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Comparing high and low performers for noise control

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Abstract

Purpose – The purpose of this paper is to investigate the dimensions that distinguish high from low performing manufacturing companies in Great Britain with respect to controlling noise. The findings should assist regulators and industry to develop interventions that help organisations to effectively manage noise, particularly amongst the low performers.

Design/methodology/approach – The research uses quantitative and qualitative methods. Survey data was obtained from 215 manufacturers and supplemented with 15 qualitative interviews to assess performance and individual, social, environmental and organisational influences on duty holders' decision making for controlling noise.

Findings – Relative to low performers, decision makers from high performing companies had: greater in-depth knowledge of noise risks and controls; taken steps to promote positive health and safety attitudes and values; were large companies; and faced fewer resource barriers (time, costs, staffing). Managers in small, low performing companies sought simple interventions with a practical focus.

Research limitations/implications – The differences reported between high and low performing companies showed a small magnitude of effect but these are considered significant in a health and safety context.

Practical implications – Improvements in training and education, and addressing workplace health and safety culture, are recommended as offering most potential to raise the standard of noise control.

Originality/value – To the authors' knowledge, this is the first study to systematically assess the specific knowledge, attitudes, values and beliefs that employers hold about noise and the influence of social, environmental and organisational factors on manager's decisions about noise controls.

Keywords Management effectiveness, Qualitative research, Organizational culture, Psychological research, Health and safety, Occupational health and safety

Paper type Research paper

Introduction

Exposure to loud noise is known to be associated with a number of adverse health and safety outcomes. Non-auditory effects include accidents, cardiovascular morbidity and work-related stress (e.g. Nandi and Dhatrak, 2008; Sliwinska-Kowalska and Kotylo, 2007; Welch, 1979). Auditory effects comprise, tinnitus and hearing loss, which can be temporary or permanent. Although hearing loss is usually gradual due to prolonged exposure to noise, sudden, extremely loud explosive noises can cause immediate onset

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(ACOEM Noise and Hearing Conservation Committee, 2003). UK companies' have a duty under the Control of Noise at Work Regulations (Council Directive, 2003) to ensure that noise exposures are as low as reasonable practicable (Regulation 6). The long-latency period may lead employers to overlook the importance of controlling noise risks. Regulations make employers' actions contingent on employee's average level of exposure. The Noise at Work guidance produced by the Health and Safety Executive (Health and Safety Executive (HSE), 2005), which regulates most risks to occupational health and safety in Great Britain, encourages employers to seek alternative equipment, processes and/or working methods that will reduce noise exposure or make work conditions quieter. Elimination or control at source is prioritised over reliance on hearing protection. The Noise at Work Guidance states that employers should first think about how to remove the source of noise altogether – for example, housing a noisy machine where it cannot be heard by workers. If that is not possible, employers should investigate, for example, engineering or technical controls to reduce, at source, the noise produced by a machine or process, designing the workplace to create quieter workstations, and using screens, barriers, enclosures and absorbent materials to reduce the noise on its path to the people exposed. Hearing protection should not be used as an alternative to controlling noise by technical and organisational means and only issued to employees as a short-term measure while other methods for controlling noise are being developed or where extra protection is needed above what has been achieved using noise control (see HSE, 2005).

A review of the evidence base as part of this research highlighted a paucity of studies directly examining factors that influence organisations in managing noise (Bell and Webster, 2011). The review showed that most studies on noise are employee-focused and examine the impact of noise on health and performance (e.g. Cheung, 2004; Williams and Purdy, 2007) or the physiological effects of noise (e.g. Casali, 2006; Smith *et al.*, 1996). Research to date shows a predominance of studies that have investigated the use and effectiveness of hearing protection (including training) amongst workers exposed to occupational noise (e.g. Mason, 2010; McTague, 2013; Stephenson *et al.*, 2011; Tickell, 2012). At the organisational level, a small number of studies have examined factors influencing the effective implementation of hearing protection, such as safety climate and the company noise policy (e.g. Bockstael *et al.*, 2013; Suter, 2012). To the authors' knowledge, no research to date has systematically assessed the specific knowledge, attitudes, values and beliefs that employers hold about noise and the influence of social, environmental and organisational factors on manager's decisions about noise controls.

