

**Occupational Health and Safety Indicators and Under-Reporting: Case Studies in Chinese Shipping**  
**Indicateurs en santé et sécurité au travail et sous-déclaration d'incidents: études de cas dans les transports maritimes chinois**

**Indicadores de Salud y seguridad ocupacional y declaración subestimada de incidentes: estudios de caso en los transportes marítimos chinos**

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[See table of contents](#)

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Article abstract

An index-based approach to indicate the outcome of Occupational Health and Safety management has been commonly used in the implementation of the *International Safety Management Code* and the operation of Occupational Health and Safety management systems in the international shipping industry. Although the index-based approach is asserted to be a convenient way to measure and quantify the outcome of Occupational Health and Safety management, it is not justified in the wider literature and further empirical research is suggested by various authors. The aim of this study is to explore the role of an index-based approach in managing Occupational Health and Safety in the shipping industry.

This article investigates the effectiveness of indicators in Occupational Health and Safety management in two Chinese chemical shipping companies. A qualitative approach is applied to examine the views of seafarers on safety reporting practice. The study reveals that, although the need for reporting is understood by most of the crew members, the reporting practice is significantly affected by different factors such as the crew's concerns for their own interests, Chinese cultural factors and management's dominant power over the crew's performance evaluation. The findings suggest that there is a significant gap between what is required by the rules and what really occurs in terms of safety reporting practice. The study highlights the emerging problems of using Occupational Health and Safety indicators as benchmark for measuring the outcome of Occupational Health and Safety management in Chinese shipping. The conclusion is drawn in a Chinese context, and although the findings may not be similar to other industries or the shipping industry in other countries, they provide valuable indications for re-thinking and re-shaping maritime regulatory strategies.

# Occupational Health and Safety Indicators and Under-Reporting: Case Studies in Chinese Shipping

Conghua Xue, Lijun Tang and David Walters

**Occupational Health and Safety indicators, such as numbers of incidents and near-misses, can be useful tools to manage and improve Occupational Health and Safety (OHS). However, under-reporting challenges the validity of these indicators. This article aims to examine the issue of indicator-based reporting through case studies in the Chinese chemical shipping industry. It reveals some economic and social factors that affect crew safety reporting practices and that lead to under-reporting as well as biased reporting. Such factors include, but are not limited to, crew's concerns over their income, future promotion and job insecurity, reputation at work, solidarity among crew, and the fluidity of employment. These elements explicitly or implicitly affect the validity of Occupational Health and Safety indicators. This article's analysis serves as a cautionary reminder for industry employers who adopt indicator-based OHS management systems.**

**KEYWORDS:** Occupational Health and Safety management, OHS indicators, case study, under-reporting, underlying factors.

## Introduction

System-based approaches to Occupational Health and Safety (OHS) management have been increasingly adopted since the 1980s. These can be traced back to the 1920s and the Western Electric Company in the United States, and the later risk management systems in the 1960s and 1970s (Bennett and Foster, 2007). These systems encourage an organization to go beyond compliance with traditional minimum legal requirements, and as such are a crucial strategy to deal with workplace hazards and reduce ill health at work (Frick and Wren, 2000). In the shipping industry, the tragic loss of the *Herald of Free Enterprise* in 1987

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catalyzed the move towards a systematic OHS management strategy (Anderson, 2003). The International Maritime Organization (IMO) adopted the *International Safety Management (ISM) Code* in 1994, which came into force in 1998 for passenger vessels, tankers, bulk carriers and high speed craft over 500 Gross Tonnage (GT), and, in 2002, for the rest of the vessels over 500 GT. The main objectives of the *ISM Code* are to ensure the safe operation of ships, create a safe working environment at sea and reduce the amount of maritime accidents (Anderson, 2003; Oltedal and McArthur, 2011).

