Hearing Loss Prevention

AUD 7228.001.17S, SPRING 2019

Syllabus updated 10 January 2019

Course Information

Time: Wednesday, 4:00 p.m. – 6:00 p.m.
Location: Callier Dallas, B108
Course Credits: 2

Professor Contact Information

Instructor: Colleen Le Prell, Ph.D.
Telephone: 214.905.3018
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Office Hours: Monday 10 am – 12 pm
and by appointment

Pre-requisites, Co-requisites, and/or Other Restrictions: AUD enrollment or permission of instructor

Course Description

This course covers the effects of noise on the inner ear, hearing conservation and industrial audiology, and recreational/leisure noise. Key content areas include: 1) the scientific data regarding how noise damages the inner ear, 2) federal regulations that have been put in place to protect worker hearing, and 3) emerging data that may guide changes in regulations in future years.

Upon successful completion of this course, students will be able to:

1) Identify important elements of the OSHA Hearing Conservation Amendment, CFR 1910.95
2) Summarize recommendations of NIOSH, and identify important differences from OSHA
3) Demonstrate functional knowledge of noise survey techniques
4) Describe processes by which noise destroys hearing
5) Calculate percentage of hearing impairment
6) Allocate hearing loss due to noise and to age

ASHA Competencies Addressed in this Course:

Standard IV-A Foundations of Practice

The applicant must have knowledge of:
A3. Normal aspects of auditory physiology and behavior over the life span
A7. Effects of hearing loss on communication and educational, vocational, social, and psychological functioning
A8. Effects of pharmacologic and teratogenic agents on the auditory and vestibular systems
A10. Pathologies related to hearing and balance and their medical diagnosis and treatment
A11. Principles, methods, and applications of psychometrics
A12. Principles, methods, and applications of psychoacoustics
A13. Instrumentation and bioelectrical hazards
A18. Principles and practices of research, including experimental design, statistical methods, and application to clinical populations
A19. Legal and ethical practices (e.g., standards for professional conduct, patient rights, credentialing, and legislative and regulatory mandates)

A23. Principles, methods, and applications of acoustics (e.g., basic parameters of sound, principles of acoustics as related to speech sounds, sound/noise measurement and analysis, and calibration of audiometric equipment), as applicable to:

a. occupational and industrial environments
b. community noise
c. classroom and other educational environments
d. workplace environments

A24. The use of instrumentation according to manufacturer's specifications and recommendations
A25. Determining whether instrumentation is in calibration according to accepted standards

Standard IV-B: Prevention and Identification

The applicant must have the knowledge and skills necessary to:
B1. Implement activities that prevent and identify dysfunction in hearing and communication, balance, and other auditory-related systems
B2. Promote hearing wellness, as well as the prevention of hearing loss and protection of hearing function by designing, implementing, and coordinating universal newborn hearing screening, school screening, community hearing, and occupational conservation and identification programs
B3. Screen individuals for hearing impairment and disability/handicap using clinically appropriate, culturally sensitive, and age- and site-specific screening measures

Standard IV-C: Assessment

The applicant must have knowledge and skills in:

C2. Assessing individuals with suspected disorders of hearing, communication, balance, and related systems
C3. Evaluating information from appropriate sources and obtaining a case history to facilitate assessment planning
C5. Conducting and interpreting behavioral and/or electrophysiologic methods to assess hearing thresholds and auditory neural function
C7. Conducting and interpreting otoacoustic emissions and acoustic immitance (reflexes)
C9. Evaluating functional use of hearing
C10. Preparing a report, including interpreting data, summarizing findings, generating recommendations, and developing an audiologic treatment/management plan

Standard IV-F: Education/Research/Administration

The applicant must have knowledge and skills in:

F1. Measuring functional outcomes, consumer satisfaction, efficacy, effectiveness, and efficiency of practices and programs to maintain and improve the quality of audiologic services
F2. Applying research findings in the provision of patient care (evidence-based practice)
F3. Critically evaluating and appropriately implementing new techniques and technologies supported by research-based evidence
F4. Administering clinical programs and providing supervision of professionals as well as support personnel

