Is the Army Hearing Conservation Programme Working in the Territorial Army?

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SUMMARY: This was a clinical and audiometric survey of a sample of 299 Territorial Army (TA) servicemen in the London area to identify the priority to be given to and the broad content of a Hearing Conservation Programme for the TA. A questionnaire was used to estimate previous noise exposure and the use of hearing protection. It is estimated that 4% of TA personnel have a hitherto undetected hearing loss which would result in their medical downgrading. Noise is likely to be responsible for three-quarters of such cases. For 86% of the sample TA service is the major source of hazardous noise. There is strong tendency for hearing loss to increase with length of TA service although it is not possible completely to disentangle the effects of age and social exposure.

Introduction

Over the years there have been several studies of Noise Induced Hearing Loss (NIHL) in the Regular Army^{1,2,3,4} which have determined the size and nature of the problem and have justified the Army Hearing Conservation Programme (AHCP). There are no similar data available for the Territorial Army (TA). The AHCP has not been fully implemented in the TA. Little is known about the auditory status of TA personnel because hearing is tested using the forced whisper test and not by audiometry⁵. It is therefore difficult to decide what priority should be given to AHCP in the TA and it is not clear whether the programme should be modified to meet the TA's specific requirements.

History and Background

That exposure to noise can cause deafness has been known since antiquity⁶; cases of hearing loss following exposure to firearms have been described since the 16th century¹ and occupational hearing loss in the 18th century⁷. A distinction was made in 1831 between rupture of the tympanic membrane and deafness of gradual onset as a result of chronic exposure to loud noise⁸. Fifty years later a causal link between the degree of noisiness of occupation and extent of resulting injury was established⁹. Much more recently the publication of a detailed report on hearing the noise in industry¹⁰ stimulated hearing protection programmes in industry and a survey of infantrymen in the mid 1960's² prompted the issue of V51R ear plugs to the Regular Army. Subsequently the AHCP was introduced. The introduction of the AHCP into the TA is incomplete. Although ear defenders are issued there is no formal health education programme and hearing assessments are carried out using the forced whisper test.

Weapons in use by both the TA and Regular Army produce high levels of noise (over 160dB) which, although of short duration (milliseconds), are very hazardous¹¹. The current method of assessing hearing sensitivity in the TA does not detect the high frequency losses which are so characteristic of early NIHL¹².

Screening audiometry is used as part of the routine series of medical examinations of regular soldiers; the technique is of proven value and offers a repeatable and quantitative method of measuring hearing¹³.

Aim

The aim of the study was to estimate mean hearing threshold levels of personnel of TA units based in London military district in order to identify the level of priority to be given to and the broad content of a TA Hearing Conservation Programme.

Subjects and Method

A clinical and audiometric survey of TA combat units based in the London area was carried out during the period November 1984–March 1985.

The drill halls of 12 battery, squadron or company sized sub-units were visited during drill nights. A random sample of 299 serving TA personnel (on the assumption that the prevalence of hearing deficit was 30%, a sample of 300 would achieve a standard error of 2.5%) completed a self-administered questionnaire under supervision. This was designed to identify types of and to estimate levels of military, occupational and social noise exposure. They were examined clinically to exclude obvious middle and outer-ear disease and underwent pure tone audiometry with semi-automatic, microprocessor controlled machines. Audiometers were calibrated at the start of the study, at approximately monthly intervals and at the conclusion of the study. Individual F Med 4's were scrutinised to ascertain currently assessed PULHHEEMS H degrees.

Data was processed using a CDC mainframe computer and the Statistical Package for Social Sciences¹⁴ was used for subsequent analyses.

Results

Questionnaires were administered to 302 subjects. Three were excluded from the study; 2 were ineligible, not being members of TA Group A units, and the third fell asleep during audiometry. The age distribution of the sample is shown at Table 1 – 71% were aged 29 or

less and the distribution of length of TA service is at Table 2. The bulk, 228 (76.2%) were infantrymen, 46 (15.3%) were artillerymen and 25 (8.3%) were in an armoured unit. Fifty eight (19.4%) admitted to exposure to loud noise in the 24 hours preceding examination; for 50 subjects the source was occupational although 5 described disco noise and 3 had fired their weapons.

Two hundred and sixty two (87.6%) were in civilian employment and 34 (11.4%) were unemployed. Of the former, only 3 could be confidently identified as having 'noisy' employment¹⁵. Forty three (14%) had worked for more than 6 months in a place where shouting was necessary in order to be heard and 37 (12.4%) indicated that they had worked for more than six months where hearing protection was provided.

One hundred and forty one (47.2%) had fired weapons in a civilian setting; the commonest weapon was the shotgun and only 70 used hearing protection all or most of the time when firing outside a service environment.