In safety-critical industries, such as oil refinery and chemical processing, adoption of OHS indicators, such as numbers of incidents and near-misses, is highly recommended, and it is suggested that managers' incentive schemes should be linked to OHS indicators (Hopkins, 2009). Nevertheless, it is widely acknowledged that such links may result in managing numbers rather than managing safety (Hopkins, 2009; Shaw and Blewett, 2000). In parallel with this argument, under-reporting is a serious issue in OHS management (Azaroff *et al.*, 2002; Probst and Graso, 2013), which undermines the validity of OHS indicators. Similarly, in shipping, the *ISM code* requires seafarers to report safety-related issues to their company, and such reporting has been considered as the most significant indicator of a well-established OHS management system as well as the creation of a safety culture in shipping companies (Anderson, 2003; Ek and Akselsson, 2005; Lappalainen *et al.* 2011; Lappalainen, 2016; Oltedal and McArthur, 2011). In practice, however, under-reporting is a major noncompliance with the *ISM Code* (Bhattacharya, 2012; Ek and Akselsson, 2005; Lappalainen *et al.* 2011; Lappalainen, 2016; Oltedal and McArthur, 2011).

While the problem of under-reporting does not necessarily mean that OHS indicators should be abandoned (Hopkins, 2009), an adequate understanding of the reasons behind under-reporting should be developed in order to manage OHS and make the indicators more robust. This article aims to examine the issue of indicator-based reporting through case studies in the Chinese shipping industry. The particular focus is on crew reporting practices as an essential part of the OHS management system for a shipping company.

## OHS indicators and under-reporting

According to the *ISM Code*, all shipping companies subject to the *Code* are required to establish mandated forms of safety management systems. Regardless of the differences between the management systems, it is essential that an OHS management policy should be clearly stated at the beginning of any OHS management system. The word 'policy' means "the general intentions, approach and objectives—the vision—of an organisation and the criteria and principles upon

which it bases its action" (HSE, 1997: 6). It is mainly set up by top management of an organization, and should reflect the values or beliefs of the organizational members who produce and implement it. An effective OHS management policy sets a clear direction for members to follow. It should not be about 'lip service' given by management, but their genuine commitment to action (HSE, 2000). In general, the ultimate goal of an OHS management policy is to maintain specified management standards and achieve expected outcomes.

An OHS management policy is brief, concise and generic. It will incorporate OHS management objectives. In association with such objectives, OHS indicators are increasingly used in various industries for indicating and measuring whether the objectives are achieved (Buchanan and Huczynski, 1997; Cox and Cox, 1996; Hopkins, 2009; HSE, 2000; Leveson, 2015; Mohammadfam *et al.*, 2017; Shea *et al.*, 2016; Wokutch and VanSandt, 2000). The use of indicators has been seen to be an effective means to manage negative events, as they are easy to measure and can serve as evidence for rewards and sanctions for employee performance (Hopkins, 2009; Wokutch and VanSandt, 2000). Based on the indicators, it is easy to establish observable cause-effect relationships between unsafe practices and negative events. The use of indicators for OHS management is also supported by Armstrong and Armstrong (2008), since it provides valuable data for cross time and cross department comparisons of the effectiveness of OHS management issues and helps shape a better form of work organization. This practice is potentially able to 'raise the profile' of OHS management for an organization (Wadsworth and Smith, 2009).

However, it is also acknowledged that the sole focus on indicators can be narrow-sighted, inadequate and even problematic due to the complexity of a wide range of OHS issues (Cox and Lippel, 2008; Hopkins, 2000; Shaw and Blewett, 2000). It over-relies on the safety records as indicators of the OHS management, and could lead to reporting biases and discourage workers from reporting safety-related issues. Gunningham (2007: 12) recognizes that a formal system becomes problematic because it could not "reveal to what extent near misses and incidents are actually reported, or to what extent or why, workers are constrained from reporting their concerns". The research by Nichols and Tucker (2000) showed the common use of reported lost time injuries rates and award system raised the concern of creating incentives not to report injuries. It could lead to the practice that 'getting the numbers right' becomes more important than improving OHS outcomes (Hopkins, 2009; Shaw and Blewett, 2000). Research has shown that employees and, in some cases, managers may be unwilling to report OHS issues in order to prevent themselves from being blamed or punished—e.g. losing their jobs, losing a bonus, being denied a promotion, and being labelled as trouble makers (Azaroff *et al.*, 2002; Probst and Graso, 2013).

