

The Value Proposition for the Occupational Health and Safety Professional *Literature Review*

A Report from the International Network of Safety
& Health Practitioner Organisations (INSHPO)



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INSHPO is the global voice for the occupational safety and health profession and acts as a forum for international collaboration among professional organisations to improve safety and health at work. INSHPO was created out of an appreciation that occupational safety and health issues and concerns are not limited by national borders. With the increasing worldwide distribution of products and provision of services, the widespread migration of workers, and the conduct of international corporate activities, almost every issue that occupational safety and health professionals face is global in scope.



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Executive Summary

This research report was commissioned by the International Network of Safety & Health Practitioner Organisations with the purpose of reviewing the evidence in support of the value proposition for the occupational health and safety professional. This report makes a small contribution to a range of activities currently

being undertaken by the International Network of Safety & Health Practitioner Organisations designed to strengthen the occupational health and safety profession's international standing and acceptance as a profession.

To fulfill the purpose of this research, a literature review was undertaken with the aim of answering the following research questions:

- 1) What is the evidence that the occupational health and safety professional improves the occupational health and safety performance of an organization?
- 2) What knowledge, skills and attributes of the occupational health and safety professional might be linked with the effectiveness of the occupational health and safety professional?
- 3) Does the impact of the occupational health and safety professional vary depending on industry and organizational size?

A conceptual framework (the value pyramid) was developed to illustrate the relationship between the occupational health and safety professional and business value. It is also used to map the findings of the literature review. Articles retrieved during the review process were classified according to a hierarchy of evidence developed for this review as follows:

- 1) Studies with strong evidence of direct value.
- 2) Studies of moderate evidence of direct value where the evidence of value is moderated by other variables.
- 3) Studies of moderate evidence of inferred value where the evidence is moderated by other variables.
- 4) Studies with weak evidence of direct value and expert opinion.



Of the 58 articles retrieved during the literature search only two (2) studies could be classified at level one (1) on the hierarchy of evidence. Both studies were conducted in the construction industry and both studies demonstrated the value of employing a suitably qualified in-house occupational health and safety professional, measured by reductions in fatality and injury rates. Two themes that emerged from the literature and which warrant further research are the importance of the line of report and the personal attributes of the occupational health and safety professional. This finding suggests that the occupational health and safety professional's ability to add value is negatively affected when the professional lacks power and the ability to influence senior decision makers.

While there is evidence that the occupational health and safety professional has an important role to play in reducing fatality and injury rates, missing from the evidence is the role they play in reducing the rates of disease and ill-health. This is a glaring omission and must be addressed by further research. Of further concern is the lack of evidence for the value proposition for the occupational health and safety professional in high risk industries other than construction.

To continue to build on and address gaps in the current evidence, a proposal for further research is made. It is proposed that future research be based on a matched pair's design of companies with high and low accident rates. Research should focus on the value of the occupational health and safety professional including the moderating or intervening factors that may impact on the value proposition for the occupational health and safety professional. It is recommended to create a concerted and professionally-shared international research effort within and across industry sectors and countries to systematically build upon the existing evidence base for the value proposition for the occupational health and safety professional.

1. Introduction

Under the auspices of the International Network of Safety & Health Practitioner Organisations (INSHPO), work is underway to raise the professional standing and recognition of the occupational health and safety (OHS) profession and the occupational health and safety professional (OHSP). This work includes the development of an internationally recognized Body of Knowledge (BOK) to underpin the OHS profession along with an internationally recognized certification scheme for OHSPs. As much as this work is driven by a desire by the OHS profession to evolve and achieve recognition and acceptance as a profession in its own right, it is also driven by the recent global financial crisis that has resulted in organizations becoming more demanding that the OHSP must be able to demonstrate their value to the organization.

The purpose of this report, therefore, is to review the literature in an effort to identify the current evidence, and the strength of that evidence, in support of the value proposition for the OHSP. This literature review will address the following research questions:

- 1) What is the evidence that the OHSP improves the OHS performance of an organization?
- 2) What knowledge, skills and attributes of the OHSP might be linked with the effectiveness of the OHSP?
- 3) Does the impact of the OHSP vary depending on industry and organizational size?

This report does not consider the evidence for any wider effect of employment of an OHSP beyond that on OHS performance, either directly or indirectly. Arguably OHSPs could save their employers money by ensuring that cost-effective risk-based and evidence-based prevention measures are taken, rather than spending money on “gold-plating” or on unproven but fashionable OHS interventions; they could influence and support the regulatory processes to help ensure that cost-benefit is

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taken into account in making new legal requirements. They could also improve the image of their employers and influence its style of management to take a broader perspective than simple profit maximization. However, such additional potential values are beyond the scope of this study.

This report is structured to systematically answer these research questions and a brief summary of each section follows. Section 2 provides the context and a framework for conceptualizing the relationship between the OHSP and value. Section 3 outlines the methodology used to conduct this literature review and provides a hierarchy of evidence for considering the type of studies found during the review and the quality of the evidence. Section 4, structured according to the hierarchy of evidence, presents the finding of the literature review and the evidence supporting a relationship between the OHSP and value. Section 5 discusses the findings of the literature review, maps the findings against the framework for conceptualizing the relationship between the OHSP and value, and answers the research questions. Section 6 identifies gaps in the evidence related to the value proposition for the OHSP and makes proposals for further research to address these gaps.



2. Conceptualizing the Relationship Between the Safety Professional & Value

There has been a long-standing interest in the value of the OHSP (see for example Adams, 2000; Greer, 2001 & Lawrence, 2008). This interest has been generated in the recent past by the Global Financial Crisis (GFC), although Hill (2006) suggests that interest in the need to demonstrate the business value of the OHSP can be traced back to at least 2000 due to downturns in the economy triggered by other financial crises. The GFC had a significant impact on the United States economy in particular, resulting in a range of cost cutting measures from which OHSPs were not immune. As a result, OHSPs today are under increasing pressure to demonstrate their relevance and value. Professional bodies, in particular the American Society of Safety Engineers, have responded to this challenge through a structured campaign to demonstrate the value proposition for the OHSP (Lawrence, 2008). Reflecting this trend, a recent article by Seabrook (2014) continues the call for OHSPs to demonstrate OHS business value in delivering sustainable and profitable organizations. While in a similar vein, Curtis (2014) questions if OHSPs are able to explain to top managers how OHS practices contribute to the “bottom-line.”

Before proceeding it is useful to define what is meant by “value” in this context. According to the Merriam-Webster (online) dictionary, “value” is a noun referring to the usefulness or importance of a person, including ideas or actions; a fair return in services or money for something exchanged. Applying this definition to health and safety, it could be expected that in exchange for the expenditure on health and safety staff (including their ideas and actions), there would be a return to the business in terms of decreased costs associated



with fewer fatalities, injuries, disease and ill-health (FIDI). In this way, the OHSP becomes both useful and important, without which, business costs would arguably be higher. Other sources of value, such as improvements to the company image and cost savings from cost-efficient prevention are not considered in this report.

The concept of “value” is closely aligned with the concept of “effectiveness.” For example, over 20 years ago Veltri (1992) recognized the need to evaluate the effectiveness of the OHS function. This need reflected a growing concern among OHSPs who were “required to justify their continued organizational existence in a strict economical sense” (p. 27). According to the Merriam-Webster (online) dictionary, “effective” is an adjective related to producing a result that is wanted, or having an intended effect. Assuming that businesses wish to reduce FIDIs and their associated costs (a result that is wanted), then OHSPs are valuable because, in theory at least, they are able to help business to

become more effective. The problem is that until recently, there has been little empirical evidence to support the proposition that OHSPs are valuable because they are effective in a business sense.

A conceptual framework for visualizing the speculated relationship between OHSPs and business value is shown in Figure 1. This framework, shown as a value pyramid, is broken into three sections. At the base of the pyramid is the OHS BOK. A BOK systematically brings together and defines OHS science knowledge in terms of theory, evidence and argument and is used to inform the accreditation of university-level OHS programs and ongoing professional development. The OHS BOK is the bedrock knowledge upon which OHSPs build their professional practice and formulate their advice to organizations on how to achieve safe operations.

The middle section of the pyramid represents the OHSP, who is the linchpin between the OHS BOK and business value. This section of the value pyramid is broken into five (5) interrelated sub-sections:

- i) qualifications (what they know)
- ii) experience (how long they have been doing it)
- iii) professional certification (recognition based on what they know and how long they have been doing it)
- iv) role and tasks, also referred to as functions (what they do)
- v) personal attributes (who they are)

It is argued that, taken together, these characteristics or qualities of OHSPs allow them to fulfill their full potential and add value to the organizations within which they work. The top section of the pyramid is built on the basis that the two

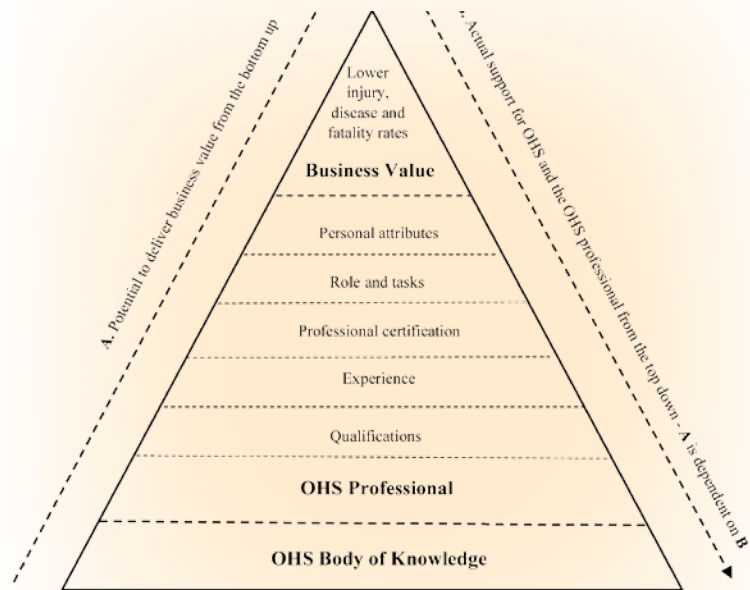


Figure 1: Conceptualizing the relationship between the occupational health and safety professional and business value (the value pyramid)

previous sections are effective and represent the business value of the OHSP in terms of safe operations and reductions in FIDI.

Further, the potential for the OHSP to deliver value is illustrated by line A on the left hand side of the pyramid, which runs from the bottom to the top of the pyramid. This potential is dependent upon the actual support from the business, shown as line B on the pyramid, which runs from the top to the bottom of the pyramid. It is hypothesized that if all conditions of the pyramid are fulfilled, then the OHS profession and individual OHS professionals will be in a strong position to argue for and to demonstrate the value proposition of both OHS and the OHSP. This conceptualization of the relationship between the OHSP and business value will be used in Section 5 of this report to map and discuss the findings of this literature review and to identify gaps in our current knowledge.

3. Methodology

An exhaustive search of the peer-reviewed and grey literature was undertaken using 36 combinations (search strings) of the following search terms: “safety officer,” “safety manager,” “safety manag*,” “safety professional,” “safety practitioner,” “safety coordinator,” “safety specialist,” improve*, org*, comp*, effect*, value, “value proposition of the safety professional,” “value proposition,” “cost effectiveness,” “return on investment,” “impact of,” “safety performance,” performance, “safety climate,” “safety professionals strategies,” successful, safety, prog*, influence (see the Appendix for a full listing of search strings).

