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Literature review: Understanding how to improve the management of exposure to wood dust amongst construction sub-contractors and manufacturing SMEs

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Literature review: Understanding how to improve the management of exposure to wood dust amongst construction sub-contractors and manufacturing SMEs

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Available evidence was reviewed to develop a better understanding of how to improve the management of wood dust exposure in small and medium-sized construction and manufacturing enterprises (SMEs).

There was a paucity of research, with most papers exploring the factors that broadly influence health and safety (H&S) management in SMEs.

Factors that influence SMEs' behaviours, included: i) limited resources (particularly for small construction and wood working companies), ii) a poor awareness of the importance of ill-health prevention, iii) risk control advice from third parties, iv) management/peer H&S attitudes, and v) negative attitudes towards risk controls. Higher levels of H&S awareness and better training provisions were some of the most noteworthy differences found in large compared to small construction companies. Lone working and managing a transient workforce were challenges identified for woodworking and large construction companies respectively.

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SUMMARY

Available evidence was reviewed to develop a better understanding of how to improve the management of wood dust exposure in small and medium-sized construction and manufacturing enterprises (SMEs). There was a paucity of research with most papers exploring the factors that broadly influence health and safety (H&S) management in SMEs. Fifteen papers were reviewed and the findings were mapped onto the Health and Safety Laboratory's (HSL) 'Make it happen' model of behaviour change, which specifies the physical, social and individual factors that influence behaviour.

Factors that influence SMEs' behaviours, included: i) limited resources (particularly for small construction and wood working companies), ii) a poor awareness of the importance of ill-health prevention, iii) risk control advice from third parties, iv) management/peer H&S attitudes, and v) negative attitudes towards risk controls. Higher levels of H&S awareness and better training provisions were some of the most noteworthy differences found in large compared to small construction companies. Lone working and managing a transient workforce were challenges identified for woodworking and large construction companies respectively.

Suggested approaches for improving the management of wood dust exposure included providing incentives to highlight the benefits of good H&S practices, offering practical guidance on risk controls, and using communication strategies to raise awareness about health risks amongst SMEs, including Tier 1 (large) construction companies. For Tier 2 (small) construction companies and manufacturing SMEs, persuasive risk communication to raise awareness of the health risks associated with wood dust, promoting worker involvement in H&S, and helping SMEs to train their workers/supervisors about the health risks from wood dust and controls seem vital.

1 INTRODUCTION AND METHOD

1.1 BACKGROUND AND RESEARCH AIM

This report forms part of the wider project, which aims to generate up-to-date intelligence on occupational exposures to wood dust in the construction and manufacturing (woodworking) industries. This literature search was carried out to develop a better understanding of how to influence construction sub-contractors and manufacturing small and medium-sized enterprises (SMEs) to better manage worker exposure to wood dust. The findings will be combined with those obtained from the next phase of the research involving telephone interviews with management/site supervisors, and assimilated into the final research report.

1.2 METHODOLOGY

A total of fifteen papers were reviewed, which included HSE/HSL reports as well as published peer-reviewed papers (see Appendix 1 for further details). For each paper, relevant information was summarised using HSL's 'Make it happen' model (see Figure 1), which captures the key influences on risk-taking behaviour in the workplace. The model is based on an in-depth understanding of the latest evidence from science and industry. It recognises that changing behaviour in the workplace requires a multifaceted approach that tackles influences on behaviour that arise from the work context (physical and social) as well as the individual (knowledge, skills, motivation, risk appraisal, attitudes and beliefs). See Appendix 2 for more information.

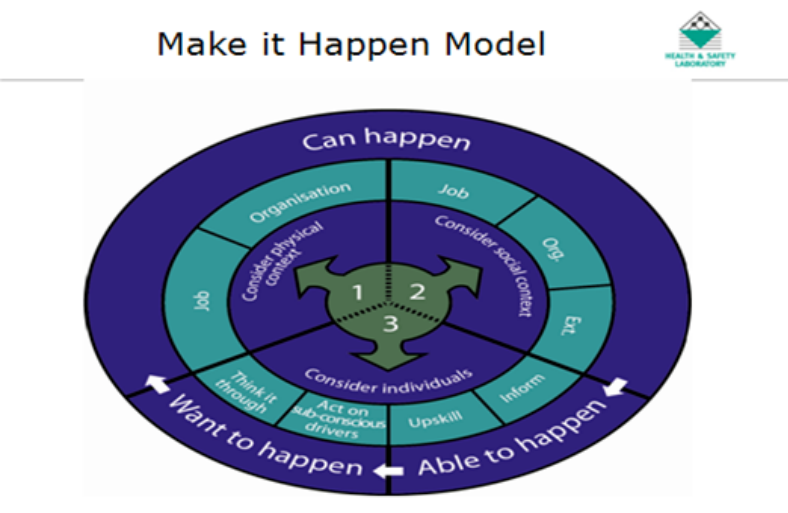

Figure 1 HSL's 'Make it Happen' model of behaviour change

By using the model as a framework for organising the findings from the literature search, it was possible to identify the areas that have received most research attention, any knowledge gaps, and the implications of the findings in terms of encouraging SMEs to better manage exposure to wood dust.

2 FINDINGS

There was a scarcity of papers that specifically examined the management of dust exposure in the construction and/or manufacturing (woodworking) sectors. As a result, the papers included in this report explored more broadly the factors (e.g. individual, job and organisational) that influence the management of health and safety (H&S) and/or occupational health in SMEs. In some cases, papers focused on a variety of industries. In such instances, key findings across the two sectors of interest were extracted. Two of the fifteen papers were generic focusing on the characteristics of successful interventions for managing occupational health in SMEs (Stephens et al., 2004) and on communication techniques that are effective in bringing about behaviour change in SMEs (Gervais, 2006).