In this context, some authors like Walters (2005), and Balka and Freilich (2008) expressed a moderate view. While there are obviously ‘positive roles’ in using indicators, some limitations such as ‘underestimation’, ‘reliability of measurement’ and ‘cause-effect’ analysis, and ‘latent conditions’ of incidents are also identified (Reason, 1997: 10; Walters, 2005: 26). These limitations, including under-reporting, need to be taken into account when incorporating indicators into an OHS management system.

In shipping, one of the key components of the *ISM Code* and an OHS management system is reporting safety-related issues such as incidents and near misses to the management of a company. Based on the reporting, OHS indicators are widely used and serve as the ‘barometer’ of OHS management. As a result, the reported statistical information can be summarized and measured against the OHS indicators so as to evaluate the outcomes of OHS management. The rationale is that the shipping company is able to measure the extent to which OHS management has been achieved. In addition, by collecting and analyzing such information, members of the company can learn from negative events, make more effective accident prevention efforts, and take a proactive approach to safety.

To a great extent, the use of OHS indicators depends on the statistics of workplace reporting. Despite the requirements of reporting in the *ISM Code*, it has been found that while reporting of fatality accidents at sea to relevant maritime authorities was inevitable, less severe accidents and incidents were under-reported (Ellis *et al.*, 2010; Hassel *et al.*, 2011, Luo and Shin, 2016; Psarros *et al.*, 2010). The study conducted by Lappalainen *et al.* (2011) showed that incident reporting did not function properly within the Finnish maritime industry. Hassel *et al.* (2011) analyzed accident data between 2005 and 2009 from the *IHS Fair Play* and the maritime authorities of seven flag states and it showed that only about half of the accidents experienced were reported. In general, the literature suggests that under-reporting is a “considerable problem” in this industry, and “a culture of under-reporting” of safety-related occurrences is prevalent (Ellis *et al.*, 2010; IMO, 2008; Olteidal and McArthur, 2011).

Factors affecting under-reporting vary. Van Der Schaaf and Kanse (2004) conducted a cross-industrial review and drew out several barriers to reporting on an individual level. They include: 1- fear of disciplinary action or embarrassment; 2- risk acceptance, because incidents are regarded as part of the job; 3- reporting is regarded as useless as reports are not acted on by management; and 4- practical reasons, for example, reporting is seen as difficult and time-consuming. The study made by Lappalainen *et al.* (2011) in the Finnish maritime industry showed that the maritime personnel have an occupational culture, which is incompatible with the rule-based safety management approach provided by the *ISM Code*. Olteidal and McArthur (2011) conducted a questionnaire survey on

a Norwegian merchant fleet and Kongsvik *et al.* (2012) conducted a similar study on offshore service vessels operating on the Norwegian continental shelf. While they drew on Van Der Schaaf and Kanse's (2004) findings, both studies extended the scope of the research to organizational factors that affect safety reporting practices. These factors include safety training and crew competence, safety management, general safety practice, feedback on reporting, and perceived demand for efficiency.

While Oltedal and McArthur (2011) and Kongsvik *et al.* (2012) touched upon fear of blame, they did not explore what underpinned such fear. Bhattacharya (2011) took a qualitative approach and shifted the focus onto how employment relations discouraged seafarers from reporting. His study showed that it was primarily the fear of losing a job that resulted in under-reporting. This fear was caused by the structure and employment practices of the industry, characterized by short-term contracts. Shipping is a globalized industry. Within the sector, it is commonplace for owners/managers to register their ships in Flag of Convenience (FOC) countries (such as Liberia and Panama) and employ seafarers from low-cost labour supply countries using local crewing agencies (Alderton *et al.*, 2004). As ship-owners take full advantage of the global seafarer market, the practice of permanent employment of seafarers has become less common and more and more seafarers are being employed from new labour-supply nations on short-term contractual employment (Alderton *et al.*, 2004). The short-term contracts are found to discourage reporting (Kongsvik *et al.*, 2012).