The following 12 databases were used to search the literature, using EBSCOhost as the major host database:

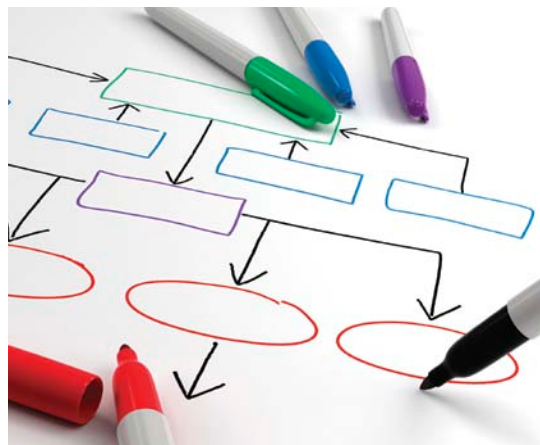
1. Academic Search Complete
2. Business Source Complete
3. Academic Search Premier
4. Applied Science and Technology Abstracts
5. Business Source Premier
6. E-Journals
7. Health Business Elite
8. Humanities International Complete
9. Inspec
10. PsycARTICLES
11. Psychology and Behavioral Sciences Collection
12. PsycINFO

These databases provide access to a broad range of journals in discipline areas related to OHS including organizational studies, management studies, psychology and sociology, as well as all safety science journals including *Safety Science*, *The Journal of Safety Research*, *Accident Analysis and Prevention* and *Professional Safety*. A search of dedicated OHS science databases including NIOSHTIC and HSELINE did not find articles beyond those found using EBSCOhost as the host database.

The search continued until saturation was reached, that is, new search strings did not find articles beyond those that had previously been found using earlier search strings. The search strings that returned the best results were:

1. “safety manager” AND value NOT “patient safety”
2. “safety professional” AND value NOT “patient safety”
3. “safety officer” OR “safety practitioner” AND value NOT “patient safety”
4. “safety manager” AND “impact of”
5. “safety professional” AND “impact of”
6. “safety officer” AND “impact of”

During the early phase of the search strategy numerous articles related to the broad area of patient safety were retrieved. Given that the focus of this research does not include patient safety, these articles were screened out of the search strategy using the modifier NOT “patient safety.”



The database search was complemented with a more general search of Google in an effort to identify articles published in the grey literature. The researchers also identified relevant papers based on their expert knowledge and experience and made these available for the review. A total of

58 articles were retrieved, read, classified for relevance and categorized according to themes. Articles that related to the OHSP but not to the value of the OHSP (for example, the growing number of papers on the role and tasks of the occupational health and safety professional) were excluded from the review. The remaining papers were classified according to a hierarchy of evidence as shown in Figure 2, which is designed specifically for this research and informed by other hierarchies of evidence, for example, those used by the Cochrane Collaboration and the Canadian Institute for Work and Health. Hierarchies of evidence are used to classify studies and to answer the question: “how strong is the evidence?” (Institute for Work and Health, p. 60). According to Davies and Crombie (2001), double-blind randomized controlled trials sit at the top of the hierarchy and provide the strongest evidence. Case-control studies sit in the middle of the hierarchy providing moderate evidence; while expert opinion sits at the bottom of the hierarchy and provides the weakest evidence. The studies retrieved for this literature review fell well short of the methodological rigor called for in a traditional hierarchy of evidence. Traditional hierarchies of evidence, however, are used to decide which intervention studies are included or excluded from a systematic review or meta-analysis. Given that the focus of this research is a literature review and not a systematic review in the pure sense and, that the studies retrieved were not intervention studies, it was deemed appropriate to develop a hierarchy of evidence that would reflect the range of studies retrieved for this review in order to capture as



much of the current evidence on the value of the OHSP as possible, regardless of the methodological quality of the studies. As a result, a four (4) tier hierarchy of evidence based upon the methodological quality of the studies retrieved for this literature review was devised:

1. Studies with strong evidence of direct value (n = 2).
2. Studies with moderate evidence of direct value but where the evidence is moderated by other variables (n = 16)
3. Studies with moderate evidence of inferred value but where the evidence is moderated by other variables (n = 6)
4. Studies with weak evidence of direct value and expert opinion (n = 34).

This hierarchy of evidence will be used to present the findings of the literature review in Section 4 of this report.

4. Evidence Supporting a Relationship Between the OHS Professional & Value

The findings from the literature are presented according to the strength of the evidence supporting a relationship between the OHSP and

value using the hierarchy of evidence as shown in Figure 2.

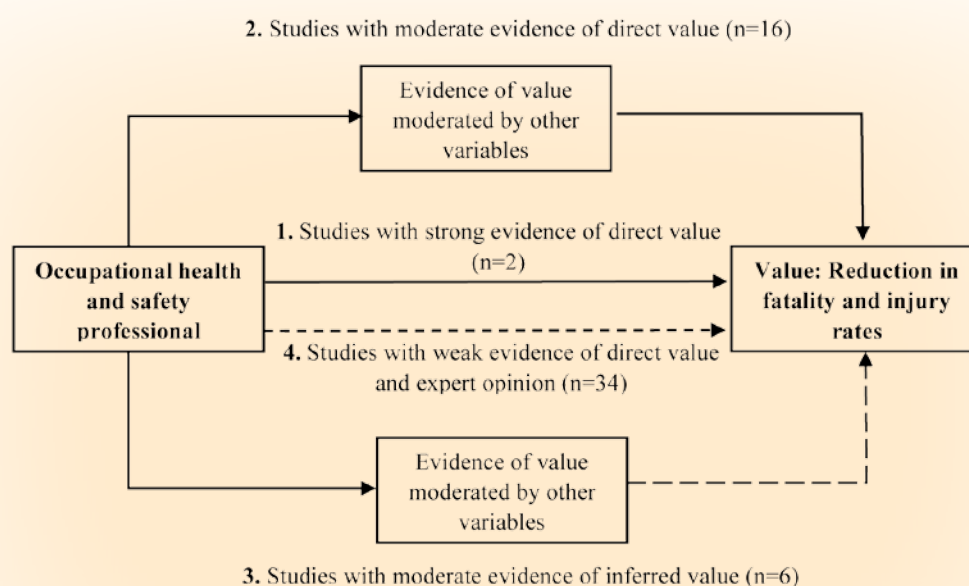


Figure 2: Hierarchy of evidence: Mapping the type of studies and the quality of the evidence

4.1 Studies With Strong Evidence of Direct Value

To date, only two studies (Cameron, Hare & Duff, 2007 & Rebbitt, 2012) have investigated if there is a direct relationship between OHSPs and value, where value is measured by lower injury rates (Cameron et al. 2007) and lower fatality rates (Rebbitt, 2012). Both studies were conducted in the construction industry.

Cameron, Hare and Duff (2007) conducted a study on behalf of the Institution of Occupational Safety and Health (IOSH) in the UK with the aim of investigating the relationship between an investment in competent OHSPs and OHS performance in UK construction companies. The objectives of the study were to:

1. Develop ways to measure the quality and quantity of OHS personnel.
2. Choose ways to measure OHS performance.
3. Find out if there is any relationship between these two factors.
4. If there is, then find out the costs and benefits of the relationship.
5. Look at how OHSPs and other key personnel operate in construction companies and how this affects OHS performance (p. 7).

Cameron et al. (2007) based their study on the assumption that the number of OHSPs employed in an organization (a measure of quantity) is the main factor associated with a lower accident frequency rate (AFR), with the experience and qualifications of the OHSP (a measure of quality) operating as a moderating factor. Therefore, they combined quantity measures (how many OHSPs) with quality measures (OHSP experience and qualifications) to develop a questionnaire sent to 101 construction companies employing 660

“Organizations that employed an in-house OHSP had an AFR 60% lower than those using only external consultants.”

OHSPs. OHS performance was measured using the reportable accident frequency rate and accident costs (Cameron et al., 2007).

This study found statistically significant lower AFRs were associated with:

- Companies who employed internal OHSPs compared with those companies that only used external consultants
- OHSPs who were members of an OHS professional body;
- OHSPs who provided training and vetted sub-contractors;
- OHSPs who have environmental responsibilities;
- OHSPs who had greater authority;
- Highly trained line managers.

Organizations that employed an in-house OHSP had an AFR 60% lower than those using only external consultants. Furthermore, construction companies that gave their OHSP management authority had an AFR that was 60% lower than those where the OHSP gave advice only. Cameron et al. (2007) define the “authority” of the OHSP as a “function of where they sit in the organisational framework, including whom they report to” (p. 16). Authority extends to the ability of the OHSP to give orders rather than advice only, and is derived from a line of report to senior manage-



ment. Cameron et al. (2007) do not clarify what is meant by authority to give orders, instead they found “that in all cases, the OHS practitioner(s) with full authority held a senior management position in the organisation” (p. 48). They suggest that holding such a position increases the influence of the OHSP and places them in a stronger position to voice concerns and have their recommendations implemented. This study also found a relationship between the functions (role and tasks) of the OHSP and OHS performance. For example, AFRs were 60% lower in construction companies where the OHSP vetted sub-contractors, compared to those construction companies where the OHSP did not vet subcontractors. In the UK, vetting subcontractors is a legal requirement. Cameron et al. acknowledge that this task could be performed by line managers and argue that it would be a mistake to conclude that this task is not carried out even if it is not performed by the OHSP. It is reasonable to assume, however, that competent OHSPs are better placed to perform this task than line managers. Based on their findings, Cameron et al. recommend that construction companies with at least a £4 million turnover should invest in an experienced and qualified OHSP. For companies with a turnover of £35 million or more, the investment in OHSPs should represent a minimum of 0.1 percent of turnover, or at least within the range of 0.1 to 0.2 percent of turnover, after which the return on investment starts to diminish. They caution, however, that continuing to increase the number of OHSPs indefinitely will not lead to lower accident rates, with the savings better spent on other strategies to improve OHS.

Cameron et al. (2007) also acknowledge the limitations of their study, including the absence of other performance measures, for example, minor accidents and ill-health. Also, that the study did

not account for other variables that may affect performance, including OHS culture.

A study by Rebbitt (2012) investigated the value proposition for the OHSP by comparing the number of OHSPs with fatality rates in the US, UK and Canadian construction industry. Unlike the IOSH study, Rebbitt confined the measure of OHS performance to fatality rates due to the lack of reliability inherent in measures of injury frequency rates. This study was designed to answer the questions:

1. Do safety professionals prevent fatalities?
2. Are safety professionals more effective than other safety personnel in preventing fatalities?
3. Are safety professionals less or more effective in preventing fatalities in high risk industries like construction? (p. 42)

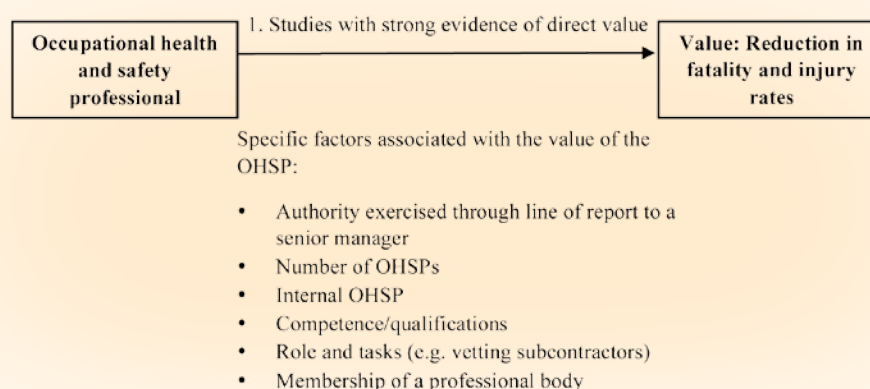
Rebbitt (2012) also studied the relationship between OHS professionals and OHS practitioners and their respective impact on fatality rates, arguing that in the construction industry in particular, “the effectiveness of professionals versus practitioners is hotly debated” (p. v). He goes on to argue that there has been an increase in the number of OHS practitioners within the construction industry because industry experience is more highly valued than the formal education and training required to become a certified OHS professional. Using linear regression analysis Rebbitt found “a strong correlation between the density of safety professionals and the fatality rate” (p. 61), meaning the more safety professionals employed, the lower the fatality rate. Rebbitt concludes that employing safety professionals saves lives, which demonstrates the value proposition for the OHSP. Conversely, and in relation to the OHS professional versus OHS practitioner debate, Rebbitt found no correlation between the number of safety

practitioners and reductions in fatality rates. Reb-bitt concludes that these findings “demonstrate emphatically that safety professionals do have a solid value proposition and that they have been, and are, effective in preventing fatalities” (p. 61).

