rule out the possibility that the babies' exposure came in any way other than through the placental blood barrier.

"It's unambiguous," he says of the resulting data. "As soon as the child starts to nurse or eat from other sources, you raise the possibility of another outside source of contamination."

Beginning in March 2002, Means along with Dr. Michael Liepman, director of psychiatry research at MSU/KCMS, and their team worked with staff members at Borgess Medical Center and Bronson Methodist Hospital to collect nearly 3,000 cord blood and meconium samples from newborns. Of those samples, about 800 were complete paired samples that included both cord blood and meconium. Samples were collected after receiving anonymous informed consent agreements from mothers and were then analyzed to ascertain levels of heavy metals, pesticides, PCBs and herbicides as well as recreational and psychoactive drugs. About 200 randomly selected samples were screened to determine whether and how much of a toxic substance was transferred across the placental blood barrier.

Researchers screened the samples using two sophisticated mass spectrometer systems to determine fetal exposure to heavy metals such as lead, mercury, chromium and cadmium; toxic organic compounds like PCBs and dioxins; and such drugs as cannabis, cocaine,

methamphetamine and cotinine, which comes from nicotine. In addition to the high levels of lead exposure, researchers found a wide range of exposure to the other measured substances. For instance, PCBs and DDT, which can lead to reduced IQ and other developmental problems, were found in about 15 percent of the samples. Mercury and cadmium also showed up in 15 percent of the samples, while the tobacco-related compound cotinine was found in more than 30 percent of the samples.

But it was the high incidence of lead that stunned the team, Means says. He notes that lead exposure has been linked to mental retardation, seizures, delays in motor development, kidney disease, and problems with bone and tooth development. Means says that their measurement tool--the inductively coupled plasma-mass spectrometer--allows researchers to measure lead in infinitesimal amounts that are far below the levels at which exposure is considered dangerous, according to federal guidelines. But unlike other tools, this one identifies lead with complete certainty. Its presence in so many of the samples is troubling, he says.

The team completed an initial round of sample collections at the end of 2002 and, with the results of the analysis in hand, a new round of research is about to begin. The first round was completed on a small budget put together with funds from the WMU Office of Research, the Kalamazoo County Healthy Babies, Healthy Start program, the National Science Foundation and MSU/KCMS. The project owes its initial success to what Means calls "excellent cooperation from the hospitals and the tireless efforts of a dedicated group of undergraduate student researchers."

An anonymous \$110,000 grant to WMU's Environmental Institute will help Means launch a new round of research. Goals for the new round include expanding the number of infants from whom complete samples are collected; relating the patterns of exposure to geographical, demographic and dietary data; and adding gene expression analysis to the tests run on the samples to determine which genes show signs of being activated or repressed by exposure to the various toxic chemicals. He also plans to add other substances of concern to the list of those being studied--like polybrominated diphenyl ether, commonly known as PBDE, a synthetic fire retardant chemical used in textiles.

The collection of data about demographics and diet will help pinpoint the source of exposure, says Means, and the zip code data will allow his team to cross reference their data with known pollution "hot spots" being documented by WMU's Great Lakes Center for Environmental and Molecular Sciences.

One last change to the research protocol would ease the scientists' concern, but to accomplish it, the team may have to avoid analyzing samples for illegal substances. Because of the possibility of finding traces of illegal substances, the blood cord and meconium samples were collected anonymously.

"Without anonymity, state requirements to report children who have been exposed to drugs of abuse during pregnancy would make it impossible to get cooperation from mothers who abuse drugs," notes Mean's research colleague Liepman.

But because the samples are collected anonymously, researchers now have no way to provide

feedback to parents whose children may be at risk from high exposure levels.

"That's disturbing," Means says. "Ideally we'd like to inform them of the problem so they can seek help. And, we'd like to follow up with additional testing of the children down the road and the involvement of other professionals who can help, like speech pathologists and those with neurological expertise."

Liepman agrees and sees a world of potential benefit from the project.

"It is possible we have stumbled upon the cause for a lot of learning problems, such as dyslexia and attention deficit disorder and other behavior problems of children in our schools," Liepman speculates.

Media contact: Cheryl Roland, 269 387-8400, cheryl.roland@wmich.edu

WMU News
Office of University Relations
Western Michigan University
1903 W Michigan Ave
Kalamazoo MI 49008-5433 USA
269 387-8400

<http://www.wmich.edu/wmu/news>