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Required Textbooks

- Hearing Conservation: in Occupational, Recreational, Educational, and Home Settings (2012). Vishakha Waman Rawool, Thieme Publishing. ISBN (Americas): 9781604062564.
- Noise-Induced Hearing Loss: Scientific Advances (2012). Le Prell, C.G.; Henderson, D.; Fay, R.R.; Popper, A.N. (Eds.) Springer; ISBN 978-1-4419-9522-3.
    - *The University of Texas library system has an electronic subscription which provides UTD students with free access to this book. All chapters are provided electronically.*

Required Regulatory and Guidance Documents

- Federal Regulations 29 CFR 1910.95 on OSHA website, with Appendices (A-I). Available at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735
- Occupational Noise Exposure Criteria Document. NIOSH Publication number 98-126, 1998. Available at: http://www.cdc.gov/niosh/docs/98-126/

Other readings as assigned in class and in e-learning – see electronic course reserve system

Date	Topic	Assigned Reading
01/16	**Introduction to NIHL and Current Federal Noise Regulations (OSHA) and Recommendations (NIOSH)**	• Suter, AH. 2010. Manual of Hearing Conservation. Council for Accreditation in Occupational Hearing Conservation, 4th edition. Chapter 6: Standards and Regulations, pp 34-56 • Federal Regulations 29 CFR 1910.95 on OSHA website, including Appendices (A-I), at http://www.osha.gov/ • Occupational Noise Exposure Criteria Document. NIOSH Pub. number 98-126, 1998. Foreword (iii-iv); Abstract (v); Glossary (xii-xv); Chapter 1 (Recommendation for a Noise Standard, pp 1-10); Chapter 2 (Introduction, pp 11-18). Available at http://www.cdc.gov/niosh/docs/98-126/
01/23	**Physiological Mechanisms of Noise Insult**	• Noise-Induced Hearing Loss: Scientific Advances (2012). Chapter 5: Noise-Induced Structural Damage to the Cochlea, pp 57-87 (B. Hu). • Wang Y, Hirose K, Liberman MC. 2002. Dynamics of noise-induced cellular injury and repair in the mouse cochlea. JARO 3:248-268.
01/30	**Noise Measurement**	• Rawool, Chapter 2: Documenting Hazardous Noise Levels and Exposures, pp 24-49 • Noise-Induced Hearing Loss: Scientific Advances (2012). Chapter 4: The Use of Kurtosis Measurement in the Assessment of Potential Noise Trauma, pp 41-56 • Occupational Noise Exposure Criteria Document. NIOSH Publication number 98-126, 1998. Chapters 3 (Basis for the Exposure Standard, pp 19-32) and 4 (Instrumentation for Noise Measurement, pp 33-35).
02/06	**Music-Induced Hearing Loss: Musicians and MP3 players** **Guest Lecture: Cory Portnuff, AUD, PHD**	• Rawool, Chapter 9: Conservation and Management of Hearing Loss in Musicians, pp 201-223 • Portnuff C.D. 2016. Reducing the risk of music-induced hearing loss from overuse of portable listening devices: understanding the problems and establishing strategies for improving awareness in adolescents. Adolesc Health Med Ther, 7, 27-35.
02/13	**EXAM 1**	