Taken together, these studies provide strong evidence of a positive direct relationship between the number of OHSPs and lower injury and fatal-

ity rates. More specifically, these studies provide strong evidence for a relationship between the authority of the OHSP exercised through a line of support to a senior manager, higher levels of competence and qualifications of OHSPs, membership of a professional body and the role and tasks performed by OHSPs and lower injury and fatality rates. These findings are summarized in Figure 3.

Figure 3: Strong evidence for the factors related to the direct value of the OHSP



4.2 Studies With Moderate Evidence of Direct Value in Which Evidence of Value is Moderated by Other Variables

Two types of studies fall within this category. First, studies with high methodological quality using matched pairs of companies with higher and lower accident rates (Cohen, 1977). Second, studies of weaker methodological quality in that they do not use the matched pairs study design. Instead, this second group of studies typically take a sample of all companies in a specific industry sector (most often the construction industry) and investigates a range of factors associated with lower accident rates (see for example Jaselskis, Anderson and Russell, 1996). This latter point makes it more

difficult to understand the relationship between the OHSP and direct value because the OHSP is only one factor of interest among a number of safety management factors that potentially affect accident rates. The exception is an intervention study conducted across industry sectors in the Netherlands (Hale, Guldenmund, van Loenhout, & Oh, 2010). Leaving aside the issues associated with varying methodological quality, this group of studies provides moderate evidence of direct value in which evidence of value is moderated by other variables.

4.2.1 Studies of matched pairs of companies with higher and lower accident rates

The seminal work in this area was undertaken by the National Institute for Occupational Safety and Health (NIOSH) in the United States, comprising a series of three studies that commenced in 1974 (Cohen, 1977). The aim of this three-phase study was to determine the factors in successful safety programs. These studies drew on six prior research studies dating back to 1964. In a summary of these earlier studies, Cohen (1977) identified nine general factors associated with safety performance. One of the nine general factors, “management commitment,” included the sub-category “safety officer holds high staff rank.” Of the six earlier studies, four identified safety staff as one factor associated with good safety performance. For example, a study by Davis & Stahl (as cited in Cohen, 1977) studied safety program practices in 12 coal mines that had won awards for reducing work-related injuries. This study found daily interactions between “safety officials,” supervisors and workers as being most important in their efforts to reduce injuries. Furthermore, this study found that the safety officer reporting directly to the mine manager was a significant factor. Of these six earlier studies, the Shafai-Sahrai study (as cited in Cohen, 1977) was used as the basis for the NIOSH study with the aim of verifying and expanding upon Shafai-Sahrai’s results.

Following Shafai-Sahrai’s approach of using matched pairs of companies with high and low accident rates, the first phase of the NIOSH study used a questionnaire sent to 42 matched pairs of companies representing six sectors of industry in the US. According to Cohen (1977) the matched pair study design overcomes the limitations of study designs based on opinion polls and analysis of companies with exemplary safety performance. The matched pairs design “involves comparisons of safety program practices and related factors in pairs of companies where the members of each

pair differ greatly in accident experience but are matched on other variables such as type of industry, company size, and geographic area” (p. 81). Therefore, using the matched pairs study design, the study for NIOSH identified eight factors associated with low accident rates, with safety training for workers, including lectures by the safety specialist, identified as one of the eight factors (Cleveland, Cohen, Smith & Cohen, 1979).



“This study found that the safety officer reporting directly to the mine manager was a significant factor.”

The second phase of the NIOSH study, a site visit to seven of the 42 matched pairs of companies, aimed to verify the results of the first questionnaire study (Cleveland, Cohen, Smith & Cohen, 1979). In this second phase of the study, and unlike the

first, the role of the safety specialist is not mentioned among the eight factors they found to be associated with low accident rate companies.

The third phase of the study aimed to verify and extend the findings from the two previous studies. For this study, instead of using matched pairs of high and low accident rate plants, five plants with the lowest lost time injury rates in the United States were sent the questionnaire and were followed up with a plant visit (Cleveland, Cohen, Smith & Cohen, 1979). This study found that in four of the five plants, the safety director had daily contact with the plant manager. Furthermore, safety personnel approved proposed changes to the design of the workplace, along with changes to production procedures.

In summarizing the NIOSH study, Cohen (1977) states that one of the eight factors associated with low accident rate companies was management commitment reflected in the “rank and stature of the company safety officer” (p. 174). This finding appears to emerge from the third phase of the NIOSH study. Given that this phase abandoned the matched pairs of high and low accident rate plants research design and looked only at companies with low accident rates, the evidence is weaker. For example, it remains unknown if safety officers in high-accident-rate plants enjoyed the same rank and status as their counterparts in low-accident-rate plants.

The NIOSH studies provide mixed evidence for a direct relationship between the OHSP and value. For example, the first phase of the study identified that OHS training for workers provided by the OHSP was one of eight factors associated with



lower accident rates. Given the high methodological quality of the first phase of this study, there is moderate evidence for a relationship between one of the role and tasks performed by an OHSP and lower accident rates. Less convincing, due to the weaker methodological quality of the third phase of the study, is the claim that the rank and stature of the OHSP is associated with lower accident rates. Presumably, the higher up the organization the OHSP reports, the more ability they have to influence the decision making of senior managers, which ostensibly translates into lower accident rates. This finding might make intuitive sense but it is a difficult argument to sustain based on the evidence available in this study.

4.2.2 Studies of a sample of companies within an industry sector or across industry sectors and accident rates

More than any other industry sector, the construction industry, particularly in the United States, has

shown an interest in identifying the OHS strategies and factors associated with excellent OHS

performance. According to a literature review conducted by Jaselskis, Anderson and Russell (1996), studies of the key factors associated with excellent safety performance in the construction industry date back to 1976. Of the 11 studies included in their literature review, three identified that improvements in safety performance could in part be attributed to the employment of a full-time safety director, safety officer or safety professional. Of the three studies, one emphasized that it was important for the OHSP to report to the president or vice-president of the company (Hinze and Harrison as cited in Jaselskis et al., 1996). This early finding from the construction industry is consistent with the findings of the NIOSH study, which found also that the rank and status of the OHSP was a key factor in that study.

Jaselskis et al. (1996) argue that these earlier studies were limited by being qualitative in nature and designed a quantitative study in a bid to overcome this limitation. They designed a questionnaire, including questions relating to the role of the safety coordinator, which was subsequently sent to 48 construction companies in the US. The results of the questionnaire were then compared with Occupational Safety and Health Administration (OSHA) incident rates and the experience modification rating (EMR) for the companies involved, the latter a measure based on worker's compensation claims experience. This study found a statistically significant lower EMR was associated with greater involvement by the safety coordinator. Greater involvement includes the OHSP conducting more safety inspections per month (7.6 per month) in companies with a lower EMR (<0.75) compared with fewer inspections (3.3 per month) in companies with higher EMR (equal to or >0.75). This study also found that companies with more detailed safety programs (146 pages for companies with an EMR <0.75) compared to companies with less detailed safety programs (64 pages for companies with an EMR equal to or >0.75). These differences were statistically significant. It

is unclear as to why OHSPs in companies with a higher EMR conducted fewer inspections and had less detailed safety programs. This finding, therefore, is open to interpretation, with either the qualifications of the OHSP or other organizational factors including cost or possibly management commitment to safety being factors.

A similar questionnaire based study by Findley (2004) of 305 construction companies in the US also found that companies with a lower EMR employed a full time safety manager. As a result, these companies were more likely to implement the elements associated with an effective OHS management program. On the basis of this finding, Findley recommends that companies wishing to improve safety and their "bottom line" should employ a full time safety manager who reports to a senior manager.

Hinze & Wilson (2000) also used the EMR, together with recordable injury rates, to survey the safety practices of 40 well-performing companies in the US to determine the improvements these companies had made as a result of the "zero accidents" and "zero injuries" initiative. They identified five high impact techniques for improving performance: i) pre-task planning, ii) worker training, iii) safety incentives, iv) drug testing and; v) accident investigation. One way to interpret these findings is that if these are considered to be the good OHS practices that lead to lower injury rates, then it is likely that it is the OHSP who initiates and implements these practices. For example, although pre-task planning could be performed by someone other than the OHSP, it is likely that the OHSP makes a significant contribution to this activity by ensuring that OHS matters are considered at an early stage.

Further, and if this interpretation is correct, it is likely to be the OHSP who has the knowledge and skills to introduce appropriate safety incentives, drug testing programs and processes for investi-

gating accidents. Without the OHSP performing these tasks it could be argued that lower injury rates would not have been achieved. The companies included in this study made additional changes, including trimming the other responsibilities of the safety director so that they could spend more time on safety and hired safety professionals to assist with safety at the corporate level. Hinze & Wilson, however, do not specify what aspects of the safety director's responsibilities had been trimmed, or what role they fulfilled at the corporate level.

Abudayyeh, Fredericks, Butt and Shaar (2006) studied the correlation between management commitment to safety and the frequency of injuries and illnesses. They surveyed a random sample of the top five hundred construction companies in the US to determine if there was a statistical correlation between management commitment and OHS performance. They found that companies that employed a safety manager on site, an indicator of management commitment, had a statistically significant lower injury and incident rates than those that did not employ a safety manager on site. In addition, they found that companies that authorize the safety manager to spend over \$1,000 on safety improvements had fewer injuries and illnesses.

In contrast, another US study by Hallowell (2010), designed to evaluate the cost-effectiveness of safety management strategies in high performing construction companies, found that employing a safety manager is less cost-effective than investments in management commitment to safety and sub-contractor selection. This finding departs from the previous studies in that management commitment is separated from employing a safety manager. The question that remains unanswered is if it is not the safety manager who vets sub-contractors, then who is it that performs this task? Arguably the safety manager would have a vital role to play in sub-contractor selection. In a

“Companies that authorize the OHS manager to spend over \$1,000 on OHS improvements had fewer injuries and illnesses.”

subsequent study, however, Hallowell & Calhoun (2011) found that the employment of a site safety manager, together with use of worker engagement, existence of site-specific safety plans and management commitment, to be the most effective element of a safety program.

In a further study, Esmaeili & Hallowell (2012) explored the diffusion of injury prevention strategies in the construction industry, finding that employing a site OHS manager was one of three innovations less frequently implemented. They conclude that the industry has reached saturation point with respect to OHS innovations, which presumably includes employing a site OHS manager, and call for new innovations to be introduced. They found that the three most frequently adopted OHS innovations were project-specific training and OHS meetings, frequent worksite inspections, and OHS orientation training. The three least frequently adopted OHS innovations were the employment of a site OHS manager, contractor selection and management, and substance abuse programs. They conclude that “the construction industry has now reached saturation with respect to traditional injury prevention strategies and new safety innovations are needed” (p. 955). These findings and conclusions could be interpreted in two ways. First, that the appointment of OHSPs made long ago is of value now and is reflected in the three most frequently adopted OHS innovations. Second, that OHSPs have not shown their value in the past and there was no need to appoint one now. Esmaeili & Hallowell (2012) do not discuss how the results should be interpreted in



relation to the value of site safety managers, except to say that one of the practical implications of their findings is that OHS managers can use the call for new safety innovations “to justify additional OHS expenditures” (p. 961). This implication tends to support the first interpretation that the presence of a safety manager remains important as a traditional injury prevention strategy (and is no longer considered an innovation), with their future value dependent upon their ability to successfully argue the business case for further expenditure on safety innovations.