There were 9 recruits who had no military noise exposure of any kind. The 7.62mm Self Loading Rifle had 235 (78.6%) users, the 9mm Sub Machine Gun was used by 54 (18%) and the pistol by 1 (0.33%). Only 175

Table 1
Age Distribution of Sample

Age	Absolute Frequency	Relative Frequency %	Cumulative Relative Frequency %
<20	42	14.0	14.0
20-24	96	32.1	46.2
25-29	77	25.8	71.9
30-34	36	12.0	83.9
35-39	28	9.4	93.3
40-44	14	4.7	98.0
45 plus	6	2.0	100.0

Table 2
Frequency Distribution of Length of TA Service

TA Service Length (years)	Absolute Frequency	Relative Frequency %
-1	89	29.8
-5	120	40.1
-10	54	18.0
-15	14	4.7
15+	22	7.4
Totals	299	100.0

Table 3
Use of Hearing Protection when Firing Personal Weapon

Reply	Frequency	(%)
Never fired	9	(3.0)
Always	175	(58.5)
Most of the time	75	(25.1)
Some of the time	32	(10.7)
Never	8	(2.7)

(58.5%) of firers stated that they always used ear defenders when firing their personal weapon. Table 3 summarises admitted hearing protection use firing personal weapons.

One hundred and seventy nine (59.9%) had been exposed to heavy weapon noise such as mortars, anti-tank weapons, artillery or armoured vehicle main armament. Sixty six (36% of those exposed) admitted to not always using hearing protection. A summary of heavy weapon noise exposure and associated use of hearing protection is at Table 4.

On otoscopy and clinical examination there were 175 subjects in whom there were signs or symptoms of conditions which might affect hearing thresholds. A summary of the findings is at Table 5.

Valid audiograms were obtained for 299 subjects. The mean hearing thresholds for the whole sample are illustrated at Figure 1 and the relative frequency distribution of the 3, 4 & 6 kHz averages are shown at Figure 2. There were 34 (11.4%) left ears and 32 (10.5%) right ears found to have a deficit of 30 dB or more of the 3, 4 & 6 kHz average; estimated standard errors and 95% confidence intervals for these prevalence rates are shown in Table 6. The difference between the prevalence rates for the left and right ears is not statistically significant ($p > 0.3$). Subsequent scrutiny of audiograms of those in whom a clinical abnormality had been noted revealed 59 normal audiograms, 25 abnormal and suggestive of NIHL alone and 47 that were abnormal but suggested conditions other than NIHL.

There were 287 (96%) left ears with an H grading of 0 or 2. This figure was the same for right ears although here a grading of 1 was more frequent. The frequency distribution of PULHHEEMS H categories is shown at Table 7.

Scrutiny of medical documents of 290 subjects (recruits had yet to be examined by their RMO) found 244 to be H2 or above with 244 (84.1%) shown as H2 in both ears and 46 (15.9%) as H1 in both.

Discussion

The age structure of the sample does not differ significantly from that of all TA Group A units; 29.8% have less than 1 years service (the figure often quoted

Table 4
Summary of Heavy Weapon Noise Exposure
Numbers of Different Heavy Weapons Fired

Types of heavy weapon fired	0	1	2	3	4	5	6
Frequency	120	106	34	23	10	4	2

Ranking of Heavy Weapons by Number of Responses		Use of Hearing Protection with Heavy Weapons	
Weapon	Responses	Reply	Frequency (%)
Shoulder launched Anti-tank	134	Always	113 (63.3)
Any artillery	57	Most of the time	37 (20.6)
Mortars	40	Some of the time	20 (11.1)
Large calibre machine gun	36	Never	7 (5.0)
Towed anti tank weapon	26		
Armoured vehicle main gun	22		

for the TA as a whole is 30%) and all were members of combat units. Were it not for the high prevalence of upper respiratory tract infection the findings of this survey could be safely generalised to combat units of the TA as a whole. The contribution that occupational exposure makes to overall noise dose in the TA has probably been under-estimated because of the relatively few found to have noisy employment (in the Midlands, for example, this proportion could reasonably be expected to be higher).

No statistically significant difference could be demonstrated between the 3, 4 & 6 kHz averages of those admitting to exposure to loud noise in the

Table 5
Summary of Findings on Clinical Examination/Otосcopy

Finding	Number of subjects	% of whole sample
History of coryza	62	20.7
Wax	53	17.7
Scarring of TM	11	3.7
Middle ear fluid	2	0.7
Complained of tinnitus	2	0.7
Perforation TM	1	0.3
Totals	131	43.8

Fig. 1 Mean hearing threshold Whole sample, n=299

Fig. 2. Distribution of threshold averages, dB at 3, 4 & 6 kHz, whole sample n=299

preceding 24 hours and those who did not. These subjects were therefore not subsequently excluded from analyses. The proportion of subjects admitting to loud noise would have implications for any routine audiometry programme in the TA. Of the 58 who might have demonstrated a noise-induced temporary threshold shift, 50 had been exposed to noise at work. It might not be practicable to insist that TA soldiers limit occupational noise exposure before audiometry – it is suggested that only those found to be H3, or worse, by routine audiometry would need repeat audiometry following a gap of 24 hours after last exposure to loud noise.