This section begins by discussing several cross-cutting themes that were identified in terms of specific factors that influence behaviours and practices in SMEs, followed by a discussion of specific approaches for encouraging SMEs to improve their H&S practices. Any sector-specific issues as well as potential differences in behaviours and/or practices between Tier 1 (T1) and Tier 2 (T2) construction companies will also be highlighted, where possible. It should be noted that in the analysis, principal/main contractors are termed Tier 1. These are typically large organisations that have overall control of the management of work activities. Sub-contractors and suppliers with a direct contract with the Tier 1 main contractor are termed Tier 2. These tend to be small/micro companies that are likely to be 'self-managed' (e.g. making own decisions about the management of work tasks, such as house builders, electricians and joiners).

2.1 FACTORS INFLUENCING SME BEHAVIOUR: CROSS-CUTTING THEMES

Consistent with the 'Make it happen' model, research findings are organised in terms of influences on behaviour that arise from i) the physical context (e.g. policies, procedures, time pressures, design/comfort of equipment), ii) the social context, which encompasses both the immediate organisational context (e.g. organisational culture, peer and management support) and the external environment (e.g. external organisations such as insurance companies, the media), and iii) the individual (e.g. knowledge, skills, habits, beliefs and attitudes towards health and safety). See Appendix 3 for a detailed summary of all issues identified.

Physical context

A key finding was that SMEs have limited resources (i.e. staff, time, and budget), and find it difficult to identify practical and affordable means of managing H&S. Not surprisingly, it was suggested that financial constraints affect SMEs' willingness and/or ability to improve occupational H&S (e.g. ability to afford dust controls in wood working shops) (e.g. Lunt and White, 2005; Stephens et al., 2004).

A broader observation was that there is a *poor emphasis on the prevention of ill health* across both the woodworking and construction industries. For instance, it is suggested that construction companies often lack knowledge of how to manage health issues and are not aware of the financial benefits of good occupational health monitoring (Tyres & Hicks, 2012; Denton, 2010). Similarly, it is argued that the woodworking industry does not sufficiently embrace the value of ill health prevention, which is partly attributed to a lack of understanding of respiratory health risks (e.g. 'acceptable' workplace exposure limits for dust; brush cleaning of wood dust even when vacuums were available) (Bell and Webster, 2011; Lunt and White, 2005).

Differences between T1 (large) and T2 (small) construction sites:

- Resources may be more limited for T2 sites (e.g. in terms of staff, time available for training, pressures to complete work quickly); as a result management may be more reluctant to invest time and resources on occupational H&S.
- Specific challenges for T1 sites include: i) communicating H&S messages down the supply chain, and across a disparate workforce (e.g. different nationalities and potential language barriers), and ii) managing a transient workforce (e.g. transient contracts making it difficult for workers to assimilate organisational H&S values; projects resourced by a range of contractors likely to have different H&S values and standards).

Issues specific to manufacturing/wood working:

- Controls for managing dust exposure may be particularly expensive for small woodworking companies.
- Challenges with accessing H&S information and/or risk communication due to lone working.
- Control of substances hazardous to health (COSHH) assessments do not appear to be consistently used by wood working companies.

Social context

A number of influences on SMEs' practices were identified from both the external environment and the immediate organisational context. More specifically:

- SMEs lack knowledge on occupational H&S risks and appropriate controls often *relying on external sources*, such as equipment manufacturers and/or suppliers and H&S consultants.
- *Keeping up with legislative changes* can be a challenge for SMEs, due to limited resources, and constitutes a potential barrier to good H&S management.
- *Management attitudes toward H&S*, i.e. level of commitment to improve H&S, attitudes towards risks (e.g. viewing dust as an 'inevitable' risk/ fatalistic attitudes) are a key driver that influences behaviours and practices.
- *Macho culture/peer pressure* may discourage the use of PPE/RPE particularly because workers pick up practices from 'significant others' (e.g. mentors) as well as experienced/older colleagues.

Differences between T1 (large) and T2 (small) construction sites:

- Worker involvement practices tend to be more common in larger construction companies along with monitoring/supervision of the workforce.
- Pressure to keep costs down and remain competitive means that T2 companies may be more reluctant to stop a job on safety grounds and/or raise H&S concerns compared to employees of the main contracting company.
- Union influence/scepticism in T1 sites: Unions can resist the uptake of behavioural safety programmes based on beliefs that such programmes place undue blame on workers.

Issues specific to manufacturing/wood working:

- Owners of small woodworking shops tend not to participate in trade associations or other professional organisations, and are more likely to rely on equipment suppliers for information about the best methods of dust control. These suppliers are not always knowledgeable about dust collection systems and their proper design.

Individual factors

According to the 'Make it happen' model, addressing individual factors (such as individuals' knowledge and abilities as well as conscious and unconscious drivers that influence behaviour) is crucial for behaviour change. A number of individual drivers were identified from the literature as influencing behaviours and practices in SMEs. Specifically:

- Management and workers in SMEs *often lack an adequate understanding of occupational health risks*; for instance, it has been suggested that, perhaps with the exception of asbestos, SMEs often have limited awareness of the risks associated with working with materials that can lead to respiratory health illnesses.
- *H&S training in SMEs tends to be variable*; where training is provided it is often not 'fit for purpose' (e.g. insufficient focus on the use of controls to guard against respiratory health risks, lack of refresher training).
- The long-latency nature of any health conditions arising from exposure (i.e. any health effects/symptoms would take a while to develop), means that workers often tend to *underestimate respiratory health risks* (Bell and Webster, 2011; Lunt et al., 2008; O'Reagan et al., 2007; Lunt and White, 2005).
- Beliefs that *risks from exposure to dust are minimised when working outdoors* (Denton, 2010) may deter the use of RPE/PPE; this is compounded by the fact that respiratory health risks (i.e. dust) are often invisible.
- *Habitual ways of working* (e.g. not using RPE for tasks that can be completed quickly), *attitudes towards PPE/RPE use* (e.g. beliefs that the use of equipment hinders task completion), fatalistic attitudes and beliefs over the extent to which workers have control over H&S risks (i.e. beliefs that exposure to dust is 'inevitable') also influence safety behaviours and practices (Mellor et al., 2012; Corr, 2009; Lunt and White, 2005).

