The Epidemiology of Occupational Hearing Loss
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When patients with bilateral, sloping, high frequency, sensorineural hearing loss (SNHL) ask their provider, "What caused my condition?" The provider responds cautiously. When substantial noise exposure has been reported, clinicians tend to say, "It appears that you have a noise-induced hearing loss." To which the patient remarks, "Am I eligible for compensation?" "Will workers' compensation pay for my hearing aid?" This is a common encounter in a busy practice where clinicians are asked to provide answers with limited information. Without hard scientific evidence, how do you answer these questions?

A literature review revealed only one study which showed in a sample of adults with hearing loss what percentage could be attributed to the different causes of hearing loss (Figure 1). Among 30,000 Hungarians with hearing loss evaluated between 1966 to 1971, noise was considered the etiologic factor for 20%. No similar study was identified on a more recent population nor among individuals with hearing loss in the United States (Surjan, 1973).

In the field of communication disorders, prevalence statistics based on self-report data are the standard epidemiologic approach (Table I). One study of a cohort of farmers validates that self-reported hearing data is a useful approximation of hearing loss documented by audiometry (Gomez et al, 2001). Self-report data from the

Figure 1. Etiology of Hearing Loss in Adults — Mean Data from Surjan (1973)
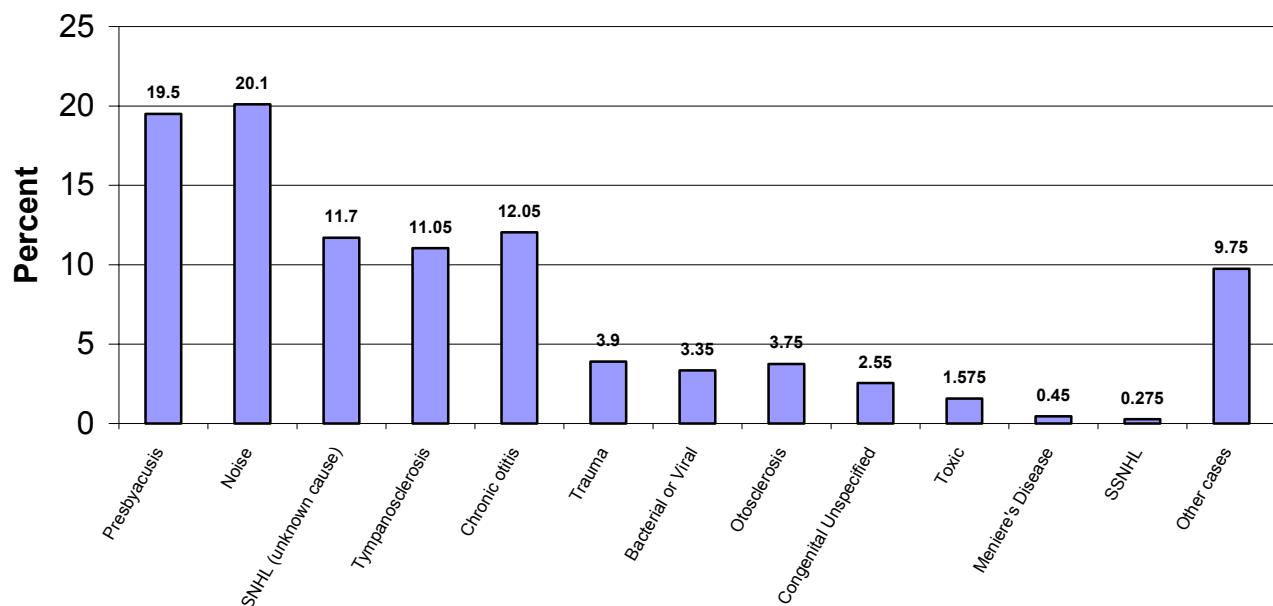
Table I. Estimate of the Prevalence of Hearing Impairments by Age Group, United States, 1990-1991			
Age Group (Years)	Population	Number of Hearing Impaired	Percent of Population
TOTAL	235,688,000	20,295,000	8.6%
3-17	53,327,000	968,000	1.8%
18-34	67,414,000	2,309,000	3.4%
35-44	38,019,000	2,380,000	6.3%
45-54	25,668,000	2,634,000	10.3%
55-64	21,217,000	3,275,000	15.4%
65 and over	30,043,000	8,727,000	29.1%

Source: National Center for Health Statistics, Data from the National Health Interview Survey, Series 10, Number 188, Table 1, 1994.

