Prevalence of Hearing Impairment among University Students

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Abstract
The prevalence of hearing impairment in university students was determined from a 6-year, pure-tone hearing screening conducted at 20 dB HL for the octave frequencies from 500 to 4000 Hz. Of the 18,424 students tested, 1.2 percent failed the screening. The ratio of unilateral to bilateral hearing impairment was found to be approximately 1:1. Sensorineural hearing loss was four times more prevalent than conductive hearing loss in this population and significant hearing loss at 4000 Hz was evident in 61 percent of the males who failed the screen.

Key Words: Pure-tone hearing screening, university students, noise-induced hearing loss

The purpose of this paper is to describe the results of a 6-year, pure-tone hearing screening program of undergraduate students conducted at Central Michigan University. Individuals enrolled in colleges and universities might be considered to be free from many of the hearing disorders found in the overall population. This perception may be due in part to the fact that these individuals have already exhibited a high level of academic achievement, which would seem to contraindicate the presence of a significant hearing loss. However, information is limited concerning the types and prevalence of hearing impairment in college students and the results of this large hearing screening may provide insights as to the prevalence of various types of hearing loss in this population.

METHOD

Audiologic data were obtained from the speech and hearing screenings that are required of all students before graduation at Central Michigan University. The screenings are usually performed during the freshman year as part of a required introductory speech course. The information was collected on 18,424 students over 6 years from Fall semester, 1981 through the Winter semester, 1987.

The hearing screenings were performed in sound treated booths at the Central Michigan University Hearing Clinic utilizing calibrated, portable audiometers. The screening procedure involved a pure-tone hearing screening at 20 dB HL (ANSI, 1969) for the octave frequencies from 500 through 4000 Hz. Failure to respond at any frequency in either ear resulted in referral for a complete hearing evaluation. The basic hearing assessment involved conventional pure-tone and speech audiometric techniques performed by graduate level audiology students under direct supervision of audiologists holding the ASHA Certificate of Clinical Competence. A computer form, which included information regarding the classification of hearing loss, magnitude of 4000 Hz hearing loss, prior knowledge of a hearing problem, and hearing aid use was completed for each student.

The data analysis determined: (1) the prevalence of hearing impairment, (2) the degree of hearing loss found during the fall versus the winter semester, (3) the type and degree of hearing impairment present, (4) the prevalence of unilateral versus bilateral hearing loss, and (5) the number of males versus females with a hearing loss.
Table 1 Prevalence of Hearing Impairment

<table>
<thead>
<tr>
<th>Year</th>
<th>Number Screened</th>
<th>Failed Screen N</th>
<th>Failed Screen (%)</th>
<th>Revaluated N</th>
<th>Revaluated (%)</th>
<th>Hearing Loss N</th>
<th>Hearing Loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981-82</td>
<td>3,275</td>
<td>57</td>
<td>1.7</td>
<td>42</td>
<td>73.7</td>
<td>26</td>
<td>61.9</td>
</tr>
<tr>
<td>1982-83</td>
<td>3,218</td>
<td>56</td>
<td>1.7</td>
<td>30</td>
<td>53.6</td>
<td>28</td>
<td>93.3</td>
</tr>
<tr>
<td>1983-84</td>
<td>3,119</td>
<td>26</td>
<td>0.8</td>
<td>16</td>
<td>61.5</td>
<td>15</td>
<td>93.8</td>
</tr>
<tr>
<td>1984-85</td>
<td>3,130</td>
<td>37</td>
<td>1.2</td>
<td>23</td>
<td>62.2</td>
<td>20</td>
<td>87.0</td>
</tr>
<tr>
<td>1985-86</td>
<td>3,130</td>
<td>18</td>
<td>0.6</td>
<td>14</td>
<td>77.8</td>
<td>12</td>
<td>85.7</td>
</tr>
<tr>
<td>1986-87</td>
<td>2,552</td>
<td>21</td>
<td>0.8</td>
<td>14</td>
<td>66.7</td>
<td>13</td>
<td>92.9</td>
</tr>
<tr>
<td>Total</td>
<td>18,424</td>
<td>215</td>
<td>1.2</td>
<td>139</td>
<td>64.7</td>
<td>114</td>
<td>82.0</td>
</tr>
</tbody>
</table>

N = number.

The number of students who were screened, reevaluated, and indicated a hearing loss. Of the 18,424 students participating, 1.2 percent failed the screening. Hearing impairment was identified in 82 percent of those who failed the screening and were reevaluated.

## RESULTS AND DISCUSSION

The results of the screening program and audiologic assessments are presented as follows: prevalence of hearing impairment, type of hearing loss, degree of hearing loss, and isolated 4000 Hz hearing loss. Within each category, the percentage of males versus females, as well as a comparison between unilateral and bilateral hearing loss is presented.

### Prevalence of Hearing Impairment

The number of students participating in the initial screening totalled 18,424. Of that number, 1.2 percent failed the screening. Hearing impairment was identified in 82 percent of those reevaluated after the initial failure. Males comprised 54 percent of the sample and accounted for 56 percent of the students identified with hearing impairments. An annual summary of information regarding the number of students screened and reassessed is contained in Table 1.

