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RELATIVE HEARING LEVELS AND TYPES OF HEARING LOSS AMONG FOUR SELECTED GROUPS OF AIR FORCE PERSONNEL

SCHOOL OF AVIATION MEDICINE
RANDOLPH AIR FORCE BASE, TEXAS

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LENNART L. KOPRA, Ph. D.
DUILIO T. PEDRINI, Ph. D.
ROGER W. FULLINGTON, B A.

The University of Texas
Austin, Texas

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Air University
SCHOOL OF AVIATION MEDICINE, USAF
RANDOLPH AFB, TEXAS
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Pure-tone air-conduction and bone-conduction audiometric tests were administered to 125 Air Force personnel. One group consisted of 25 non-noise-exposed men. The other three groups were noise-exposed individuals: 25 Class A, 50 Class B (re AFR 160-3, 1956), and 25 Class C (500-2000 cps average of more than 15 db). Relative hearing levels of right and left ears within and between groups are presented. Results showed: good agreement between median and mean thresholds at almost all test frequencies; no significant differences between right and left ears within groups; that the Class Ann and A median and mean thresholds were within a few decibels of the American Standard reference normal; that the Class B group deviated from the Class A groups only at 3000, 4000, and 6000 cps; that, with the exception of Class B at 4000 and 6000 cps, the Class C group was significantly different from the other groups at all test frequencies; that approximately 13 percent of Class B and Class C groups had either conductive or mixed-type hearing loss, the remaining 87 percent being perceptive-type hearing loss; that 35 out of 75 individuals in Class B and Class C groups expressed a preference for an ear and of these 35 individuals, 25 chose the better ear correctly.

In the evaluation of hearing loss among noise-exposed individuals, medical personnel are faced with many problems in determining whether or not a casual relationship exists between job noise and hearing loss. Basic questions which confront the interpreter of audiometric results include the following: (a) How do the test results compare with an accepted standard of normal acuity? (b) What is the type of hearing loss? (c) Is this type of loss related to a given job-noise environment?

The audiologic data which have been accumulated at Bergstrom AFB include pure-tone air-conduction and bone-conduction threshold data and relevant history information. The present investigation was carried out in order (a) to compare the hearing acuity of a selected group of non-noise-exposed Class A Air Force personnel with selected groups of noise-exposed Class A, Class B, and Class C individuals, (b) to compare the auditory thresholds of these Air Force groups with normative data provided by other studies, and (c) to determine the incidence of conductive, perceptive, and mixed-type hearing loss in Air Force Class B and Class C groups.

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PROCEDURE

The 125 male subjects selected for this study were Air Force personnel stationed at Bergstrom Air Force Base. Their ages ranged from 18 to 44 years. The men were chosen so as to include 25 Class A non-noise-exposed individuals (hereafter abbreviated Class Ann), 25 job-noise-exposed Class A, 50 job-noise-exposed Class B, and 25 job-noise exposed Class C individuals.[1] The 25 non-noise-exposed personnel used in this study do not necessarily represent a typical sample of non-noise-exposed Air Force personnel. The individuals chosen with Class A hearing were from a group of non-noise-exposed men in which the incidence of Class A, Class B, and Class C hearing is unknown. From an originally identified group of 41 flight-line personnel with Class C hearing, 25 were available for testing in this study (7). The number of subjects

[1]Unless otherwise specified, Classes A, B, and C hearing will refer to individuals' worse-ear hearing as follows:

Class A – no hearing loss greater than 15 db in either ear from 500 cps through 6000 cps.

Class B – hearing loss of more than 15 db in either ear at any frequency from 500 cps through 6000 cps but not averaging more than 15 db for the three speech frequencies, 500, 1000, and 2000 cps.

Class C – average hearing loss in either ear of more than 15 db for the three speech frequencies, 500, 1000, and 2000 cps.

in the noise-exposed groups was based on desirable sample size and does not represent proportional sampling of Class A, B, and C hearing among noise-exposed Air Force flight-line personnel.

Hearing status for an individual is identified by his worse ear (Air Force Regulation 160-3, dated 29 October 1956). An individual with a Class C hearing status may have a Class A, a Class B, or a Class C ear. For this reason, ears as well as individuals status will be considered.

As used in this study, a Class C ear is one in which the average loss for 500 to 2000 cps is more than 15 db as contrasted to Class C hearing as defined in Air Force Regulation 160-3 where Class C hearing is identified as average worse-ear hearing of 20 db or more. Since the 500 to 2000 cps pure-tone average is a good estimate of the hearing loss for speech and because it is generally accepted that hearing losses in excess of 15 db appear to be significant in terms of hearing adequately in social situations, an average of more than 15 db appeared more desirable than the 20-db cut-off point for Class C hearing. For this reason and unless otherwise qualified, in this report Class C hearing is based on a 500 to 2000 cps average of more than 15 db.

