Study of the incidence of hearing impairment in three Job Corps centers

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A STUDY OF THE INCIDENCE OF HEARING IMPAIRMENT
IN THREE JOB CORPS CENTERS

By

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Dean, Graduate School
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The writer wishes to express her gratitude and sincere appreciation to Dr. Charles D. Parker for guidance and assistance throughout this study.

Appreciation is also expressed to the directors and instructors of the Anaconda, Cedar Flats, and Cottonwood Job Corps Centers, as well as to Mr. Mike Papich, District Field Supervisor for the Office of Economic Opportunity, and Mr. Vern Erickson of Region I, United States Forest Service, for their assistance, and permission to carry out this study.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II. PROCEDURE</td>
<td>8</td>
</tr>
<tr>
<td>III. RESULTS</td>
<td>14</td>
</tr>
<tr>
<td>IV. DISCUSSION</td>
<td>20</td>
</tr>
<tr>
<td>V. SUMMARY AND CONCLUSIONS</td>
<td>27</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>29</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hearing Levels Used for Screening Enrollees of the Anaconda, Cedar Flats, and Cottonwood Job Corps Centers</td>
<td>10</td>
</tr>
<tr>
<td>2. Summary of the Number of Corpsmen Evaluated for Hearing Acuity</td>
<td>15</td>
</tr>
<tr>
<td>3. Summary of Results of Hearing Screening and Threshold Determinations</td>
<td>16</td>
</tr>
<tr>
<td>4. Summary of Chi Square Analysis of Screening and Threshold Determination Results</td>
<td>18</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

One-fifth of the people in America endure "a daily struggle to secure the necessities for even a meager existence."¹ Young men and women are often trapped in this kind of environment, having been deprived of a decent education, reared in a broken home, often in a hostile environment, and with inadequate health conditions and medical care. These individuals have not had the opportunity to acquire the skills necessary to leave the environment in which they find themselves.

The Job Corps was established to provide an opportunity for young men drawn from those "whose background, health, and education make them least fit for useful work."² The opportunity to develop skills and continue education is offered to the corpsmen with the hope that some of them can escape from the poverty which they have inherited.

¹U.S., Economic Opportunity Act of 1964, Title I, Youth Programs, Part A--Job Corps, Sec. 101 s 2642.

There are two main types of Job Corps centers in operation, the Conservation Center and the Job Corps Training Center. The combined mission of these centers is to "conserve manpower" by teaching the corpsmen reading, writing, and other simple skills up to the eighth grade level, and to instruct them in vocational skills. The program of the Conservation Center is designed to prepare the enrolled corpsmen to qualify for: (1) a Job Corps Training Center; (2) military service; or (3) entering a high school or other institution of learning.

Enrollment in the Job Corps is voluntary. Eligibility for the Corps is determined by environmental factors such as the occupational status of the parents of each applicant, the applicant's educational background, and any skills which would enable him to be self-supporting. An applicant must rate low in these areas. For example, environmental factors which could designate the individual as a candidate for the Corps are: his family's being supported by some form of public assistance and including no skilled wage-earner; poor living conditions in the home; poor

3Ibid.

4All the Job Corps centers in Region I, United States Forest Service, are Conservation Centers, including the three centers in which corpsmen were tested for this study. Therefore all references to Job Corps Centers in this study apply to Conservation Centers.
and his being expelled or dropping out of school or being a selective service rejectee.5

The above factors required for eligibility for the Job Corps indicate that the young men who are inducted are primarily from the lower socio-economic level of our society. The poor health standards and inadequate medical care which typically characterize this portion of our society6,7 produce a lack of opportunity for discovering those children with hearing problems. Also, the scarcity of proper medical care could result in a lower percentage of children with impairing diseases of the ear which would be remedied medically. For these reasons, a greater incidence of hearing loss might be expected in the Job Corps population.

Problems of hearing acuity seem to be superficially considered at the time of admittance into the Job Corps. No audiometric examination is administered and

5Frank Bernatz, Montana State Employment Service, Missoula, Montana. (Personal communication with the author.)


the medical examination and history are limited. Little is usually known about the hearing of individual corpsmen and no rehabilitation for hearing problems is offered within the Job Corps. It was the writer's opinion that the incidence of hearing impairment and need for hearing rehabilitation in the Job Corps should be investigated.