Differences between T1 (large) and T2 (small) construction sites:

- Workers and management in large construction sites tend to be more aware of H&S law and regulations although knowledge of occupational health risks tends to be limited; managers of small sites tend to have more limited understanding of H&S law and may thus be unable to enforce H&S requirements.
- Workers/managers in small construction sites are more likely to rely on their experience in managing H&S risks due to lack of or limited knowledge and training.

Issues specific to manufacturing/wood working:

- Training practices in the wood working sector appear to be mainly 'on the job' (e.g. poor or patchy training/instruction, not perceived as proper training and potentially lacking quality, and reliance on worker experience)

2.2 APPROACHES TO BEHAVIOUR CHANGE IN SMES

According to the 'Make it happen' model, changing behaviour in the workplace requires a multifaceted approach that tackles influences on behaviour that arise from both the work context and the individual. Consistent with this, a number of suggested approaches for promoting better working practices in SMEs emerged from the literature that could be used to address the three different types of factors (physical, social and individual) that drive H&S behaviours. This section discusses the 'top level' approaches of promoting behaviour change in SME behaviour. A detailed summary of more specific approaches can be found in Appendix 3.

Some papers specifically explored the best means of engaging with SMEs and the characteristics that interventions should have to be effective in bringing about improvements in occupational health behaviours. Specific recommendations included:

1. **Focusing on managers as the main target for interventions:** It is suggested that the main point of 'influence' within a SME should be the 'gatekeeper', that is, the person who 'controls' resources and is able to facilitate change in occupational health practices (e.g. an owner or manager). An effective intervention strategy would involve complementary interventions that were directed at the 'gatekeeper' as well as interventions aimed at the workforce.
2. **Providing positive/negative incentives:** Positive incentives could help promote the benefits of following good occupational practices to SMEs (e.g. reducing sick absenteeism, reduced insurance premiums), and/or could provide assistance to comply with good practice (e.g. grants towards purchasing equipment). Negative incentives could also be used to emphasise the potential costs of not adopting good occupational health practices (e.g. costs related to absenteeism). This approach would be useful in addressing some of the influences from the 'physical context' discussed in section 2.1.
3. **Providing practical/affordable solutions**: It is suggested that because SMEs are invariably short of time and resources, which in turn affects their willingness, and/or ability to improve occupational health, it is important that they are provided with practical solutions. This could include guidance on risk controls and their associated costs, as well as the development of case studies demonstrating examples of effective management of occupational health risks in other similar organisations.
4. **Raising employers' awareness of occupational health risks and controls through intermediaries:** Given that SMEs rely on external sources/third-party advisors to obtain information on occupational health risks and controls, it is suggested that intermediaries, such as trade associations, could assist in the communication of relevant H&S information. For 'hard to reach' companies (such as in the wood working sector), use of innovative ways of communicating messages will be required (e.g. through industry events or developing links with external bodies such as manufacturers).This approach would be useful in addressing some of the 'social context' influences in section 2.1.
5. **Health and safety messages should be focused and sector-specific:** It is recommended that messages should be tailored using terminology that is 'right' for the woodworking sector. For instance, construction companies do not view health risks as being separate from safety risks (Thompson and Ellis, 2011). Therefore, messages should be branded under the umbrella of 'health and safety' (rather than occupational health) otherwise communications may not be seen as relevant and may not capture companies' interest. Using simple, straightforward and non-technical language when contacting SMEs is also important. This approach would be useful in addressing some of the 'individual factors' discussed in section 2.1.

A number of other specific recommendations for improving H&S practices in SMEs were also identified, which included: i) provision of worker/management training to raise awareness of the risks associated with working with materials that can lead to respiratory health illnesses, and the range of controls available, and ii) use of 'personalised' risk communication, such as testimonies from employees suffering from respiratory ill health (e.g. asthma, silicosis) to raise workers' awareness of their own personal susceptibility, and the link between their behaviours and health risks. Other recommendations were sector-specific and focused on how best to manage a transient workforce in T1 construction sites (see Appendix 3), which included:

- Understanding contractors' values and integrating them into a company's H&S system for instance, by promoting joint working between contractors and supervisors,
- Encouraging contractors to speak up and raise H&S concerns, and

- Providing effective supervision to better monitor contractor competency.

Suggested approaches for improving the management of occupational health risks in T2 construction companies and manufacturing/woodworking SMEs included:

- Using persuasive (i.e. worker testimonies) risk communication to increase knowledge and awareness of health risks associated with wood dust seems vital. Given that these are 'hard to reach' workers, innovative methods to communicate messages could be used (e.g. through industry events, links with manufacturers/suppliers). Consistency of messages from different sources is also important.
- Linked to the above, developing a business case demonstrating the performance benefits of health hazard control to engage T2 construction companies and manufacturing SMEs would be beneficial. This should also assist those responsible for H&S in T1 construction and larger manufacturing companies to secure buy-in from senior management of the importance of managing occupational health risks, such as wood dust.
- Helping SME owners to train their supervisors/workers (including sub-contractors) of the health risks, behavioural consequences and controls. It is also important to involve them in H&S decision making, giving them the autonomy and confidence to speak up when they think doing something a certain way puts their and/or others' health at risk. Utilising Union support is also important for both construction and manufacturing SMEs.
- Providing better supervision to monitor work practices.
- The use of H&S champions and informal peer leaders to improve compliance practices in manufacturing SMEs.