In a study of a single university construction site in the US, McDonald, Lipscomb, Bondy and Glazner (2009) were able to identify a range of factors associated with an injury rate for the construction project which was half that for the rest of the construction industry. One factor, among a number of factors, was the employment and visibility of a full-time OHSP. The OHSP was involved in accident investigation and conducting site walks to check practices, equipment and compliance with safety regulations.

Pre-dating the IOSH study discussed in Section 4.1 by almost 20 years was a Canadian study conducted by Hinze & Raboud (1988) that examined the relationship between company policies and practices designed to influence OHS in the workplace and OHS performance measured in terms of injury frequency rates. This study found that injury rates were lower in companies that employed a full-time OHS officer.

Studies exploring the relationship between the OHSP and OHS performance have not been confined to the construction industry. A study of the management practices that contribute to a safe work environment in 62 hospitals in the US healthcare industry found that the OHSP had no impact on injury rates (Vredenburg, 2002). This study also found that “what differentiated the hospitals with low injury rates was that they also

employed proactive measures to prevent accidents” (p. 259). Based on this finding, and despite finding that the OHSP had no impact on injury rates, Vredenburg proposes that one implication of this study is that the OHSP should hold a “management-level classification” (p. 259). Although the reasoning behind this proposition is not clarified in the study, it is presumably because the OHSP is the best person to implement proactive measures to prevent accidents

“One factor among a number of factors, was the employment and visibility of a full-time OHSP.”

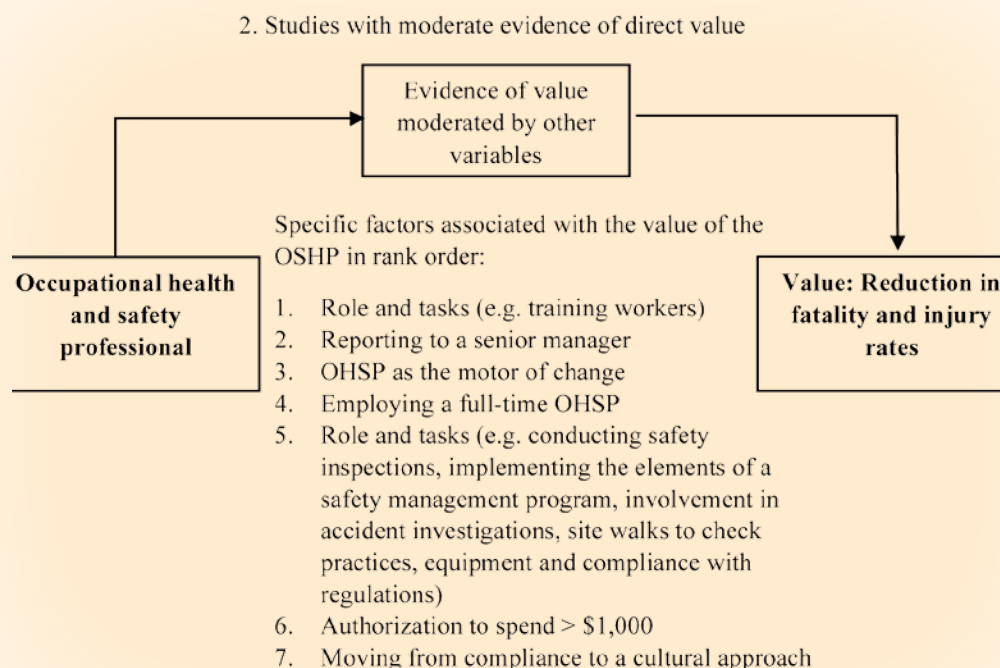
An intervention evaluation study conducted in the Netherlands investigated 17 projects across 29 companies, this time drawn from different sectors of industry (Hale, Guldenmund, van Loenhout, & Oh, 2010, see also Guldenmund & Hale, 2012, Guldenmund, Hale, van Loenhout, & Oh, 2008, Hale, Jacobs & Oor, 2010). This study found that the OHSP was central to the successful implementation of a range of OHS initiatives. Hale et al. (2010) found that a distinguishing factor in successful interventions was “the amount of energy and creativity injected by top managers and, above all, by the coordinator (OHS professional)” (p. 1026). They found that the OHSP or the top manager were the “active motor to make the change” (p. 1033). When interventions were not being driven by these motors, particularly the OHSP, companies were five times more likely to be unsuccessful in implementing OHS initiatives.

The methodological quality of the studies in this category range along a continuum from weak to strong based on the quality of the study design. Studies investigating only a sample of compa-

nies, and in some instances one company with lower accident rates within one industry sector (Abudayyeh, Fredericks, Butt and Shaar, 2006; Findley, 2004; Hinze & Wilson, 2000; Jaselskis, Anderson & Russell, 1996; McDonald, Lipscomb, Bondy and Glazner, 2009), fall notionally toward the weaker end of the continuum. The matched pairs of companies with lower and higher accident rates (Cohen, 1977) and the only intervention evaluation studies conducted across a range of

industry sectors based on a before and after design (Hale, Guldenmund, van Loenhout, & Oh, 2010) fall toward the stronger end of the continuum. It is prudent, therefore, to present the evidence of the factors related (although moderated by other variables) to the direct value of the OHSP in rank order according to the methodological quality of the study design. These findings are summarized in Figure 4.

Figure 4: Moderate evidence for the factors related to the direct value of the OHSP



4.3 Studies with moderate evidence of inferred value in which evidence of value is moderated by other variables

The studies included in this category are unique in that although there is evidence that companies that employed an OHSP had better safety cli-

mate scores, there is only an inferred relationship between safety climate scores and value in terms of lower accident rates.

4.3.1 The impact of the OHSP on safety climate

Zohar (1980) conducted what is generally accepted as the first study of an organizational climate for safety. According to Zohar, worker perceptions of the importance the organization places on OHS is reflected in workers' safe behavior. Drawing on earlier studies, including the study conducted for NIOSH by Cleveland, Cohen, Smith, and Cohen (1978), Zohar developed a 40 item questionnaire comprising seven dimensions, one of which was the perceived organizational status of the safety officer. The questionnaire was sent to 20 organizations in Israel. Zohar found that safety climate was correlated with the effectiveness of the safety program in the organizations that he studied. Of the two climate dimensions that influence safety climate, one was managers' perceived attitude towards safety "exhibited in workers' eyes by the organizational status of both the safety officer and safety committee" (p. 101). Zohar goes on to conclude that the "status of the safety officer can be assessed by executive authority relegated to him [sic] (e.g., authority to remove workers from production hall or to stop production processes when safety regulations are not followed)" (p. 101). This characterization of the status of the safety officer is one that places an emphasis on their role as an enforcer of regulation.



"This study found that the role of the OHS manager shifted from one of providing advice to being more 'hands-on.'"

Wu, Liu, and Lu (2007) conducted a questionnaire-based OHS climate study across 100 university and college laboratories in Taiwan. Building on the results of their previous safety climate studies conducted in the manufacturing industry that found that the presence of a safety manager significantly improved OHS climate, their study of university laboratories explored five organizational

factors that affect OHS climate, including the presence of a OHS manager. They found that universities that employed a safety manager had better safety climate scores, and that this finding was statistically significant. They conclude that "for the purpose of preventing accidents and controlling loss resulting from the accidents, a safety manager is one of the safety structures set up by the school"

(p. 98). In a later study, Wu, Lin and Shiau (2010) conducted a questionnaire-based study of the predictive factors of safety culture in 22 departments of five telecoms firms in Taiwan. In part, this study focused on the leadership and role behaviors of the OHSP, including OHS counselling, OHS coordination and OHS regulation. They found that those who employed an OHS manager had a better OHS climate.

In an earlier study of role behavior Cameron and Duff (2007) recognized the importance of management commitment for improving the safe behaviors of workers, but focused specifically on the safety performance of construction managers. They developed seven measures of management safety performance, including the actions of the safety managers. This intervention study, using a before and after design on one large construction project in Scotland, used a behavioral audit tool to measure changes in safety behavior. They found that OHS manager actions improved during the six month intervention period. During the period of the intervention, OHS managers became more involved in employee consultation and training and risk assessment. This study also found that the role of the OHS manager shifted from one of providing advice to being more “hands-on,” becoming “more involved in employee consultation, employee training and risk assessment” (p. 879). Management viewed this shift in role as more motivating, although the study does not clarify if it was motivating for managers, workers or both. This study is unique in that it uses goal setting to change the behavior of managers, including safety managers, but falls short of demonstrating a correlation between management safety behavior and lower accident rates. According to Cameron & Duff, the study lends support to the view that behavioral interventions result in a positive safety climate (Cameron & Duff, 2007).

Cameron and Duff’s (2007) finding that the OHS manager was more motivating when they changed their behavior to a more “hands on” approach runs counter to the argument that OHSPs are better placed to add value when they are given more authority and have a line of report to senior management (Cameron et al., 2007). This apparent contradiction raises the question: what style of OHSP practice (e.g. hands-on, providing advice only, strategic advisor with authority, motor for change) produces more value?

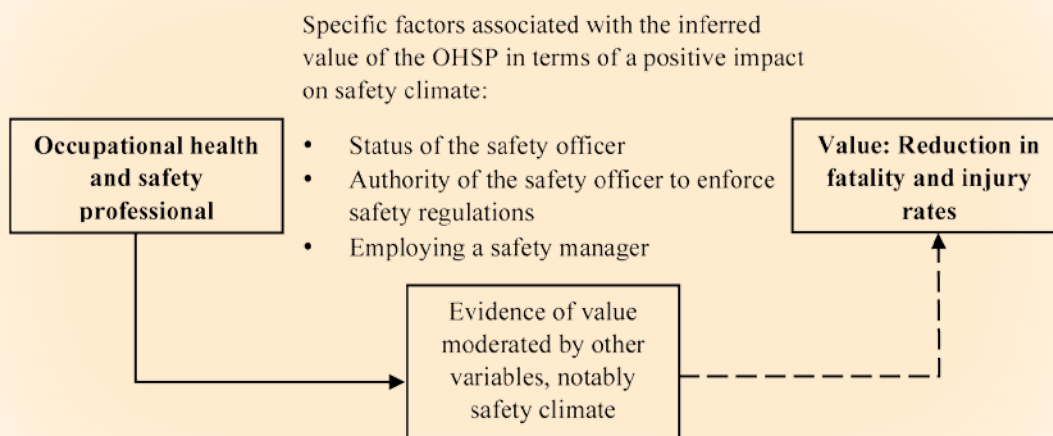
A UK study of safety culture conducted by Smith and Wadsworth (2009a) on behalf of IOSH explored the relationship between safety culture, competent safety and health advice and safety performance. This study measured safety culture via a safety climate survey sent to 40 organizations representing different industry sectors. The study found a significant relationship between “favourable” OHS cultures and better OHS performance. Smith and Wadsworth (2009b) also found a significant, yet independent, relationship between OHSP advice and OHS performance, although the “relationship between advice and performance is more complicated and there’s no clear pattern” (p. 8). They found that “less positive corporate safety performance was associated with more competent safety and health advice” (Smith & Wadsworth, 2009a, p. 64), which is on the face of it a negative finding about the value of well-trained OHSPs, in contrast with findings reported earlier. However, in considering this finding, the researchers suggest that high risk industries are more likely to employ more highly qualified OHSPs, however the researchers were unable to test this assumption because the study did not include sufficient numbers of high and low risk industries, nor did it include sufficient numbers of OHSPs with different qualification levels. They go on to suggest that more research is required comparing different sectors of industry, with different risk levels with the

qualification levels of OHSPs. The findings of this study are difficult to interpret with no clear pattern emerging for the value or otherwise of the OHSP. As a result, the findings of this study and how to interpret them remain unclear.

