

## ABSTRACT

Listen up! Excessive noise exposure is the most common preventable cause of hearing loss (Alberti et al., 1979). According to the World Health Organization in 2020, approximately 34 million children around the globe experience debilitating hearing loss, and 60% of this hearing loss could be prevented. Moreover, 1.1 billion children are at risk of hearing loss as a result of acoustic trauma from extreme noise exposure. The purpose of this evidence-based review paper is to evaluate findings from scholarly literature on noise-induced hearing loss in the pediatric population.

There has been significant research done on noise-induced hearing loss in the pediatric population. An extensive review of the literature suggests that excessive exposure to loud levels of noise can lead to noise-induced hearing loss and result in debilitating, irreversible consequences. First, the evidence for an increase in noise-induced hearing loss among the pediatric population is reviewed. Then, the vulnerability and causes of noise-induced hearing loss in the pediatric population are discussed. Next, the symptoms and consequences of noise-induced hearing loss are evaluated. Finally, practical advice on hearing loss prevention for the pediatric population and future intervention strategies are discussed.

Multiple findings from this evidence-based review have shown that hearing protection, parental mediation, early intervention and the use of different educational and public health prevention strategies will help to reduce the consequences of noise-induced hearing loss among the pediatric population.

## VULNERABLE POPULATIONS

Vulnerable populations susceptible to noise exposure include:

- Pre-term infants in the Neonatal Intensive Care Unit (NICU); Almadhoob, 2020)
- Infants and young children on ototoxic medication (Carvalho et al., 2005)
- Children with learning/attention difficulties (Carvalho et al., 2005)
- Children frequently exposed to loud sounds (Tamburlini et al., 2020)



Figure 2. Pre-term Infant in the NICU

Many studies have examined the effects of continuous noise exposure to infants in the NICU. Moreover, pre-term babies must cope with the loud environment in the NICU with immature organ systems. The last stages of maturation occur, in part, during the time the pre-term child is in the NICU (Brandon, 2008). As a result of these environmental and developmental factors, hearing impairment has been diagnosed in 2% to 10% of pre-term infants as compared to only 0.1% of the general pediatric population (Brandon, 2008).

## PREVENTION STRATEGIES TO REDUCE NIHL IN THE PEDIATRIC POPULATION

Strategies to reduce the risk of noise induced hearing loss in the pediatric population have been suggested by several authors (Almadhoob, 2020; CDC, 2020; Kornak, 2020) and include:

### Parental Interventions

- Keep your child away from sounds over 85 dB
- Create a quiet home for your child by setting TV to low volume, buying quiet toys, keeping window/doors closed
- Encourage your child to use earplugs or earmuffs

### Educational Interventions

- Teaching safe listening habits
- Discuss environments where hazardous levels of noise may exist
- Demonstrate hearing protection utilization
- Reduce technology sound signals Ex. Dangerous Decibel Program & Cheers for Ears Program

### Public Health Interventions

- Raising awareness about the risks, developing and enforcing relevant legislation
- Encouraging children to use personal protective devices such as earplugs and noise-cancelling earphones
- Ex. Make Listening Safe Initiative (WHO, 2020)

### Use of Hearing Protection

- Reduces the level of sound that reaches inner hair cells by 15-30 dB
- Hearing protection levels vary by their Noise Reduction Rating (NRR)
- Higher the NRR = greater the protection
- Ex. NRR of 22 reduces harmful noise by 22 decibels, therefore a 100 dB noise would be reduced to a safe level of 78 dB

