

NOISE-INDUCED HEARING LOSS

Hearing Loss Caused by Exposure to Occupational and Recreational Noise; Does Not Include Tinnitus or Acoustic Trauma

For Hearing Injuries, see “Hearing Injuries” case definition.

Background

This case definition was developed by the Armed Forces Health Surveillance Center (AFHSC) for the purpose of epidemiological surveillance of noise-induced hearing loss (NIHL) caused by exposure to recreational and occupational noise. This case definition is intended to capture cases of NIHL only. It is not intended to capture *hearing injuries* as described in the case definition developed by the Army Institute of Public Health.

Hearing loss due to occupational noise is preventable and has been the leading cause of disability compensation claims among military veterans.¹ The highest rates of hearing loss diagnoses are found in combat-related occupations (e.g., infantry, artillery, seamen, aircrew) and are usually associated with noise exposure during military operations.^{2,3} Whether permanent or temporary, NIHL can significantly degrade the health, well-being, and operational effectiveness of service members.

Clinical Description

Noise-induced hearing loss is a sensorineural hearing deficit that begins at the higher frequencies (3,000 to 6,000 Hz) and develops gradually as a result of repeated exposure to excessive sound levels. Although the loss is typically symmetric, noise from sources such as firearms or sirens may produce an asymmetric loss. Exposure to potentially harmful sound levels may occur in the workplace⁴, during recreational activities (e.g., snowmobiling, motorcycle riding) and during exposure to other nonoccupational sources of noise (e.g., chain saws, power tools, amplified music).⁵

Clinically, NIHL begins with a temporary threshold shift (TTS), with the extent of the shift related to noise intensity, frequency, and duration of exposure. A major risk factor for NIHL is prolonged, unprotected exposure to levels of noise above 85 decibels adjusted (dBA).⁶ High frequency noise is more damaging than low frequency noise and continuous noise is often more damaging than intermittent noise.⁷ Intermittent impulse noise from certain machinery can also be very damaging.

¹ Army Medical Surveillance Activity. Noise-Induced Hearing Loss among Men- US Armed Forces, 1998-1999. *Monthly Surveillance Monthly Report (MSMR)*. 2001 March; 7(3): 12-15.

² Bender DR, Mueller HG. Military noise induced hearing loss: incidence and management. *Mil Med*. 1981;146(6):434-7.

³ Health status of Vietnam veterans. II. Physical Health. The Centers for Disease Control Vietnam Experience Study. *JAMA*. 1988;259(18):2708-14.

⁴ Occupational noise-induced hearing loss. ACOEM Noise and Hearing Conservation Committee. *J Occup Med*. 1989;31:996.

⁵ Meyer-Bisch C. Epidemiological evaluation of hearing damage related to strongly amplified music (personal cassette players, discotheques, rock concerts): high definition audiometric survey on 1,364 subjects. *Audiology*. 1996;35:121-42.

⁶ The dBA level that results in noise-induced hearing injury varies in the literature. DODI 6055.12 (Hearing Conservation Program) cites 85dBA as the action level and recommends workplace noise be reduced to levels below 85dBA. OSHA's permissible noise exposure limit (PEL) is 90dBA for an 8 hour work day. The National Institute for Occupational Safety and Health (NIOSH) recommends noise exposure in the workplace be controlled to a level below 85dBA.

⁷ Pourbakht A, Yamsoba T. Cochlear damage caused by continuous and intermittent noise exposure. *Hear Res*. Apr 2003; 1781 (1-2): 70-78.



Hearing loss due to noise can be temporary or permanent and may be associated with tinnitus (ringing in the ears).

Case Definition and Incidence Rules

For surveillance purposes, a case of noise-induced hearing loss is defined as:

- *One hospitalization or outpatient medical encounter* with any of the defining diagnoses of noise-induced hearing loss (see ICD9 code list below) in *any* diagnostic position.

Incidence rules:

For individuals who meet the case definition:

- The incidence date is considered the date of the first hospitalization or outpatient medical encounter that includes a defining diagnosis of noise-induced hearing loss.
- An individual is considered an incident case only *once per lifetime*.
- If analysis requires counts of individuals with an incident diagnosis in a specific hearing loss category, an individual is allowed one incident event per category per lifetime.