02/20	**Audiometric Monitoring/Auditory Testing**	• Rawool, Chapter 4: Monitoring of Auditory Sensitivity and Follow-up Procedures, pp 65-105 • Occupational Noise Exposure Criteria Document. NIOSH Publication number 98-126, 1998. Chapter 5 (Hearing Loss Prevention Programs, pp 36-60).
02/27	**Hearing Protection Devices Pt 1- Selection**	• Noise-Induced Hearing Loss: Scientific Advances (2012). Chapter 12: Hearing Protection Devices: Regulation, Current Trends, and Emerging Technologies, pp 257-284 • Rawool, Chapter 6: Hearing Protection and Enhancement Devices, pp 136-173. • Occupational Noise Exposure Criteria Document. NIOSH Publication number 98-126, 1998. Chapter 6 (Hearing Protectors, pp 61-68).
03/06	**Hearing Protection Devices Pt 2 – Fit Testing**	• Schulz TY. 2011. Individual fit testing of earplugs: a review of uses. Noise Health, 13(51) 152-162. • Federman J, Duhon C. 2016. The viability of hearing protection device fit-testing at navy and marine corps accession points. Noise Health. 18(85):303-311.
03/13	**Noise Control**	• Rawool, Chapter 3: Noise Control, pp 50-64
03/20	***No Class***	***Spring Break***
03/27	**Military Noise** **[AAA – alternative video lectures]**	• Noise-Induced Hearing Loss: Scientific Advances (2012). Chapter 3: Noise-Induced Hearing Loss and Tinnitus: Challenges for the Military, pp 27-38 • Casali JG, Ahroon WA, Lancaster JA. 2009. A field investigation of hearing protection and hearing enhancement in one device: for soldiers whose ears and lives depend upon it. Noise Health; 11(42):69-90. • Yankaskas K. 2013. Prelude: Noise-induced tinnitus and hearing loss in the military. Hear Res, 295: 3-8.
04/03	**Synaptopathy and supra-threshold deficits: aka "Hidden Hearing Loss"**	• Kujawa SG, Liberman MC. 2015. Synaptopathy in the noise-exposed and aging cochlea: Primary neural degeneration in acquired sensorineural hearing loss. Hear Res 330, 191-199. • Le Prell CG. 2019. Effects of noise exposure on auditory brainstem response and speech-in-noise tasks: a review of the literature. Int J Audiol. 2018 Dec 18:1-30. doi: 10.1080/14992027.2018.1534010. [Epub ahead of print]
04/10	**EXAM 2**	
04/17	**Handicap**	• Dobie RA. (2015). Medical-Legal Evaluation of Hearing Loss (3rd Edition). Singular – Thomson Learning. Chapter 5 Impairment, Handicap, and Disability, pages 83-113.

04/24	**Age vs Noise; Allocation of Hearing Loss**	• Noise-Induced Hearing Loss: Scientific Advances (2012). Chapter 10: Effects of Early Noise Exposure on Subsequent Age-related Changes in Hearing (Bielefield), pp 205-222 • Dobie RA. (2015). Medical-Legal Evaluation of Hearing Loss (3rd Edition). Singular – Thomson Learning. Chapter 13, Diagnosis and Allocation, pages 281-319.
05/01	**Pharmacological Interventions**	• Noise-Induced Hearing Loss: Scientific Advances (2012). Chapter 13: Prevention of Noise-Induced Hearing Loss: Potential Therapeutic Agents (Le Prell and Bao), pp 285-338 • Le Prell CG, Lobarinas E (2015) Strategies for assessing antioxidant efficacy in clinical trials. In: Oxidative Stress in Applied Basic Research and Clinical Practice: Free Radicals in ENT Pathology (Miller JM, Le Prell CG, Rybak LP, Armstrong D, eds). New York: Springer.
May 8 – 4 pm – final examination		**Callier Dallas J 108**

Exam 1, Exam 2, and Final examination:

True/False, Multiple Choice, Short Answer, Essay, and problems/calculations are used to provide comprehensive assessment of student grasp of factual information, understanding of current controversies, and ability to complete problems requiring practical application of guidelines to different noise scenarios.

Attendance and Participation:

As per UTD policy (http://go.utdallas.edu/syllabus-policies), regular and punctual class attendance is expected. Participation is expected, but is not graded.

Resources:

Optional noise dose calculations; these are sample problems akin to what you will see on exams. Independent completion of worksheet strongly encouraged as self-assessment tool.

Optional Hearing Protection Device calculations; these are sample problems akin to what you will see on exams. Independent completion of worksheet strongly encouraged as self-assessment tool.

Optional Hearing Handicap calculations/exercises; these are sample problems akin to what you will see on exams. Independent completion of worksheet strongly encouraged as self-assessment tool.

Optional Allocation calculations/exercises; these are sample problems akin to what you will see on exams. Independent completion of worksheet strongly encouraged as self-assessment tool.

Exam Policy

Exams are closed book and are to be completed independently. **Students are required to bring basic calculators – no smart phone calculators or other apps may be used.**

Policy Related to Make up Exams or Other Work

All late submissions will have 15% of the total points possible deducted; any additional deductions will be cumulative (i.e., in addition to the deductions for late submissions).