The 25 Class A non-noise-exposed individuals had duty assignments at the 4473d USAF Hospital. The Class A, Class B, and Class C (with one exception) noise-exposed personnel had duty assignments on the flight line, and their jobs intermittently exposed them to noise levels ranging from 90 db to approximately 135 db. Exposure to criterion-level noise ranged from a few minutes to a few hours per day. In our study, *criterion-level noise* refers to on-the-job noise which partly or totally masks loud speech close to the ear of the listener. Noise causing this amount of difficulty approximates an over-all level of 95 db or greater for a broad spectrum noise. No effort has been made in this report to quantify the noise levels and exposure duration for the personnel engaged in "noisy" jobs, such as aircraft maintenance.

A Beltone Model 15A audiometer with Telephonics TDH-39 earphones was used in the administration of the pure-tone audiometric tests. Subjects were tested in an Industrial Acoustics Company Model 401 Audiometric Testing Room which was installed in one of the wards of the base hospital. The audiometer room met the requirements of specifications set forth in the Air Force Regulation 160-125, dated 13 August 1957, and as discussed by Cox (3).

The tests were administered during a four-month period. Three times during this period the audiometer earphones were calibrated at the School of Aviation Medicine, USAF, according to the procedure recommended by the National Bureau of Standards (1). One calibration was made before hearing tests were begun; a second calibration was made about midway in the four-month testing period; and the third calibration was made at the conclusion of the hearing tests. Considering all test frequencies, the range of calibration corrections for SPL output was from minus 5.9 db to plus 3.5 db. Corrections to the closest 0.1 db were applied to the mean- and median-threshold data, so that hearing loss is reported relative to the American Standard audiometer zero (3). Frequency calibration results on three separate occasions showed less than 3 percent error for all test frequencies.

For air-conduction thresholds, frequencies were tested in the following order for all subjects: 1000, 1500, 2000, 3000, 4000, 6000, 1000, 500, and 250 cps. For bone-conduction tests the order was as follows: 1000, 2000, 4000, 1000, 500, and 250 cps. In determining thresholds, the experimenter used a modified psychophysical method of limits. The hearing-loss dial was set at minus 10 db, and settings were increased in 10-db increments until the subject responded. Several tone presentations were given at this level to establish it as a 100 percent response level. The intensity of the tone was then diminished by 5-db steps until the subject did not respond to several tone presentations. The hearing-loss dial setting was then increased until a response was obtained. The examiner then "bracketed" a "twilight zone" by increasing and decreasing the intensity by 5 db until 50 percent or more correct responses were observed for each series of tone presentations. This hearing-loss dial setting was then recorded as the threshold for the frequency under test. It should be pointed out that some individuals gave a 100 percent correct response for a series of tone presentations when the hearing-loss dial was set at maximum attenuation (i.e., minus 10 db). This result means that the minus 10 db which was recorded as the pure-tone threshold was not a good estimate of the actual auditory sensitivity re zero normal or the current American Standard. This problem could be overcome if an auxiliary attenuator pad were installed so that thresholds lower than minus 10 db re audiometer zero could be measured.

During a test session each subject was interviewed, and a comprehensive history questionnaire was completed for him.

RESULTS

The audiometric data were analyzed in order to determine the relative hearing levels[2] of right and left ears within and between the four groups under study. The air-conduction/bone-conduction relationship was assessed to establish the incidence of perceptive, conductive, and mixed-type hearing loss among personnel who had Class B and Class C hearing. Awareness of a preferred or better ear on the part of Class B and Class C personnel was investigated and compared to the actual better ear based on pure-tone threshold results.

Median and mean thresholds for right ears and left ears

Twenty-fifth percentile, median, and seventy-fifth percentile hearing levels for right ears and left ears of Class Ann, A, B, and C groups are shown in table I. The median age and the age range for each group are also shown. The median ages for the groups ranged from 20.2 years for the Class A group to 24.4 years for the Class C group.

To compare two estimates of central tendency, mean and median hearing levels for the four groups were calculated. Comparison of means and medians can be made by inspection of data in figure 1 and table I. For the Class Ann and Class A groups there was good agreement between median and mean thresholds at all test frequencies in both right and left ears. In the Class B group similar agreement was noted from 250 cps through 2000 cps. However, in the Class B group the effect of extreme losses from 3000 cps through 6000 cps in some cases influenced the mean threshold and made it considerably larger than the median; for example, at 6000 cps the median was 23.8 db, and the mean was 30.1 db. There was relatively good agreement between median and mean thresholds at all test frequencies in the Class C group. With the exception of the high frequencies in the Class B group, the medians and means approximated each other. In other words, the differences between medians and means at the various test frequencies were negligible.