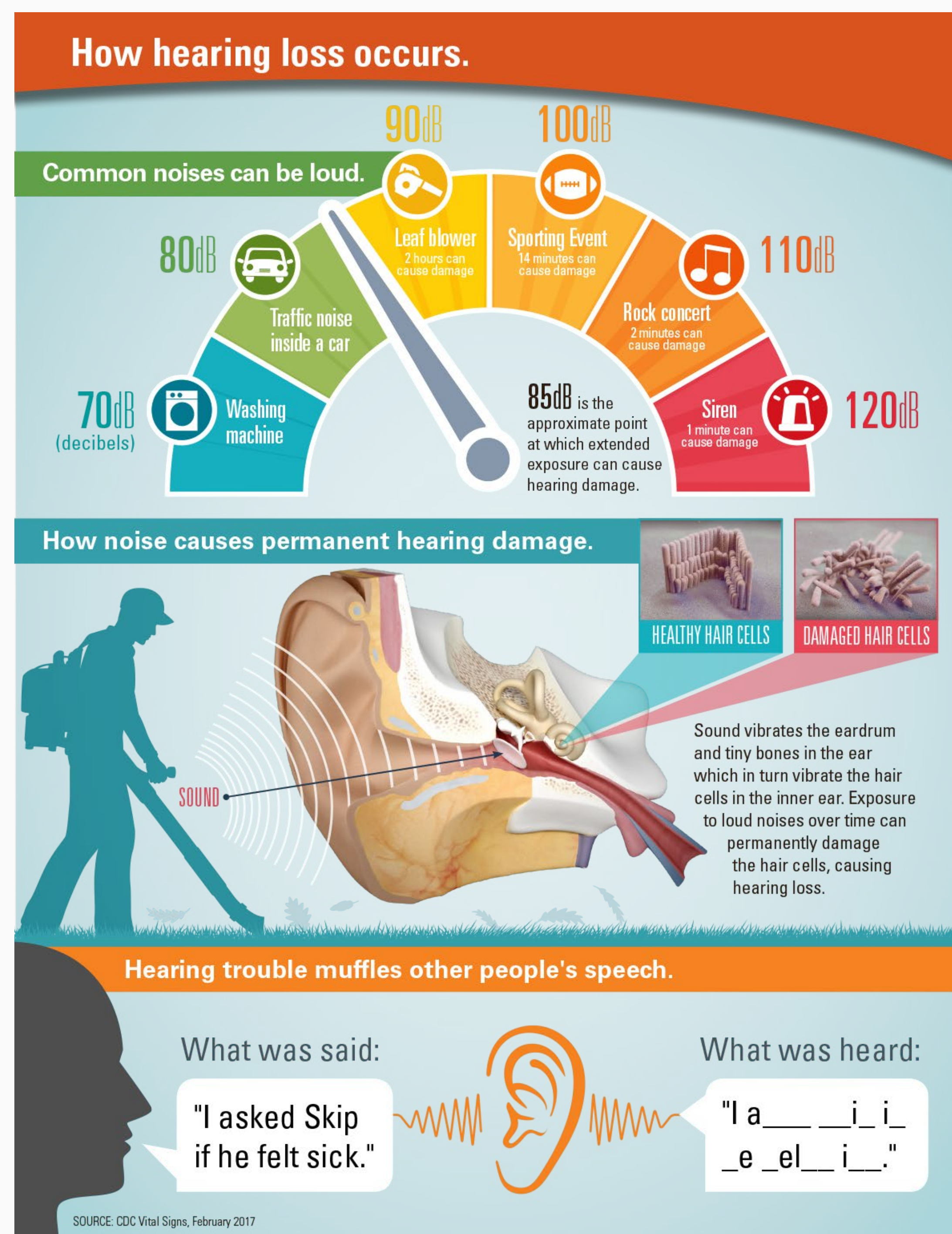


Figure 1. How Noise Induced Hearing Loss Occurs

## NOISE-INDUCED HEARING LOSS IN PEDIATRICS

Excessive noise exposure is the most common preventable cause of hearing loss (Alberti et al., 1979).

- Reportedly, 1.1 billion children are at risk of hearing loss as a result of acoustic trauma from extreme noise exposure (WHO 2020).
- Approximately 12.5% of the pediatric population have suffered irreversible hearing damage as a result of noise-induced hearing loss (CDC, 2020)

## STRATEGIES TO REDUCE SOUND LEVELS IN THE NICU

Almadhoob & Ohlsson (2020) suggested several strategies for reducing sound levels in the NICU to 45 dB SPL or less (APA, 1997):

- Treating infants in the NICU to a private room
- Use incubators with sound level controls
- Reducing the sound levels that reach the infant by using earmuffs or earplugs

## BENEFITS OF REDUCED SOUND LEVELS IN THE NICU

Almadhoob & Ohlsson (2020) suggest reduced noise levels resulting in the following:

- Less stress on the cardiovascular, respiratory, neurological, and endocrine systems
- Promotion of growth
- Diminished adverse neonatal outcomes



Figure 3. Pediatric Earmuffs to Reduce Noise Exposure

## REFERENCES

- American Academy of Pediatrics. (1997). Noise: A hazard for the fetus and newborn. *Committee on Environmental Health*, 100(4), 724-27. Retrieved from <https://doi.org/10.1542/peds.100.4.724>
- Almadhoob, A., & Ohlsson, A. (2020). Sound reduction management in the neonatal intensive care unit for preterm or very low birth weight infants. *Cochrane Database of Systematic Reviews*, 1, CD010333. DOI:10.1002/14651858.CD010333.pub2
- Brandon, D. H. (2008). Effect of environmental changes on noise in the NICU. *Advances in Neonatal Care*, 8(5), S5-S10. DOI:10.1891/0730-0832.26.4.213
- Centers for Disease Control and Prevention. (2020). Preventing noise-induced hearing loss. Retrieved from <https://www.cdc.gov/ncbddd/hearingloss/noise>
- Kornak, J. (2020, August 12). Teaching children about dangerous decibels. *ASHA Leader*. Retrieved from <https://leader.pubs.asha.org/doi/10.1044/leader.LML.25082020.28/full/>
- World Health Organization. (2020, March 1). Deafness and hearing loss. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss>