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Hearing Handicap Among Adult Residents of an Urban Homeless Shelter

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Abstract: This retrospective study was undertaken to identify the prevalence of hearing loss in the homeless population and its implications for vocational rehabilitation. Audiometric threshold data for adult residents of an urban homeless shelter were collected and reported. Subjects with hearing loss were identified and defined by their binaural high-frequency pure tone average (B-HFPTA). Those subjects were assigned a predicted Hearing Handicap Inventory for Adults-Screener (HHIA-S) score. Their HHIA-S scores, in turn, were used to predict hearing handicap and hearing aid candidacy. Significant hearing handicap was predicted for 35.6% of subjects; 10.6% were identified as hearing aid candidates. These findings have implications for vocational rehabilitation that have not been previously addressed.

Key words: Homelessness, hearing loss, hearing handicap.

There is a dearth of literature addressing identification and remediation of hearing loss among homeless people and how hearing loss might adversely affect their education and vocational rehabilitation. This is surprising considering that some risk factors for hearing loss (including exposure to loud noise in the military, exposure to infectious disease, human immunodeficiency virus, tuberculosis, hepatitis, and alcohol abuse) are more prevalent among homeless people.\textsuperscript{1,2,3} The purpose of this retrospective study was to quantify hearing loss, to estimate hearing handicap among people residing in one urban homeless shelter for adults, and to consider the implications for remediation.

Homelessness. Wasson described three patterns of homelessness: (a) economic, (b) situational, and (c) chronic.\textsuperscript{4} The economically homeless cannot obtain housing because of low personal income and/or lack of available low-income housing. People who experience homelessness because of life crises such as divorce and/or domestic abuse are situationally homeless. Chronically homeless individuals are those who have adjusted to street life and rarely use shelter facilities. The majority of homeless people are single male high school graduates who are economically or situationally homeless.

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and not receiving public assistance.\textsuperscript{4,5,6,7,8} Forty percent of homeless males in the United States are military veterans.\textsuperscript{9}

The heterogeneity of the homeless population has resulted in significant barriers to the delivery of health services.\textsuperscript{10,11,12} The health of homeless people is usually addressed by a wide variety of individual agencies in response to crisis situations. As a result, treatments are usually short term,\textsuperscript{4} include only minimal follow-up,\textsuperscript{12} and therefore leave homeless people at increased risk for exacerbation of otherwise treatable medical conditions.\textsuperscript{13}

**Hearing loss.** The most common manifestation of hearing loss is reduced sensitivity of the auditory system.\textsuperscript{14} Hearing threshold levels are a measure of hearing sensitivity conventionally measured for pure-tones comprising the frequency spectrum of speech (octaves from 250 Hz through 8000 Hz). Threshold is defined as the intensity level at which an individual behaviorally responds to 50% of pure tone stimuli presentations. That level is typically established with normal hearing sensitivity as a 0 dB reference, a scale referred to as dB HL (decibel hearing level).\textsuperscript{15} The range of normal hearing thresholds at any given frequency is $-10$ to $25$ dB HL.

**Risk factors for hearing loss.** Long-term exposure to intense noise, including military noise, occupational noise, and recreational noise, can adversely affect hearing sensitivity.\textsuperscript{16,17,18} The initial audiometric profile for noise-induced hearing loss (NIHL) includes decreased sensitivity near 4000 Hz. With continued noise exposure, the damage increases and the decreased sensitivity expands to frequencies above and below 4000 Hz.\textsuperscript{16}

Relationships between human immunodeficiency virus (HIV) and hearing loss have been established in the literature. It has been reported that otologic disorders such as otitis media and sensorineural hearing loss are among the most common manifestations of early HIV.\textsuperscript{19,20,21} Hearing loss has been shown to be more severe for subjects with more severe HIV manifestations.\textsuperscript{20,22} Hearing loss secondary to otitis has been identified as a complication of tuberculosis (TB)\textsuperscript{23} and associated HIV infection.\textsuperscript{24,25} A relationship between hepatitis and hearing loss has also been shown.\textsuperscript{26,27,28,29}

A significantly greater incidence of hearing loss has been shown among all substance abusers than among control subjects.\textsuperscript{30} Increased risk for hearing loss has been reported for subjects who consumed two or more units of alcohol daily and who slept less than seven hours per night.\textsuperscript{31}