The literature available revealed no published data on the incidence of hearing problems in the Job Corps population or other like groups. However, William Morton investigated the incidence of hearing impairment at the Job Corps Center at Curlew, Washington. His findings revealed that 26% of 145 corpsmen tested exhibited hearing loss greater than the 15 dB screening level used (re: 1964 ISO standards). He found that 10% of the corpsmen had "significant hearing losses deemed serious enough for medical referral." However, Mr. Morton did not state the criteria for a medically significant hearing loss. He used a screening level which seems unduly stringent considering the testing environment in which the screening was done, which was a room provided by the center. Also, no reliability checks on his testing and no calibration

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procedures before or during his testing sessions were reported. If Morton's reported incidence of hearing loss for the Curlew Job Corps Center are valid, they represent a much higher percentage of hearing loss than has been previously reported. Silverman found that 5% of school-age children have hearing impairment of some kind, and that one or two of every ten in this group require special educational attention. The others will probably respond to medical care, or their hearing will not likely reach the handicapping stage. The survey, "Hearing Sensitivity in Children and Related Factors," compiled by Eagles et al., reported the incidence of hearing loss greater than 15 dB (re: ASA standards) to be approximately 3% in the population he evaluated. Another survey by an American Speech and Hearing Association committee estimated an incidence of 2.1% of the population over nineteen years of age having handicapping hearing problems. This estimate was felt by the authors to be conservative. However, none of these studies has adequately taken into


account the incidence of hearing impairment in the lower socio-economic groups from which the applicants for the Job Corps come.

Statement of the Problem

The purpose of this study was to investigate the incidence of hearing impairment in Jobs Corps Conservation Centers located in Region I of the United States Forest Service. All of the corpsmen available within the three centers were tested. Percentages were computed for the number of corpsmen who failed the screening test. Pure tone thresholds were established for those corpsmen who failed the screening test. Using these results, percentages were computed for those corpsmen who were considered to have "medically" significant hearing losses.

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For purposes of this paper, the range of normal hearing will be considered to extend to hearing levels of 15 dB (re: ASA standards, though in this study, the corresponding values using ISO standards will be used). An individual who exhibits hearing levels, particularly in the speech range, which exceed 15 dB will be considered to have impaired hearing. Hayes A. Newby, Audiology (New York: Appleton-Century-Crofts, 1964), p. 222.

Ibid., p. 102.

If, in threshold determination, a subject exhibits hearing levels of 15 dB or greater at any two frequencies in either ear, his impairment will be considered "medically" significant. Ibid., p. 222.
and educationally significant hearing losses.\textsuperscript{16}

To permit generalizing from the results obtained in this study to the population from which the subjects, Job Corpsmen, were taken, the Chi Square measure of independence was applied to the testing results for the three centers. The Job Corps Centers tested were found to represent the same population concerning hearing acuity. The reliability of the experimenter's testing was checked by comparing results of screening and threshold determinations obtained by the experimenter with the results obtained by other audiometrists.

\textsuperscript{16}For purposes of this study, a hearing loss of 35 dB or greater will be considered educationally significant. A hearing aid might be recommended for the individual with this much loss in the speech range (between 500 and 2000 Hz) and favorable seating in the classroom is necessary. For those whose losses are greater than 45 dB, in addition to the recommendations for hearing aids and favorable seating, special speech and language training and instruction in speech reading may be necessary. Davis and Silverman, \textit{op. cit.}, p. 456.
CHAPTER II

PROCEDURE

The purpose of this study was to determine the incidence of hearing loss in three Job Corps Conservation Centers: Anaconda, Cedar Flats, and Cottonwood. These centers were under the auspices of Region I, United States Forest Service, and all were operated by Forest Service personnel.

All of the corpsmen available for testing in the above-mentioned Job Corps Centers were screened for auditory acuity at hearing levels established by the American Academy of Ophthalmology and Otolaryngology. Corpsmen who failed the screening test were administered pure tone threshold audiometric tests. After the determination of hearing acuity, corpsmen were classified as having (1) no significant hearing loss, (2) "medically" significant hearing loss, and (3) educationally significant hearing loss. The subjects consisted of 440 corpsmen from the three centers, representing 88.7% of the total population of these centers at the time of testing.