Table II. Age at Onset of Hearing Loss for the Estimated Population of Hearing Impaired Persons, United States, 1990-1991		
Age at Onset (Years)	Number	Percent
Before 3	1,091,000	5.4%
3-18	2,876,000	14.2%
19 and over	15,484,000	76.3%
Unknown	8,444,000	4.1%
TOTAL	20,295,000	100%

Source: National Center for Health Statistics, Data from the National Health Interview Survey, Series 10, Number 188, Table 13, 1994.

Table III. Factors Affecting Individual Susceptibility	
Endogenous Factors	Exogenous Factors
Well Accepted	Well Accepted
Age	Chemical Exposure
Limited Evidence	Limited Evidence
Family History	Whole Body Vibration
Elevated Lipid Levels	Smoking
Eye Color	
Diabetes	
Race	

National Health Interview Survey (NHIS) of 1990 estimated that over 20 million Americans age 3 or older are deaf or hard of hearing.

Further review of the NHIS data (Table II) reveals that the age of onset for most hearing impairment is after the age of 18 (76%). The National Center for Health Statistics (NCHS) indicates that based on self reports, prevalence rates for deafness and hearing impairment rose from 80/1000 to 93.5/1000 (17% increase) from 1979 to 1992 (Collins, 1997).

According to the NCHS in 2001, only 12.8% of the US population was comprised of persons above the age 65, however 37% of all hearing impaired individuals are in this older age group (Desai et al). In a longitudinal study, Wallhagen and her colleagues (1997) attempted to remove the effects of aging by using a direct method of age-adjusted data. This study of greater than 2,470 people over 50-year-olds used self-report responses and reported an increased risk of 1.45 for individuals with occupational noise exposure. Using this odds ratio, the attributable risk for work-related noise was 45%.

Noise-induced hearing loss (NIHL) is one of the most common work-related diseases in occupational medicine. In the United States, more than one-tenth of the nation, or 30 million workers, is currently exposed to noise on a regular basis above levels associated with hearing loss, and, approximately 10 million of these workers have NIHL (ASHA, 1991). It should be noted that the relative risk of unprotected exposure to noise has not been examined in a prospective design that includes close observation of ear protection placement and compliance.

Factors that have been associated with hearing loss and deafness besides loud noise, are certain diseases, certain medications, aging (Cruickshanks, 1998) and genetic factors (Morton, 1991). There are additional factors that have been reported to affect susceptibility for noise-induced hearing loss (Table III).
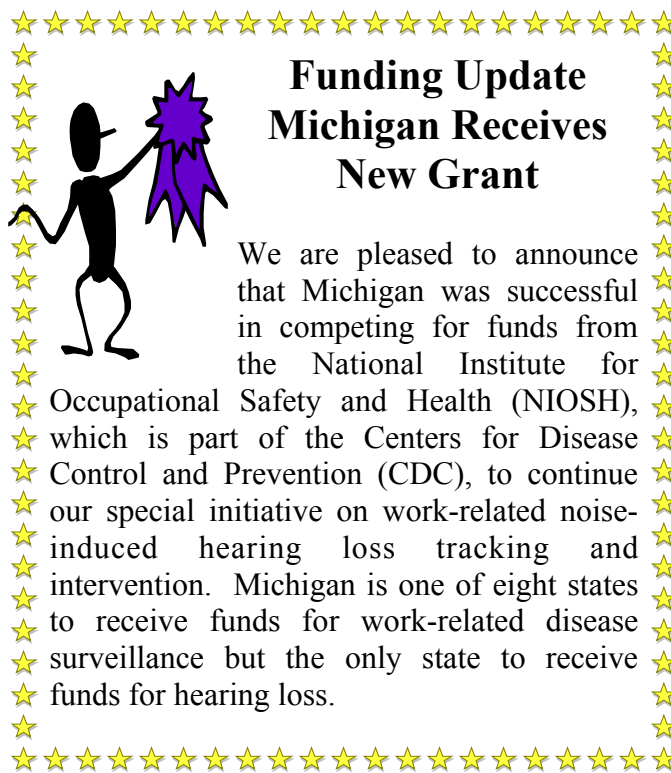
One of the tenets of public health is to focus intervention activity on the most prevalent health problems. The lack of studies on how much hearing loss is secondary to noise inhibits prioritization by a public health intervention plan. For example, universal newborn hearing screenings, childhood deafness, and cochlear implant technology have recently received most of the attention regarding hearing health, however, childhood deafness accounts for a minority of the total number of hearing disorders (ASHA, 2000). The actual number of children (less than a million) with hearing loss is appreciably less than the number of adults affected (19 million).