Such employment relations give rise to strong power inequalities between managers and seafarers, which can have a negative impact on the development of trust (Cook *et al.*, 2005; Oskarsson *et al.*, 2009). Even though shipping companies claimed to have a non-blame culture in place, seafarers had no faith in it as the lack of long-term employment made seafarers vulnerable to managers' power (Bhattacharya, 2011 and 2012). Without trust, workers would not communicate with their managers freely and openly, and honest reporting would not be achieved (O'Reilly, 1978).

While Bhattacharya's (2011 and 2012) detailed exploration of fear of blame goes beyond individual and organizational barriers and extends to the structure of the industry and the associated power inequality, it nevertheless focuses mainly on the power of managers to terminate seafarers' employment. Arguably, this is one end of the full spectrum of the ways in which managers can exert power. Manpower shortage has been a longstanding issue in the industry and recruitment and retention of qualified seafarers is a big concern of ship managers. Consequently 'poaching' of seafarers is not uncommon in the industry (Leong, 2012). In this context, threatening employment termination is unlikely to be a common strategy that managers would use to discipline seafarers.

As mentioned in the introduction, this article will examine indicator-based reporting practices in Chinese shipping. Considering the research on fear, power and OHS reporting in the maritime industry, this article contributes to this literature by providing a close examination of crew reporting practices in the Chinese context. It seeks to better understand crew reporting by exploring a broad range of factors that contribute to under-reporting, which is supposed to be properly addressed by shipping companies as well as the international shipping industry.

## The case studies and research methods

The research consisted of case studies of two Chinese chemical shipping companies. Both companies are located in the Yangtze delta area in China. Company 1 (C1) is dedicated to oil and chemical transportation. It was established in 1994 by its Group Company. By 2017, the company had 16 special cargo carriers, among which 11 were chemical tankers. C1 has had its OHS management system in place since its establishment. The system was named the *Quality, Safety and Environment Management System* (QSEMS), in line with the *ISM Code*, *National Safety Management (NSM) Code*, ISO 9001: 2000 and ISO 14001: 2004. In addition, the system considered the standards from OHSAS18001 (*Occupational Health and Safety Assessment Series*), TMSA (*Tanker Management and Self-Assessment Guide*) and VIQ (*Vessel Inspection Questionnaire*). The QSEMS is regarded as a 'statutory document' in which the company's OHS management policy, corresponding objectives and management commitment are clearly stated. In order to quantify and measure the achievements of its safety policy, the company accordingly laid down detailed objectives. In line with each of these objectives, there was an affirmative statement or numerical value attached for the purpose of measurement and assessment (See Table 1).

**TABLE 1**  
**The Objectives of OHS Management (C1)**

<b>Safety Objective</b>	No significant accidents, aiming at zero accidents and zero pollution
<b>Health Objective</b>	Rate of casualty is zero; work-related injury $\leq 1$
<b>Inspection Outcome Objective</b>	Rate of ship detention by PSC <sup>1</sup> : zero; rate of passing oil majors inspection: 90%
<b>Ultimate Objective</b>	To achieve zero accidents, zero pollution through thorough implementation of the OHS management system

1 Port State Control.

TABLE 2  
The Objectives of OHS Management (C2)

Health Index	Personal casualty rate: LTIF <sup>1</sup> ≤2.0; TRCF <sup>2</sup> ≤4.0
Safe Operation Index	Average Loss: no occurrence of average level accidents; minor incidents ≤ 2/Annum  Machine Damage: no occurrence of average level accidents; minor incidents ≤ 2/Annum
Environmental Protection Index	No occurrence of average level pollution accidents; minor incidents≤ 2/Annum
Safety Inspection Index	PSC/FSC <sup>3</sup> detention rate: zero; industrial inspection pass rate: ≥90%

- 1 Lost Time Injury Frequency.
- 2 Total Recordable Case Frequency.
- 3 Flag State Control.