The differences in hearing levels between right and left ears within each group were analyzed. Hearing levels in right ears and left ears were grouped according to greater or less loss than the median loss for both ears and were tested by chi square. In general, there were no significant differences at the 5 percent level of confidence (or better) between right and left ears within Classes Ann, B, and C when median-threshold differences were tested by chi square and when mean-threshold differences were tested by the t-test (9, 5). However, in the noise-exposed Class A group, significant differences between right- and left-ear thresholds were observed at 2000 cps and at 3000 cps.

Mean air-conduction and bone-conduction audiograms for Classes Ann, A, B and C are shown in figure 1. In considering the differences between Class A (or Ann), B, and C, one must expect the reported thresholds to differ from each other at some frequency or frequencies, since the criterion of selection is based upon differences in hearing levels. The similarities as well as the differences between groups are apparent in figure 1. In general, the thresholds for the right and left ears in Class Ann and Class A appear to be the same. When the right- or left-ear thresholds for Ann and A were compared with those of Class B, no statistically significant differences were observed for frequencies 250 cps through 2000 cps. The differences between Class Ann and Class A when contrasted with the B group appeared at 3000,

[2]The term *hearing level* is used here in the sense suggested by Davis et al. (4) and refers to "the deviation in decibels of an individual's threshold of hearing from the American Standard value for the reference zero for audiometers."

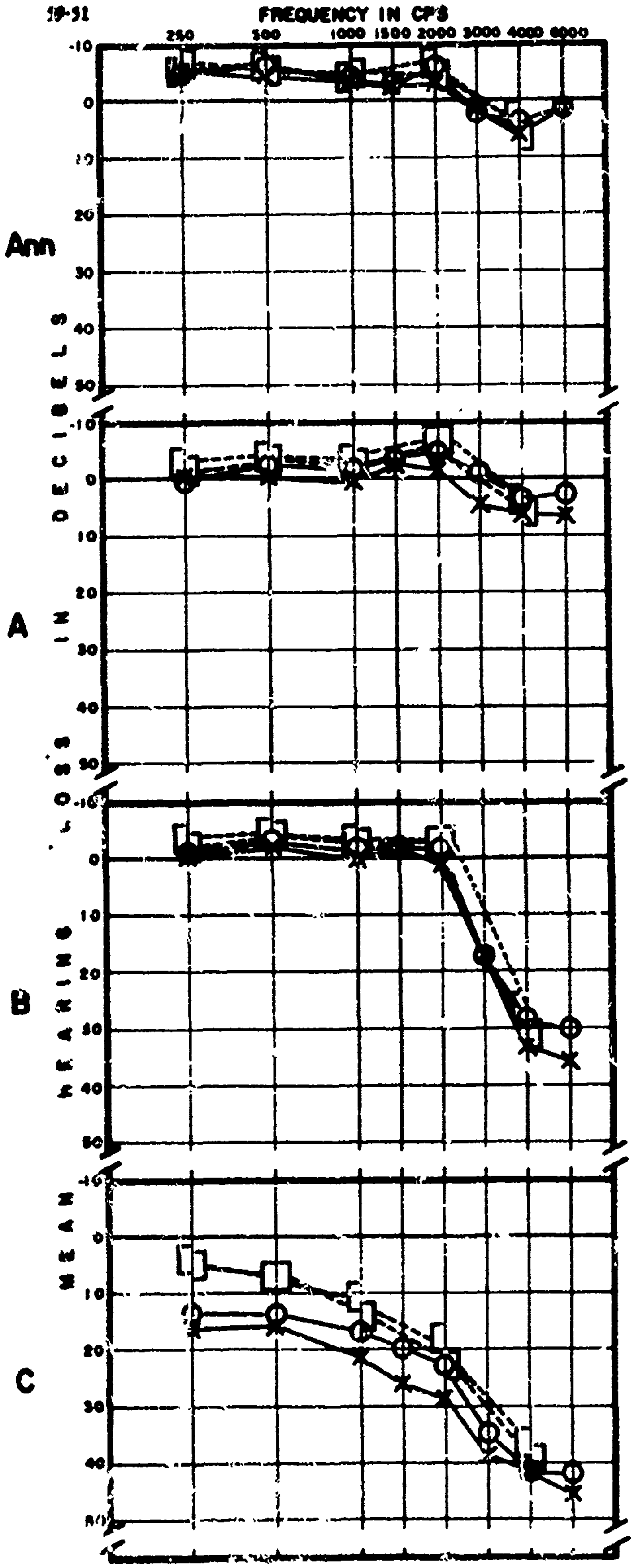

FIGURE 1

Mean air-conduction and bone-conduction thresholds for right ears and left ears of Class Ann, Class A, Class B, and Class C groups.