The OHS climate and OHS culture studies suggest that companies employing an OHSP have better OHS climate scores. These studies fall short, however, of making a direct link between the OHSP, OHS climate and lower accident rates. When, however, the lens is widened to consider the broader literature on OHS climate, evidence

emerges that OHS climate is a significant predictor of injuries rates. For example, Zohar and Polachek (2013) state, in relation to OHS climate, that “recent meta-analytic studies indicated that its effect size on safety performance and objective injury data equals or surpasses all other known safety risk indicators, including unguarded physical hazards at the workplace” (p. 1). Therefore it is possible to infer a relationship between the OHSP and value, albeit through OHS climate where climate is a predictor of safe behavior, and by extension, lower accident rates. These findings are summarized in Figure 5.

Figure 5: Moderate evidence for the factors related to the inferred value of the OHSP



3. Studies with moderate evidence of inferred value

4.4 Studies with weak evidence of direct value and expert opinion

There have been a number of studies that have returned surprising and often difficult to interpret findings on the relationship between the OHSP and value. Indeed some of these studies, at first glance, have found a negative relationship between the OHSP and value (section 4.4.1.). Another group of studies included in this section have considered the status of the OHSP (who they report to – 4.4.2.), their competence and qualifications

(what they know – 4.4.3.), their role and tasks (what they do – 4.4.4.) and the industry sector (where they work – 4.4.5.). The evidence emerging from this grouping of studies is weak due to the quality of the study design or is suggestive only based on expert opinion. However, it does contribute to the understanding of what qualities and competences are expected or required of good OHSPs.

4.4.1 Studies with ambiguous evidence of direct value

Shannon, Mayr and Haines (1997) undertook a systematic review of the literature published between 1970 and 1994 to examine the relationship between injury rates and organizational and workplace factors. Of the 61 studies retrieved, only 10 met their inclusion criteria (including the NIOSH study discussed in Section 4.2.1). Of the 10 studies they reviewed, one found an association between the OHSP being represented on joint OHS committees and reduced injury rates. When considering all 10 studies, however, and after applying their consistency criteria, Shannon et al. conclude that the amount of training received by committee members was the only factor consistently associated with lower injury rates. Therefore there is no evidence of a relationship between the OHSP and lower injury rates even though they were represented on such committees. While this particular study cited by Shannon et al. does not provide direct evidence for a relationship between an OHSP being represented on an OHS committee and lower injury rates, it does not necessarily mean that this finding is not evidence that the OHSP does not add value elsewhere. Participating in safety committee meetings is but one role an OHSP fulfills. They may add value through other roles and tasks they perform which fall outside the remit of this particular study.

Mearns, Whitaker and Flin (2003), in a bench-

“Participating in safety committee meetings is but one role an OHSP fulfills. They may add value through other roles and tasks they perform which fall outside the remit of this particular study.”

marking study conducted in the off-shore oil and gas industry on behalf of the UK Health and Safety Executive (HSE), interpret the results of the Shannon et al. study differently. They suggest that representation of OHSPs on joint OHS committees was “consistently associated with lower injury rates” (p. 7). In their research, undertaken to inform the HSE benchmarking study, Mearns et al. developed a Safety Management Questionnaire (SMQ) as an audit tool comprising six elements. Element one, safety and health policy, sought to explore the “number and status of dedicated safety and health staff” (p. 648). In year one of the study,



they found that the presence of an off-shore OHSP was significantly correlated with “unfavorable” (p. 665) performance. A similar result was found in year two of the study. Mearns et al. comment that unfavorable scores predicted an increased propensity to report accidents. Rather, the opposite could be argued – that the presence of the OHSP had a positive impact on accident (dangerous situation and near miss) reporting rates, which is a good thing for learning and improvement (Hale et al., 2010).

A further study by Mearns, Whitaker and Flin (2001), also conducted as part of the HSE benchmarking study, draws on a 1997 internal company report for British Petroleum, Conoco and the

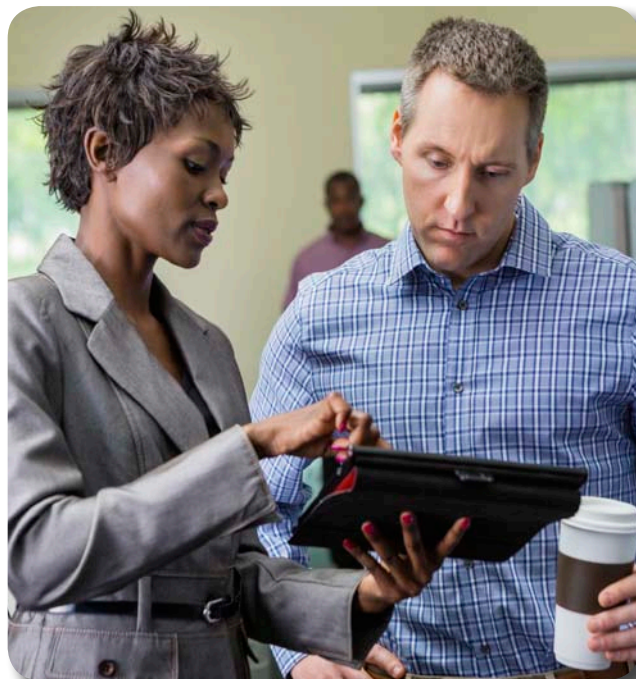
Royal/Dutch Shell Group conducted by Sykes, Paxman and Thoem (as cited in Mearns, Flin & Whitaker, 2001). This study identified that one aspect of best practice was that the corporate OHS advisor made policy recommendations and chaired a committee “comprising senior business managers” (p. 773). This finding suggests an indirect relationship between the OHSP and value as a result of their role (high status) and their function (chairing a high level committee). This study is limited, however, because the extent to which best practices equate with lower accident rates remains unclear. The issue of who the OHSP reports to is, however, a recurring theme with potential to affect the value proposition of the OHSP.

4.4.2 The status of the OHSP and speculated value (who they report to)

The status of the OHSP has emerged repeatedly (see for example Zohar, 1980) as a factor that may be associated with the ability of the OHSP to add value. For example, Hopkins (2007) argues that “the best companies have safety staff at several different points of the hierarchy, with safety officers reporting directly to the most senior manager at that level, not via a human resources manager or some other intermediary ... there are also reporting links between the safety staff at various levels” (p. 217). A recent salary and attitude survey conducted by IOSH (2012) of 3,939 OHSPs, titled “The Value of Health and Safety,” found that 55% of OHSPs do report directly to the board. Disturbingly, however, the IOSH survey found also that respondents were unable to articulate the value of their proposed OHS interventions, a finding that has the potential to undermine their perceived value by managers. This is an issue of competence and role and tasks and will be explored further in subsequent sections.

Although Hopkins argues for a high status for the OHSP and a line of reporting to managers at different points in the organizational hierarchy, Min-

nick (2013) proposes a different view of the line of report for the OHSP. Drawing on a survey of ASSE members in the United States, Minnick argues



there are two viewpoints on reporting structures for OHSPs. First, through a “line of power,” for example to a Chief Executive Officer; and second, through a “functional unit,” for example an environmental, health and safety department. Minnick surveyed 442 ASSE members to understand the antecedents of role conflict and role ambiguity. Minnick found that role stress was less when the OHSP reported to a functional unit. Minnick also found that OHSPs were experiencing role overload “due to the expansion of the safety role into other roles, such as environmental safety and security, while expecting the same level of safety performance” (p. 152). This latter finding suggests that expanding the OHSP role, without an equivalent increase in the numbers of OHSPs, may inadvertently undermine the ability of the OHSP to add

value. This raises an interesting paradox. Expanding the role of the OHSP to include, for example, environmental management, is generally viewed as a necessary step towards demonstrating the value of the OHSP to business. Doing so, however, may have the reverse effect given Minnick’s findings. Minnick’s former finding, that role stress was less when OHSPs reported to a functional unit, could, in part, be explained by the inability of the OHSP to articulate the business case for OHS when reporting directly to the Board or senior management. It also has to be recognized that stress, up to a point, may be good as it can reflect being in a position of influence close to the reins of power, rather than having a comfortable, but less influential position in a separate safety, health and environment unit.

4.4.3 OHSP competencies and speculated value (what they know)

Notwithstanding who OHSPs report to, a survey study (Peter Wager & Associates, 2010) of Australian Chief Executive Officers (CEOs) found that CEOs perceived that OHSPs lacked the ability to understand business strategy, were unable to constructively influence business objectives and were “too negative or bureaucratic in managing the balance between business and OHS imperatives” (p. 110). Without these skills, it is not difficult to imagine that OHSPs would feel stressed, and feel safer reporting to a functional unit as Minnick (2013) found. Role stress may be compounded by the OHSPs’ inability to measure safety in a manner that is meaningful to senior managers, the end result being that OHSPs could find themselves caught in a vicious rather than virtuous cycle. The inability of the OHSP to engage senior managers is also highlighted in a US report that explored the return on investment of the environmental health and safety function (BLR, 2006). This study found that the function is under-valued by senior executives due to “communication barriers between EHS professionals and executive management, and a lack of standard metrics for evaluating all aspects

“Role stress may be compounded by the OHSPs’ inability to measure safety in a manner that is meaningful to senior managers, the end result being that OHSPs could find themselves caught in a vicious rather than virtuous cycle.”

of EHS performance.” The report goes on to suggest that OHSPs must “measure the performance of their programs using the tools of business managers and the format and language of the organization’s financial analysts” (p. 28).



In a bid to close the gap between OHSPs (and what they know) and managers (what they expect OHSPs to know), Leemann (2005) proposed a framework that would allow OHSPs to demonstrate their value-added contribution to an organization. Leemann developed a matrix showing the relationship between OHSPs roles, functions and competencies; linked to the core competencies and products of an organization. Leemann breaks the OHSPs role into five categories: i) ensure compliance; ii) no incidents; iii) communications; iv) influence; and v) cost-effective. Each role is broken down into functions. For example, the role of “ensure compliance” is broken down into the functions of audit, training and compliance requirements. Roles and functions are cross-referenced to their underpinning competencies, ranging from “impact and influence” to “perseverance.” For example, the function of “audit” associated with the role of “ensure compliance” has two competencies: i) impact and influence and ii) order, accuracy and clarity; and a further two threshold competencies: i) technical expertise and ii) translation capability. Leemann goes on to offer three competency clusters for the OHSP: i) cognitive

competence, ii) interpersonal competence and iii) intrapersonal competence. For example, the cluster “interpersonal competence” contains competencies including “negotiating skills” and threshold competencies including “relationship building.” An interesting inclusion in this framework is the interpersonal skills of the OHSP, which is an area that is overlooked in the safety science literature. Pryor (2014), however, conducted a grounded theory study exploring the strategic influence of the OHSP. She interviewed seven (7) dyads of senior OHSPs and their managers across a range of industry sectors in Australia. She found that trust was central to the OHSPs being able to influence the strategic decision making of their senior manager. Although Leemann’s framework and Pryor’s findings fall short of demonstrating the value of the OHSP in direct terms, a picture starts to emerge that an OHSP who enjoys high status (power) would benefit from complementing their role and functions with a set of personal attributes (influence). Together these may positively impact how managers perceive the value of the OHSP and may result in senior managers being increasingly inclined to make decisions in favor of OHS that deliver real value in terms of lower rates of FIDI.