Company 2 (C2) was established in 2004. It operated 19 chemical tankers in 2017. The company’s management system was named the *Quality and Safety Management System* (QSMS). The company has passed the ISM as well as NSM verification. Similar to C1, this company broke down its general policy statement into quantified annual objectives. The objectives, illustrated in Table 2, are extensions to the original statement.

In C1, the crewing company of the Group Company was in charge of making crewing arrangements. The majority of crew signed long-term contracts with the company. The average working period on board was between 6 and 9 months. In C2, the crew department was in charge of crew recruitment from the domestic seafaring labour market. Most of the crew signed short-term contracts with the company, and only 15 percent of them had long-servicing contracts (usually 3 or 5 years). Both companies’ fleets were mainly registered in China. The major trading areas for both companies were in the western Asia Pacific region, and a few large ships were operated globally. Both companies adopted an index-based approach to OHS management and the objectives of the management have been quantified accordingly. They were referred to by the management at regular intervals and further compared with actually reported cases in order to measure the quality of their OHS management.

In line with the common practice of case studies (Yin, 2009), this research took a qualitative approach in order to achieve an in-depth understanding of the issue. The field work included one researcher’s visits to two companies’ offices and sailing with four of their chemical tankers (two tankers from each company) for four short voyages. The study mainly used semi-structured interview



techniques. In total, 55 interviews with crew were conducted in Chinese during the research voyages. Afterwards, they were all translated and transcribed into English for the convenience of data analysis. The field work also included the observation of crew's daily work activities, informal chatting with them on various occasions and analysis of collected documents in relation to this study. The ethical approval for conducting the research was granted by Cardiff University. Various sources of data were merged in this study. However, prior to such integration, analysis of individual data sources was carried out and key concepts were highlighted in the text. Then, the Nvivo software was used to assist data coding and in-depth analysis. As a result, some of the common themes in relation to this study were identified. In general, the results showed a significant gap between what is required and what really occurs in terms of crew safety reporting. These results are now presented.

### **Similar understanding, inconsistent behaviours**

The safety management policy and objectives were required to be posted on public areas on board ships of both companies. The crew members on board the four ships demonstrated a clear understanding of safety reporting policy. Also, they were aware of the general principle of reporting practice, i.e. 'seeking truth from the fact'. According to the requirements of the management systems of both companies, crew safety reporting covered a wide range of OHS management activities. Each of the crew members on board a ship was obliged to report safety-related events to the shore management no matter how minor they were—even if they were 'pins' or 'wires' for fixing or lashing a lifeboat, as long as they had implications for improving shipboard work safety. For example, a junior engineer said:

According to the requirement (of the management system), even a tiny problem should be reported. Even if it had occurred today, and would be repaired tomorrow, it should also be written and reported.

In general, the importance of making such reports was acknowledged by the crew members during the interviews. Another junior engineer gives the following statement:

The report must be made. Self-inspection reports must be made regularly. If you don't have any deficiencies to report, is it realistic?

Self-inspection was one of the major OHS management activities on board of a ship. The inspection result should be reported to the shore management at regular intervals. The crew more or less understood that there were certain safety-related problems on board a ship. In a few cases, it might be that there were no deficiencies to be identified, but that did not mean that the ship was perfect:

If you cannot find out the problems yourselves, it doesn't mean you are 100 percent perfect. If you dared to claim so, the shore management would come to assess and inspect ... to see whether you actually were 100 percent safe. (A bosun)

Thus, a lack of any report of safety issues was construed as a crew's failure to identify safety-related problems, which further pointed to their incompetence regarding on board safety management.

While the need for safety reporting was understood by the crew members, in practice, it was found that they behaved in a different way and, as a matter of fact, OHS-related problems were not fully reported. The interviews with the crew members showed that a significant number of them showed a relatively conservative attitude—only a few of them were willing to participate in voluntary reporting. For the lower-ranking crew, they showed a significant disinterest in reporting. They thought it was unnecessary to make such reports:

The reporting is done by the captain. Whether he reports to the shore management, it's up to him. The lower-ranking crew would not make a report. It's unnecessary to talk about this. It has nothing to do with my job. (A motorman)

This motorman thought the reporting was done mainly by senior officers and so it was irrelevant to his work. Another rating also showed an indifferent attitude towards reporting near misses:

The near miss ... It didn't have any real consequences. We feel it has passed and there is no need to report it. What is it for?