3 SUMMARY

The findings highlight that there are multiple factors influencing sub-contractors and SMEs' behaviours, which need to be taken into account when determining appropriate intervention strategies. Influences from the physical context include limited resources (which may be particularly pronounced for T2 construction and small woodworking companies) and a poor awareness/emphasis on the importance of ill-health prevention; these influences were common across both sectors. Issues relating to lone working (for the wood working sector) and to the challenges of managing H&S in the context of a transient workforce (for T1 construction companies) were also identified. In addition to the immediate organisational context (such as management attitudes and social norms/peer pressure around H&S), the broader social context also appears to influence SMEs' practices as they tend to rely on external sources (such as manufacturers) to obtain information on occupational health and risk controls. Furthermore, individual factors, such as a tendency to underestimate respiratory health risks, fatalistic attitudes as well as negative attitudes towards the use of controls emerged as key influences on behaviours across both sectors. While the evidence highlights the importance of addressing the three areas of the 'Make it happen' model (physical, social and individual influences), the physical and social context appear to have received more research attention compared to individual factors. Knowledge gaps appear to be around how manufacturing SMEs and T2 construction companies equip workers with the necessary knowledge and skills to protect themselves against health risks. In addition, little is known about how to assist workers with changing unhealthy work habits that they may have developed over time.

Communication strategies seem vital for raising awareness amongst SMEs, including T1 construction companies, of workers' personal susceptibility to ill health from wood dust and the need to use risk controls. The right language needs to be used to engage with the industry in collaboration with trusted intermediaries to convey important messages. Providing incentives to highlight the benefits of adopting good occupational health practices and offering SMEs with practical and affordable solutions/guidance on how to utilise risk controls are also important.

Sector-specific recommendations focused on how best to manage a transient workforce in T1 construction sites (e.g. integrating contractors into a company's H&S system encouraging contractors to raise H&S concerns). For T2 construction companies and manufacturing/woodworking SMEs, using persuasive risk communication to raise awareness of the health risks associated with wood dust, training supervisors/workers (including sub-contractors) on the health risks and controls, appointing H&S champions and increasing worker involvement in H&S is important.

3.1 RESEARCH CAVEATS

Given the paucity of research specifically examining the management of dust exposure, many of the papers reviewed focused on other risks/health conditions/controls within the construction and manufacturing industries (including noise, RPE, asthma, and other respiratory conditions). However, consistent with the 'Make it happen' model, it is anticipated that similar factors will impact on behaviours in relation to the use of wood dust. In addition, papers that focused on SMEs in the construction industry did not typically distinguish between T1 and T2 sites. Therefore, the assumption was made that large and small construction companies were equivalent to T1 and T2 sites respectively.

3.2 ISSUES FOR CONSIDERATION

The findings point to a number of topics that could be explored in the next stage of the project. Specifically, the interviews with managers and supervisors could explore the following topic areas:

- Current levels of understanding regarding the health risks associated with dust exposure (e.g. long-latency nature of health effects, types of respiratory health illnesses associated with dust inhalation),
- Sources of information used to find out about health risks and controls (e.g. training, experience, or external sources such as peers, HSE, H&S advisors),
- Types of controls in place for managing dust exposure, and factors that influence the choice of controls (e.g. resources, convenience, advice from manufacturers/suppliers),
- Strategies used to raise awareness among the workforce about health risks associated with wood dust (e.g. type of training provided including refresher training, use of incentives and supervision to ensure that the appropriate controls are used),
- Factors that influence safe/unsafe working practices (e.g. task familiarity/complacency, peer pressure/macho culture, risk perception), and
- Factors that would encourage SMEs to change and/or adopt safer working practices (e.g. financial incentives, tailored recommendations/guidance on the use of risk controls).

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5 APPENDICES

5.1 APPENDIX 1: LITERATURE SEARCH

The literature review was undertaken by:

- Reviewing 15 papers identified by the HSE Information Services team, HSL's search team, the project research team and the HSE customer using the following pre-defined search criteria:
  - manufacturing
  - construction
  - wood dust
  - behaviour
  - exposure
  - influences
  - transient
  - transience
  - risk management
  - risk
  - risk perception
  - contractors
  - sub-contractors
  - SMEs

- Sifting articles according to the following criteria:
  - Published within the last ten years,
  - Focused on research conducted in construction and/or manufacturing industries,
  - Focused on SMEs,
  - Research related to transience in construction,
  - Research focused on wood working,
  - Research focused on the factors influencing management and worker behaviour, and
  - Excluding papers exploring the impact of behavioural interventions.

- Extracting the key findings and implications from each paper into an excel spread sheet.

- Summarising these findings by populating an Excel spread sheet in accordance with the key influences and behaviour change interventions using HSL's 'Make it happen' model.

Relevant HSE and HSL research was included together with published research obtained from databases such as the Web of Science and OSHROM. Research put forward by the HSE customer was also considered. Only the most pertinent papers were included. Table 1 provides information on the searches conducted and associated papers selected.

Table 1. Summary of literature searches and papers selected

Search by	Papers found	Papers selected
HSE search team	27 results (6 ProQuest ICONDA, PsycInfo, Medline, Embase, Health & Safety Abs, 6 elibrary, 6 oshupdate, 6 Web of Science)	**3**
HSL search team	3 results (elibrary)	**0**
HSL research team	13 (HSL/HSE library and reports database)	**8**
HSE customer	7 (HSE research)	**4**
	TOTAL	**15**

5.2 APPENDIX 2: HSL'S 'MAKE IT HAPPEN MODEL'

HSL's 'Make it Happen' Model for health and safety (H&S) summarises the sources of influence that drive risk-taking behaviour and the key criteria for changing behaviour in the workplace. This includes:

- Factors arising from the work context either enable or act as barriers to safe behaviour. The context or work environment has both physical (e.g. equipment, procedures, etc.) and social characteristics (e.g. workmate's attitudes to H&S) that can affect risk taking behaviour. The context is also divided into the immediate work surroundings (job environment), the wider organisational environment, and external environment. Addressing these factors means that safe behaviour **'Can happen'**.
- Individual factors that influence behaviour concern an individual's capability (e.g. their knowledge and skills) and improvements in this area means that behaviour change is **'Able to happen'.**
- Behaviour change also depends on how motivated individuals are to change. Motivational influences operate at conscious (*reflective*) and sub-conscious (*automatic*) levels of awareness. We are often without full conscious realisation of all the reasons why we choose to behave in a certain way. Addressing these means that the workforce will **'Want'** behaviour change **'to happen'.**