The present research seeks to identify the factors that influence employers' behaviour in managing risks from noise, including how these vary between companies considered to be high performing at controlling noise risks and those considered to be low performing. Doing so should help regulators and industry develop interventions that help organisations to effectively control noise risks, particularly amongst the low performers.

Methods

Research design

A multi-method approach using both quantitative (survey) and qualitative (interviews) methodologies was adopted. This was to allow for a comprehensive assessment of the influencing factors for managing noise.

Quantitative survey

Sample selection. The manufacturing sector was selected due to the high levels of noise characterising parts of the sector. To achieve a power of 0.8 and medium effect size (average size of observed effects in various field studies; Cohen, 1988) a prospective power analysis revealed 200 responses as necessary for avoiding type II error (Clarke-Carter, 2004). Allowing for a typical response rate of 25 per cent for employee surveys (Newell *et al.*, 2004; Keisler and Spoull, 2001) meant that 800 surveys were administered to a stratified sample of 15 sub-sectors. Just over 300 ($n = 302$) surveys were distributed to companies involved in the manufacture of metal products (metallic) and 498 to non-metallic companies. This was proportionate to the overall number of companies in each grouping. Companies were randomly selected from a public database to establish the views from a broad sample and to permit greater confidence that the findings accurately represent the sub-sectors. In total, 215 surveys were completed (micros, $n = 107$; small, $n = 187$; medium, $n = 24$; large companies, $n = 4$).

Survey development

The development of the survey instrument was based on an established, theoretical psychosocial framework. This guided inclusion of important social-environmental, organisational and individual factors that influence behaviour and behaviour change in work settings, (i.e. the PRECEDE model – see Green *et al.*, 1980; Green and Kreuter, 1991). In total, 15 dimensions emerged from the review of the evidence base (Bell and Webster, 2011) as having the potential to influence noise management. These 15 dimensions were collapsed into ten dimensions following independent inspection of a correlation matrix for all survey items by two researchers. Table I shows the ten dimensions included in the survey (and changes from the original 15 dimensions), two of which represented demographic items (company size and managerial role). The survey consisted of mostly closed items (see examples in Table I) with five-point Likert scales, which is appropriate for attitudinal and behavioural ratings (Coolican, 2004).

Cronbach's α was used to test the internal consistency of the items that comprised each dimension; excluding demographics. A factor analysis would have provided a robust test on the factor structure and the extent to which they were mutually exclusive. There was an insufficient number of questionnaires returned, however, to permit reliable and valid exploratory factor analysis (Comrey and Lee, 1992). As shown in Table I, five dimensions achieved a Cronbach's α of 0.7 or above, which is the standard aspired to in conventional test design (see Kline, 1993). The remaining three dimensions achieved an α of 0.5 or above, which is considered a sign of acceptable internal consistency (see Bowling, 2002). Additional reliability and validity checks involved: independent assessment of the correlation matrix by two researchers and joint agreement of the ten dimensions; including a minimum of three items per dimension; agreement of the labels assigned to each dimension by the principal researcher with those made by an independent researcher (construct validity); obtaining expert confirmation from six regulatory inspectors of face and content validity of the survey; and piloting the survey with seven companies randomly selected from the public database. Minor changes were made following the pilot study and consisted of rephrasing certain items.

Procedure

Managers responsible for health and safety completed surveys. As an incentive, small charity donations were made. Assigning unique numbers as identifiers preserved anonymity. Participants were also informed that they could withdraw at any time.