LEGEND

AIR CONDUCTION
O——O RIGHT EAR
X——X LEFT EAR

BONE CONDUCTION
[-----[RIGHT EAR
]-----] LEFT EAR

TABLE I

Twenty-fifth percentile, median, and seventy-fifth percentile hearing level in decibels for right ears and left ears of Class Ann, A, B, and C groups

Class	n	Median age (range)	Percentile	Frequency in cps: 250 Right	250 Left	500 Right	500 Left	1000 Right	1000 Left	1500 Right	1500 Left	2000 Right	2000 Left	3000 Right	3000 Left	4000 Right	4000 Left	6000 Right	6000 Left
Ann	25	21.6 (18-34)	25th	-10.8	-12.5	[illegible]	-9.6	-7.8	-8.3	-7.4	-7.4	-9.4	-6.7	-2.3	-4.2	-0.3	0.7	-3.8	-5.1
			50th	- 6.5	[illegible]	- 6.2	-5.5	-3.7	-4.2	-3.7	-3.1	-5.9	-3.2	2.4	0.6	2.9	4.6	1.6	[illegible]
			75th	1.1	- 0.1	- 1.7	0.3	-0.5	1.0	1.9	1.2	-2.7	0.2	6.4	5.7	9.4	11.8	5.6	7.7
A	25	20.2 (18-39)	25th	- 5.3	- 5.0	- 7.1	-5.6	-4.9	-4.6	-7.8	-7.0	-8.9	-5.4	-4.7	-0.6	-1.3	0.8	-2.7	[illegible]
			50th	- 0.1	0.4	- 3.2	0.3	-1.9	0.3	-5.0	-2.3	-5.4	[illegible]	-1.1	6.9	2.2	5.3	3.6	7.9
			75th	4.4	4.4	2.0	5.1	1.4	5.0	0.5	2.2	-0.3	3.6	2.8	9.5	8.9	11.8	7.5	12.1
B	[illegible]	[illegible] (18-44)	25th	- 6.1	- 5.9	- 8.3	-6.6	-5.2	-5.4	-7.5	-8.1	-7.4	-7.0	4.4	7.9	9.3	16.5	6.5	15.2
			50th	- 1.3	- 0.7	- 3.6	-2.4	-1.4	0.1	-1.3	-2.0	-2.8	0.8	10.6	14.0	23.5	29.7	23.8	29.4
			75th	3.8	4.6	0.8	2.3	2.9	4.9	3.9	4.3	4.0	7.6	25.0	22.8	47.9	49.1	52.7	56.9
C	25	24.4 (19-44)	25th	2.1	1.4	0.4	-1.3	4.2	8.8	4.6	11.2	6.0	12.9	17.3	23.3	24.2	24.2	[illegible]	18.1
			50th	8.9	12.0	10.2	14.6	13.6	17.8	19.9	20.9	19.2	29.1	34.1	[illegible]	42.4	42.8	41.1	43.1
			75th	22.1	27.0	20.6	25.2	27.4	35.2	41.9	44.7	38.8	46.5	49.8	56.6	62.4	60.5	69.2	[illegible]

4000, and 6000 cps. When the Ann and A groups were contrasted with the Class C group, the differences between thresholds at the various test frequencies were all significant at the 1 percent level of confidence. The Class B group when compared with the Class C group differed significantly from 250 cps through 3000 cps, but at 4000 cps and at 6000 cps no statistically significant differences were found. In other words, the Class A groups were similar to the Class B group in the lower frequencies, and the Class B group was similar to the Class C group at the two highest test frequencies.

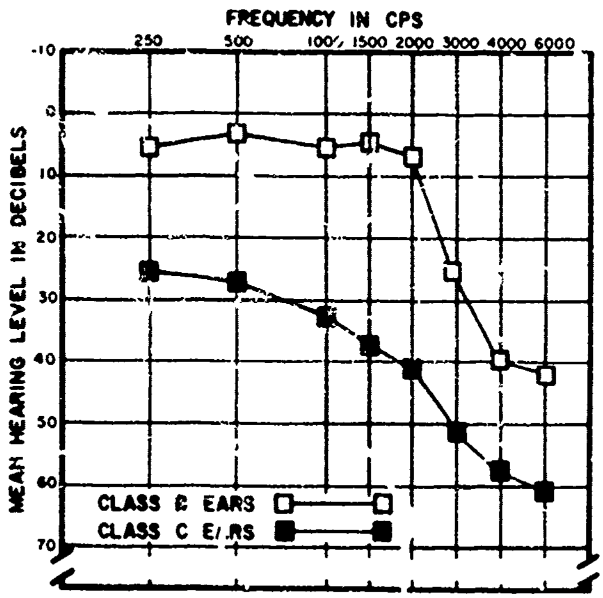

FIGURE 2

Mean air-conduction thresholds for 93 Class B ears and for 36 Class C ears of 50 Class B individuals and 25 Class C individuals.