4.4.4 OHSP role and tasks and speculated value (what they do)

The OHS community is not immune to criticisms that a gap exists between OHSPs and their ability to engage senior managers. It has taken it upon itself to promote the need for OHSPs to be able to argue the business case for OHS (see for example Byrne, 2013; Hill, 2006; Veltri, 1992; Veltri et al., 2007; Veltri et al., 2013 & Williamson et al. nd) through the use of cost-benefit analysis (see for example Behm, Veltri & Kleinsorge, 2004 & Deshkar, 2010).

Indeed, the need to evaluate the business value of the safety function was recognized over 20 years ago by Veltri (1992), who proposed a conceptual

model for evaluating the safety function. Veltri argued that OHSPs must demonstrate the strategic value of what they do. Instead of focusing solely on regulatory compliance, Veltri argues that OHSPs must also contribute to productivity and business performance.

“OHSPs must demonstrate the strategic value of what they do.”





In an early effort to describe the safety functions of OHSP, DeJoy (1993) surveyed 1,190 safety professionals in the United States spanning 10 industry sectors. DeJoy identified five primary functions: 1) serving as safety consultant/advisor; 2) coordinating compliance/control activities; 3) assessing the effectiveness of controls; 4) analyzing hazards and losses, and 5) conducting specialized studies and reviews. He went on to identify that OHSPs require good communications skills to carry out their functions.

Blair (2004) also found “soft skills” such as business and communication skills to be essential skills, particularly for the OHSP. Blair studied 400 Certified Safety Professionals and 100 safety educators’ perceptions of the most important competencies for OHSPs in the United States. He found no difference between the perceptions of the two groups, with “communicating effectively” rated as the most important competence, followed by “accepting responsibility” and “translating solutions into practical terms.” Blair concludes that safety educators should teach business and communica-

tion skills as part of their safety programs.

In a similar study conducted in Taiwan, Chang, Chen and Wu (2012) set out to develop a competency model for OHSPs. Unlike Blair (2004), they found different perceptions of what constitute important OHSP competencies among OHSPs and OHS educators; although both groups did agree that applying business management principles was important, it was the least valued competency by both groups.

The role and tasks of the OHSP have attracted significant attention for some time (see for example Borys, Else, Pryor & Sawyer, 2006; Brun & Loiselle, 2002; Hale, 2004) with the role variously described as one of a “politically reflective navigator” (Broberg & Hermund, 2004; Olsen, 2012), “change agent” (see for example Brown & Larson, 1998; Brun & Loiselle, 2002; Hasle & Jensen, 2006; Hill, 2006; Limborg, 1995 & Swuste & Arnoldy, 2003) or “compliance agent” (Hopkins, 2007). The notion that the OHSP should act as a “change agent” is often cited in the literature based on expert opinion. There is no evidence that acting as

a change agent does or does not add value. Acting as a change agent is only suggestive of value.

In a UK study, Conchie & Burns (2009) studied how employee trust in an information source shaped workers' safe behavior. They collected data from 131 workers on a single construction site and found that the OHS manager, together with the Health and Safety Executive, were the most trusted sources of information influencing worker behavior.

A Norwegian study conducted by Nytrö, Saksvik, and Torvatn, (1998) explored the implementation of internal control regulations in an effort to determine the organizational factors that predict the successful implementation of systematic management of health, safety and environment programs. They found that the availability of a suitably qualified OHSP working within the organizations they studied was the strongest predictor of success in managing a systematic approach to health, safety and environment. They caution, however, that improvements in activity, that is, increased implementation of the internal control regulations, does not guarantee effectiveness as measured by reductions in the rate of fatalities, injuries and disease. Nevertheless, this finding does suggest that it is the OHSP, rather than any other job function, who will have the knowledge and skills to implement systematic approaches to managing OHS, therefore ensuring organizations are capable of implementing the requirements of internal control regulations. A similar study conducted by Chaves et al. (2009) interviewed "key contacts" in 78 companies in Bahia to evaluate the implementation of occupational health and safety programs. They found that company-related, employee-related and occupational health and safety specialist-related factors were associated with the successful implementation of these programs.

A recent study by Veltri et al. (2013), argues that the key is to ensure that safety is fully integrated into business operations. According to Veltri et al. (2013) this shifts the responsibility for OHS and operations to operations managers:

This process then reduces hazards without formal practices being led by a safety function. Because the organization is managing safety as part of the operational management system, operational practices that are used to manage operations (quality, cost, delivery and inventory) are simultaneously or in the terminology of this research jointly used to manage safety. Safety has therefore achieved full integration with operations, rather than being relegated to "sidecar" status. (p. 130)

The Veltri et al. study (2013) is unique. It broke down the research silos between OHS researchers and operations management researchers. The research team comprised nearly equal numbers of researchers (nine altogether) from both research disciplines, based on the assumption that both groups had a shared interest in practice. Using 10 case studies from nine organizations drawn from different industry sectors in Ontario, Canada, the researchers explored the relationship between safety and operational practices and outcomes, comparing the results with data on injury rates. They found that the "top performing facilities on operational outcomes were also the top performers on safety outcomes and these facilities all had supportive cultures and used joint management systems" (p. 127). On the basis of these findings, it is reasonable to argue that the value of the individual OHSP and the OHS function may be measured by the degree to which OHSPs are successful in integrating safety and health into the day-to-day operations of the business, hence avoiding the "sidecar" (Veltri et al., 2013) status of the safety department, operating instead as Hale et al. (2010) found as a "motor" of change.

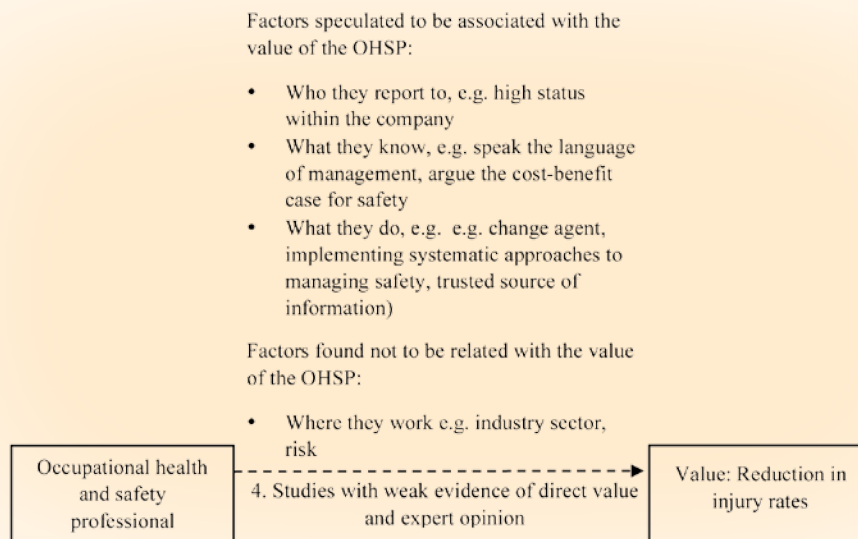
4.4.5 Industry sector (where they work)

The previously discussed IOSH OHS culture study speculated that a determining factor related to the impact of the OHSP may be the type of industry and its associated level of risk. Contrary to this view, an earlier study conducted by DeJoy (1993) found that OHS functions did not differ across industries (including mining, construction and electronics), operations or size. Furthermore, in their single industry sector study of OHS climate in university and college laboratories in Taiwan, Wu, Liu and Lu (2007), found no difference in OHS climate scores based on organizational size and lo-

cation, whereas employing an OHSP resulted in all locations achieving better OHS climate scores. If OHS climate is taken as a proxy measure for OHS performance, then the presence and functions of the OHSP seems to make a difference irrespective of organizational size and location.

The studies included in this category are diverse and it is only possible to speculate from these studies on the factors that may be associated with the direct value of the OHSP, or not, as shown in Figure 6.

Figure 6: Weak evidence for the factors with speculated value of the OHSP





5. Discussion

Four overarching themes emerge from the findings of this literature review. First, the distinction between the value of the individual OHSP, and the value, or the business value (positive or negative) of OHS. It is possible to argue that these are complementary rather than competing perspectives. These may need to be teased out in future research on the basis that OHSPs' value may be measured by the extent to which they are able to convince organizations in the first instance of the business value of OHS.

Second, only two studies have been conducted to date that provide strong evidence in support of the value proposition of the OHSP. These studies are important because the value of the OHSP is not moderated by other variables or factors investigated to have a relationship with lower accident rates. Both these studies were conducted in the construction industry and the construction industry is over-represented in the whole literature review. It is unclear why there has been interest in the construction industry but not in other high-risk industries, for example mining, or the (chemical) process industry.

Third, all the studies included in this literature review measure the value of the OHSP in terms of either a reduction in fatality rates or injury rates. There are no similar studies that explore the rates of disease and ill-health. This is a glaring omission.

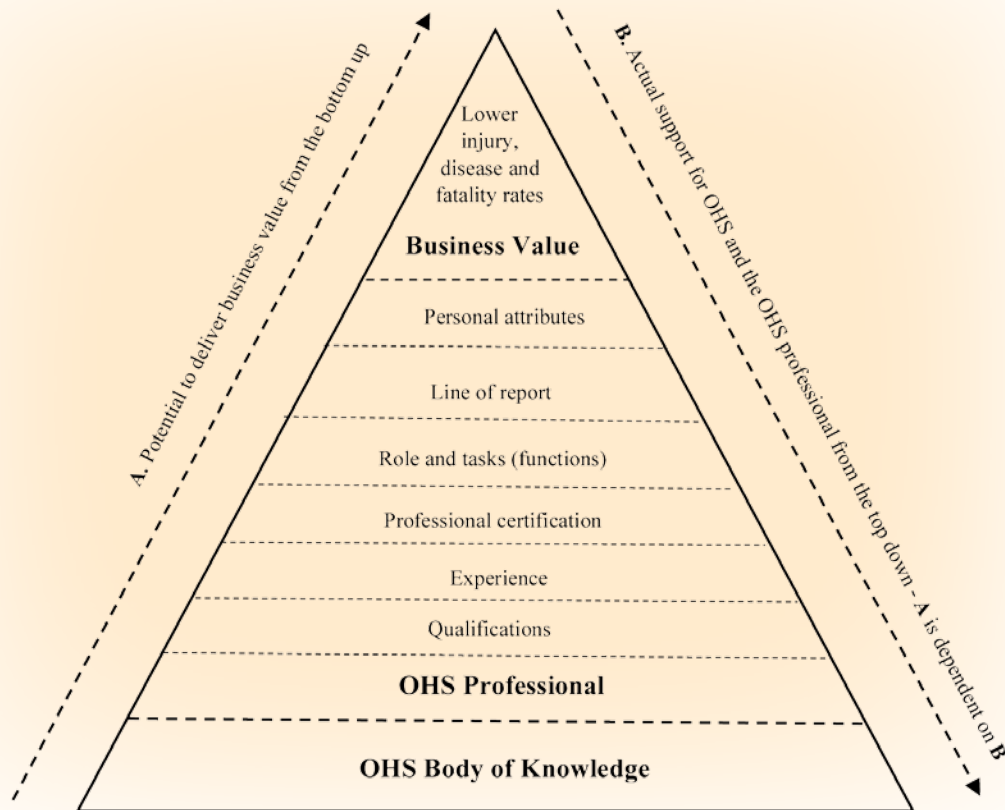
Fourth, the methodological quality of all the studies undermines the strength of the evidence. The study by Cohen (1997) represents the highest methodological quality by using matched pairs of companies with high and low accident rates. Unfortunately this study investigated the value of the OHSP as one among many variables resulting in only moderate evidence for the value of the OHSP. Furthermore, this study is over 40 years old and few if any studies have replicated this study design.