Dimension	Internal consistency	Definition	Example items
1. Knowledge and awareness	$\alpha = 0.700$	Managers' knowledge of noise risks and technical/organisational solutions to reduce noise, including training received	How satisfied are you with: The amount of training that you have received just on noise The quality of training received just on noise To what extent do you agree with the following statements? Replacing just one machine/tool with a quieter model makes little difference to noise levels Quieter models of machines/tools that we use do not exist
2. Attitudes towards protecting workers against noise risks (Originally three dimensions: "Attitudes towards health and safety", "Values and beliefs" and "Noise risk perception")	$\alpha = 0.534$	Managers' attitudes towards protecting their workers from noise risks	To what extent do you agree with the following statements? Workers do not need telling about noise risks when they have been working in the industry for years Noise problems are solved by workers wearing their hearing protection I am concerned about the health of my workers Risks from noise cannot be controlled by management
3. Self-efficacy	$\alpha = 0.718$	Managers' beliefs/confidence in their ability to manage noise risks	To what extent do you agree with the following statements? When I have a noise related problem, I can usually find the right solution I am confident in my ability to make decisions on noise I often feel helpless about dealing with noise issues in my job
4. Autonomy and competence (Originally two dimensions: "Skills/competence" and "Control")	$\alpha = 0.740$	Extent to which managers are doing what they know they should be doing to control noise risks. Includes interpersonal skills, technical skills and autonomy to act and/or make own decisions about improvements	To what extent do you agree with the following statements? I develop action plans for resolving noise issues and drive through changes I do not have difficulty motivating workers to protect themselves against industrial deafness I have a wealth of experience to draw from when making decisions on how to reduce noise

(*continued*)

Table I.
Ten dimensions measured by the survey

Table I.

Dimension	Internal consistency	Definition	Example items
5. Resources (Originally two dimensions: "Resources" and "Capability for making improvements")	$\alpha = 0.895$	Time management, funds, equipment and staffing enablers/ barriers to noise control	How much does each of the following prevent you from tackling noise in your company? The cost of replacing machinery/tools for quieter models The demands of my job Health and safety budgets
6. Information and communication	$\alpha = 0.717$	Noise information/guidance managers' seek or receive	To what extent do you agree with the following statements? I have all the information I need to understand how to deal with noise risks in my company I know where to get help when I have a problem with noise We cannot find information on quieter models of machinery/tools we use
7. Organisational health and safety values	$\alpha = 0.531$	Health and safety culture (workplace norms and values, senior management commitment, prioritisation of worker health and well being)	To what extent do you agree with the following statements? We only make significant improvements if something goes wrong I have an open door policy on health-related issues Senior managers take noise risks seriously
8. Business motivators (Originally three dimensions: "Compliance/ legislation", "economic/ financial" and "Corporate reputation")	$\alpha = 0.588$	Compliance, potential benefit of investment in human capital, and/or fear of civil proceedings/ prosecution	To what extent do you agree with the following statements? Health and safety legislation drives what we do about noise Our insurers have told us to reduce noise levels/ exposures Eliminating/minimising noise will save us money in the long term
9. Company size (demographic)[a]	N/A	Micro ($\leqslant 10$ employees) vs small (11-49), medium (50-249) and large ($\geqslant 250$)	How many people does your company employ?
10. Managerial role (demographic)[a]	N/A	Director/owner, health and safety manager or other (e.g. senior manager, supervisor)	What is your role?

Note: [a]Dimensions 9 and 10 were originally subsumed under one dimension, i.e. "workplace characteristics"

Analysis of quantitative data (surveys)

Categorisation of high and low performers. Two researchers jointly developed a categorisation method in consultation with the wider research team. This categorisation method was independently cross-checked by a third researcher who had not been involved in the development process. The third researcher agreed with the categorisation. Performance categorisation entailed scoring responses to "noise control implementation" and "business risk" items. Noise control implementation reflected the effectiveness of controls used. A higher score denoted the use of technical/organisational controls (e.g. use of enclosures to reduce noise, buying "quiet" machinery) and a lower score indicated worker-focused controls (e.g. reliance on personal protective equipment, training workers on noise risks). Business risk was based on perceived noise levels and proportion of workers exposed. Companies were assigned to one of six categories along a continuum of risk (see Table II). Higher business risk meant that noise was perceived as presenting a significant risk to worker health based on the category assigned to the company.

A total score out of 22 was assigned to each company for "noise control implementation". Table III illustrates that respondents received one point for each basic control implemented, and two points for each higher level control. The scoring accounted for the selection of up to three red herrings (i.e. non-viable noise controls) to gauge social desirable reporting (see Coolican, 2004). Analysis showed that participants' selection of the three "red herrings" questions appeared random and not subject to social desirability.

There was some degree of overlap between the high and low categorisation for companies that obtained scores ranging from 9 to 13. This overlap was considered acceptable on the premise that a score higher than 8 was unlikely if only basic controls had been implemented and a score higher than 13 was unlikely unless higher-level controls had been implemented. As such, companies obtaining a score between 9 and 13 were more likely to be moderate performers.