TABLE II

Incidence of Class B and Class C hearing in right ears and left ears of 50 Class B individuals and 25 Class C individuals

Right ear	Left ear			
	A	B	C	Total
A	-	13	2	15
B	3	34	9	46
C	3	0	11	14
Total	6	47	22	75

Figure 2 shows mean air-conduction thresholds for 93 Class B ears and for 36 Class C ears among 50 Class B individuals and 25 Class C individuals. When these threshold results are compared to the mean thresholds of right and left ears of Class B and Class C individuals which appear in figure 1, the effect of considering class of individual rather than class of ear can be seen. From 250 cps through 2000 cps the mean threshold for Class B ears is approximately 5 db, and at 4000 and 6000 cps it is about 40 db. It must be remembered that some of the Class B ears occurred in Class C individuals. In general, the audiometric contour is displaced downward an average of about 7 db when the mean thresholds of Class B ears are contrasted with the mean thresholds of combined right and left ears of Class B individuals. When the mean thresholds of right and left ears in Class C individuals in figure 1 are compared with the mean thresholds of Class C ears in figure 2, it can be seen that the audiometric contour remains about the same. The difference between these mean thresholds ranges from about 11 db at 250 cps to about 17 db at 6000 cps when the Class C thresholds in figure 1 are compared to those which appear in figure 2.

Table II shows the incidence of Class B and Class C hearing in right and left ears of 50 Class B and 25 Class C individuals. This table shows that 34 of the Class B individuals had binaural Class B hearing and that there were 84 Class B ears in this group of 50 men. In the Class C group, 11 had binaural Class C hearing, and there were 36 Class C ears in the group of 25 Class C individuals. Proportionally, there was more binaural Class B hearing in the Class B group than binaural Class C hearing in the Class C group.

Speech-reception threshold data were not accumulated from the subjects used in this study. However, the relationships between pure-tone thresholds and predicted speech-reception thresholds are fairly well known (2). The 500 to 2000-cps average closely approximates the speech-reception threshold. In the group of 50 Class B individuals, 34 had binaural Class B hearing. No significant reduction in speech-reception ability should be expected as a result of high-frequency loss in the Class B group. The effect of the high-frequency loss on speech discrimination in this group would need to be established before the effect on social adequacy could be described.

The estimated speech-reception threshold for both ears of the Class C group as a whole would be approximately 17 db. The binaural Class C group would have speech-reception thresholds in excess of 20 db. In an earlier study by Kopra et al. (7) the incidence of Class A, Class B, and Class C hearing was established for a group of 996 Air Force flight-line personnel: Class A – 49 percent, Class B – 47 percent, and Class C – 4 percent. In the present study, 11 of 25 Class C individuals had binaural Class C ears. In the 996 flight-line personnel tested previously, the incidence of binaural Class C hearing among flight-line personnel was approximately 1.8 percent. The medical reversibility among this latter group should be studied before statements concerning the probable need for aural rehabilitation can be made. The recently inaugurated hearing conservation program in the Air Force should identify Class C hearing among Air Force recruits and among active service personnel so that remedial attention can be given. The subsequent disposition of individuals identified as having binaural Class C hearing should reduce the incidence of binaural Class C hearing among Air Force personnel. Therefore, the effect that the hearing conservation program has in reducing this incidence should be taken into account if estimates of binaural Class C hearing among flight-line personnel are based on these results.

Figure 3 shows a comparison of median thresholds in right and left ears of three groups of young males: (a) an age-selected Class A non-noise-exposed Bergstrom AFB group in the present study; (b) Air Force recruits at Lackland AFB as reported by O'Connell (8); and (c) a selected group of males in the 1954 Wisconsin Hearing Survey as reported by Glorig et al. (6). The median thresholds of the Bergstrom group and the Lackland group are close to each other from 500 cps through 2000 cps and at 6000 cps. When compared to the selected group of Bergstrom AFB males, the Lackland male recruits had better median thresholds at 3000 cps and 4000 cps. At this time it is difficult to determine the actual significance of this difference. With one exception (at 4000 cps), the Bergstrom AFB group of non-noise-exposed young males had better median thresholds than the Wisconsin selected normal group. It is very probable that the psychophysical method used in the measurement of "threshold hearing" accounts for the consistent threshold differences between these groups. Before one can meaningfully compare and evaluate the differences between two or more sets of data, obviously the effects of different psychophysical methods and all other test variables should be taken into account.