**Hearing loss and homelessness.** Little is known about hearing loss among homeless people despite the fact that researchers have attempted to identify the magnitude of and the specific health care needs of homeless individuals using self-assessment methods.\textsuperscript{12,32,33} Wojtusik and White found 18.8% of their homeless subjects reported hearing problems. Greater than half of the subjects reported that their health-related problems limited their ability to work.\textsuperscript{12}

Many homeless people face risk factors that have been linked to hearing loss. As many as 40% of homeless males in the United States are military veterans.\textsuperscript{9} It makes sense to assume that many homeless veterans have been exposed to hazardous noise in the military and are therefore at greater risk for NIHL.

Homeless people are at risk for HIV and TB related hearing loss. Zolopa et al. reported that 8.5% of the homeless adults they studied were HIV positive,\textsuperscript{3} with preva-
lence of HIV increasing with duration of homelessness and with injection drug use. They also reported that TB infection is one and one-half to three times more prevalent in the homeless population than in the general population. Like HIV, prevalence of TB infection also increased with increased duration of homelessness.3

The prevalence of intravenous drug use among homeless people is greater than in the general population.3 A positive relationship between injection drug use and the prevalence of viral hepatitis has been reported.34,35 As a result, hepatitis incidence is greater among homeless people than in the general population,36 putting homeless people at greater risk for hepatitis-related hearing loss.

Hearing loss may also be more prevalent among homeless people because of pervasive substance abuse.2 Wright reported that, of homeless people using primary health care services, 38% abused alcohol and 13% abused other substances.37 Breakey et al. estimated that the prevalence of alcohol abuse among the homeless was 67% among men and 26% among women.38

**Hearing handicap.** The functional effect of hearing loss is usually referred to as *hearing handicap*.39 Hearing handicap, unlike hearing loss, is influenced by psychological, psychosocial, and emotional factors, as well as physical health factors.40 Researchers have studied the relationship between audiometric thresholds and hearing handicap.1,12,43 Goodman proposed predicting hearing handicap from pure tone thresholds, an approach widely accepted by audiologists.44,45,46 More specifically, Goodman advocated averaging pure tone thresholds for 500 Hz, 1000 Hz, and 2000 Hz pure tones, commonly referred to as the pure tone average (PTA).45 Although the three-frequency PTA is most commonly used, PTA has been based on other frequencies as well.47,48,49,50

Hearing handicap self-assessment scales have been developed in an attempt to quantify subjective hearing handicap.51 These self-assessment scales have become increasingly popular among audiologists as they attempt to identify specific treatment needs and to assess treatment outcomes. The Hearing Handicap Inventory for Adults (HHIA) was developed to target hearing impaired adults.41,52 The HHIA is a 25-item scale designed to quantify psychosocial perceptions related to hearing loss and also includes questions designed to identify the effects of hearing loss upon employment and vocational status.52 A screening version of the HHIA (HHIA-S) was subsequently developed, including only 10 questions in an effort to minimize administration time without compromising reliability. Test-retest reliability is high for the HHIA-S (r = .97).41

Stewart et al. studied the relationship between hearing loss and hearing handicap among subjects exposed to recreational gunfire. For 187 males and 45 females ranging in age from 13 to 77 years (mean age 40 years) they found a significant correlation between HHIA-S scores and hearing loss defined as a binaural high frequency pure tone average (B-HFPTA: thresholds 1000, 2000, 3000, and 4000 Hz). They concluded that HHIA-S scores could be divided into four categories. Subjects with HHIA-S scores of 1–10 had mean B-HFPTA of 25 dB, scores of 11–20 corresponded to B-HFPTA of 30 dB, and scores of over 20 corresponded to B-HFPTA of greater than 45dB. The latter subjects were judged likely to require hearing aid use.43

**Subjects.** The sample consisted of 132 homeless adults who were either recruited from the resident population or who requested evaluation. There were 83 (63%) men and 49 (37%) women, ranging in age from 18 to 69 years. Mean and median ages
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were established at 42 years for both sexes (SD = 11 and 12 years for men and women, respectively). Specific age data were not available for four subjects. All subjects were either employed or actively seeking employment at the time of their evaluation and fell into the categories of economic and situational homelessness. Criteria for intake into the homeless shelter included registration with the Florida Office of Vocational Rehabilitation (OVR). None of the subjects were identified by OVR as needing audiological evaluation or treatment. Data regarding marital status, previous noise exposure, medical problems, and other specific demographic information were not available.