As shown in Table IV, high performing companies were those that had implemented technical/organisational controls and perceived noise levels and worker exposure as being "low" (due to e.g. purchasing "quiet" machinery). Conversely, low performing companies presented a high risk to employee health from noise, but tended to only have basic controls in place (e.g. hearing protection). Contrasting high and low performers in this way elucidated practices associated with better performance in managing noise. To minimise researcher bias, a second researcher independently classified all companies as "high", "moderate" or "low" performers. The same categorisation was achieved in all instances.

Statistical analysis

Between-subjects Mann Whitney-*U* tests were conducted to compare high ($n = 60$) and low ($n = 50$) performing companies on the first nine of the ten dimensions in Table I.

Noise levels[a]	Proportion of workforce exposed
High – impossible to talk even shouting in someone's ear	High – about three-quarters or all (75/100%)
Medium – need to shout when talking to a workmate 1 or 2 metres away	Medium – about a quarter or half (25-50%)
Low – noise is comparable to a busy street	Low – under 10%

Notes: [a]Taken from the Health and Safety Executive (HSE) noise at work: guidance for employers on the control of noise at work regulations, 2005

Table II.
Scoring system for "business risk"

Mann Whitney-*U* is a non-parametric test used to determine if the mean scores for each group on the nine dimensions are different from each other. This non-parametric test was used because data were not normally distributed and equal variances between the groups could not be assumed (Clarke-Carter, 1997). A χ^2 test was conducted to assess whether performance groupings varied according to managerial level. This was an appropriate test for comparing responses from high and low companies on this categorical (rather than numerical) variable (Clarke-Carter, 1997).

Categorisation of high and low performers

Companies were classified as high ($n = 7$), moderate ($n = 4$) or low ($n = 4$) performers immediately after each interview using predetermined criteria (see Table V). These were based on the scoring system developed to categorise survey respondents on

Noise controls implemented	Score (range)
Basic controls included	1
Hearing protection for workers	("0"-"8")
Training on how to use hearing protection	
Monitoring HSE updates on noise	
Training on noise risks	
Contacting external experts on noise	
Checking workers are wearing hearing protection	
Noise risk assessments	
Correct worker poor practice	
Higher level controls included	2
Barriers/screens/enclosures to reduce noise	("0"-"14")
Hearing tests for workers	
Limit operator time in noisy areas	
Building layout to control noise	
Buying "quiet" replacement machinery/tools	
Regular maintenance of noisy machinery	
Engineering/technical noise reduction programme	
Red herrings that have little impact on employee health	−1
Stop people working when they reach exposure limits	(Subtracted from total score for
Record how long workers use hearing protection	each item selected)
Red herring that could negatively impact employee health	−2
Replace radios with MP3 players	(Subtracted from total score if selected)
Total score	−4 – 22

Table III. Scoring system for "noise control implementation"

	"Noise control implementation"	
"Business risk"	Worker-focused	Technical/organisational
Highest risk (1)	*L (n = 1)*	M (n = 0)
High risk (2)	*L (n = 29)*	M (n = 6)
High to medium risk (3)	*L (n = 20)*	M (n = 9)
Medium risk (4)	M (n = 1)	M (n = 1)
Medium to low risk (5)	M (n = 8)	M (n = 6)
Low risk (6)	M (n = 58)	*H (n = 60)*

Table IV. Company performance classification – high (H), moderate (M) or low (L)

High performers	Moderate performers	Low performers
Medium and low criteria plus the following	*Low criteria met plus the following*	Noise risk assessments
Hearing protection/noise risk training	Check workers wearing hearing protection/general compliance	Provide hearing protection
Compliance/good use of hearing protection	Noise measurements/survey	
Noise action planning	Noise policy	
Researched/implemented engineering/ technical noise reduction programme	Audiometry/health surveillance	
Regular maintenance of noisy machinery/ tools	Barriers/screens/enclosures/hearing protection zones	
Job rotation/limit worker exposure	Possible – included noise in machinery/ tool purchasing decisions	
Worker involvement (formal and/or informal)	Possible – hearing protection/noise risk training	

Table V. Interview performance classification criteria

"noise control implementation" (see Table III), modified slightly to specify criteria for moderate performers and accommodate researcher observations during visits. Using these criteria enabled cross referencing of interview and survey data. To minimise the impact of researcher bias, all classifications were cross checked by an independent researcher.

