

# Make Fetal Noise Protection Part of Audiology Care

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**H**igh noise levels can lead to hearing loss and developmental consequences for fetuses and newborns. Given that the impact of minimal hearing loss on educational, social, and emotional development are well-known, a closer review of the noise exposures of pregnant women and newborn babies should be part of audiological care and counseling.

In 1997, the American Academy of Pediatrics Committee on Environmental Health reported the potential for noise-induced hearing loss and other health effects in fetuses and newborns (*Pediatrics* 1997;100[4]:724-727).

More recently, research on noise exposure of preterm infants in the neonatal intensive care unit has shown adverse effects for hearing, brain development, and physiological changes (*Ann N Y Acad Sci* 2012;1252:17-24).

Other than animal studies and consensus group recommendations, though, recent literature on fetal noise exposure is seriously lacking. However, the paucity of data does not mean the fetus is safe from these risks.



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For example, exposure to industrial and recreational noises (e.g., race cars, airplanes, processing equipment, firearms, and loud music and entertainment venues) should be analyzed for potential overexposure.

As Charlene Krueger and coauthors say, the fetus should not be exposed to intense or sustained sound because of the relationship with hearing damage and with cortisol, lactogen, and chromosomal abnormalities, as well as with abnormal social behavior following birth (*J Obstet Gynecol Neonatal Nurs* 2012;41[2]:166-170).

To protect the fetus, study groups have advised separating noise exposure from acceptable limits of sound. Basic recommendations based on Occupational Safety and Health Administration

(OSHA) standards may be the most prudent but are not necessarily fully protective.


For example, the fetus is exposed to the mother's voice at approximately 80 dB. Activities of daily living reach this level, with an occasional peak value that is even higher. These noise sources, including the occasional in utero MRI or the acoustic stimulation test, have been shown to have no effect on the fetus.

Noise that is clearly damaging exceeds 80 dB and has different characteristics—chronic and steady state or impulsive.

For example, firearm noise is primarily a low-frequency event, with high intensities transmitted to the fetus. There is a risk for the pregnant police officer and fetus, even without the comorbid effects of lead dust (*Clin Occup Environ Med* 2003;3[3]:641-648).

In shift work where high noise is continuous for hours, the exposure to the pregnant woman and fetus also can represent overexposure (*J Occup Environ Med* 1995;37[8]:945-950).

Recommendations for safe sound exposure in the fetus and preterm infant suggest containing noise exposure to limit the potential negative effects on neuroplasticity and maturation.

Counseling parents on acceptable limits of noise exposure from the prenatal and infant stages through adulthood is an important part of hearing conservation in audiological care. 

## WITHIN ACCEPTABLE LIMITS

The fetal brain develops at amazing speed, with 250,000 neurons replicated per minute. The connections occur so rapidly that by the 24th week of gestation, the auditory system is functional.

Unlike that of mature terrestrial beings, the fetus's hearing is primarily low frequency, with sound transmitted via bone conduction through the outer and middle ear's fluid-filled cavities or the skull (*J Perinatol* 2000;20[8 pt 2]:S20-S30).

The aquatic environment transfers low-frequency signals to the inner ear without attenuation, resulting in a rich intrauterine sound environment.

Consequently, mechanical damage to the inner and outer hair cells in the middle and apical turns of sacrificed fetal sheep cochlea has been demonstrated following intense noise exposure (*Ear Hear* 1999;20[1]:21-32).

Noise also has been reported to create secondary effects on the pregnant woman and fetus as circadian rhythms, blood pressure, and other physiological aspects are altered by stress.

Recommendations for pregnant women, including those from the U.S. Navy and the Mayo Clinic, have suggested that high noise levels be limited.



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