The World Health Organization (WHO, 1997) indicated, "There is a great lack of good quality data describing the epidemiology of acquired adult sensorineural hearing impairment worldwide." The WHO estimated that there are 441 to 580 million people with slight to mild hearing

loss within the speech frequency range across the globe. There are 127 million individuals with moderate hearing impairment, and 39 million with severe loss of hearing.

Work currently underway should provide more reliable results on the prevalence of hearing loss in the United States. As part of the Nation Health and Nutrition Survey (NHANES IV, 1999-2004), hearing testing on adults has been conducted to obtain more current and reliable prevalence rates. However, no recent studies were identified nor are we aware of any underway to investigate in a group of adults with hearing loss how much hearing loss could be attributed to specific risk factors such as disease, noise, age and genetics. This is a complicated issue because hearing loss has a multi-factorial etiology that normally is not attributed to a single risk factor.

Since there are no studies that specifically address the patient's questions in the first paragraph, your answer will depend on your professional judgment on whether you think work-related noise was at least a significant contributor to the patient's hearing loss. This is the same criteria used for determining which cases are required to be reported under Michigan's Occupational Disease Reporting law and whether or not workers' compensation will pay for hearing aids. Unfortunately, there is no definitive test to determine the etiology of sensorineural hearing loss in any one patient. History obtained from the patient is very important. Until we have better data, we and our patients must learn to accept a level of uncertainty about the cause of hearing loss. This should not, however, impede you from reporting suspected work-related noise-

Funding Update
Michigan Receives
New Grant

We are pleased to announce that Michigan was successful in competing for funds from the National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention (CDC), to continue our special initiative on work-related noise-induced hearing loss tracking and intervention. Michigan is one of eight states to receive funds for work-related disease surveillance but the only state to receive funds for hearing loss.

induced hearing loss as required by law or telling the patient they should apply for workers' compensation for hearing aids when in our judgment noise at work more likely than not (50% or greater chance) contributed to their hearing loss.

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Michigan Law Requires the Reporting of Known or Suspected Occupational NIHL

Reporting can be done by:

FAX
517-432-3606

Telephone
1-800-446-7805

E-Mail
ODREPORT@ht.msu.edu

Web
www.chm.msu.edu/oem

Mail
MDCIS Div. of Occ. Health
P.O. Box 30649
Lansing, MI 48909-8149

Suggested Criteria for Reporting Occupational NIHL

1. A history of significant exposure to noise at work; AND
2. A STS of 10 dB or more in either ear at an average of 2000, 3000 & 4000 Hz. OR
3. A fixed loss.*

*Suggested definitions: a 25 dB or greater loss in either ear at an average of: 500, 1000 & 2000 Hz; or 1000, 2000 & 3000 Hz; or 3000, 4000 & 6000 Hz; or a 15 dB or greater loss in either ear at an average of 3000 & 4000 Hz.

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