Methods. Audiometric data obtained between January 1, 2001 and April 2, 2002 were extracted from clinical records. The subjects had been tested within the shelter facility in a room that met American National Standards Institute (ANSI) criteria for ambient noise levels during audiometric testing.

Otoscopic inspection was completed and tympanograms were obtained for each subject prior to threshold testing to ensure the absence of cerumen/foreign object impaction and overt outer/middle ear pathology. Subjects with suspected outer and middle ear pathology were excluded from the study. Audiometric testing was administered by audiology and/or speech-language pathology graduate students under the direct supervision of a licensed audiologist. Hearing threshold levels had been obtained for each subject at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz utilizing the modified Hughson Westlake procedure. The subjects voiced understanding of the procedure and all responded reliably. The pure tones were generated with MA-41 (MAICO, Inc., Minneapolis, MN) or GSI 17 (Grason-Stadler, Madison, WI) audiometers routed through 3-A insert earphones. Equipment calibration was maintained according to ANSI S3.6-1996 specifications and biological calibration was conducted prior to each testing session.

Hearing sensitivity was quantified by calculating a B-HFPTA for each subject. Threshold information for 3000 Hz was not available and therefore was not included in the calculation. HHIA-S scores were predicted from the B-HFPTA based on data reported by Stewart et al. Predicted HHIA-S scores of zero, up to and including 10, 11–20, and greater than 20 were assigned to subjects with B-HFPTA of less than 25 dB HL, 25–29 dB HL, 30–44 dB HL, and 45 or greater dB HL, respectively.

B-HFPTA for 85 subjects was within the range of normal, 33 subjects had mild hearing loss, and 14 subjects had moderate hearing loss (Table 1). Mean binaural high frequency averages B-HFPTA, increased with advancing age as shown in Figure 1. Mean B-HFPTAs across all age categories were 22.9 (SD = 13.3; range = 7–79) and 19.5 dB HL (SD = 11.4; range = 7–58) for males and females, respectively. A paired samples t-test revealed that mean B-HFPTAs were not significantly different between sexes (t = 1.57; df = 130; p < .05).

Mean frequency specific thresholds increased as age increased (Figure 2). A series of independent sample t-tests was conducted with mean frequency specific threshold as the dependent variable and sex as the independent variable. Mean thresholds were significantly worse for males than for females at 4000 Hz only. Threshold data as a function of sex is shown in Figure 3. Figure 4 shows mean 4000 Hz thresholds by sex and age category.

HHIA-S scores were predicted for each subject using the B-HFPTA as described
above (Table 1). Forty-seven subjects (35.6%) were predicted to be hearing handicapped. Seventeen of those subjects (12.9%) were predicted to have a predicted HHIA-S score within the 1–10 range. Sixteen subjects (12.1%) were predicted to have a more significant hearing handicap, that is, a predicted HHIA-S score within the 11–20 range. Fourteen subjects (10.6%) were predicted to have sufficient hearing handicap to require hearing

Table 1. 

DISTRIBUTION OF SUBJECTS FOR B-HFPTA CATEGORIES

<table>
<thead>
<tr>
<th>B-HFPTA</th>
<th>Male % (n)</th>
<th>Female % (n)</th>
<th>Total % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25 dB</td>
<td>37.1 (48)</td>
<td>28.0 (37)</td>
<td>65.1 (85)</td>
</tr>
<tr>
<td>25–29 dB</td>
<td>8.3 (12)</td>
<td>3.8 (5)</td>
<td>12.9 (17)</td>
</tr>
<tr>
<td>30–44 dB</td>
<td>9.9 (13)</td>
<td>2.3 (3)</td>
<td>12.1 (16)</td>
</tr>
<tr>
<td>≥45 dB</td>
<td>7.6 (10)</td>
<td>3.0 (4)</td>
<td>10.6 (14)</td>
</tr>
</tbody>
</table>

B-HFPTA = binaural high-frequency pure tone average

Figure 1. Mean binaural high frequency pure tone average (B-HFPTA) as a function of age category and sex. Bars represent mean B-HFPTA; vertical lines represent the B-HFPTA range.
Figure 2. Mean frequency-specific thresholds as a function of subject age group. Bars represent mean thresholds for each test frequency.