5.3 APPENDIX 3: SUMMARY OF FINDINGS USING THE 'MAKE IT HAPPEN' MODEL

Table 2. Summary of literature review findings using the 'Make it happen' model[1]

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
Ensuring that the right behaviours '**Can Happen':** Provision of **physical support**	**CONSTRUCTION (T1 Large):** • Disparate workforce: various nationalities and cultures with varying degrees of receptiveness to safety; employment of foreign workers can create a language barrier in being able to communicate H&S messages effectively (3, 7); Ill-health prevention advice not filtering through the supply chain (15) • Sub-contractors will have different H&S standards and values; SMEs also unable to check contractor qualifications (3) • Production pressures and needing to win future work (7) • Economic climate prevents contractors from providing high standards of OH facilities (15) • Union influence: rejecting the use of behavioural safety (7) • Complex and dynamic work environments e.g. depending on weather conditions, hazards, customer priorities, changing sub-contractors impacts on consistency, standards and vigilance (7) • Lack of ill-health prevention awareness and expertise within the construction industry; larger construction companies still do not know how to manage health issues; occupational health industry poor at highlighting the financial benefits of good occupational health monitoring (6, 15) • Lack of a leading indicator for health (15) • Reliance on PPE (15) • Clients lack interest in OH issues (15) • Lack of understanding of contractor responsibilities (15) Transience of the workforce, which impacts on: • Resources to train workers and ability to implement a consistent behavioural change approach (7) • Isolation of workers and reduced exposure to company ethos (8)	**CONSTRUCTION (T1 Large):** • Allow sufficient time and resource (7, 15) • Implement a top down, bottom up approach (7, 15) • Utilise trade union support (7) • Provide a strong legislative steer (7) • Develop a consistent message (7) • Use sub-contractor performance reviews to increase engagement with them (7) • Offer financial incentives to employers to encourage better management, e.g. tax breaks, grants, reduction in insurance premiums (7) • Create a Health Impact Frequency rating (15) • Include OH in senior management meetings to encourage contractors to share their experiences, to maximise learning and promote good practice (15) • Proactive engagement between OH team, managers and workers to solve problems (15) • Early engagement with designers, architects and CDM co-ordinators, further training for them on OH issues to ensure they effectively design them out before they reach work sites (15) • Senior level commitment and leadership from contractors and clients (15) • Set standards for good practice in OH provision (15) • Use competitions or well-being issues to introduce OH, and encourage knowledge sharing (15) • Highlight the benefits of OH (including cost benefit)

[1] *The numbers in brackets refer to the source of reference which can be found in the 'References' section.*

[2] *Findings that relate specifically to large and small construction companies are grouped under 'construction (T1) large' and 'construction T2 small' respectively; issues that emerged as common to both the construction and manufacturing sectors (typically where these two sectors where included in studies that examined a number of sectors) are grouped under 'manufacturing and construction'; any issues that related specifically to the wood working sector are grouped under 'manufacturing/wood working'; and findings from papers that focused on the construction sector but did not distinguish between small versus large sites are grouped under 'construction'.*

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
	• Reduced trade union representation (8) • Reduced site familiarity (hazards and working conditions) (8) • Likelihood of investment from management (8) • Competency management (8) • Ability to establish trust between workers and managers (7) **CONSTRUCTION (T2 Small):** • The reactive nature of SMEs in response to H&S issues (7) • Workers spend less time on site, leaving the OH team struggling to influence workers. Also, as there are more limited numbers of workers available, time off to attend training or medicals is more noticeable (15) • Smaller contractors can be resistant to messages about OH issues (15) • Lack of management commitment to making improvements in OH, due to concerns about, and availability of, time and resources (15) • Work on small sites less likely to be completed on time - this increases pressure on the workforce to finish work quickly especially towards end of project (12) • Small construction sites do not always use the appropriate equipment for the job (unlike large sites) (12) • Small construction enterprises, acting as sub contractors, will rely on and follow the main contractor risk assessments (12) **MANUFACTURING AND CONSTRUCTION:** • SMEs struggle to find practical and affordable solutions, invest in H&S, offer health surveillance/occupational health due to limited resources (staff, finance and time) (1, 2, 9) • Financial and time constraints can elevate productivity above occupational health concerns (9); time pressures and short duration of work encourage staff to take shortcuts (3) • Limited resources e.g. for training, availability of equipment; consideration of costs means that SMEs may only provide what is considered a 'legal necessity' (3, 10, 14) • Legislative updates/changes potential barrier for H&S management for firms that did not have the staffing capability/resources to keep up with changes (14) • Control availability, location and history of use of specific controls influences managers' choice of controls (1, 9) • Immediate work environment characteristics, e.g. ease of use of controls, comfort, communication obstruction, task interference influence compliance (9) • Fear over consequences, e.g. employment prospects can influence worker decision to	(15) • Continue to apply the hierarchy of controls (15) Transience of the workforce: • Understand contractor values to build trust and integrate them into the company's H&S management system and H&S values (e.g. encouraging contractors to work with supervisors) (8) • Ensure contractors feel confident to speak up (8) • Provide effective supervision to better monitor competency (8) • Check sub-contractor qualifications (3) **CONSTRUCTION (T2 Small):** • Need for SMEs to be encouraged with specific tailored messaging that resonates with them (15) • Communicating the message that safety should never be compromised, even when profit margins are tight is something that the industry needs to embrace more strongly (6) **MANUFACTURING AND CONSTRUCTION:** • SMEs need practical/affordable solutions; Guidance on controls needs to be supplied with associated costs (2) • Case studies demonstrating the impact of good and bad management of health risks (14) • Supervisory feedback important for sustained compliance in RPE/PPE use (10) • SMEs to be kept up to date with their responsibilities around employee health and any legislative and regulatory changes (14) • Guidance should be succinct using lay terms (14) • Mitigate employee / employers' fears of any economic consequences. Sector specific business cases, contrasting employer costs incurred by early or delayed diagnosis could lend employers greater incentive to widen access to occupational health services (9) • Maintaining occupational health needs to be considered

