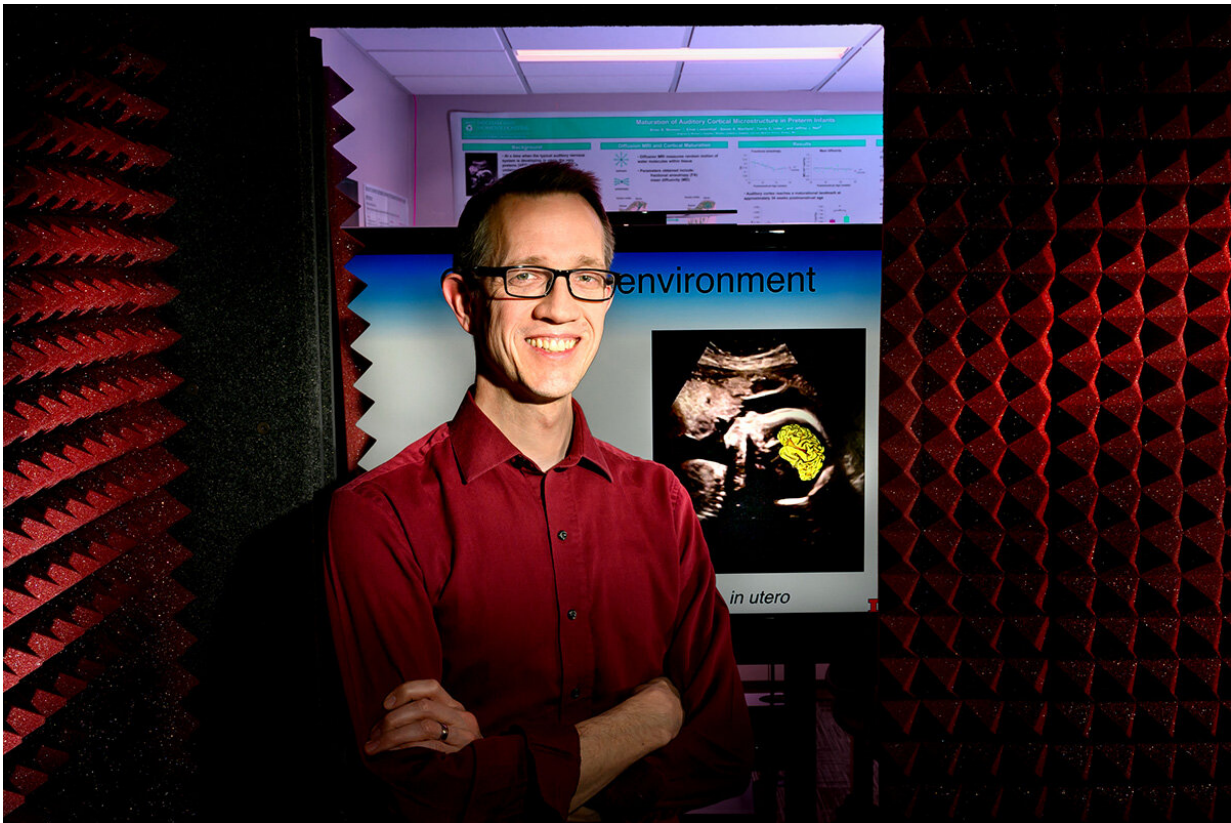


Study compares third-trimester sound exposures in fetuses, premature infants

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Speech and hearing science professor Brian Monson led a study comparing the sound exposures of fetuses in the last 16 weeks of pregnancy with their age-matched premature peers. Credit: Fred Zwicky

A new study is the first to compare the sound exposures of fetuses in the

last 16 weeks of pregnancy with their age-matched premature peers. The analysis reveals profound differences in their exposures to noise, language and the biological sounds of the mother, with implications for the infants' development.

The findings are reported in the *Journal of Pediatrics*.

Along with the other challenges that come with being born early, premature infants are exposed to a completely different [sound](#) landscape than fetuses that remain in the womb for the full course of pregnancy, said University of Illinois Urbana-Champaign speech and hearing science professor Brian Monson, who led the study with researchers and clinicians at Carle Foundation Hospital in Urbana. The study will help clinicians develop ways to give [preterm infants](#) sound exposures more like those of fetuses, he said.

"The intrauterine environment is unique, with constant, primarily low-frequency sounds of the mother's cardiovascular and digestive systems and voice transmitted to the fetal ear via amniotic fluid," the researchers wrote. "Also present are others' nearby vocalizations, music and other airborne sounds that impinge on the abdomen of the mother."

In contrast, infants in hospital neonatal intensive care units are often exposed to a variety of electronic and mechanical sounds, including the beeps of alarms. They are exposed to language, but only when nurses or parents are speaking nearby. Before this study, the evidence and informal observations suggested that premature infants hear much less language over the course of the day than their counterparts still in the womb.

Previous studies have taken only a cursory look at the differences, however, Monson said. For example, some collected sound-exposure data only at a couple of time points over the course of a premature

infant's stay in the NICU. Some studies compared premature infant exposures with those of full-term newborns, rather than tracking exposures in the womb to capture the same developmental window in each group.

Earlier research has found that preterm infants who spend several weeks in hospital NICUs often lag behind age-matched full-term infants in [language acquisition](#) and other neurodevelopmental milestones in [early life](#), the researchers report. Auditory function begins in the [fetus](#) as early as 23 weeks of gestation, Monson said. Later in the pregnancy, a fetus with healthy auditory function will begin to recognize the voice or language of its mother.

In the new study, Monson and his colleagues analyzed more than 23,000 hours of auditory exposure data collected from 27 typically developing fetuses and 24 preterm infants. The study gathered the "extrauterine" sound exposures of fetuses by asking their mothers to wear 24-hour audio-recording devices twice per week for up to 14 weeks in the third trimester of their pregnancies. The team also recorded 24-hour NICU sound-exposure data three times per week for each premature baby in the study.

Using an automated algorithm, the researchers analyzed the data to look for differences in the extent and types of sound exposures experienced by fetuses in utero and [premature infants](#) in the NICU.

"We found a fivefold increase in nearby language exposure per day for fetuses relative to preterm infants," Monson said. "That, to me, is an alarming difference."

The two groups also differed in the amount of silence and noise they heard, and in the timing of these sound exposures. Deprived of the sounds normally heard in the womb, "very preterm infants also spend

long periods in silence, a condition that never occurs in utero," the researchers wrote.

"Replacing the language exposure were sounds like mechanical noise and alarms from essential equipment in the NICU," Monson said.

For NICU infants, the sound exposures were evenly distributed throughout a 24-hour period, whereas fetuses experience a much more pronounced day/night cycle of sounds. Remedying this difference may allow the preterm infants to establish a healthy circadian rhythm, Monson said.

"This is a time of life when the auditory nervous system is anticipating healthy sound exposures in order to mature properly," Monson said.

"These differences could be having negative effects on these tiny infants and their developing brains."

More information: Brian B. Monson et al, Language exposure for preterm infants is reduced relative to fetuses, *The Journal of Pediatrics* (2023). [DOI: 10.1016/j.jpeds.2022.12.042](https://doi.org/10.1016/j.jpeds.2022.12.042)

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