The research by Bailey *et al.* (2007) identified different levels of risk perception in the maritime industry, and lower-ranking crew also showed a lower level of risk perception. Regarding the officers, they were supposed to be more active and were obliged to submit reports. The data, however, suggested that voluntary reporting was also rare among them in both companies. A captain described the gap between what the shore management expected and what the crew actually thought:

It is very likely they will not submit a report. They (shore management) are leaders and they want to know everything about us: "Don't hide anything!". But it is difficult to do as they wish.

As mentioned above, a lack of safety-related reports was not acceptable. However, as a practical solution, some crew members commented that the reporting could be done in an alternative way. For example, a chief officer said:

We had certain considerations. The ship could not report all the issues to the shore management. Also, the ship could not report nothing. (As a solution), some innocuous cases can be reported.

The interview data indicated that innocuous cases referred to issues of less significance to the OHS management. One second officer explained:

Sometimes, if it is hard to find anything, I just randomly write something unimportant, for example, I find something that is going to expire.

Unsurprisingly crew members, particularly senior officers, would take “deliberate considerations” prior to making reports to the shore management. One captain talked about the “principle” that guided his reporting:

Basically for us, the principle of reporting is to report only the good and not the bad, to avoid critical points and to dwell on the trivial.

## Concern self, concern others

In light of this study’s results, the question emerges, why did crew members under-report OHS incidents? A straightforward response here is to note that safety reporting was significantly affected by individual crew members concern about their self-interest. For example, the interviews suggested that crew perceived that incident reporting could adversely affect management’s impression of their performance. If many nonconformity cases were reported by a ship, the management might think that the ship’s leaders were not good:

If you reported many, the shore management would have second thoughts. They would think that your ship had safety problems and the ship’s leaders were not good enough.  
(A second engineer)

From the crew’s perspective, the reporting could imply that their safety management on board had problems, and accordingly, would be perceived negatively by shore management. Thus, crew members were sensitive about the reporting.

The research further found that safety reporting could affect crew’s income. In C1, it was called “performance pay”, while in C2, it was called “safety bonus”. The reported items would be assessed by the shore management as evidence for determining payment. One captain mentioned that there were often deductions from his salary by his company:

Now it is tricky. If a problem was reported, my money would be deducted. Personally, my salary was often docked by the company.

The quote showed that the reporting was closely related to crew’s income, which is likely to affect the crew’s willingness to making reports. Apart from this, it was found that the reporting could affect their prospects of promotion. In order to be able to be promoted to a higher position, a crew member’s certificate upgrading exam needed to be arranged by their company. This is particularly the case in C1 where most of them had long-term contracts. The arrangement would prioritize those whose performance was assessed as good by the shore management. The reported cases were a key indicator of a crew member’s performance. For example, a second officer said:

If your work was not done well and reported, this would affect the company's consideration for the arrangement of your license upgrading exam ... affect your promotion. They are all relevant.

More directly, the impact of a crew member's job arrangement was also significant. For instance, a chief engineer gave the following reason:

If a senior officer does not perform well, it is impossible for him to be promoted to captain or chief engineer. A superintendent can decide that a person cannot be a captain on the ship supervised by him. He has this power, since it involves shared responsibilities.

The implication is that a superintendent had the decisive power over the appointment of a crew member, particularly a senior officer. This means that even if a chief officer gained a captain's qualification, he might not be able to be appointed to a ship as a captain supervised by a superintendent who disliked that person or distrusted his capability.

As soon as a case report, particularly a near miss, was received by the shore management, it would be assessed by the managers in both companies. If the result of the investigation was judged as valuable for improving a ship's safety, it would be circulated among the company's fleet. Although this was done in an anonymous way, the person who caused it could be easily identified by his fellow colleagues. For example, a second engineer expressed his worry about the potential impact on his personal reputation:

Even though the person's name is not mentioned, other colleagues could know by guessing, since they would know who the second engineer is on that ship. It causes a bad impression on the person.