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
	undergo health surveillance for health conditions, e.g. asthma (9) • Fear over costs associated with health conditions, e.g. asthma, such as sickness absence and compensation, can influence management decisions regarding health surveillance (9) **MANUFACTURING/WOODWORKING:** • Fear of civil claims motivated managers to implement noise controls (2) • Management control: decision making authority over interventions (2) • Customer pressure (2) • The industry H&S culture/values towards prevention of ill health, e.g. lack of knowledge/understanding of the risks (e.g. exceeding exposure limit, few COSHH assessments or hazards seen as inconvenient than serious risk) or lack of action (e.g. poor work practices - brush cleaning of wood dust, little use of RPE, health surveillance, acceptance of controls due to lack of ease of use, risk resignation ('part of the job') or reactive approach to H&S) (9, 2) • Resource limitations evident in the wood manufacture sector included time (e.g. no time to read H&S information or attend training), money (e.g. barrier to training, ability to afford dust controls etc.) and knowledge (e.g. incorrect knowledge of RPE use) (9)	as integral to productivity to achieve a positive 'health climate' (9) **MANUFACTURING / WOODWORKING:** • Open channels of communication between management, workers and unions (2) • Need for procedures whereby managers can discuss good and poor practice with workers (2) • SME managers need to achieve a balance between effective risk control and the practical constraints that they face (e.g. building size, available resource) (2) • Need for simple, tailored guidance and support in how to implement solutions correctly to their own situation (2) • Better education on the hierarchy of control principles and a focus on elimination (e.g. RPE as a means of control is not cost effective long term) (2) • Developing a business case outlining the short and long term gains for use of controls could help managers to secure resources for occupational health matters and to obtain senior management buy-in (2) • Woodworking SMEs need better information, awareness and recognition that some controls may be too expensive for them (9) • Discourage performance incentives in the wood industry that exclusively focus on productivity at the expense of occupational health (9) • Develop business cases in wood working demonstrating performance benefits of health hazard control (9) • Emphasise potential ramifications of poor risk control to dependents (9)

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
Ensuring that the right behaviours '**Can Happen'**: Provision of **social support**	**CONSTRUCTION (T1 Large):** • Extent of worker engagement practices undertaken (7); worker involvement more common practice in large sites (12) • Supervisor attitudes towards safety (7) • Management attitude: high number of sub-contractors impacts on management incentive and opportunity to manage workforce exposure (7) • Variance in nationalities and cultures likely to impact on team cohesiveness (7) • Large sites tend to monitor the workforce (12) **CONSTRUCTION (T2 Small):** • 'Significant others', such as a mentor in their original trade or a former boss, as well as fellow workers and other contractors influence H&S attitudes (4) • Influences from older workers who may encourage or discourage unsafe behaviours (11) • 'Macho' culture may encourage/discourage unsafe behaviours (such as wearing PPE) (11) • Picking up practices from experience of working in small and large sites (4) • External factors: during recession pressure to keep costs down to remain competitive (4) and/or may be reluctant to stop a job as working on sub-contractor basis (11) • Devolution of H&S responsibility from contractors to sub-contractors e.g. if there is an accident it is the subcontractor's responsibility (4) • Nature of employment contract: sub-contractors may feel less able to raise H&S concerns (e.g. about asbestos) compared to employees of main contracting company (11) • Supervision of workforce on small sites variable (12) • Worker involvement variable in small sites (12) **MANUFACTURING AND CONSTRUCTION:** • Legislation/compliance with law and external audits by HSE and insurers (i.e. to reduce premiums) are key motivators instigating RPE programme development (1) • External information sources/advisors used for RPE decisions (e.g. RPE manufacturers and/or suppliers, H&S consultants, HSE guidance/website, industry contacts, publications and events, sharing information with sister companies) (1) • Management attitudes towards H&S (e.g. their level of commitment/motivation to improve, recognition that their own actions influence workers, fatalism) and dust exposure (1, 2) • Peer pressure and management commitment to occupational health influence worker	**CONSTRUCTION (T1 Large):** • Need for a focus on personalised risk communication due to management attitudes (7) (see subconscious influences on behaviour) • Training people in worker engagement skills, ensuring effective control over and engagement with the supply chain, building standards into sub-contracts, making any intervention part of a daily H&S management system (7) **CONSTRUCTION (T2 Small):** • Employers should be given the full facts about risks as they have the power to 'influence' and shape the organisation's safety culture (11) • Good safety culture is important to encourage workers to come forward with any H&S concerns (11) **MANUFACTURING AND CONSTRUCTION:** • Visible, senior management and supervisor commitment to H&S and seen to take it seriously, e.g. ensuring that workers receive training on health risks and by monitoring worker use of controls (2, 7, 15) • Demonstrable management commitment to occupational health, supervisory support and inclusion of staff within occupational health-related decisions is necessary for compliance (9) • Work-related social norms, as reflected in colleagues' and managers' behaviour and attitudes to health risk, must send message that following guidelines and avoiding health risks is important (9) • Matching interventions to the maturity of the organisation (7) • Formal assessments of the organisation's H&S culture and support to managers in developing interventions to aid cultural improvements (2) **MANUFACTURING / WOODWORKING:** • Focus on management attitude: a strong ethos of looking after the workforce (2)