Figure 3. Mean frequency specific thresholds for males and females. Numbers on bars represent the mean threshold for each frequency.
aid use, that is, a predicted HHIA-S score in the greater than 20 range. Ten of the 83 male subjects (12.1%) and 4 of the 49 female subjects (8.2%) were predicted to require hearing aid use (Table 1 and Figure 5).

Discussion

Hearing loss refers to the loss of hearing sensitivity. Hearing handicap refers to the functional and psychosocial limitations imposed by hearing loss. In this study, hearing loss was quantified and hearing handicap was predicted for adults who resided in an urban homeless shelter. A significant number of homeless people were identified as having hearing loss and predicted hearing handicap. More than 1 in 3 of the subjects were predicted to have some degree of hearing handicap. More importantly, more than 1 in 10 subjects were predicted to have handicap sufficient to require the use of hearing aids. Hearing loss generally worsened similarly among males and females with increase in subject age. There was an exception for 4000 Hz thresholds, which may reflect a higher incidence of noise exposure for the male subjects, consistent with Rosenheck's report that 40% of homeless males are military veterans.9,18

Finding and maintaining employment is a persistent problem for individuals with disabilities, including hearing loss.55,56 While vocational rehabilitation programs attempt
to empower people to become employed, remain employed, and improve their status within the workplace, hearing loss can present significant obstacles. All subjects in this study had entered the vocational rehabilitation system but none had been identified as needing audiological evaluation or treatment. This is not surprising considering the apparently limited training vocational counselors receive regarding hearing loss and hearing handicap.

Conclusions, limitations, and future directions. As mentioned above, one limitation of this study is that a random sample of subjects was not possible because hearing evaluation was not mandatory for admission into the shelter. Therefore, care must be taken when attempting to generalize findings to a larger population of homeless people. Another limitation was the lack of subject placement into sub-categories such as by marital status, medical and substance abuse history, and circumstances that precipitated homelessness. Finally, the data in the present paper were interpreted from the perspective of Stewart et al. However, Stewart et al.’s subjects were not homeless and likely not exposed to some or all of the aforementioned risk factors. Furthermore, their subjects were exposed to noise whereas it is likely that only some of the subjects in this study were so exposed. Nevertheless, there were similarities between this study and the study by Stewart et al., such as a similar mean age (within 2 years), predominance of

HHIA-S = Hearing Handicap Inventory for Adults-Screener
male subjects, all subjects being free from middle ear pathology, and a high-frequency hearing loss audiometric pattern. The amount of training regarding hearing loss and hearing handicap that is currently offered to student vocational counselors may not be sufficient. The results of the present study suggest that vocational counselors should be prepared to recommend audiologic evaluations for their clients with a history of hearing loss risk factors, who report hearing handicap, or who simply present with auditory communication difficulty. Minimally, counselors should be trained on the psychosocial ramifications of hearing handicap. They should also be prepared to administer and interpret hearing handicap scales such as the HHIA-S. Vocational counselors must understand the difficulties a hearing impaired person might encounter seeking and maintaining work and the accommodations that may be needed, such as hearing aids or other prosthetic devices. Finally, vocational counselors should understand how to employ compensatory strategies for effective communication with hearing handicapped people.

The results of the present study suggest the need for further research into the prevalence of hearing loss and hearing handicap among homeless people who are seeking employment. Of interest is the effect that hearing handicap may have on the ability of homeless people to become employed, to maintain employment, and to improve their status in the workplace. Where intervention strategies are implemented, their effectiveness should be studied.

Acknowledgements

Evaluation of subjects in this study was supported by a DHHS-HRSA/Nova Southeastern University student training grant. The authors would like to express appreciation to the audiology faculty and students of Nova Southeastern University for their assistance in this project.

Notes

49. National Institute of Occupational Safety and Health (NIOSH). Criteria for