Qualitative interviews

Sample. Companies that were not selected to complete a survey were randomly selected for interview. Representation was obtained for ten of the 15 sub-sectors with a total sample of 15 companies, mostly medium sized ($n = 7$). Interviews were conducted with a health and safety representative from each of the 15 companies.

Procedure

Companies were recruited for interview by telephone. Interviews took place on company premises lasting up to 90 minutes. All interviews were recorded and transcribed. Dimensions measured by the survey were explored in-depth during semi-structured interviews with the 15 health and safety representatives.

Qualitative content analysis

Qualitative content analysis was used to identify patterns (themes and sub-themes) within and across interviews (see Graneheim and Lundman, 2004). Using a systematic approach, the frequency of themes across participating companies was used to compare high and low performers. Key differences between high and low performing companies were extracted.

Results

Quantitative results (survey)

High and low performing companies significantly differed on four of the ten dimensions. These were: first, knowledge and awareness of noise risks and technical/organisational noise reduction methods ($U = 1023$, $z = -2.876$, $p < 0.01$, $n = 110$); second, organisational health and safety values towards eliminating/minimising noise risks and protecting worker health ($U = 1082$, $z = -2.521$, $p < 0.01$, $n = 110$); third, company size ($U = 1122$,

$z = -2.500, p < 0.01, n = 110$); and lastly, resources in terms of available time, staff, funds and equipment ($U = 938, z = -3.376, p < 0.001, n = 110$).

Following Cohen's (1988) effect size classification, individual *z*-scores were converted into *r*-values for each of the four dimensions that showed a significant difference between high and low performers in the Mann Whitney-*U* tests. Resulting *r*-values were then categorised into "insubstantial" ($r < 0.1$), "small" ($r = 0.1$-0.3), "medium" ($r = 0.3$-0.5) or "large" effect ($r > 0.5$). As shown in Table VI, corresponding effect sizes were small.

These findings indicate that: high performers had better knowledge of noise risks and greater awareness of technical/organisational noise reduction methods; management had embedded positive health and safety values, and faced fewer barriers to resourcing noise management than low performing companies. Low performers tended to be smaller in size (micro/small).

The two performance groups did not significantly differ according to managerial level illustrating that the authority level of those who completed the survey had no impact on performance levels (χ^2 (2, $n = 107$) = 0.132, $p > 0.05$).

Qualitative results (interviews)

Consistent with the quantitative results, qualitative content analysis showed that low performers were exclusively small companies, and high performers were mostly large. Low performers demonstrated little knowledge of noise risks and awareness of technical/organisational controls beyond the purchase of "quiet" machinery. High performers adopted a more strategic approach to managing noise shown by their implementation of a comprehensive package of controls (training, health surveillance, action planning, supervision, etc.). Lower levels of health and safety cultural maturity were also apparent amongst low performers (e.g. limited worker observations and involvement, focus on worker level controls). (See Appendix).

Further insights from the qualitative content analysis include:

(1) Knowledge and awareness – differences between the high and low performers appeared to be influenced by the level of formal health and safety training received and noise-related information sources used. Unlike low performers, high performers had received some form of training, which had motivated them to make improvements. They had also established networks as an additional source of advice (e.g. liaison with Trade Associations and Federations). Despite lower knowledge levels, low performers were generally confident with their approach to managing noise risks.

(2) Organisational health and safety values – higher level cultural maturity amongst high performers was reflected in committed senior management, noise-related training for workers, supervision of control use and programmes to encourage positive health and safety behaviours. One manager said that

Table VI. Effect sizes for Mann Whitney-*U* tests

Dimension	*z*-score	*R*-value	Effect size category
Knowledge and awareness	−2.876	−0.20	Small
Health and safety values	−2.521	−0.17	Small
Company size	−2.500	−0.17	Small
Resources	−3.376	−0.23	Small

their noise training, "[…] covered everybody in the factory [in a] noise awareness session." Conversely, low performers generally did not provide noise training to their workforce as they considered hearing protection use to be common sense. No monitoring of control use or initiatives designed to improve health and safety attitudes/behaviours were in place. Nevertheless, managers in both high and low performing companies' focused on risk of injury and death. For this reason, other health and safety risks (e.g. manual handling, musculoskeletal disorders) took priority over noise risks. "[…] I tend to consider the big physical risks as being your actual risk to life and limb […] then you have the risks that will affect your quality of life but you're still alive, and that's where hearing comes in."