This represents a lost opportunity and one that should be addressed now. The study with arguably the second highest methodological quality is the intervention evaluation study conducted by Hale et al. (2010). This study employed a before and after design, but like the Cohen study, investigated the value of the OHSP as one among many variables – resulting in this study being classified as providing only moderate evidence for the value of the OHSP. The two studies in the construction industry that provide the strongest evidence for the value proposition for the OHSP are rated strong, not so much as a result of their study design, but because they directly study and find a relationship, and found one: between the OHSP and value. More studies of this type are required and should be supported by a stronger study design.

“OHSPs who lack the personal skills to engage senior managers may be missing out on the opportunity to add value, irrespective of their knowledge and skills.”

A recurring theme in the literature is the importance placed on high status and line of report for the OHSP. Although there is no strong evidence to support this claim, the pervasiveness of this idea in the literature should not be overlooked and represents an area for further research. To reflect the potential importance of this theme, the OHSP value pyramid has been re-conceptualized to include the line of report as shown in Figure 7. Another

Figure 7: Re-conceptualizing the relationship between the occupational safety and health professional and business value



emerging area of research interest is the personal attributes of the OHSP. The study by Pryor (2014) suggests that the line of report, role and tasks and qualifications of the OHSP will only be effective to the extent to which the OHSP is influential with senior decision makers. Conversely, OHSPs who lack the personal skills to engage senior managers may be missing out on the opportunity to add value, irrespective of their knowledge and skills. This is an area that warrants further research.

The findings of the literature review are summarized in Table 1 with the strength of the evidence cross-referenced with value pyramid elements. There is strong evidence for the value proposition of the OHSP associated with the elements role and tasks (functions), professional certification, qualifications and employing in-house OHSPs. It is with these elements (in combination, not isola-

tion) where the evidence is strongest, at least in the construction industry. It is apparent, however, that there remain significant gaps in the evidence base. For example, no strong evidence was found in support of personal attributes or line of report or experience, representing opportunities for further research. In recent years OHS professional bodies have moved to define the core Body of Knowledge for OHSP. Research is needed to investigate the extent to which the various BOKs, for example in Australia and the US, are delivering (through formal university programs) the requisite knowledge, skills and attitudes of the OHSP that will allow them to successfully add value. It would be of interest to also know the extent to which senior managers value and implement the ideas (and which ones) for improving OHS performance that OHSPs recommend based on their formal education.

Table 1: Strength of the evidence mapped against the value pyramid elements

Value pyramid elements \ Strength of the evidence	Strong evidence for the factors associated with business value	Moderate evidence for the factors associated with business value	Weak evidence for the factors associated with business value
Personal attributes			<ul style="list-style-type: none"> Trusted source of information
Line of report		<ul style="list-style-type: none"> Reporting to a senior manager Status of the OHS officer 	<ul style="list-style-type: none"> High status within the company
Role and tasks (functions)	<ul style="list-style-type: none"> Vetting subcontractors 	<ul style="list-style-type: none"> Training workers OHSP as the motor of change Conducting OHS inspections Implementing the elements of a OHS management program Involvement in accident investigations Site walks to check practices, equipment and compliance with regulations Authorization to spend > \$1,000 Moving from compliance to a cultural approach Authority of the OHS officer to enforce OHS regulations 	<ul style="list-style-type: none"> Speak the language of management, Argue the cost-benefit case for safety Change agent Implementing systematic approaches to managing OHS
Professional certification	<ul style="list-style-type: none"> Membership of a professional body 		
Experience			
Qualifications	<ul style="list-style-type: none"> Competence/qualifications 		
OHS professional (including number of and employed in-house)	<ul style="list-style-type: none"> Number of OHSPs Internal OHSP 	<ul style="list-style-type: none"> Employing a full-time OHSP Employing an OHS manager 	
OHS Body of Knowledge			

“It would be of interest to also know the extent to which senior managers value and implement the ideas (and which ones) for improving OHS performance that OHSPs recommend based on their formal education.”

The aim of this research was to conduct a literature review to explore the evidence in support of the value proposition for the OHSP and to provide answers to three research questions:

1. What is the evidence that the OHSP improves the OHS performance of an organization?

There is strong evidence from the construction industry that employing an in-house OHSP results in lower fatality and injury rates.

2. What knowledge, skills and attributes of the OHSP might be linked with the effectiveness of the OHSP?

There is strong evidence from the construction industry that the knowledge, skills and attributes of the OHSP, expressed through qualifications, professional certification and the role and tasks they perform, results in lower fatality and injury rates.

3. Does the impact of the OHSP vary depending on industry and organizational size?

There is no evidence that the impact of the OHSP varies according to industry, organizational size or levels of risk.

6. Proposal for further research

Currently only two studies have investigated the value proposition for the OHSP. Given this dearth of research evidence, a proposal for further research is justified. It is proposed that future research be based on a matched pair's design of companies with high and low accident rates. Research should focus on the value of the OHSP, including the moderating or intervening factors that may impact on the value proposition for the OHSP. It is also important to investigate how the elements in the value pyramid are related to one another and their relative contribution to the value

proposition for the OHSP. Value, and how it is measured, requires careful consideration to overcome the lack of validity inherent in lag indicators. At the very least, future research should bring into focus and measure rates of disease and ill-health as well as fatalities and injuries as measures of value. A desirable outcome would be a coordinated international research effort within and across industry sectors and within and across countries, leading to a concerted and professionally-shared effort to systematically build the evidence base.



“Research should focus on the value of the OHSP including the moderating or intervening factors that may impact on the value proposition for the OHSP.”

7. Conclusion

OHSPs are facing increasing pressure to justify their value to their organizations, driven in part by a struggling global economy which is placing pressure on organizations to cut costs wherever they can. Being forced to justify one's value, however measured, is never easy. The sole purpose of the OHS profession must be to assist organizations to protect the safety and health of people at work. This is a moral measure of value from which economic benefits will flow to individual workers, organizations and to society. In tough

economic times it is easy to marginalize the role of the OHSP. The purpose of this literature review was to determine the strength of the evidence in support of the value proposition for the OHSP. While many studies have investigated a range of safety management factors associated with better safety performance, including the role of OHSP, only two studies bring into sharp relief the value of the OHSP in reducing workplace fatalities and injuries. This finding is at once disappointing and encouraging – disappointing due to the dearth of studies on such an important topic, encouraging because there is evidence for the value proposition of the OHSP. The challenge before the profession and safety researchers is to work together to conduct further research on this topic so as to strengthen the evidence in the hope that in the future, the OHSP will be immune to the knock-on effects of a struggling global economy. In fact, through their efforts, their value will be realized through cost savings due to decreased numbers of FIDI. Hence the moral and economic value proposition for the OHSP will be unquestioned.



"The sole purpose of the OHS profession must be to assist organizations to protect the safety and health of people at work."

REFERENCES

- Abudayyeh, O., Fredericks T. K., Butt, S. E. & Shaar, A.** (2006). An investigation of management's commitment to construction safety. *International Journal of Project Management*, 24(2), 167-174.
- Adams, S.** (2000). Today's safety professional: Manager or engineer? *Safety Professional*, June, 24-27.
- Blair, E. H.** (2004). Critical competencies for SH&E managers: Implications for educators. *The Journal of SH&E Research*, 1(1), 1-13.
- BLR.** (2006). The ROI of EHS: Practical strategies to demonstrate the business value of environmental, health and safety functions. Business & Legal Reports Inc.: Old Saybrook, CT, USA.
- Behm, M., Veltri, A., Kleinsorge, I.** (2004). The cost of safety: cost analysis model helps build business case for safety. *Professional Safety*, 49(4), 22-29.
- Borys, D., Else, D., Pryor, P. & Sawyer, N.** (2006). Profile of an OHS professional in Australia in 2005. *The Australia and New Zealand Journal of Occupational Health and Safety*, 22(2), 175-192.
- Broberg, O. & Hermund, I.** (2004). The OHS consultant as a 'political reflective navigator' in technological change processes. *International Journal of Industrial Ergonomics*, 33, 315-326.
- Brown, H. & Larson, T.** (1998). Making business integration work: A survival strategy for EHS managers. *Environmental Quality Management details*, Spring, 1-8.
- Brun, J. P. & Loiselle, C. D.** (2002). The roles, functions and activities of safety practitioners: The current situation in Québec. *Safety Science*, 40, 519-536.
- Byrne, R.** (2013). Costing accidents. *The RoSPA Occupational Safety & Health Journal*, January, 13-15.
- Chaves, S. C. L., Santana, V. S., de Leão, I. C. M., de Santana, J. N. & de Almeida Lacerda, L. M. A.** (2009). Determinants in an occupational health and safety program implementation. *Pan Am Journal of Public Health*, 25(3), 204-212.
- Cameron, I. & Duff, R.** (2007). Use of performance measurement and goal setting to improve construction managers' focus on health and safety. *Construction Management and Economics*, 25, 869-881.
- Cameron, I., Hare, B. & Duff, R.** (2007). *Superior safety performance: OSH personnel and safety performance in construction Full Report*, IOSH: UK.
- Chang, S., Chen, D. & Wu, T.** (2012). Developing a competency model for safety professionals: Correlations between competency and safety functions. *Journal of Safety Research*, 43, 339-350.
- Chaves, S. C. L., Santana, V. S., de Leão, I. C. M., de Santana, J. N. & de Almeida Lacerda, L. M. A.** (2009). *Pan Am J Public Health*, 25(3), 204-212.
- Cleveland, R., Cohen, H. H., Smith, M. J. & Cohen, A.** (1979). Safety program practices in record-holding plants. NIOSH: USA.
- Cohen, A.** (1977) Factors in successful occupational safety programs. *Journal of Safety Research*, 9(4), 168-178.
- Conchie, S. M. & Burns, C.** (2009). Improving occupational safety: Using a trusted information source to communicate about risk. *Journal of Risk Research*, 12(1), 13-25.
- Curtis, L.** (2014). Should we change our professional title? *Professional Safety*, 59(2), 9-10.
- Davies, H. T. O. & Crombie, I. K.** (2001). What is a systematic review? 1(5), 1-6. Retrieved from www.evidence-based-medicine.co.uk
- DeJoy, D. M.** (1993). Development of a work behavior taxonomy for the safety function in industry. *Accident Analysis and Prevention*, 25(4), 365-374.
- Deshkar, S.** (2010). Ergonomics investment: Making the case in any economy. *Professional Safety*, October, 48-50.
- Donald, I. & Canter, D.** (1994). Employee attitudes and safety in the chemical industry. *Journal of Loss Prevention in the Process Industries*, 7(3), 203-208.
- Esmaili, B. & Hallowell, M. R.** (2012). Diffusion of safety innovations in the construction industry. *Journal of Construction Engineering and Management*, 138(8), 955-963.
- Findley, M., Smith, S., Kress, T., Petty, G. & Enoch, K.** (2004). Safety program elements in construction: Which ones best prevent injuries and control related workers' compensation costs? *Professional Safety*, 49(2), 14-20.
- Greer, M. E.** (2001). SHE: A value-added function. *Professional Safety*, July, 7.
- Guldenmund F. W. & Hale A. R.** (2012). *The tricks of the trade: lessons from the program improving safety*. In Podgorski D. (Ed). Proceedings of 6th International conference of Working on Safety Network: Towards safety through advanced solutions. Central Institute for Labour Protection. Warsaw, Poland. 8 pages
- Guldenmund, F. W., Hale, A.R., van Loenhout, P & Oh, J.** (2008). *The secret of successful safety interventions*. Crete, 4th International Conference Working on Safety 2008.
- Hale, A. R., Jacobs, J. & Oor, M.** (2010). *Safety culture change in two companies*. Proceedings of the 10th International Probabilistic Safety Assessment and Management Conference (PSAM10) Seattle, Washington
- Hale, A. R., Guldenmund, F. W. van Loenhout, P. L. C. H. & Oh, J. I. H.** (2010). Evaluating safety management and culture interventions to improve safety: Effective intervention strategies. *Safety Science*, 48, 1026-1035.
- Hale, A. & Ytrehus, I.** (2004). Changing requirements for the safety profession: Roles and tasks. *The Australia and New Zealand Journal of Occupational Health and Safety*, 20(1), 23-35.
- Hallowell, M.** (2010). Cost-effectiveness of construction safety programme elements. *Construction Management and Economics*, 28, 25-34.
- Hallowell, M. & Calhoun, M.** (2001). Interrelationships among highly effective construction injury prevention strategies. *Journal of Construction Engineering and Management*, 137(11), 985-993.
- Hasle, P. & Jensen, P.** (2006). Changing the internal health and safety organization through organizational learning and change management. *Human Factors and Ergonomics in Manufacturing*, 16(3), 269-284.
- Hill, D.** (2006). Time to transform? Assessing the future of the SH&E profession. *Professional Safety*, December, 62-71.