Types of hearing loss

The diagnosis of the type of hearing loss among job-noise-exposed personnel is important. Significant temporary or persistent threshold shifts may have medical, job-placement, and rehabilitational implications. The pure-tone audiometric thresholds established for each individual in this study revealed the hearing level for that individual. Since test-retest threshold differences were not available from these data, no meaningful significance could be attached to hearing levels which indicated a significant deviation from the American Standard value for reference zero in audiometers. However, it is worthwhile to note the incidence of the types of hearing loss among Class B and Class C individuals. Table III shows the number of ears diagnosed as conductive, perceptive, and mixed-type hearing loss in Class B and Class C (AFR 160-3 definition) groups. Of the total 127 right and left ears in Class B and Class C noise-exposed individuals (excluding one "indefinite"), the approximate percent of each type of hearing loss is as follows 7 percent conductive, 87 percent perceptive, and 6 percent mixed-type hearing loss.

The types of hearing loss in right ears and left ears which fell into Class B and Class C (500-2000 cps average of more than 15 db) categories are shown in table IV. Of the total 127 ears considered, 59 right ears and 68 left ears were identified in Class B and Class C

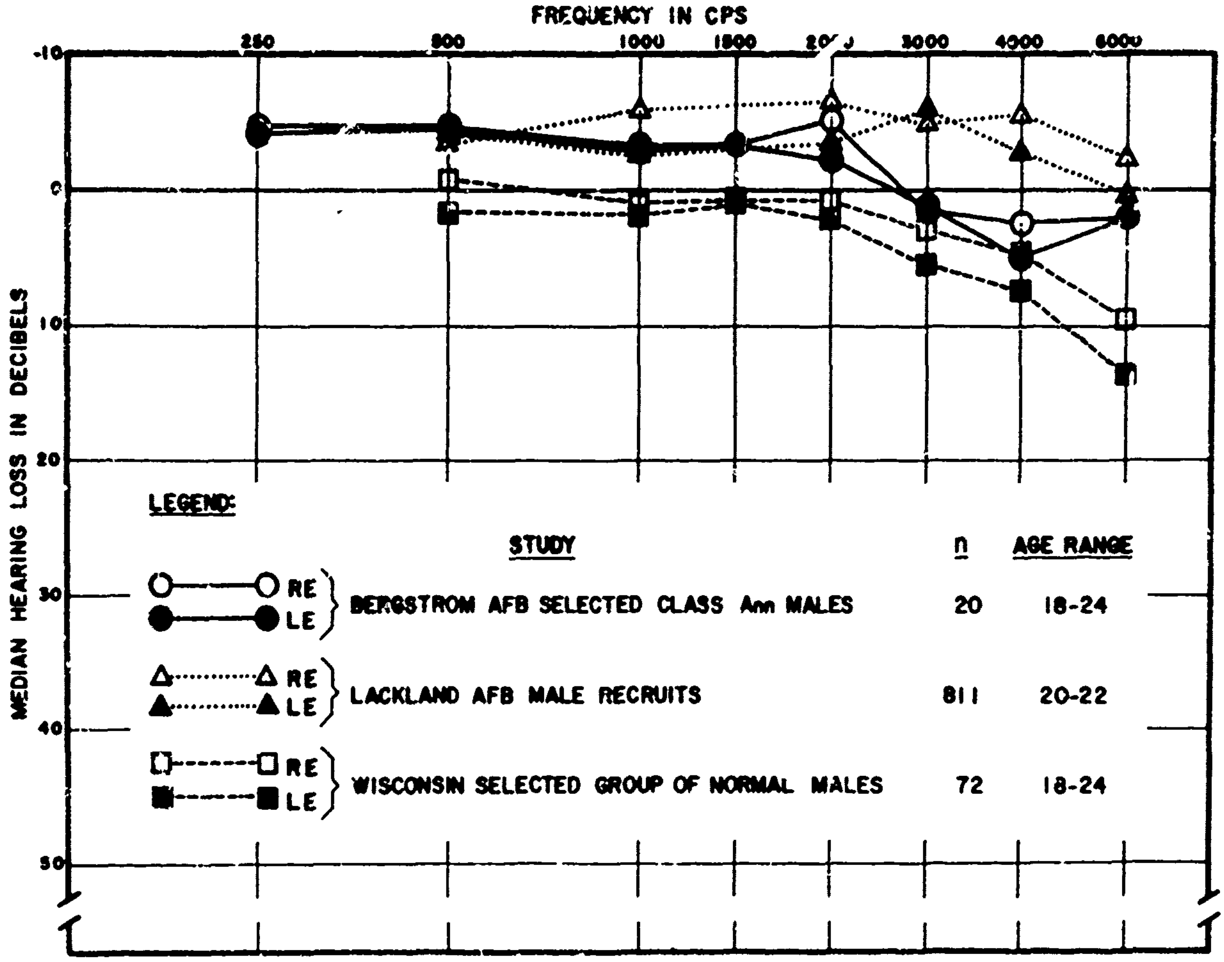

FIGURE 3

Median hearing losses in right and left ears of (a) an age-selected Class A non-noise exposed Bergstrom AFB group, (b) Air Force recruits at Lackland AFB, and (c) a selected group of males in the 1954 Wisconsin Hearing Survey.

TABLE III

Number of ears diagnosed as conductive, perceptive, and mixed-type hearing loss in Class B and Class C groups as defined by Air Force Regulation 160-3, dated 29 October 1956

Class	Type of hearing loss				
	Conductive	Perceptive	Mixed	Indefinite	Total
B	5	93	5	0	103
C	4	16	3	1	24
Total	9	109	8	1	127*

*One Class C individual had a significant nonorganic component and was, therefore, omitted from this tabular description. The type of hearing loss was diagnosed for 127 ears. The remaining 21 ears of Class B and Class C individuals were Class A ears and, therefore, were not diagnosed conductive, perceptive, or mixed. The total of 103 Class B ears includes 10 Class C ears (500-2000 cps average of more than 15 db) that changed to Class B when AFR 160-3 definition was used to identify Class C ears.

groups. Right ears had approximately the same percent of each type of hearing loss as the left ears had. Omitting 3 "indefinite" ears, 7 percent of the right and left ears were diagnosed as conductive hearing loss, 86 percent were perceptive hearing loss, and 7 percent were diagnosed as mixed-type hearing loss. This incidence is approximately the same as that observed for right and left ears in Class B and Class C individuals when the AFR 160-3 definition was used