Hearing loss in British Army musicians

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Background
Military musicians increasingly fulfil front line roles. Existing literature suggests that musicians are at greater risk of hearing loss than the general population. It is important to ascertain whether these findings apply to military musicians if they are to be placed in operational acoustically hazardous environments.

Aims
To compare hearing loss between groups of British Army musicians and with their administrative (non-musician) counterparts.

Methods
Routine health surveillance audiometric data for a group of military musicians were compared with military administrative staff during the first 8–12 years of their careers. Structured interviews were used to identify those meeting the study inclusion criteria (8 year minimum service, no significant, relevant medical history, no previous extraordinary loud noise exposure, service within study employment group throughout military career), and to clarify the instrument played.

Results
Eighty-four musicians and 44 administrators participated. Using the Health & Safety Executive's (HSE's) age- and gender-correcting system, 12 (14%) musicians and 9 (20%) non-musicians had a deterioration in hearing. The overall odds ratio for developing hearing loss in musicians was 0.65 (95% CI 0.25–1.68). Compared with woodwind instrumentalists, the odds ratio for hearing loss in brass instrumentalists was 2.00 (95% CI 0.85–3.44) and for percussionists 1.83 (95% CI 0.77–2.90).

Conclusions
The findings suggest that military musicians are at no greater risk of hearing loss than their administrative counterparts after 8–12 years in service. This may represent a healthy-worker effect. There is no statistically significant differential risk of hearing loss between different instrumental groups.

Key words
Audiometry; music; musicians; noise; noise-induced hearing loss.

Introduction
Increasing numbers of soldiers are downgraded due to noise-induced hearing loss (NIHL) [1]. Army musicians have started to fill operational staffing gaps by assuming more frontline roles. It is essential that the hearing of these professional musicians is not jeopardized in order to minimize adverse health effects and to enable them to continue their roles as musicians and soldiers and for legislative reasons.

It is known that the sound pressures produced by the instruments used in military bands exceed the Control of Noise at Work Regulations 2005 (CNWR) upper exposure and exposure limit peak values [2,3]. Evidence for the effect of music on hearing is mixed in terms of methodology, statistical power and findings [4]. A deleterious effect has been proposed after as few as 5 years of exposure [5], with the greatest effect after 10 years [6].

All army personnel, including musicians and administrators, undergo routine audiometric health surveillance, in accordance with the CNWR, due to their routine work-related exposure of annual weapon tests. Army musicians regularly undergo audiometry for individual health-screening purposes, in accordance with the CNWR. This study used this grouped data to establish whether hearing loss is higher among army musicians than in non-musicians. The referent group comprised army Staff and Personnel Support (SPS) and Education and Training Service (ETS) staff, whose noise exposure
through routine military work is similar to that of army musicians.

**Methods**

Retrospective analysis of audiometric data was supplemented with structured interviews and individuals with potential confounding exposures excluded. Ethical approval was granted by the Ministry of Defence Research and Ethics Committee for this study.

Audiometric health surveillance data from participants’ pre-employment and 8–12 year medicals were graded using the HSE’s age- and gender-correcting system [2], allowing direct comparison of the groups. The system requires summation of dB thresholds across the frequencies 1, 2, 3, 4 and 6 kHz. The summated figure is used to derive a grade for each ear. Individuals whose summated figure is less than the warning level are graded 1. Those within the warning level spectrum are graded 2. Those in the referral level range are graded 3. If, however, there is >60 dB difference in summated thresholds between the two ears, individuals are graded 4. The range of 8–12 years reflects the variable historical timing of post-employment medicals.

Musicians from the most common type of band (Regular Army Non State Bands) were identified to participate. These bands consist of full-time professional musicians and similar instrumental composition. A comparison group of military clerical (SPS) and ETS staff was identified. The following criteria were applied so that the only difference between the groups’ noise exposure was music:

(i) 8 years minimum service duration,
(ii) No significant relevant medical history, e.g. baro-trauma, cholesteatoma,
(iii) No history of extraordinary loud noise exposure (occupational or non-occupational) and
(iv) Service in their study group employment cadre throughout army career.