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17Newby, op. cit., p. 102.
The standard sweep check procedure\textsuperscript{18} was used for screening corpsmen. Research has demonstrated that this method is an efficient hearing screening method.\textsuperscript{19, 20} The hearing levels at which each screening frequency was presented are shown in Table 1.\textsuperscript{21} The screening hearing levels specified are taken to be the lower limits of normal hearing as defined by the American Academy of Ophthalmology and Otolaryngology.\textsuperscript{22} If a corpsman failed to respond to one or more of the frequencies screened in either ear, he was considered to have failed the sweep check.

\textsuperscript{18}Ibid., p. 217.


\textsuperscript{21}The screening levels suggested by the AA00 have been accepted nationally as a standard of comparison for screening procedures. These levels were established with reference to ASAD standards of audiometer calibration. Recently a 1964 ISO standard of calibration was accepted. There is a discrepancy between the standards at all frequencies being approximately 11 dB. The data in this study will be reported with reference to the 1964 ISO standards unless otherwise specified. The screening levels to be used can be compared with the AA00 screening levels by applying them to Table 1.

\textsuperscript{22}Davis and Silverman, \textit{op. cit.}, p. 257.
For all corpsmen who failed the screening test, pure tone thresholds were established employing the Hughson-Westlake Method. Pure tone thresholds were obtained for the following frequencies: 500, 1000, 2000, 4000, and 6000 Hz. The thresholds obtained were recorded on audiograms which were used to categorize corpsmen as having no significant hearing loss, "medically" significant hearing loss, or educationally significant hearing loss.

### TABLE 1

<table>
<thead>
<tr>
<th>Hz</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>6000</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB</td>
<td>30</td>
<td>25</td>
<td>25</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

A Beltone 10-C audiometer calibrated to 1964 ISO standards was used for the screening procedures and pure-tone threshold determinations. Rudmose earphone enclosures, "Otocups," were employed to achieve "... an

attenuation of ambient noise comparable to that provided by a single-wall test booth.\textsuperscript{24}

It is claimed that when Otocups are used, zero dB hearing levels can be obtained on normal hearing subjects provided that in the room in which the testing is performed, the level of ambient noise does not exceed 55 dB in any octave bands between 150 and 1200 Hz.\textsuperscript{25}

No sound level meter was available to the experimenter, so rooms with the lowest ambient noise levels were selected subjectively for conducting the audiometric testing. The audiometer was checked for calibration before each testing session by two audiometrists whose hearing acuity was known. It was the intent of the experimenter that if any deviation in audiometer output was consistent for the two subjects, the difference would be noted and corrections applied to hearing level dial readings.\textsuperscript{26}

In addition to determining the percentage of hearing loss in each center, the experimenter was interested in determining if individuals in the Job Corps Centers surveyed represented the same general population insofar as hearing acuity was concerned. To make this determination, the Chi Square measure of independence was applied to the results obtained from the three centers.

\begin{itemize}
  \item \textsuperscript{24}Newby, \textit{op. cit.}, p. 274.
  \item \textsuperscript{25}Ibid.
  \item \textsuperscript{26}Ibid., p. 87.
\end{itemize}
An attempt was also made to compare the number of corpsmen reported to have hearing impairment at the time they were admitted to the Job Corps to the number of corpsmen found to have hearing losses by the experimenter. For this purpose the medical records for each of the corpsmen who was screened were reviewed.

In this type of study, reliability presents a problem. The experimenter was interested in two kinds of reliability: (1) can the experimenter adequately do audiological testing; and (2) are the audiological results reliable under the field conditions of the project. To assess the reliability of pure tone threshold determinations, fifteen subjects between the ages of sixteen and twenty-one were administered pure tone threshold examinations by the experimenter and two other qualified examiners. Each audiometrist tested five of the fifteen subjects first, five subjects second, and five subjects third. The results obtained were compared to establish inter-tester reliability using the Hughson-Westlake method of threshold determination. Secondly, 10% of the corpsmen tested by the experimenter were tested a second time in the same acoustical environment by another audiometrist using the sweep check procedures defined. The results obtained by the two examiners were compared in an effort to assess inter-tester reliability using the screening
Duplicate records of the audiograms of each corpsman found to have a significant hearing loss were made and submitted to the director of each center along with a summary of results of the study.
CHAPTER III