to define Class C hearing. The effect of using "more than 15 db" for the 500-2000 cps average compared to "20 db or more" to define Class C hearing can be seen by comparing the incidence of Class C hearing (24 re AFR 160-3 definition) in table III and the incidence of Class C hearing (34 re our definition) in table IV. Generally, perceptive-type hearing loss predominates among Class B and Class C noise-exposed individuals. It should be noted, however, that a significant proportion (approximately 13 percent) of these ears have either conductive or mixed involvement. This latter observation should be borne in mind when attempts are made to study the antecedent-consequent relationships between noise exposure and hearing loss.

Ear preference

During the interview part of the examination, each subject was asked if he had a preferred or better ear—that is, one with which he heard noticeably better. Out of a total of 59 Class B individuals, 16 expressed a preference for an ear. In the Class C group, 19 out of 25 stated that they had a better ear. The better ear was identified in three ways: first, the better over-all average (the smaller sum of the losses at all test frequencies); second, the better 4000-cps threshold; third, the better 500-2000 cps average (the smaller average for thresholds at 500, 1000, 2000 cps).

Table V gives the number of individuals in Class B and Class C groups who stated that they had a better ear and the number of times that the chosen ear was actually better as indicated by pure-tone threshold results. These results show that in both Class B and Class C groups there is excellent agreement between the number of times that the right ear was chosen as the preferred ear and the number of times that it actually was the better ear as indicated by the better over-all ear average, the better 4000-cps threshold, and the better 500 to 2000 cps average. The left ear was chosen as the preferred, or better ear, fewer times than the right ear (right ear, 22 times; left ear, 13 times). Also, the number of times that the left ear was actually better as determined by pure-tone threshold results is proportionally smaller. Obviously, as an individual's

TABLE IV

*Number of right ears and left ears diagnosed as conductive, perceptive, and mixed-type hearing loss in Class B and Class C ears as defined in this study**

	Class	Type of hearing loss				
		Conductive	Perceptive	Mixed	Indefinite	Total
Right ear	B	2	42	2	0	46
	C	3	9	1	0	13
	Total	5	51	3	0	59
Left ear	B	3	44	0	0	47
	C	1	12	5	3	21
	Total	4	56	5	3	68

*This classification differs from Air Force Regulation 160-3, dated 29 October 1956. Class C hearing is defined as "*an average hearing loss*, in either ear, of 20 db or more for the frequencies 500, 1000 and 2000 cps." The Air Force classification is based upon an individual's worse-ear hearing. Class C ears, as used in this report, include individual ears having an average hearing loss of more than 15 db for 500 to 2000 cps.