- Hinze, J. & Wilson, G.** (2000). Moving toward a zero injury objective. *Journal of Construction Engineering and Management*, 126(5), 399-403.
- Hinze, J. & Raboud, P.** (1988). Safety on large building construction projects. *Journal of Construction Engineering and Management*, 114(2), 286-293.
- Hopkins, A.** (2007). Beyond compliance monitoring: New strategies for safety regulators. *Law & Policy*, 29(2), 210-225.
- Institute for Work and Health**, (2006). Systematic reviews help users keep up with expanding volume of research evidence. *J Can Chiropr Assoc*, 49(1), 56-62.
- IOSH.** (2012). The value of health and safety. IOSH: UK.
- Jaselskis, E. J., Anderson, S. D., Russell, J. S.** (1996). Strategies for achieving excellence in construction safety performance. *Journal of Construction Engineering and Management*, 122(1), 61-70.
- Lawrence, T.** (2008). Championing the SH&E professional. *Professional Safety*, November, 40-42.
- Leemann, J. E.** (2005). Delivering business value by linking behavioral EHS competencies to corporate core competencies. *Corporate Environmental Strategy: International Journal for Sustainable Business*, 12(1), 3-15.
- Limborg, H. J.** (1995). Qualifying the consultative skills of the occupational health and safety service staff. *Safety Science*, 20(2-3), 247-252.
- McDonald, M. A., Lipscomb, H. J., Bondy, J. & Glazner, J.** (2009). "Safety is everyone's job:" The key to safety on a large university construction site. *Journal of Safety Research*, 40(1), 53-61.
- Mearns, K., Whitaker, S., Flin, R. Gordon, R. & O'Connor, P.** (2003). Factoring the human into safety: Translating research into practice. Benchmarking human and organizational factors in offshore safety Volume 1 (of 3). Health and Safety Executive.
- Mearns, K., Whitaker, S. M. & Flin, R.** (2001). Benchmarking safety climate in hazardous environments: A longitudinal, interorganizational approach. *Risk Analysis*, 21(4), 771-786.
- Mearns, K., Whitaker, S. M. & Flin, R.** (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, 41, 641-680.
- Miller, P. & Haslam, C.** (2009). Why employers spend money on employee health: Interviews with occupational health and safety professionals from British industry. *Safety Science*, 47, 163-169.
- Minnick, W.** (2013). Understanding the antecedents of role stressors in the safety professional. *Journal of Workplace Behavioral Health*, 28, 134-157.
- Merriam-Webster Dictionary.** Retrieved from <http://www.merriam-webster.com/>
- Nytrö, K., Saksvik, P. O. & Torvatn, H.** (1998). Organizational prerequisites for the implementation of systematic health, environment and safety work in enterprises. *Safety Science*, 30(3), 297-307.
- Olsen, K.** (2012). Occupational health and safety professionals strategies to improve working environment and their self-assessed impact. *Work*, 41, 2625-2632.
- Pryor, P.** (2014). *Towards an understanding of the strategic influence of the occupational health and safety professional*. Unpublished Masters by Research Thesis, Federation University Australia.
- Seabrook, K.** (2014). Connecting the dots: Demonstrating safety's business value. *Professional Safety*. 59(2), 8.
- Shannon, H. S., Mayr, J. & Haines, T.** (1997). Overview of the relationship between organizational and workplace factors and injury rates. *Safety Science*, 26(3), 201-217.
- Smith, A. P., & Wadsworth, E. J. K.** (2009a). *Safety culture, advice and performance*. Full Report IOSH: UK.
- Smith, A. P., & Wadsworth, E. J. K.** (2009b). *Safety culture, advice and performance*. Research Summary. IOSH:UK.
- Swuste, P. & Arnoldy, F.** (2003). The safety advisor/manager as agent of organizational change: A new challenge to expert training. *Safety Science*, 41, 15-27.
- Veltri, A., Pagell, M., Behm, M. & Das, A.** (2007) A data-based evaluation of the relationship between occupational safety and operating performance. *The Journal of SH&E Research*, 4(1), 1-22.
- Veltri, A.** (1992). Evaluating the safety function: A conceptual model. *Journal of Safety Research*, 23, 27-38.
- Veltri, A., Pagell, M., Johnston, D., Tompa, E., Robson, L., Amick III, B. C., Hogg-Johnson, S. & MacDonald, S.** (2013). Understanding safety in the context of business operations: An exploratory study using case studies, *Safety Science*, 55, 119-134.
- Vredenburg, A. G.** (2002). Organizational safety: Which management practices are most effective in reducing employee injury rates? *Journal of Safety Research*, 33, 259-276.
- Williamson, A., Fister, D. & Ramchandra, R.** (nd) Evolving role of EHS manager in industrial sustainability programs: Case studies incorporating a pollution prevention approach to problem solving
- Wu, T., Liu, C. & Lu, M.** (2007). Safety climate and college laboratories: Impact of organizational and individual factors. *Journal of Safety Research*, 38, 91-102.
- Wu, T., Lin, C. & Shiau, S.** (2010). Predicting safety culture: The role of employer, operations manager and safety professional. *Journal of Safety Research*, 41, 423-431.
- Zohar, D.** (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology*, 65(1), 96-102.
- Zohar, D., & Polachek, T.** (2013, August 12). Discourse-Based Intervention for Modifying Supervisory Communication as Leverage for Safety Climate and Performance Improvement: A Randomized Field Study. *Journal of Applied Psychology*. Advance online publication. doi:10.1037/a0034096

APPENDIX A – LIST OF SEARCH STRINGS

Nos.	Search Strategy
1	<p>Safety AND officer AND improve* AND org* AND effect = 392 articles</p> <p>Limiter a)</p> <p>“safety officer” AND improve* AND org AND effect* = 9 articles</p> <p>Limiter b)</p> <p>“safety officer” AND improve* AND org AND effect* NOT medication = 5 articles (2 x industrial safety, 2 x patient safety, 1 x environmental safety)</p>
2	“safety manager” AND improve* AND org* AND effect* NOT patient = 4 articles (1 x industrial safety, 4 x other)
3	“safety professional” AND improve* AND org* AND effect* NOT patient = 4 articles (1 x industrial safety, 4 x other)
4	“safety practitioner” AND improve* AND org* AND effect* NOT patient = 0 articles
5	“safety officer” AND improve* AND org* AND performance NOT “patient safety” = 1 article
6	“safety manager” AND improve* AND org* AND performance NOT “patient safety” = 4 articles (3 x industrial safety, 1 x other)
7	<p>“safety professional” AND improve* AND org* AND performance NOT “patient safety” = 2 articles (2 x industrial safety)</p> <p>Note: Adding “health and safety professional,” “health and safety officer,” “health and safety manager” = 0 articles.</p> <p>Conclusion: Adding the word “health” had not effect.</p>
8	“safety manager” AND improve* AND comp* AND “safety performance” = 4 articles (4 x industrial safety)
9	“safety officer” AND improve* AND comp* AND “safety performance” = 4 articles (4 x industrial safety) = 0 articles
10	“safety professional” AND improve* AND comp* AND “safety performance” = 4 articles (4 x industrial safety) = 1 articles (1 x industrial safety)
11	“safety practitioner” AND improve* AND comp* AND “safety performance” = 4 articles (4 x industrial safety) = 0 articles
12	“safety manager” AND value NOT “patient safety” = 16 articles (15 x industrial safety, 1 x other)
13	“safety manager” AND value NOT “patient safety” = 16 articles (15 x industrial safety, 1 x other)
14	<p>“safety officer” OR “safety practitioner” AND value NOT “patient safety” = 1304 articles</p> <p>Limiter a)</p> <p>“safety officer” OR “safety practitioner” AND value NOT “hospital” = 1304 articles</p> <p>Limiter b)</p> <p>“safety officer” OR “safety practitioner” AND value NOT “nursing” = 1304 articles</p> <p>Limiter c)</p> <p>“safety officer” AND value NOT “patient safety” = 11 articles (3 x industrial safety, 8 x other)</p> <p>Limiter d)</p> <p>“safety practitioner” AND value NOT “patient safety” = 0 articles</p>
15	“safety manager” AND “return on investment” = 1 article (1 x industrial safety)

Nos. Search Strategy

16	"safety professional" AND "return on investment" = 0 articles
17	"safety officer" AND "return on investment" = 1 article (1 x other)
18	"safety practitioner" AND "return on investment" = 0 articles
19	"safety manager" AND "impact of" = 17 articles Limiter a) "safety manager" AND "impact of" NOT "patient safety" = 15 articles (9 x industrial safety, 6 x other)
20	"safety professional" AND "impact of" = 19 articles (14 x industrial safety, 5 x other)
21	"safety practitioner" AND "impact of" = 1 article (1 x industrial safety)
22	"safety officer" AND "impact of" = 22 articles Limiter a) "safety officer" AND "impact of" NOT "patient safety" = 14 articles (1 x industrial safety, 13 other)
23	"safety climate" AND "safety officer" = 0 articles
24	"safety climate" AND "safety manager" = 1 article (1 x industrial safety)
25	"safety climate" AND "safety professional" = 0 articles
26	"safety climate" AND "safety practitioner" = 0 articles
27	Influence AND "safety officer" AND "safety climate" = 0 articles
28	"safety professionals strategies" = 1 article (1 x industrial safety)
29	"value proposition of the safety professional" = 0 articles Limiter a) "value proposition" AND "safety professional" = 1 article (1 x industrial safety)
30	"safety professional" = 411 articles (articles of relevance already retrieved)
31	"safety coordinator" = 187 articles (not relevant)
32	"safety manager" = 1099 articles (no new articles found)
33	"safety officer" (no new articles found – reached saturation point)
34	"cost effectiveness" AND "safety Manager" OR "safety professional" = 1467 articles (no new articles found – reached saturation point)
35	"cost effectiveness" AND "safety officer" OR "safety specialist" = 459 articles (no new articles found – reached saturation point)
36	Successful AND safety AND prog* AND "safety professional" OR "safety manager" OR "safety officer" = 2421 articles (no new articles found – reached saturation point)



INSHPO is the global voice for the occupational safety and health profession and acts as a forum for international collaboration among professional organisations to improve safety and health at work.