Dog noise as a risk factor for hearing loss among police dog handlers

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Aim
To determine the sources of noise exposure among police dog handlers and to examine whether these levels might lead to noise-induced hearing loss.

Methods
We conducted a cross-sectional study at four Royal Air Force bases using a noise survey, a postal questionnaire and medical record review. The noise survey was conducted following task analysis. We surveyed police dog handlers and a comparison group of police who had never been dog handlers, using a postal questionnaire on noise exposures and confounders. Audiometric and otological data were extracted from medical records.

Results
The noise survey revealed significant exposures due to dogs, travelling in vans and aircraft noise during foot patrol. The overall response rate to the questionnaire was 56% (29 police dog handlers, 24 police officers). Five subjects (9.4%) had age-corrected hearing loss exceeding 10 dB, averaged over the 4 and 6 kHz frequencies, affecting the left ear only, but there were no differences between dog handlers and controls.

Conclusion
Although the measured noise exposures of police dog handlers did not exceed current legal limits, the noise levels at times are such that the proposed Physical Agents (Noise) Directive has implications for employers who use dogs for security purposes.

Key words
Noise; noise-induced hearing loss; police dog.

Introduction
It is not known whether noise from dogs’ barking poses a significant risk to their handlers. Some police dog handlers have raised concerns that exposure to dog noise may have affected their hearing [1]. The Ministry of Defence is the UK’s largest employer of police dog teams [2], with most military police dogs being used for patrol work, although some are trained for drug or explosives detection.

We wished to determine the pattern of noise to which RAF police dog handlers are exposed and to determine whether RAF police dog handlers are at risk of noise-induced hearing loss (NIHL) from dog noise.

Methods
We undertook a cross-sectional study of RAF police dog handlers and a comparison group of RAF police officers who had never been police dog handlers. We defined the study population as all RAF police officers currently serving at the four air bases in Scotland. The study had three components: a noise survey, a questionnaire survey and a medical record review.

The Defence Medical Services Clinical Research Committee approved the study and all participants gave written informed consent.

Task analysis determined the main noise sources and,
with the exception of one exposure reconstruction, all measurements were taken from typical work days. A calibrated Brüel & Kjaer Type 2230 Precision Integrating Sound Level Meter Type 1 (Brüel & Kjaer, Denmark) was used to measure specific sound sources. Brüel & Kjaer Type 4436 personal noise dosimeters, calibrated with Brüel & Kjaer Type 4230 Sound Level Calibrator (conforming to the UK Accreditation Service level), were used to record noise levels at the ear. The data were downloaded using Brüel & Kjaer 2260 Investigator Communication Link software into a Microsoft Excel spreadsheet. Spectral band analysis was not carried out, although previously collected RAF data were available.

Self-recording audiometry can demonstrate a significant change when hearing threshold has deteriorated by 10 dB [4]. The RAF employs such devices, and comparison between entry and current audiogram was used to determine hearing loss, assuming 10 dB to be the minimum detectable difference. The results were compared with values calculated from ISO 7029 [3], which provides hearing thresholds for ‘otologically normal’ persons (defined as a person in a normal state of health free from all signs or symptoms of ear disease and from obstructing wax in the ear canals, and who has no history of undue noise exposure). Using the standard deviation information in ISO 7029, a sample size of 17 in each group has 80% power to detect a difference in means of 10 dB using a two-group t-test with a 0.05 two-sided significance level.

We designed a questionnaire seeking information on confounding noise exposures, such as aircraft, vehicles, gunfire and DIY. The questionnaire was piloted at the University of Aberdeen and with the RAF police, resulting in some minor modifications.

The RAF provided lists of currently serving police personnel in Scotland, identifying those with dog-handling qualifications. Questionnaires were distributed with an information sheet, consent form and freepost return envelopes. All non-responders received a second mailing 3 weeks later.

From the medical records, 4 and 6 kHz data were extracted from the earliest and most recent audiograms. The mean difference between the earliest and most recent audiogram was calculated for right, left and both ears. The records were examined for relevant medical conditions and use of potentially ototoxic medication. A database was constructed using SPSS 11 (SPSS Inc.). Those subjects identified as having a hearing loss greater than or equal to 10 dB were extracted and median values from ISO 7029 [3] applied to detect any significant loss following age adjustment.

The following data were not normally distributed: years of service, total van and 4×4 vehicle hours, and exposure to aircraft and leisure time noise. An independent t-test was used to compare the means of the normally distributed or successfully transformed variables (only aircraft noise complied with an approximately normal distribution after log transformation). Those remaining were compared using the Mann–Whitney U-test.

**Results**

Ninety-five questionnaires were distributed, and 79 were returned of which 26 were excluded due to one or more of the following: only one audiogram available (19), withholding consent to examine medical records (2), duplicate response (1), incomplete (1) or late response (3). Fifty-three subjects were included in the final analysis (29 police dog handlers, 24 police officers), giving a response rate of 56% (Table 1).