Grading

Exam 1	30% of course grade
Exam 2	30% of course grade
Final Exam	40% of course grade

Point System

Minimum Percent Required	Letter Grade	Grade Points
97	A+	4
94	A	4
90	A-	3.67
87	B+	3.33
84	B	3
80	B-	2.67
77	C+	2.33
74	C	2
70	C-	1.67
67	D+	1.33
64	D	1
60	D-	0.67
below 60	E	0
	WF	0
	I	0
	NG	0

Course Grade Policies

Per the AuD program handbook, C grades (including C+ or poorer) do not demonstrate adequate competency in the topic area and remediation or repetition of the course will be required. *Remediation of content does not result in a grade change for the course; the only way to earn a course grade change on your transcript is to repeat the course.*

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at: https://catalog.utdallas.edu/2015/graduate/policies/grades#grades-and-grade-point-average.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.
Please go to http://go.utdallas.edu/syllabus-policies for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.

Highly useful texts for those interested in this area:

- Berger EH, Royster LH, Royster JD, Driscoll DP, Layne M. (2000). The Noise Manual (5th Edition). Fairfax, VA: AIHA Press. (6th edition is currently in preparation for anticipated 2019 publication.)
- Council for Accreditation in Occupational Hearing Conservation. (2014). Hearing Conservation Manual, 5th edition. Editors: Thomas Hutchinson and Theresa Schultz.
- Dobie RA. (2015). Medical-Legal Evaluation of Hearing Loss (3rd Edition). San Diego, CA: Singular – Thomson Learning.

Other suggested readings for additional information on specific topics:

Regulatory and Guidance Documents

- Preventing Occupational Hearing Loss: A Practical Guide, NIOSH Document Number 96-110, 1996 (Introductory material: pp i-ix, plus pp 1-9). Available at: http://www.cdc.gov/niosh/docs/96-110/

Documenting the problem and prevalence of NIHL

- Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M (2005) The global burden of occupational noise-induced hearing loss. Am J Ind Med 48:446-458.
- Rabinowitz PM (2012) The public health significance of noise induced hearing loss. In: Noise-Induced Hearing Loss: Scientific Advances, Springer Handbook of Auditory Research (Le Prell CG, Henderson D, Fay RR, Popper AN, eds). New York: Springer Science+Business Media, LLC.
- Ruben RJ (2000) Redefining the survival of the fittest: communication disorders in the 21st century. Laryngoscope 110:241-245.
- Shargorodsky J, Curhan SG, Curhan GC, Eavey R. 2010. Change in prevalence of hearing loss in US adolescents. JAMA 304, 772-8.
- Henderson E, Testa MA, Hartnick C. 2011. Prevalence of noise-induced hearing-threshold shifts and hearing loss among US youths. Pediatrics 127, e39-46.

Noise measurement using apps

- Kardous CA, Shaw PB. Evaluation of smartphone sound measurement applications. 2014. Journal of the acoustical Society of America Express Letters 135(4):EL186-92.
- Nast DR, Speer WS, Le Prell CG. 2014. Sound level measurements using smartphone "apps": useful or inaccurate? Noise Health 16(72):251-6.

Audiometric monitoring/audiometric testing relevant to NIHL

- Franks, JR. 2001. Hearing measurement. In: Goelzer B., Hansen C., Sehrndt G. (Eds.). Occupational Exposure to Noise: Evaluation, Prevention and Control, Dortmund, Germany, World Health Organization, pp 183-232. This chapter is available at http://www.who.int/occupational_health/publications/occupnoise/en/print.html
- Shrivastav, M.N. 2012. Suprathreshold Auditory Processing In: Noise-Induced Hearing Loss: Scientific Advances, Springer Handbook of Auditory Research. Le Prell CG, Henderson D, Fay RR, Popper AN, eds., pp 137-150. New York: Springer Science+Business Media, LLC.
- Rawool, Chapter 5: Comprehensive Audiological, Tinnitus, and Auditory Processing Evaluations, pp 106-135

Speech-in-Noise Testing

- Le Prell, C.G., and Brungart, D.S. (2016). Potential effects of noise on hearing: supra-threshold testing using speech-in-noise and auditory evoked potentials, *Otology & Neurotology, 37: e295-e302*.
- Le Prell, C.G., and Clavier, O. (2017). Effects of noise on speech recognition. *Hearing Research, 349:76-89*.