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
	behaviour (9) • Culture: e.g. maturity, evidence of a family business culture - moral driver to look out for one another's H&S; macho culture (1, 2, 3, 7) • Workers from lower socio-economic groups are potentially exposed to greater health risks, e.g. asthma (9) **MANUFACTURING / WOODWORKING:** • The main peer contacts in wood working were colleagues (e.g. prefer 'word of mouth' communication and learning from others), and customers (e.g. feel that the H&S onus is on the client) (9) • Trade associations/journals have diminished leaving SMEs feeling isolated from peers. Use of information in the wood manufacture sector was limited and appeared to be determined by legal requirements and fear of inspection (9) • SMEs dependent on (and trust) supplier and outside expert advisor knowledge – lack the knowledge themselves (2) **CONSTRUCTION:** • Senior management focus is typically on safety and not health; lack of emphasis on occupation health; policies focusing on respiratory health and safety are rare (6) • Lack of clear management supervision and enforcement in SMEs results in cutting corners (3) • Site supervisors generally look out for workers' health although typically for very obvious respiratory hazards (e.g. a large cloud of dust from demolition works) (6) • Although there is information in industry (e.g. toolbox talks, industry developed DVDs etc.) difficulties in engaging workers with the information; despite legislation requiring companies to consult with their workforce, companies are still falling short of the mark (6) • Good standards developed but wider industry uptake is slow particularly around respiratory health (6)	• Recruit informal peer leaders in wood working to exert positive pressure that conforms to compliance/good practice (9)In woodworking SMEs, utilise a H&S champion to improve compliance practices (9) **CONSTRUCTION:** • Managers to set clear standards that operatives should follow (6) • Embedding a culture where leaders of organisations (clients and contractors) take responsibility for health and safety, and implement robust health and safety management systems (6) • Industry itself should take greater responsibility for raising health and safety standards (6)

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
Ensuring that the right behaviours **Able to Happen:** Provision of **knowledge**	**CONSTRUCTION (T1 Large):** • Designers lack understanding of potential health consequences of design decisions (15) • Employers lack knowledge of OH aspects and risks (15) • Site managers of large construction sites have good knowledge of H&S law (12) • Workers in large sites more aware of H&S regulations (12) **CONSTRUCTION (T2 Small):** • Lack of worker knowledge about how to deal with risks (e.g. from asbestos) (11) • Site managers from small sites had limited knowledge of H&S law and would be unable to enforce H&S requirements (12) • Managers' beliefs that they do not need to improve their knowledge of H&S law (12) • Small construction enterprises more likely to rely on their own experience due to lack of knowledge and training (12) **MANUFACTURING AND CONSTRUCTION:** • Managers' knowledge/awareness of the hazard as a significant, long-term health risk, potential health consequences and knowledge of technical and organisational controls to reduce exposure, as well as own experience and research undertaken, e.g. into controls, practical solutions, the risks, etc. (2, 1) • Managers' belief that they have the knowledge, having been in the industry for years (1) • Workers' appraisal of risk influenced by their knowledge of the risk, consequences and controls (9) • SMEs, especially workers, are less aware of occupational health risks (9); lack of awareness surrounding the risks of working with materials that can lead to respiratory illnesses (aside from asbestos) (6) • Clients lack knowledge of the importance of H&S (3) • Inadequate risk knowledge (10) **MANUFACTURING / WOODWORKING:** • Managers knowing how best to encourage appropriate behaviour amongst their workers to make sure that they properly use the selected controls (2) • SMEs more likely to seek non-HSE guidance (2)	**CONSTRUCTION (T1 Large):** • Address knowledge gaps (7) • Educate workers and managers on the risks to health (15) **CONSTRUCTION (T2 Small):** • Improve knowledge on health risks (e.g. from asbestos exposure) through wider distribution of HSE materials (11) **MANUFACTURING AND CONSTRUCTION:** • Ensure accurate knowledge of the risks including provision of knowledge of long-latency risk of health conditions (9, 2) • Raising awareness about risks through training (10) • Provision of management knowledge (through training and education) of workplace hazards, potential consequences of not sufficiently protecting workers, the risks, the range of controls available and the conditions needed for such controls to work effectively to make an informed choice about which ones to implement (1, 2) **MANUFACTURING / WOODWORKING:** • Provision of HSE guidance and information can assist with management attitude change (2) • Use of innovative ways of communicating key messages about management of risk to 'hard to reach' companies, e.g. industry events, via large companies, links with external bodies, such as manufacturers, etc. (2) • Increase knowledge of risks and controls (9)