RESULTS

Spring quarter, 1966, all the corpsmen available in three Job Corps Centers in Region I of the United States Forest Service were screened by the experimenter for hearing acuity using a sweep check screening test. Of a total of 496 corpsmen enrolled in the three centers at the time of testing, 440 or 88.7% of the corpsmen were actually evaluated. (See Table 2.) The remaining corpsmen enrolled were not available for hearing evaluations because of conflicts in the scheduling of the work groups at the center and the testing sessions for this study.

If a corpsman failed to respond to one or more frequencies screened in either ear, he was considered to have failed the screening test and was evaluated further using the Hughson-Westlake method for pure tone threshold determination. Of the corpsmen tested, 107 or 24.5% failed the screening test. (See Table 3.)

On the basis of pure tone audiological examinations, the corpsmen were segregated into three categories: (1) no hearing loss; (2) "medically" significant hearing
TABLE 2
SUMMARY OF THE NUMBER OF CORPSMEN EVALUATED FOR HEARING ACUITY

<table>
<thead>
<tr>
<th>Job Corps Center</th>
<th>Corpsmen Enrolled at Time of Testing</th>
<th>Corpsmen Actually Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaconda</td>
<td>96</td>
<td>83 (86.4%)</td>
</tr>
<tr>
<td>Cedar Flats</td>
<td>200</td>
<td>177 (88.5%)</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>200</td>
<td>180 (90.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>496</td>
<td>440 (88.7%)</td>
</tr>
</tbody>
</table>
TABLE 3

SUMMARY OF RESULTS OF HEARING SCREENING AND THRESHOLD DETERMINATIONS

<table>
<thead>
<tr>
<th>Job Corps Center</th>
<th>Subjects Screened</th>
<th>Subjects Failing Screening</th>
<th>Subjects with &quot;Medically&quot; Significant Hearing Loss</th>
<th>Subjects with Educationally Significant Hearing Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaconda</td>
<td>83</td>
<td>14 (16.9%)</td>
<td>6 (7.2%)</td>
<td>3 (3.6%)</td>
</tr>
<tr>
<td>Cedar Flats</td>
<td>177</td>
<td>45 (27.1%)</td>
<td>45 (9.6%)</td>
<td>8 (4.5%)</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>180</td>
<td>45 (25.0%)</td>
<td>24 (13.3%)</td>
<td>6 (3.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>440</td>
<td>107 (24.3%)</td>
<td>47 (10.7%)</td>
<td>17 (3.9%)</td>
</tr>
</tbody>
</table>
loss; and (3) educationally significant hearing loss. Of the 107 corpsmen who were considered to have failed the screening test, 60 corpsmen, on re-evaluation, were found to have no hearing loss. Forty-seven or 10.7% of the 440 corpsmen in the three centers who were available for testing were found to have "medically" significant hearing losses. Seventeen or 3.9% of the corpsmen tested were found to have educationally significant hearing losses. (See Table 3.)

The Chi Square measure of independence\(^{27}\) was used to compare the number of corpsmen who failed the screening test and those who passed in each of the three centers. The number of corpsmen who were found to have "medically" significant hearing losses in each center was similarly compared. In both cases the conclusions drawn from the Chi Square test indicated that the results of the screening tests were independent of the Job Corps Center in which they were taken. (See Table 4.)

To find tester reliability for threshold determinations, the experimenter and two other audiometrists obtained puretone thresholds under "ideal" clinical testing conditions for fifteen students between the ages of sixteen and twenty-one. Each of the examiners was the

### TABLE 4
SUMMARY OF CHI SQUARE ANALYSIS OF SCREENING AND THRESHOLD DETERMINATION RESULTS

#### Chi Square Analysis of Hearing Screening Results

<table>
<thead>
<tr>
<th>Passed Screening</th>
<th>Cottonwood</th>
<th>Cedar Flats</th>
<th>Anaconda</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>136.26</td>
<td>133.99</td>
<td>62.83</td>
<td>333</td>
</tr>
<tr>
<td>Failed</td>
<td>43.74</td>
<td>43.01</td>
<td>20.17</td>
<td>107</td>
</tr>
<tr>
<td>Total Screened</td>
<td>180</td>
<td>177</td>
<td>83</td>
<td>440</td>
</tr>
</tbody>
</table>

\[ X^2 = 3.3059 \]

