No evidence of hidden hearing loss from common recreational noise: study

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Exposure to loud noises during common recreational activities is widely cited as a cause of "hidden hearing loss." A new study of young adults, however, finds that while hearing is temporarily affected after attending a loud event, there is no evidence of auditory nerve injury or permanent hearing difficulties. The study is the first to look for a causal relationship between recreational noise exposure and auditory function in humans.

Rodent studies have suggested that loud noises can permanently damage nerve and hair cells in the ear, even if there is no permanent change to threshold sensitivity—that is, is the level below which certain sounds cannot be detected. Such neural injury is often called hidden hearing loss as it cannot be detected by standard hearing tests, which look for a permanent threshold shift.

These studies raised alarm about potential hidden hearing loss in humans—and more recently, whether typical recreational noise can cause such damage.

"The rodent studies serve as the basis for concern that adolescents and young adults may be at risk of neural injury from dance parties, listening to music on personal headphones, and other common activities," explains Dr Colleen Le Prell, a Professor of Hearing Science at the University of Texas at Dallas, USA. "However, the level of noise exposure in these rodent studies was very high. Later studies with a lower noise exposure showed reduced or no neural injury."

Given the worrying implications of hidden hearing loss caused by recreational noise, Le Prell and her team assessed neural function and hearing performance in young adults before and after attending a loud recreational event. Different people attended different types of events, which included a concert, a multi-day music festival, a bar with live or electronic music, and a movie. The team also looked for any relationship between the participants' history of noise exposure in the previous 12

months and their baseline "before" assessments.

The study, published in open-access journal *Frontiers in Neuroscience*, is the first to prospectively monitor potential hearing change: Previous studies have only examined this retrospectively based on self-reported noise exposure history. In another first, the participants used a smartphone app to measure the sound level during the recreational event. The tests included assessments of middle ear, cochlear and auditory nerve function, determination of the hearing threshold level, and a Words-in-Noise test to evaluate how well the participants could understand speech in background noise.

The team did not find any statistically significant relationship between retrospective recreational noise history and neural function. While a temporary threshold shift was observed within 24 hours of attending the recreational event, the effect was generally small and had disappeared one week later. Similarly, while Words-in-Noise performance was lower one day after the event, there was no significant effect one week later. There was also no evidence of neural injury following the recreational event, either within 24 hours of the event or one week later.

"Despite multiple calls for alarm in the media and in the scientific literature, we found no evidence that typical recreational noise exposure is associated with permanent decreased auditory nerve function or poorer understanding of speech when there is background noise," says Dr Le Prell.

This does not mean that all recreational loud noise is safe, however. Other studies suggest that firearm users, for example, are almost certainly likely to be at risk for neural injuries.

"We do not know where risk begins in humans for acute recreational noise exposure or for acute high-level exposure," says Dr Le Prell. "We

also do not know how, or if, the risk of injury changes with frequent, repeated noise exposure, such as chronic daily exposure in a loud working environment."

She advises that anyone experiencing temporary hearing changes or "ringing" in their ears (tinnitus) should protect their hearing in future loud situations.

The study suggests that hearing-in-noise tests may be more sensitive for detecting hearing loss than the current gold standard of testing for permanent threshold shifts.

"If future studies show that hearing-in-noise is the earliest auditory deficit to emerge following exposure to loud noises, then testing for this instead of threshold shifts may allow earlier detection of noise injury," says Dr Le Prell.

"This is extremely relevant for occupational noise regulations and monitoring. Hearing-in-noise tests may also be more appropriate for measuring the safety of recreational events, as well as for assessing new otoprotective drugs," she says.

More information: Sarah K. Grinn et al, Hidden Hearing Loss? No Effect of Common Recreational Noise Exposure on Cochlear Nerve Response Amplitude in Humans, *Frontiers in Neuroscience* (2017). DOI: 10.3389/fnins.2017.00465

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