Thirty-five percent of the students who failed the screening did not return to the university hearing clinic and may have been evaluated elsewhere. If the assumption is made that these students had similar hearing losses as those who returned for reevaluation, then hearing loss was found in approximately 1.0 percent of the 18,424 students who were screened.

This number is smaller than the results of two national surveys of hearing impairment. The Health Examination Survey (HES, of 1960 to 1970) reported the prevalence of hearing impairment within the 12- to 17-year-old age bracket was 1.2 percent, and the Health Interview Survey (HIS) estimated the prevalence of hearing loss in the 12- to 17-year-old age group at 2.5 percent (Leske, 1981). Although college students are generally older than 17, the lower prevalence of hearing impairment in the college population is consistent with the findings of the National Center for Health Statistics (NCHS, 1982), which reported that persons with hearing impairment had less education than persons without hearing impairment.

Lipscomb (1972) reported on the prevalence of high-frequency hearing impairment among college students during a 2-year period. A failure criterion of 15 dB at any one of the frequencies (2000, 3000, 4000, and 6000 Hz) in either ear was utilized. The prevalence of high-frequency hearing impairment was 32.9 percent of 2,769 students in the first year and 60.7 percent of 1,410 students in the second year of the study. This much higher prevalence of hearing impairment than was found in the present study is probably a result of the lower failure criterion of 15 dB and the inclusion of the additional test frequency of 6000 Hz.

When the prevalence of hearing impairment between the fall and winter semesters was examined, the percentage of the total number of hearing impairments identified was essentially equivalent — 51 percent in the fall semesters and 49 percent in the winter semesters. A greater failure rate during the winter semester was expected, since the winter semester is usually associated with cold and flu symptoms, both of which may elevate hearing thresholds above screening levels.

Bilateral hearing impairment was found in 47 percent of the students identified with a hearing loss. This college population reported a lower ratio of unilateral to bilateral hearing loss than reported...
by HIS or NCHS. Both surveys placed the estimated ratio at 2:1 (HIS, 1.7 percent unilateral and .8 percent bilateral; NCHS, 6.3 percent unilateral and 3.2 percent bilateral) whereas the present screening indicated a ratio of 1:1 (0.3 percent unilateral and 0.3 percent bilateral).

The prevalence of unilateral hearing loss in the college population was 3 per 1,000 students. This observation is lower than the estimated 17 per 1,000 or 63 per 1,000 reported by HIS and NCHS, respectively. The results from the present study are interesting in light of the auditory, academic, and social difficulties experienced by unilateral hearing impaired school-aged children as reported by Bess, Tharpe, and Gibler (1986) and Culbertson and Gilbert (1986).

**Type of Hearing Loss**

The prevalence of conductive, sensorineural, and mixed types of hearing loss is shown in Figure 1. The majority of the identified hearing losses were sensorineural. Females exhibited more conductive hearing losses, whereas the males had about 5 percent more sensorineural and mixed hearing losses.

**Degree of Hearing Loss**

The degree of hearing impairment as a function of gender is illustrated in Figure 2, which shows the number of ears rather than the number of subjects in order to include all unilateral and bilateral hearing losses. Mild hearing impairments were the most prevalent in both males and females (55 percent and 46 percent respectively). However, the majority of the remaining females had moderate and moderately-severe hearing losses, whereas, the majority of the remaining males had severe and profound hearing losses.

**Isolated 4000 Hz Hearing Loss**

The presence of a sensorineural hearing loss at 4000 Hz when the three-frequency, pure-tone average was within normal limits was also identified. Among those students reevaluated, a 4000 Hz notch was exhibited in 61 percent of all the males and 20 percent of all the females with hearing loss. Males exhibited a greater prevalence of both unilateral and bilateral isolated 4000 Hz hearing losses as can be seen in Figure 3. Lipscomb (1972) reported a similar gender effect in the prevalence of high-frequency hearing impairment among college students.
bilateral. Females exhibited primarily a gradual degree of hearing loss whereas males exhibited primarily a precipitous degree of hearing loss at 4000 Hz (Fig. 4).

The prevalence and degree of noise-related hearing loss in university-age males raises concern regarding their levels of environmental and recreational noise exposure. It also points out the need for the education of young adults regarding the importance of using ear protection. The above-cited prevalence of 4000 Hz notches suggests that about 61 percent of the hearing losses found in male college students and about 20 percent of the hearing losses in female college students could be reduced through the use of proper noise conservation techniques.

**SUMMARY**

This study summarizes the results of a hearing screening program conducted on university students. During a 6-year period, 18,424 students were screened for hearing impairment. Of the 215 students who failed the screening, 139 were reevaluated at the Central Michigan University Hearing Clinic with a full audiologic assessment and 114 were identified as having a hearing loss. While males and females were fairly equally represented in the number of students reevaluated, and who exhibited a hearing loss, there were differences in the type, degree, and configuration of their losses. Females had a greater prevalence of conductive hearing impairment, but males had a greater prevalence of mixed and sensorineural hearing loss and typically a greater degree of impairment. Of the students failing the screening, 61 percent of the males and 20 percent of the females had an isolated hearing loss at 4000 Hz.

**REFERENCES**