**Table 1. Demographic characteristics of the study groups**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Years in the armed forces</th>
<th>Hours per year spent shooting</th>
<th>Total van and 4×4 vehicle hours per week</th>
<th>Times per day conversation interrupted by aircraft noise</th>
<th>Years of noisy leisure time activities a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualified dog handler (n = 29)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>32.2 (6.2)</td>
<td>11.7 (6.3)</td>
<td>7.7 (6.3)</td>
<td>13.0 (8.2)</td>
<td>8.3 (7.2) b</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>32.0 (9.5)</td>
<td>12.0 (9.3)</td>
<td>6.0 (9.0)</td>
<td>11.0 (10.0)</td>
<td>6.5 (10.0)</td>
</tr>
<tr>
<td>Minimum</td>
<td>21.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>44.0</td>
<td>28.0</td>
<td>30.0</td>
<td>40.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Non-dog handler (n = 24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>35.3 (5.3)</td>
<td>15.4 (5.7)</td>
<td>5.3 (3.7)</td>
<td>3.0 (3.7) c</td>
<td>6.2 (6.2)</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>35.0 (7.0)</td>
<td>15.0 (8.5)</td>
<td>4.5 (6.0)</td>
<td>2.0 (4.3)</td>
<td>4.0 (8.0)</td>
</tr>
<tr>
<td>Minimum</td>
<td>25.0</td>
<td>3.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>48.0</td>
<td>26.0</td>
<td>12.0</td>
<td>12.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

aDefined as noise exposure during leisure time with examples offered including shooting, motorcycles, playing in a band, personal stereo, concerts and disco attendance.

bData missing for 1 subject.

cData missing for 2 subjects.
A number of noise surveys were undertaken. A police dog handler’s personal noise exposure during a typical shift was measured and the background noise levels ranged from 70 to 75 dB. The greatest exposures occurred when collecting the dog from the kennels (98 dB) and patrolling close to a taxiing aircraft (94 dB). The maximum one minute $L_{eq}$ was 98 dB, $L_{A,max}$ was 117 dB and $L_{pk}$ was 127 dB. $L_{EP,d}$ for the whole shift was calculated at 82 dB (Figure 1).

Personal dosimetry was carried out during a van journey with two dogs. The 1 min $L_{eq}$ ranged from 80 to 102 dB, giving an $L_{EP,d}$ of 82 dB. The maximum 1 min $L_{eq}$ was 102 dB, $L_{A,max}$ was 114 dB and $L_{pk}$ was 125 dB (Figure 2).

Figure 3 shows data collected from scenarios forming the regular duties of a dog handler. The loudest exposures during dog handling activities ranged from 101 to 105 dB.
The maximum 1 min $L_{eq}$ was 107 dB, with $L_{A,max}$ of 119 dB and $L_{pk}$ of 134 dB.

Thirteen (24.5%) individuals had a hearing loss of 10 dB or more, either unilaterally or bilaterally. None had an age corrected loss of 10 dB or more in the right ear, although five (9.4%) individuals had a loss in the left ear ranging from 10 to 26 dB. When averaged over both ears, nobody had a hearing loss of 10 dB or more. Of a total of 106 right and left audiograms reviewed, 48 (45%) audiograms were worse than the initial audiogram, 36 (34%) were apparently improved (and excluded from further analysis) and 22 (21%) were unchanged.

There was a significant difference between the group means for years of service ($P = 0.037$), with dog handlers having shorter service. For total hours per week spent in a van or 4×4 vehicle ($P < 0.001$), dog handlers had the higher hours, although total vehicle hours were very similar (non-dog handlers spending more time in cars). Uncorrected hearing loss showed no significant difference between the groups, and there was no significant correlation between age and hearing loss even after age correction.

**Discussion**

This small study has shown that dogs are a significant noise source among police handlers. Typical exposures were measured, rather than making a detailed noise survey, but most measurements represented real life exposures. The highest levels came from noisy dogs inside a vehicle, although this was within the 85 dB $L_{EP,d}$ First Action level of the Noise at Work Regulations [5].

In spite of the high noise exposures of these personnel, we found no evidence of hearing loss in the group we studied. Improving health and safety activities and job changes altering exposure are possible sources of systematic bias. By studying two groups drawn from the same occupation, we hoped to reduce selection bias, but it remains possible that the non-responders had worse hearing than those who attended. As at least two audiograms were required, this tended to select out younger personnel, who would only have had one audiogram. Leisure noise exposures were not significantly different between the groups. There was no evidence of a healthy worker effect; personnel with mild hearing loss may be medically downgraded, but RAF police fitness requirements mean they would remain fit for duties. If the accuracy of either audiogram is in doubt, then it is not measuring what it purports to measure, and so measurement bias may have been significant.

Civilian dog handlers may not be directly comparable to our RAF police subjects, particularly if they spend more time in vehicles. Notwithstanding whether a dog is ‘noisy’, dog handlers recognize that excitement such as responding to an incident will cause barking. Given their more passive patrol work, this was uncommon in RAF police dogs. Communications noise from radios was a minor source for RAF personnel, but may be more
significant for civilians. Overall dog noise remained within current legislative standards, but high noise exposures are possible and susceptible individuals may be at risk of NIHL. The European Union Physical Agents (Noise) Directive [8] proposes a new exposure action value of 80 dB. This study shows that sound levels encountered during shift work and van travel will exceed the lower exposure action value, and dog handlers may need to be placed on a hearing conservation programme.

In summary, we conducted a small cross-sectional study of RAF police dog handlers and other RAF police using a noise survey, postal questionnaire and medical record review. The noise survey identified significant noise exposures when transporting noisy dogs in vans and during foot patrol near taxiing aircraft. The measured noise exposures did not exceed current legal limits, but the Physical Agents (Noise) Directive has implications for organizations employing police dog handlers.

Acknowledgements

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References