Noise Induced Injury: Mechanisms

- Le Prell, C.G., Yamashita, D., Minami, S., Yamasoba, T., Miller, J.M. 2007. Mechanisms of noise-induced hearing loss indicate multiple methods of prevention. Hear. Res. 226, 22-43.
- A.L. Poirrier, J. Pincemail, P. Van Den Ackerveken, P.P. Lefebvre and B. Malgrange. 2010. Oxidative Stress in the Cochlea: An Update. Current Medicinal Chemistry, *17,* 3591-3604.

Exchange Rate

- Dobie RA, Clark WW. 2014. Exchange rates for intermittent and fluctuating occupational noise: a systematic review of studies of human permanent threshold shift. Ear and Hearing, 35(1):86-96.
    - See related letters to the editor by Suter (2015); Morata et al. (2015); Dobie and Clark (2015)

Hearing protection devices

- Berger EH. 2003. Hearing Protection Devices. In: Berger EH, Royster LH, Royster JD, Driscoll DP, Layne M, (Eds.), The Noise Manual (5th ed). American Industrial Hygiene Association, Fairfax. pp. 379-454.
- Groenewold MR, Masterson EA, Themann CL, Davis RD. 2014. Do hearing protectors protect hearing? American Journal of Industrial Medicine, 57(9):1001-10.
- Byrne DC, Murphy WJ, Krieg EF, Ghent RM, Michael KL, Stefanson EW, Ahroon WA. 2017. Inter-laboratory comparison of three earplug fit-test systems. J Occup Environ Hyg. 2017 Apr;14(4):294-305
- Nodoushan MS, Mehrparvar AH, Jahromi MT, Safaei S, Mollasadeghi A. 2014. Training in using earplugs or using earplugs with a higher than necessary noise reduction rating? A randomized clinical trial. International Journal of Occupational and Environmental Medicine. 5(4):187-93.
- Tufts JB, Jahn KN, Byram JP. 2013. Consistency of attenuation across multiple fittings of custom and non-custom earplugs. Ann Occup Hyg. 57(5):571-80.
- Verbeek JH, Kateman E, Morata TC, Dreschler WA, Mischke C. 2012. Interventions to prevent occupational noise-induced hearing loss. *Cochrane Database of Systematic Reviews* 2012, Issue 10. Art. No.: CD006396. DOI: 10.1002/14651858.CD006396.pub3.
- Voix J, Hager LD. 2009. Individual fit testing of hearing protection devices. Int J Occup Saf Ergon. 15(2):211-9.

MP3 players

- Levey, S., Levey, T., Fligor, B.J. 2011. Noise exposure estimates of urban MP3 player users. Journal of Speech Language and Hearing Research, Vol 54(1):263-77.
- Portnuff CD, Fligor BJ, Arehart KH. 2011. Teenage use of portable listening devices: a hazard to hearing? Journal of the American Academy of Audiology, 22(10):663-677.
- Le Prell CG, Spankovich C, Lobarinas E, Griffiths SK. (2013). Extended high-frequency thresholds in college students: effects of music player use and other recreational noise. J Am Acad Audiol 24(8):725-39.

Military Noise

- Clasing JE, Casali JG. 2014. Warfighter auditory situation awareness: Effects of augmented hearing protection/enhancement devices and TCAPS
  for military ground combat applications. Int J Audiol; 53: S43–S52.
- McIlwain DS, Gates K, Ciliax D. 2008. Heritage of Army Audiology and the Road Ahead: The Army Hearing Program. American Journal of Public Health, 98(12):2167-2172.
- Cleveland L. 2014. Over the ear Tactical Communication and Protection System use by a light infantry (airborne) brigade in Afghanistan. US Army Med Dep J. 2014 Jul-Sep:55-8.
- Lee, K. Casali, J. 2016. Effects of low speed wind on the recognition/identification and pass-through communication tasks of auditory situation awareness afforded by military hearing protection/enhancement devices and tactical communication and protective systems. Int. J. Audiol. 55 Supl 1: S21-9.