#### Chi Square Analysis of Threshold Determination Results

<table>
<thead>
<tr>
<th>Passed Screening</th>
<th>Cottonwood</th>
<th>Cedar Flats</th>
<th>Anaconda</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>161.28</td>
<td>158.59</td>
<td>74.37</td>
<td>394</td>
</tr>
<tr>
<td>Significant</td>
<td>18.72</td>
<td>18.41</td>
<td>8.63</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>177</td>
<td>83</td>
<td>440</td>
</tr>
</tbody>
</table>

\[ X^2 = 2.9086 \]
first to test five of the subjects, second to test five, and third to test five, in an effort to control differences in results which might occur because of the order in which the subjects were tested. The examiners used the Hughson-Westlake method for determining thresholds. The Beltone 10-C audiometer was used. The audiograms obtained from these tests were categorized into (1) those exhibiting a significant hearing loss and (2) those not exhibiting a significant hearing loss. There was perfect agreement among the examiners on thirteen of the fifteen subjects. In the remaining two cases the results obtained by the experimenter were in agreement with those obtained by one of the other two audiologists. These results were considered to represent a high level of agreement and are indicative of the experimenter's ability to do audiological testing under normal clinical conditions.

Thirty-two corpsmen selected at random from the 440 available subjects were screened a second time by another audiometrist who used the sweep check screening procedure and did the testing under the same field conditions as did the experimenter. A comparison of the results was made in an effort to establish inter-tester reliability. There was agreement between the examiners concerning the passing or failing of 26 of the 32 corpsmen tested by both examiners. This is an agreement of 81.3%.
CHAPTER IV

DISCUSSION

Experimental Population

In Region I of the United States Forest Service there are eleven Job Corps Centers, ten of which are under the auspices of the Forest Service. Three of these Job Corps centers were chosen for this study because of their proximity to Missoula. Although two other centers were within reasonable geographical range, the directors of these centers would not make their corpsmen available for this study at the time the project was planned.

In addition to obtaining information regarding the hearing acuity of individuals, the experimenter was concerned with the possibility of generalizing to a larger population than the corpsmen tested in each of the three centers. Statistical treatment of the data makes it possible to consider the corpsmen from each of the three centers as coming from a common group. Further, all information available indicates that individuals are placed in the various centers in Region I on a non-selective basis, and it seems feasible to generalize from the data obtained
at these three camps to all the Job Corps Centers in Region I. Because there appears to be no selective factor in the placement of corpsmen in any of the centers, generalizing the results of this study beyond Region I of the Forest Service to all the Job Corps Centers seems justified.

**Hearing Evaluation for Corpsmen**

This audiological survey does not determine if hearing impairment found among the corpsmen is permanent or temporary, medically remediable or if rehabilitative techniques are necessary. Ideally all of the corpsmen found to have significant hearing losses in this study would receive otological evaluations. Following this medical evaluation, those individuals whose hearing could not be restored medically or surgically should be reassessed for rehabilitative need. It is expected that many corpsmen with unremediable (educationally significant) hearing losses would benefit from rehabilitative services. Without these services they will have difficulty in the educational, and possibly in the vocational, environment of the Job Corps centers. Preferential seating, speech reading, auditory training, and evaluation for amplification should be considered on an individual basis for those

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28 Davis and Silverman, *op. cit.*
who were found to have educationally significant hearing losses in this study, and for their counterparts throughout the Job Corps.

Correlations with Medical Records

An attempt was made to compare the number of hearing losses reported in the health records prepared at the time each corpsman was enrolled in the Job Corps to the number of hearing losses found by the experimenter. At the time of enrollment there were two areas pertaining to hearing in the medical history and evaluation administered to Job Corps applicants. Each applicant was asked to answer affirmatively or negatively the following question. "Do you have, or have you ever had: ear, nose, or throat trouble; running ears; or hearing loss." In the clinical evaluation, a physician had the opportunity to record observations of the ears in general, and of the ear drums in particular. These were reported as "normal," "abnormal," or "not examined." If hearing testing was performed, it typically involved the whispered and/or spoken voice tests which are not currently recognized as valid

tests of hearing acuity. In the review of the 107 records there was no evidence that pure tone audiometric testing had been done. There were only six reported incidences of ear trouble and/or hearing loss on the medical forms for all the corpsmen in the three centers. It is obvious that the information reported in the medical records at the time of induction is not sufficient to discover a majority of hearing problems which the corpsmen have.