Table 8 shows an increasing level of hearing threshold with TA service length; the differences in each ear are statistically significant. It would be unwise to suggest that these changes were due to TA service alone but, given that the predicted change in 3, 4 & 6 kHz average at age 45 is only 7dB (using the method described by Robinson¹⁶ which now has limitations because it was developed before the advent of the loud disco and personal stereos) and the relatively few subjects with occupational noise exposure, TA service must represent an important source of hazardous noise.

Answers to questions relating to the use of ear defenders when firing weapons in both civilian and military settings have implications for the health education content of AHCP in the TA. Under 60% said they always used hearing protection when firing their personal weapons and the response was little better for those who had fired support or heavy weapons. It is clear that the use of hearing protection is by no means universal in the TA.

The large number (131) of subjects found to have signs or symptoms of conditions which might have affected hearing thresholds was of some concern. These audio-

grams were scrutinised – 59 were normal, 25 had audiograms suggestive of NIHL and 47 audiograms were suggestive of conductive deafness. Of this latter group there were only 10 left and 10 right ears with a 3, 4 & 6 kHz average of greater than 30dB; all were graded H3 or H2 except 2 left and 3 right ears which were H3. It may therefore be concluded that although 35% of those found to have a clinical abnormality were subsequently demonstrated to have associated audiometric abnormalities, few would have been graded below H2 as a result. In other words it is suggested that up to 4% of personnel of TA independent units might have hitherto undetected hearing loss which would make them H3 or worse; NIHL is likely to be responsible for at least 75% of such cases.

Comparison with other military studies might help to put the audiometric findings of this study into perspective and allow at least a general conclusion to be drawn about the audiometric status of the sample. The most recent available data on Regular Army units are those assembled by Brown in his study of NIHL sustained during the Falklands war¹⁷. He used results of routine audiometry before the campaign as a starting point and these are used in Table 9 to compare the relative frequency distribution of PULHHEEMS gradings with this study. No statistically significant difference can be demonstrated between the proportions of H gradings in the 2 groups. Figure 1 compares the frequency distribution of 3, 4 & 6 kHz averages of Brown's pre-Falkland sample with this sample. The frequency distributions are very similar and no statistically significant difference can be demonstrated between the proportions found by each study with the same threshold averages. It has not been possible to standardise these data for length of service or age but it is still worrying that a sample with such a high proportion of soldiers with less than 1 year's service has an auditory status so close to comparable regular soldiers.

Table 6

Prevalence of 3, 4 & 6 kHz average of 30dB loss or more

Ear	Prevalence %	Estimated Standard Error	95% Confidence Interval
Left	11.4	1.8%	7.8% to 15%
Right	10.5	1.8%	7.0% to 14%

Table 7

Absolute and (relative %) frequency distribution of PULHHEEMS H grading after audiometry

H Category/ Ear	1	2	3	4/8
Left	202 (67.6)	85 (28.4)	10 (3.3)	2 (0.7)
Right	228 (76.3)	59 (19.7)	11 (3.7)	1 (0.3)

Table 8
3, 4 & 6 kHz averages by TA service length

Length of TA service (years)	Left ear	Right ear	n
<1	9.97	7.79	89
1-5	12.95	11.40	120
6-10	15.39	13.80	54
11-15	18.5	18.79	14
over 15	26.86	20.23	22
	F=10.61 P<.0001 df=4	F=7.42 P<.0001 df=4

Fig. 3. Comparison of 3, 4 & 6 kHz averages with a sample of regular soldiers¹⁶

Table 9
Comparison of relative frequency distribution of PULHHEEMS H grading with regular soldiers pre-Falklands¹⁷.

H grade Worst ear	Regular pre-Falklands (n=205)	This study (n=299)
1	58.0	60.9
2	31.2	31.4
3	10.2	7.0
4/8	0.4	0.6

Conclusions

It is estimated that up to 4% of personnel of TA independent units might have a hitherto undetected hearing loss which would make their PULHHEEMS grading H3 or worse. NIHL is likely to be responsible for 75% of such cases, and TA service represents an important source of hazardous noise.

Comparison with studies of the Regular Army suggests that the auditory status of independent TA combat units is similar to their regular counterparts whereas it could reasonably be expected to be better. AHCP is not working in the TA. It should be fully implemented and the use of hearing protection when firing weapons must be enforced and audiometry must be introduced.

The associated health education programme should be amended to reflect the different circumstances in the TA.

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MILITARY HOSPITAL FOR HEAD INJURIES 1913-1945

On Monday 6 June, 1988, the Anniversary of D-Day, the Chancellor of the University of Oxford will unveil a plaque to commemorate the use of St. Hughs College, Oxford as the Military Hospital for Head Injuries. It is hoped that patients who were treated and medical and ancillary staff who served at St. Hughes during this time will come to the ceremony.

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