Synaptopathy; Age/Noise interactions

- Kujawa SG, Liberman MC. 2009. Adding insult to injury: cochlear nerve degeneration after "temporary" noise-induced hearing loss. Journal of Neuroscience, 29(45):14077-85.
- Furman AC, Kujawa SG, Liberman MC. 2013. Noise-induced cochlear neuropathy is selective for fibers with low spontaneous rates. J Neurophysiol. 110(3):577-86.
- Lin HW, Furman AC, Kujawa SG, Liberman MC . 2011. Primary neural degeneration in the Guinea pig cochlea after reversible noise-induced threshold shift. J Assoc Res Otolaryngol. 12(5):605-16.
- Wang Y, Ren C. 2012. Effects of repeated "benign" noise exposures in young CBA mice: shedding light on age-related hearing loss. J Assoc Res Otolaryngol. 13(4):505-15.

Clinical Trials: Models and Data

- Kopke R., Slade M.D., Jackson R., Hammill T., Fausti S., et al. 2015. Efficacy and safety of N-acetylcysteine in prevention of noise induced hearing loss: A randomized clinical trial. *Hear Res*, 323, 40-50.
- Le Prell CG, Dell S, Hensley B, Hall JW 3rd, Campbell KC, Antonelli PJ, Green GE, Miller JM, Guire K. 2012. Digital music exposure reliably induces temporary threshold shift in normal-hearing human subjects. Ear Hear. 33(6):e44-58.
- Le Prell C.G., Fulbright A., Spankovich C., Griffiths S., Lobarinas E., et al. 2016. Dietary supplement comprised of β-carotene, vitamin C, vitamin E, and magnesium: failure to prevent music-induced temporary threshold shift. Audiol Neurootol EXTRA, 6, 20-39.
- Anderson J.M. & Campbell K. 2015. Assessment of interventions to prevent drug-induced hearing loss. In: J.M. Miller, C.G. Le Prell & L.P. Rybak (eds.) Oxidative Stress in Applied Basic Research and Clinical Practice: Free Radicals in ENT Pathology. New York: Humana Press, pp. 243-269.
- Campbell, K.C.M. and Fox, D. J. (2016). Cisplatin-induced hearing loss. In Le Prell, C. G., Lobarinas, E., Fay, R. R., and Popper, A. N. *Translational Research in Audiology, Neurotology, and the Hearing Sciences, Springer Handbook of Auditory Research*, pp. 141-164. New York: Springer.
- Kil J, Lobarinas E, Spankovich C, Griffiths SK, Antonelli PJ, Lynch ED, Le Prell CG.Safety and efficacy of ebselen for the prevention of noise-induced hearing loss: a randomised, double-blind, placebo-controlled, phase 2 trial. Lancet. 2017 Sep 2;390(10098):969-979

Chemicals and noise

- Springer, Chapter 11: Effects of Exposure to Chemicals on Noise-Induced Hearing Loss, pp 223-254 (Morata and Johnson)

Noise-Induced Tinnitus

- Hickox AE, Liberman MC. 2014. Is noise-induced cochlear neuropathy key to the generation of hyperacusis or tinnitus? J Neurophysiol. 111(3):552-64.
- Kaltenbach JA and Manz R. 2012. The Neurobiology of Noise-Induced Tinnitus. In: Noise-Induced Hearing Loss: Scientific Advances, Springer Handbook of Auditory Research. Le Prell CG, Henderson D, Fay RR, Popper AN, eds., pp 151-175. New York: Springer Science+Business Media, LLC.

Genetics of ARHL and NIHL

- Springer, Chapter 9: Genes that influence susceptibility to NIHL, pp 179-204
- Sliwinska-Kowalska M, Pawelczyk M. 2013. Contribution of genetic factors to noise-induced hearing loss: A human studies review. Mutation Research, 752, 61-65.
- Ohlemiller KK. 2006. Contributions of mouse models to understanding of age- and noise-related hearing loss. Brain Research, 1091: 89-102.
- Bowl MR, Dawson SJ. The Mouse as a Model for Age-Related Hearing Loss - A Mini-Review. 2015. Gerontology 61(2):149-157.
- Allyse M, Milner LC, Cho MK. 2011. Ethics watch: the G.I. genome: ethical implications of genome sequencing in the military. Nat Rev Genet. 12(9):589.
- Kokotas H, Petersen MB, Willems PJ. 2007. Mitochondrial deafness. Clinical Genetics, 71: 379-391

Compensation for NIHL

- Rawool, Chapter 11: Workers Compensation for Noise-induced Hearing Loss and Forensic Audiology, pp 242-265
- Dobie RA. 1996. Compensation for Hearing Loss. Audiology, 35:1-7.