Comparison with Other Studies

The results of William Morton's survey of hearing impairment at the Curlew Job Corps Center are very similar to the results obtained in this study. Both of these investigators found a greater percentage of hearing impairment in the Job Corps populations they tested than was reported in any of the studies mentioned in the introductory chapter of this thesis. In accounting for this difference, it is apparent that a significant variable is the socio-economic background of the populations tested. For example, in the Eagles study the hearing acuity of


31Morton, op. cit.
approximately 5000 children ranging in age from three to fifteen years was tested.\textsuperscript{32} This population was felt by the authors to be representative of the Pittsburgh, Pennsylvania, school system. In the contrasting population, the Job Corpsmen were primarily from lower socio-economic backgrounds. Inadequate medical attention and poor health conditions in the environment from which the corpsmen come would conceivably contribute to the higher percentage of hearing loss found.

Reliability

The experimenter and two other audiometrists tested fifteen high school students using the Hughson-Westlake method of threshold determination and the results were compared to assess the reliability for threshold determination. These results were considered to represent a high level of agreement and were felt to be indicative of the experimenter's ability to do audiological testing under normal clinical conditions.

Thirty-two corpsmen were screened a second time by another audiometrist when the screening procedures were being employed at the three Job Corps Centers. The results were compared in an effort to assess the reliability of the screening results. There was agreement

\textsuperscript{32}Eagles, \textit{et al.}, \textit{op. cit.}
between the examiners on 26 or 81.3% of the 32 corpsmen. While this is not a high level of agreement, there are several factors that might conceivably have influenced the results of the screening testing. Although the quietest place available for testing was selected at each center, the ambient noise level varied with the number of corpsmen with free time outside the room and the machinery operating in the near environment, so the testing environment did not represent ideal audiological testing conditions; however, no other facilities were available. Secondly, most of the corpsmen were anxious about "passing" the examination and took advantage of any cues which the examiner might inadvertently give. It was necessary for the experimenter to spend more time than is normally needed for this type of examination, and to repeat the procedure until consistent and reasonable responses were obtained from the corpsmen. However, the generalizations drawn from this project appear to be valid.

Limitations

The primary limitation to this study was the recognized problem of ambient noise which was particularly obvious in the testing conditions at the Cottonwood Job Corps Center. However, the noise level problems
at the Anaconda and Cedar Flats Centers, while seemingly lower, did not show differences in hearing testing results when statistically analyzed.

Secondly, the corpsmen who were subjects for this study were known to have limited social and educational backgrounds. In general, testing these subjects was difficult and, while most of the corpsmen were very cooperative, they expressed a fear of "failing" the test and tended to respond too readily, often when no tone was presented. However, it is the experimenter's opinion that, in general, reasonable responses were obtained from the vast majority of corpsmen tested. The experimenter had no feeling that there was an unwillingness to participate among the corpsmen.
Of the 440 corpsmen screened for hearing acuity, 107 or 24.3% failed the screening test and were further evaluated for threshold determinations using the Hughson-Westlake method. Results of the threshold evaluation revealed that 47 or 10.7% of the corpsmen were considered to have "medically" significant hearing losses, and 17 or 3.9% of the corpsmen had educationally significant hearing losses.

Comparison of the results of this study to other studies demonstrated that a higher percentage of hearing loss was found in the Job Corps population than in samples representing a cross-section of the general population.

The results of this study may have been limited by the following:

(1) The test conditions were not ideal because of ambient noise.

(2) The limited social and educational backgrounds of most of the corpsmen made testing difficult.

Results of this study indicate a need for audiological and otological evaluation of the corpsmen at the time they are admitted into the Job Corps. Individuals with hearing losses (educationally significant hearing losses) that are not remediable by medical or surgical means should receive the necessary rehabilitative services they require.
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