(3) Company size – high performers were all large or medium-sized companies (mostly large), whereas low performers were small in size. Larger companies appeared to have adopted a thorough approach to the selection of noise controls (see Appendix).

(4) Resources – high performers appeared to face fewer barriers to resourcing health and safety improvements than low performers, providing they submitted a strong business case for approval by senior management. Low performers tended to invest in personal protective equipment or consultants. Lack of time and awareness of available options could have served as barriers. As another manager stated, "Newer machinery would help, but obviously it [has] cost implications."

Overall, both sources revealed that managers in high performing companies tended to have better knowledge of noise risks and awareness of organisational/technical control measures as a result of training, information and networking. Higher performers had also taken steps to promote positive health and safety attitudes and cultural norms. High performers tended to be large companies, and low performers small companies, which might explain the reason for uncovering a fourth influential dimension, resources. Resources intuitively overlap with company size, as high performers usually faced fewer barriers to resourcing noise management (time, money, staffing) than low performers. Regardless of whether high or low performing, less priority was given to noise risks compared with potential immediate physical safety and health risks.

Discussion

This study has helped substantiate what has up until recently been predominantly anecdotal evidence on the decision-making influences that are important for a high standard of noise management. Key dimensions found to distinguish between high and low performers stemmed from managers' knowledge of noise risks, awareness of controls, health and safety culture and available resource. These findings were derived from two independent data sources and are consistent with the few related studies that have been conducted on noise (e.g. Foster, 1996; Hughson *et al.*, 2002; Leinster *et al.*, 1994; Suter, 2012). In common with general health and safety research (e.g. Bentley and Haslam, 2001; Gardner *et al.*, 1999; Rundmo and Hale, 2003; Ward *et al.*, 2008), smaller companies tended to possess less knowledge, fewer resources and tended to perform less well for noise control than larger companies. Conversely, findings differed from more general health and safety research with respect to the role of external drivers. Generally, external factors can have a pertinent role in duty holder's decision making (e.g.

Ghent, 2012; Wright *et al.*, 2006), but in the current study, external factors, particularly noise legislation, did not appear as important an influence.

These findings suggest that the selection of technical/organisational solutions for managing noise risks are driven by factors originating within organisations, predominantly through its culture. High performers had procedures in place whereby managers discussed good and poor practice in noise control with workers. These managers showed commitment towards good health and safety practices in the workplace by, for example, ensuring that workers had received noise-related training and by monitoring their use of controls. They were also more knowledgeable about the range of noise controls available to them and the conditions that need to be present for such controls to work effectively in order to make an informed choice about which ones to implement. The differences noted between high and low performers in the level of sophistication in managers' decision making suggested that noise improvements were contingent on what was practical, affordable and feasible more so in small than larger companies. Managers, particularly those in small companies, need to achieve a balance between effective noise control and the practical constraints that they face (e.g. building size, available resource).

Implications of the findings

Implications for the design of future interventions by industry bodies and regulators are fourfold. First, inclusion of health and safety culture will require positive shifts in attitudes towards health and safety practices so that use of noise control can be encouraged. Interventions that omit aspects of health and safety culture change are unlikely to be sustained. Second, some tailoring to company size would be required. Doing so could help improve managers understanding of noise control risks, and take account of smaller companies' tendency towards practical and affordable options. Third, developing a business case outlining the short and long-term gains for technical/organisational noise controls could assist managers in companies of all sizes to secure resources for occupational health matters like noise, and to obtain senior management buy-in. Awareness of other technical/organisational controls other than machinery replacement seems vital. Training and education seems to offer more potential than written information for motivating low performing companies to make improvements. Any practical guidance needs to be accompanied by realistic costings to emphasise that some technical measures are within the budget of small businesses. Companies need to be made aware that personal hearing protection is not a cost effective option in the long run and is often difficult to maintain. Finally, raising awareness, and possibly acceptance, of the debilitating effects of noise as a long-latency condition should be done to mitigate manager's apparent underestimation of noise relative to other risks.

