

The effects of aging and loud music on hearing¹

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This paper addresses the effects of loud sound and the aging process upon the human auditory system. There is no question that loud sound, regardless of whether it is impact noise, heavy-metal rock music, or classical music, can be damaging to auditory nerve cells. It is the level of the sound as well as the duration of exposure that constitutes danger to this precious sense organ—the ear.

Index terms: Hearing loss, noise-induced • Music

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Two common problems that affect the hearing and consequently the performance of musicians are advancing age and loud music. In attempting to determine the extent of hearing loss and to differentiate its causes, it is helpful to measure and establish normal levels of hearing.

Measurement of hearing

Hearing in its broadest sense encompasses the entire auditory process. This includes detection (sensitivity), discrimination (acuity), and comprehension (understanding). This section predominantly addresses the sensitivity of the auditory system. Hearing is usually tested with an audiometer, an electronic instrument capable of generating pure tones beginning at 125 Hz and increasing in octaves to 8,000 Hz. The decibel is the unit of measure of the strength of the signal. The decibel represents a ratio series as opposed to an interval series and is a logarithmic unit of measurement. Therefore, for every 10-dB increase, there

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Table. Average hearing levels for men and women as a function of age versus frequency (extrapolated from Davis and Silverman¹⁵)

Age (yr)	600 Hz		1 kHz		2 kHz		3 kHz		4 kHz		6 kHz	
	M	F	M	F	M	F	M	F	M	F	M	F
18-24	6	6	5	5	5	2	10	5	10	5	12	10
35-44	10	10	5	5	6	5	12	5	19	5	25	15
45-54	12	...	8	...	10	...	20	...	25	...	30	...
55-64	12	16	10	15	12	16	30	16	38	18	49	30
65-74	15	18	13	15	25	17	50	23	55	30	62	35
75-79	21	24	19	22	35	30	55	34	65	38	75	55

port that orchestral musicians can be exposed to potentially damaging sound pressure levels¹⁰ and that certain musicians (violinists, flutists) may be at risk for unilateral loss caused by the way they hold their instruments.

Loud sound is only one of the many hazards for the human auditory system. In addition to disease, ototoxic drugs, and physical trauma, the musician must cope with the effects of the aging process on his ability to hear.

Hearing loss and aging

There is no question that, as technology advances, the average life expectancy of American citizens increases.¹³ In the data presented by Jacobs-Condit and Fein,¹³ it has been projected that by 2050 there will be 67 million (22%) persons 65 years old or older in the United States and about 16 million who are 85 years old or older. Research suggests that the percentage of the population with speech and hearing impairments rises rapidly after age 60 and will affect almost 40% of the population. Figures currently indicate that 43% of the population in the United States over 65 have hearing impairments. By 2050, it is projected that this figure will be 59% of that population.

Presbycusis (hearing loss) associated with advancing age is the most common cause of sensorineural hearing loss in the United States. It occurs gradually over a number of years, affecting the high frequencies first and, with advancing age, the lower frequencies as well. The condition is bilateral and symmetrical. Schuknecht's text¹⁴ offers excellent documentation (including teaching slides) of inner ear pathology accompanying presbycusis. If there are great differences in hearing between two ears that cannot be explained

on the basis of noise exposure or previous history, a complete audiological and neuro-otologic evaluation are strongly warranted. The hearing loss associated with advancing age is quite complex. It may start as a sensory hearing loss (inner ear), later involving neural elements (sensorineural), and finally affecting the central mechanisms of the auditory nervous system (hearing disorder). Between the ages of 50 and 60 an individual may begin to admit slight problems in hearing. The clinical picture may be that of "difficulty hearing in noise," or "I can hear, I just can't understand," or "I have no problem hearing if people speak clearly." The individual misses key words and cannot discriminate easily in noisy situations. Frequently, the elderly will try to excuse their hearing loss by saying such things as "I hear what I want to hear," "I'm hard of listening," or "my wife says I have a hearing problem, but she mumbles." Typically, the audiogram will be that of a falling audiogram with hearing sensitivity falling within normal tolerances up to about 2,000 Hz and then gradually declining, getting poorer and poorer in the high frequencies. With advancing age, the higher frequencies will continue to decline in sensitivity with the lower frequencies following (Table). However, the audiometric configurations associated with advancing age may be augmented by previous hearing loss caused by noise exposure or disease. Hearing loss associated with advancing age is insidious in that our speech is well above our sensitivity and surrounding ambient noise. Therefore, the signal-to-noise ratio decreases as hearing loss increases. However, once a hearing loss begins to dramatically affect a person's communication skills and a hearing aid is applied, the environmental noise returns as a din, which is often unacceptable to the hard-of-hearing senior citizen. One of the

most common complaints regarding a hearing aid is "It's too noisy!" Hearing aids do have a certain amount of internal noise. However, there is no question that we live in a noisy society composed of sound being generated by air conditioners, radiators, typewriters, radios, fluorescent lights, electric fans, etc. The senior citizen who has been experiencing a gradual loss of sensitivity has, little by little, had the background noise reduced or eliminated by virtue of their hearing loss. Consequently, the hearing aid brings all of this noise back and many people find it intolerable.

Many individuals are under the misconception that short exposures to loud sound are not harmful to their hearing mechanism. This is a serious and even dangerous assumption. The hearing mechanism is a delicate sense organ, and its design is such that it can detect something as quiet as a snake slithering through leaves. The critical portion of the auditory system, the hair cells, are submicroscopic and consequently vulnerable to high-level impact sounds (firecrackers, shotguns) as well as to high-level prolonged sounds (jet engines, unmuffled vehicles, chain saws, etc). Among the potential hearing-damaging sound generators are: amplifying systems for electric guitars, public address systems, many of the percussion instruments, and certain wind instruments. It is, therefore, imperative that the musician recognize the potential hazards to his hearing such as loud sound, drugs, and trauma. Today, the scientific and scholarly community does not know enough about hearing to retard hearing loss associated with advancing age. However, preventative measures to protect the sensitivity of the hearing mechanism can be employed and is advocated. Further, exposure to exceedingly loud sound should be avoided, or when

unavoidable, appropriate protection for the ears should be used.

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