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
Ensuring that the right behaviours are **Able to Happen:** Up skilling	**CONSTRUCTION (T1 Large):** • Site managers from are more likely to receive H&S training (12) **CONSTRUCTION (T2 Small):** • Lack of training and/or no refresher training (e.g. on asbestos) (11) • Training not fit for purpose (e.g. not sufficient focus on how to use controls) (11) • H&S training in small sites variable (12) **MANUFACTURING AND CONSTRUCTION:** • Lack of management training (1) • Training (e.g. on controls and use of PPE/RPE) (10) **MANUFACTURING / WOODWORKING:** • Management skills, e.g. self-efficacy – confidence in their own ability to implement the correct controls and action plans (2) • Training in SMEs typically takes place 'on the job' (perception that experience equates to training competence) (9) • Training practices in the wood manufacture sector appeared to be mainly 'on the job' (e.g. poor or patchy training/instruction, not perceived as proper training and potentially lacking quality, and reliance on user experience) or college based (9)	**CONSTRUCTION (T1 Large):** • Improve vigilance through situational awareness training (7) • Supervisors and workers require the skills necessary to be able to identify what they need, or at least feel able to highlight issues with poor PPE and ask for improvements (15) **CONSTRUCTION (T2 Small):** • Training to focus on the practical aspects of using controls (e.g. how to deal with asbestos) (11) **MANUFACTURING AND CONSTRUCTION:** • Repeated skills training, ensuring adequate availability of appropriate controls, and minimisation of job hindrances or stressors. Training should encompass risk assessment and control use to optimise compliance (9)
Ensuring that people **Want** (the right behaviours) **to Happen: Subconscious/Automatic influences on behaviours**	**CONSTRUCTION (T2 Small):** • Habits: difficult to change experienced/older workers' way of working (4) • Health issues can be seen as 'chance'/'lottery'; long-latency nature of health effects (i.e. arising from exposure to asbestos) means that young workers find it difficult to identify with the risks (11) **MANUFACTURING AND CONSTRUCTION:** • Latency of the health condition can cause an underestimation of the risk/hazard to health, e.g. asbestos, noise, asthma (2, 7, 9) • Risk perception biases, e.g. underestimation of risk generated by the latency of the health threat, familiarity, and an assumption that personal protective equipment (PPE) provides risk immunity, can distort risk judgements (9, 10) • Perception that risks from exposure to airborne dust are minimised when working outdoors (6) • Habits (9, 10)	**CONSTRUCTION (T2 Small):** • Better information to workers about the nature of risks to reduce likelihood of workers taking unprotected risks (11) • More focused messages about risks e.g. not just 'asbestos kills', but more detailed message about how many die and how (11) **MANUFACTURING AND CONSTRUCTION:** • Raising awareness, and possibly acceptance, of the debilitating effects of health conditions, e.g. noise as a long-latency condition, should help mitigate managers' underestimation of the risk (2) • Use prompt cards to remind workers of their treatment requirements, and to monitor their symptoms and manage their exposure according to the tasks and

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
		hazards they are working with for that day (9)
Ensuring that people **Want** (the right behaviours) **to Happen: Conscious/Reflexive influences on behaviours**	**CONSTRUCTION (T1 Large):** • Underlying decision-making processes by individuals are more likely to influence health-related behaviours (7) • Negative / poor worker attitudes to H&S impact on H&S (15) **CONSTRUCTION (T2 Small):** • Small sites perceived to be safer as workers know and trust each other (e.g. no 'unknown' hazards; no 'traffic' or heavy plant in small sites) (4) • Beliefs that risks cannot be completely eliminated (4) **MANUFACTURING AND CONSTRUCTION:** • Management values and beliefs (e.g. concern for the wellbeing of staff and desire to do the right thing) (1, 2) • Management beliefs/assumptions that knowing how to use controls/protect themselves, e.g. PPE, should be common sense for workers – leads to lack of awareness of the need for training (1, 2) • Management experience of a previous serious accident and/or enforcement action, experience of health-related claims, or experience of a worker becoming ill (1, 2) • Workers' decisions to comply are based on a cost-benefit judgement (9) • Workers' perceptions/belief that they possess the skills for regulating risk, and that their actions will be effective, will shape their motivation to comply (9) • Employee attitudes towards their own health: especially younger people do not take H&S in the workplace seriously (14) • Fatalistic attitudes and health beliefs (including self-efficacy) influence behaviour of workers; fatalistic attitude leading to ignoring risks (e.g. no choice but to work with risks) (9, 10) • Lack of PPE use due to beliefs that it is easier to do the job without them (3) **MANUFACTURING / WOODWORKING:** • Management beliefs that the controls are sufficient (2)	**CONSTRUCTION (T1 Large):** • Shape individual's attitudes and beliefs towards the desired healthy behaviour, e.g. beliefs about harm, capability, attention and willingness to comply with social norms (7) • Ensure individuals have a sense of control over their ability to affect change e.g. participatory goal setting • Develop individuals' self-efficacy (7) • Develop personalised risk communication messages to 'intrinsically' motivate SMEs to engage in proactive compliance (7) **CONSTRUCTION (T2 Small):** • Messages should focus on salient values e.g. close working relationships, the importance of experience, the ubiquity of hazards and the dangers of rushing, over-confidence (4) • Using photos, rather than text, will have more impact on getting messages through (4) **MANUFACTURING AND CONSTRUCTION:** • Ensure risk communication is perceived by workers as relevant, expressed in their language/jargon, and delivered by a credible source (9, 14) • Training is more effective when provided prior to commencing a job and repeated throughout to instil positive H&S attitudes (9) • Need for risk assessment training, control usage training, and training provision generally within SMEs (9) • Interventions based on helping workers to plan how they are going to improve compliance/change their behaviour coupled with line management support (9) • Focus on increasing workers' acceptance of their own personal susceptibility to illness and control acceptance to encourage them to use the controls, i.e. beliefs in the controls (9)

Behaviour change component	Key findings: influences on behaviour / characteristics of the industry[2]	Potential learning for HSE / Approaches to influencing behaviour
		MANUFACTURING / WOODWORKING: • Appropriately tailoring future messages about the health risks (2) • Focus on increasing persuasive risk communication in wood companies. Screen and train in-house trainers in risk communication techniques via inspectors (9) • Persuasive risk communication should be perceived as personally relevant. Testimonies from employees with the health condition, e.g. asthma, biomarker feedback and video monitoring tailored to 'employee types', could provide employees more tangible evidence of the link between behaviour and health risks (9)

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Literature review: Understanding how to improve the management of exposure to wood dust amongst construction sub-contractors and manufacturing SMEs

Available evidence was reviewed to develop a better understanding of how to improve the management of wood dust exposure in small and medium-sized construction and manufacturing enterprises (SMEs).

There was a paucity of research, with most papers exploring the factors that broadly influence health and safety (H&S) management in SMEs.

Factors that influence SMEs' behaviours, included: i) limited resources (particularly for small construction and wood working companies), ii) a poor awareness of the importance of ill-health prevention, iii) risk control advice from third parties, iv) management/peer H&S attitudes, and v) negative attitudes towards risk controls. Higher levels of H&S awareness and better training provisions were some of the most noteworthy differences found in large compared to small construction companies. Lone working and managing a transient workforce were challenges identified for woodworking and large construction companies respectively.

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