Exclusions:

- None

Codes

The following ICD9 codes are included in the case definition:

Condition	ICD-9-CM Codes	CPT Codes
Sensorineural hearing loss	389.10 (sensorineural hearing loss, unspecified) 389.11 (sensory hearing loss, bilateral) 389.15 (sensorineural hearing loss, unilateral) 389.16 (sensorineural hearing loss, asymmetrical) 389.17 (sensory hearing loss, unilateral) 389.18 (sensorineural hearing loss, bilateral)	NA
Noise-induced hearing loss	388.10 (noise effects on inner ear, unspecified) 388.12 (noise induced hearing loss)	
Significant threshold shift	794.15 (nonspecific abnormal auditory function studies)	



Development and Revisions

- This case definition for noise-induced hearing loss was developed in 2012 by the AFHSC Surveillance Methods and Standards (SMS) working group for the purpose of epidemiological surveillance of noise-induced hearing loss (NIHL) caused by exposure to recreational and occupational noise. The case definition was developed based on reviews of the ICD9 codes, the scientific literature, and previous AFHSC analyses.

Case Definition and Incidence Rule Rationale

- The case definition and incidence rules may be modified to address unique questions requiring special analyses.

Code Set Determination and Rationale

- This code set differs from that used for surveillance of noise-induced hearing *injury* (NIHI) in that it does not include the following ICD9 codes for tinnitus and acoustic trauma: 388.30 (tinnitus, unspecified), 388.31 (subjective tinnitus), 388.32 (objective tinnitus) and 388.11 (acoustic trauma, explosive, to ear) The outcome of interest for this case definition is hearing loss, not other effects of excessive acoustic pressure and trauma (see *Comments* section for additional information).
- ICD9 codes 389.1x (sensorineural hearing loss) includes hearing loss with a wide variety of causes, (e.g., genetic and disease causes). The codes are not specific to noise-induced hearing loss and are used widely by audiologists to describe hearing loss regardless of the actual cause. As such, inclusion of this code in the case definition may capture cases of hearing loss that are not related to noise and may not be “true cases” of NIHL. This should, however, be an unusual occurrence in a healthy, working, military population that has undergone medical screening and evaluation prior to acceptance into the uniformed services.
- The ICD9 codes in the code set do not allow researchers to distinguish between temporary and permanent hearing loss. Therefore, some cases captured may be temporary cases and not “true cases” of permanent NIHL.

Reports

None

Review

Dec 2012	Case definition reviewed and adopted by the AFHSC Surveillance Methods and Standards (SMS) working group.
Aug 2012	Case definition developed by AFHSC MSMR and SMS working group staff.

Comments

Noise Induced Hearing Loss versus Acoustic Trauma: Current literature on damage to the cochlear structures is separated into distinct categories: noise-induced hearing loss and acoustic trauma. These categories may seem to overlap because acoustic trauma produces NIHL. However, an understanding of the anatomical consequences of the two shows that the modes of injury are quite different.

NIHL refers specifically to an injury that is caused by repeated exposures to moderate or high-intensity noise. The noise may initially cause only a temporary threshold shift (TTS), but at some point, the injury may become a permanent threshold shift (PTS). This type of hearing loss, regardless of the



frequency of the noise that caused it, usually begins audiometrically at 3000-6000 Hz and spreads to both higher and lower frequencies. The mode of destruction is more subtle, and the auditory effects evolve more slowly, than with acoustic trauma.

Acoustic trauma refers to injury that is caused by impulse or impact sounds of short duration and high intensity, which produce immediate, permanent hearing loss. The mode is mechanical. All structures of the ear are vulnerable to mechanical damage, but the most susceptible is the organ of Corti. Mechanical trauma to the auditory system usually produces both PTS and TTS components, but some audiometric recovery (of the TTS component) may occur over a period of weeks.⁸

⁸ Donahue AM, Ohlin DW. Noise and the impairment of hearing. (Chapter 7) In: Deeter DP, Gaydos JC, eds. *Occupational Health: The Soldier and the Industrial Base*. Bethesda, MD: Borden Institute, Office of the Surgeon General, Department of the Army; 1993:207-252.