Study limitations

The strength of the present study lies in the triangulation of methods which enabled the collection of more robust evidence. The consistency between quantitative and qualitative findings increases confidence in the conclusions reached. The quantitative survey reflected the industry profile by obtaining a high response from small (micro) companies, which are typically hard to reach (Vickers *et al.*, 2003). Whilst the differences reported between high and low performing companies showed a small effect, in a health and safety context, these are regarded as important despite being small (Rosnow and Rosenthal, 1989). However, our study is not without limitations. A potential selection bias in favour of more motivated companies may explain why almost half of the qualitative sample ($n = 7$) were high

performers. Nevertheless, the objective of the interviews was not to obtain a representative sample, but to explore the themes in the survey.

Conclusions

This research provides evidence on the motives and barriers influencing employers' decision making in noise management. By highlighting how high and low performers differ in terms of knowledge, attitudes and behaviour, it offers informed insights that may be incorporated into the design of interventions or initiatives by industry bodies and regulators. By directly addressing dimensions such as knowledge, awareness and capability of the target audience, the health and safety culture of the individual workplace and the ability to secure resources, noise control interventions will be more capable of sustained reductions in occupational noise exposure.

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(The Appendix follows overleaf.)

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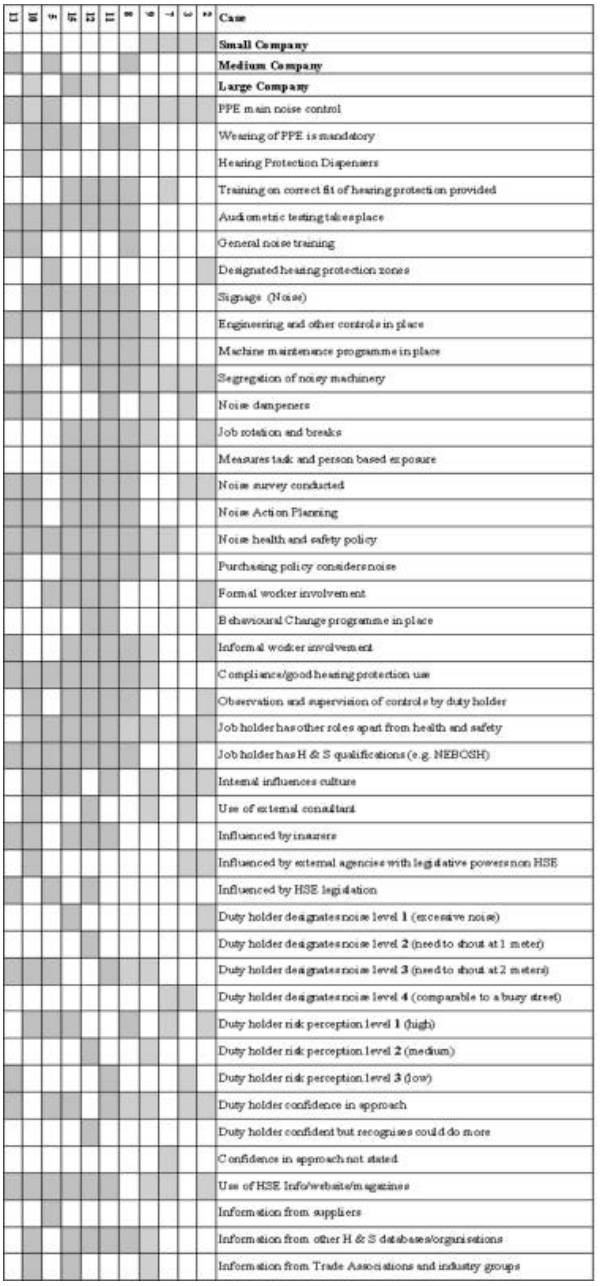
Appendix



Notes: Low performers: cases 2,3,7,9; high performers: cases 8,11,12,15,5,10,13; shaded area denotes evidence where activity takes place within the company uncovered during site visit

Table AI.
Summary of content analysis – high vs low performers