TABLE V

The number of individuals in Class B and Class C groups who stated that they had a preferred or better ear and the number of times that the chosen ear was actually better as indicated by pure-tone threshold results

Class	Preferred right ear	The right ear had			Preferred left ear	The left ear had			Had a preferred ear
		Better over-all average	Better 4000-cps threshold	Better 500-2000 cps average		Better over-all average	Better 4000-cps threshold	Better 500-2000 cps average	
B	11	10	10	11	5	1	3	1	16
C	11	9	8	10	8	3	4	3	19
Total	22	19	18	21	13	4	7	4	35

right and left ears differ more in acuity, there is an improvement in his ability to choose the better ear correctly.

Finally, 35 individuals out of a total of 75 in Class B and Class C groups stated that they had a better ear. Of these 35 individuals, approximately 25 chose the actual better ear. This finding is interpreted to mean that one-third of all Class B and Class C individuals probably had sufficiently discrepant hearing in one ear so that in their daily living they noticed some disability in social and other situations in which auditory perception is required.

SUMMARY

The relative hearing levels of right and left ears were investigated in four selected groups of Air Force personnel. One group consisted of 25 non-noise-exposed Class A men (designated Ann); the other three groups were made up of noise-exposed individuals, specifically, 25 Class A, 50 Class B (re AFR 160-3, 1956), and 25 Class C (average of more than 15 db). Pure-tone air-conduction and bone-conduction audiometric tests were administered with a Beltone Model 15A audiometer with Telephonics TDH-39 earphones. Air-conduction thresholds were established for each subject at the following frequencies: 250, 500, 1000, 1500, 2000, 3000, 4000, and 6000 cps. Bone-conduction thresholds were measured at 250, 500, 1000, 2000, and 4000 cps. Each subject was interviewed, and a comprehensive history questionnaire was completed for him. Data on each subject's awareness of a preferred or better ear were also obtained.

The audiometric data were analyzed in order to determine the relative hearing levels of right and left ears in the four groups. The air-conduction/bone-conduction relationship was assessed to establish the incidence of perceptive, conductive, and mixed-type hearing loss among personnel who had Class B and Class C hearing. Awareness of a preferred or better ear on the part of Class B and Class C personnel was investigated and compared to the actual better ear based upon pure-tone threshold results.

The results are summarized as follows:

1. With a few exceptions in the high frequencies, there was good agreement between median thresholds and mean thresholds at all test frequencies.

2. In general, there were no significant differences between right and left ears within Classes Ann, B, and C when hearing levels were grouped according to greater or less loss than the median loss for both ears and were tested by chi square and when mean-threshold differences were tested by the t-test. Significant differences between right and left ears within Class A occurred at 2000 and 3000 cps.

3. When threshold differences between groups were considered, Class Ann and Class A were not significantly different. From 250 cps through 2000 cps, the right- and left-ear thresholds of Class Ann and A were not statistically significantly different from those observed in the Class B group. However, thresholds differed significantly at 3000 4000, and 6000 cps for the A and B groups. Significant differences were observed at all test frequencies when

the Class Ann and Class A groups were compared to the Class C group. These differences are obviously accounted for by class definition. Median and mean thresholds at 250 cps through 3000 cps differed significantly when Class B was compared to Class C. However, at 4000 and 6000 cps no significant differences were observed between the Class B and Class C groups.

4. In this study, 11 of 25 Class C individuals had binaural Class C hearing.

5. The median thresholds in right and left ears of an age-selected Class A non-noise-exposed Bergstrom AFB group agreed closely with results that have been reported for Air Force recruits at Lackland AFB. When the median thresholds of these two Air Force groups were compared with thresholds reported for a selected normal group of young males in the Wisconsin Hearing Survey, consistently better thresholds were noted for the Air Force personnel. Probably the psychophysical method employed in the measurement of auditory thresholds accounts for these differences.

6. Approximately 13 percent of Class B and Class C noise-exposed individuals had either conductive or mixed-type hearing loss; 87 percent had perceptive-type hearing loss.

7. In both Class B and Class C groups, there was good agreement between the number of times that the right or left ear was chosen as the preferred ear and the number of times that either actually was the better ear as shown by better pure-tone threshold results. Of the 75 individuals in Class B and Class C groups, 35 expressed a preference for an ear. Of these 35 individuals, 25 chose the actual better ear correctly.

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