Participants attended a plenary brief, were given a participant information sheet and invited to consent for access to their health-surveillance records. Structured interviews assisted in application of the inclusion and exclusion criteria as described above and to identify which instruments musicians played. A questionnaire for the structured interviews was developed by the authors.

The questionnaire is appended in the online version of this paper. It was not piloted or validated.

Analysis was undertaken using the Predictive Analytics Software (PASW) Statistics 18 [Statistical Package for the Social Sciences (SPSS) version 18] to calculate odds ratios (OR), \( \chi^2 \) and Fisher’s exact probability test.

**Results**

There were 175 musicians and 63 non-musicians available for study participation. Eighty-four (89% male) musicians of mean age 29 years at follow-up (range 26–47 years) and 44 (64% male) non-musicians of mean age of 30 years (range 26–40 years) were eligible for the study. One musician elected not to participate, giving no reason. All other eligible participants consented to take part.

There was no significant difference in initial hearing grades. Hearing deteriorated in 12 (14%) musicians and 9 (20%) non-musicians, in either one or both ears during the first 8–12 years of their career [OR = 0.65; 95% CI 0.250–1.683 using Mantel-Haenszel Common OR Estimate; Cochran’s \( \chi^2 = 0.801 \), \( P = 0.4 \) and Fisher’s exact probability test (two-tailed) of obtaining the observed result or one more extreme was 0.452].

Table 1 shows the hearing loss effect for each instrumental group compared with woodwind instrumentalists over the study period.

**Discussion**

In this study, professional musicians experienced hearing loss over the first 8–12 years of their military career no more or less than non-musician army administrators with similar additional occupational noise exposure related to weaponry. There were no significant differences in hearing loss between instrumental groups.

Longitudinal data collection 8–12 years apart may have introduced bias due to inter-operator technical variability.

Most of the existing literature suggests that musicians are at greater risk of NIHL than the general population [3]. HSE categorization of data in this study revealed a hearing loss rate of 14% compared with 25% objectively reported for musicians elsewhere [7]. Obeling et al. suggested that musicians are trained to listen to the tested frequencies by virtue of their work and are better at undertaking pure tone audiometry (PTA) than the general population [8].

| Table 1. Number of musicians with a deterioration in HSE grade for each instrumental group |
|---------------------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                            | Brass n (%)     | Percussion n (%)| Woodwind n (%)  | Total n (%)     |
| Deterioration in one or both ears           | 1 (1)           | 10 (12)         | 1 (1)           | 12 (14)         |
| No deterioration for either ear             | 6 (7)           | 55 (65)         | 11 (13)         | 72 (86)         |
| Total                                       | 7 (8)           | 65 (77)         | 12 (14)         | 84 (100)        |
If so, this could have masked any differential hearing loss in musicians in this study. There is also well-established evidence that some individuals may have a greater genetic susceptibility to hearing loss [9,10].

The findings may represent an element of a healthy-worker effect. Musicians who develop measurable hearing loss may leave the armed forces early in their career, through medical discharge or voluntarily, resulting in a resilient in-service population at 8–12 years.

Future studies should have a longer follow-up period, larger sample size and means of including those that have left the service. Military personnel would be a good study population, with PTA undertaken since 2008 being of a standardized and reproducible quality.

Army musicians do not appear to be at greater risk of developing hearing loss during the first 8–12 years of service, although this may represent a healthy-worker effect or the implication that weapon noise exposure has an overwhelming effect on hearing relative to that of music. There appears to be no differential effect on hearing loss in different instrumentalist groups. Caution must be applied in allowing these findings to affect the use of noise control measures.

**Key points**

- Army musicians do not appear to be at greater risk of hearing loss during the first 8–12 years of their career than the reference population used in this study.
- The findings may represent a healthy-worker effect.
- There was no statistically significant difference in hearing loss between different instrumental groups.

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**Conflicts of interest**

None declared.

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