The importance of reputation at work for Chinese people has been highlighted in the literature. This issue is seen as a salient feature of Chinese culture (Fang, 1999; Lu, 1991). Typically, in a particular group or unit, it is acceptable to give voice to positive news to outsiders whereas this is not the case for negative news. In a similar vein, loss of face on the part of a person reporting a problem with safety protocol, particularly in the eyes of colleagues, prevents crew being willing to report an incident or potential problem.

Apart from the above-mentioned points, the study further revealed a strong presence of solidarity on board ships, which meant that the crew members on the same ship tended to protect each other. Therefore, senior officers would think twice about whether to report certain cases or not when such cases would implicate their colleagues. For example, a chief engineer expressed his concern regarding younger crew members:

The young men ... they are very good usually. One might show dangerous behaviour due to carelessness. I met this situation on this ship. Should I kick him out? Then how

should I deal with it? Try my best to remedy the situation, rather than something else (reporting).

This description showed a strong sense of solidarity among Chinese crew members. As they worked together on the same ship for a prolonged period, the crew believed that harmonious relationships were in everybody's interest and the reporting could result in tensions, which were not good for safety either.

In addition, one of the major concerns for the shore management was the need to pass external inspections. The self-reported deficiencies would be easily observed by an external inspector, which could lead to further enquiry into the deficiencies. In this case, not only would the relevant crew members interests be affected, but also the ship might be ordered to take remedial action, or even be detained, in which case the ship's sailing schedules, as well as its owner's reputation, would be negatively impacted. Also, such delays could unsettle bottom-line orientated management and further lead to investigatory and disciplinary actions against relevant crew. Under such a circumstance, a senior engineer felt he was placed in a dilemma about whether a problem should be reported:

If a problem was reported, you knew it was wrong and you didn't solve it ... not only would the crew be in trouble, but also the company would be in trouble. It was very easy to be identified by inspectors.

Thus, it could be seen that recording deficiencies could affect an inspector's judgement of a ship's OHS management status. For the purpose of protecting crew themselves, as well as their companies, some cases were intentionally excluded from the reports.

As a consequence, and in order to avoid trouble, a crew's pre-communication with shore management was usually seen to be an initial step before a formal written deficiency report was sent. The reporting would be 'advised' by the manager or superintendent responsible for that ship regarding what and how to report. For example, a chief officer described the issue as follows:

Sometimes, the superintendent wants you (crew) to report by telephone; sometimes, he wants you to report by written (report). If you (communicate) through a written report directly, it's very formal. This might not help us. So we would make a telephone call to him to report in advance in order not to annoy him.

## **Compulsory reporting, limited role**

In parallel with reporting safety-related problems, reporting near misses received equal emphasis in this study, since a near miss case could have the same underlying causes as an accident. In C1, the report was requested as soon as a near miss was identified on board; while in C2, there was a compulsory

requirement that at least two near misses be reported every month. Meanwhile, the management systems of the two companies specified that the reported cases should not be repetitions of those that had been reported previously from any of the ships. The reason was that all ships had been informed of those cases, and the repeated reporting meant a lack of care regarding the company's notifications, which equally meant the lack of a sense of responsibility. For instance, a chief officer said:

All the near misses that have been reported previously should not be repeated. If it has occurred once and it occurs a second time, then it proves that your (ship's) management was not good.

The recurrence of a particular case could signify a vulnerability that was more likely to cause an incident or accident. Discouraging the reporting of such cases could result in the company missing valuable data. As a result of such discouragement, a captain commented that they faced a dilemma:

Generally, the number of reportable near misses was reduced. We have almost finished reporting whatever we are able to think of, because we should not repeat the mistakes we have made previously.

In order to deal with this dilemma, the crew members described their strategies, among which the following one was typical:

We have to submit a report even if there are no such cases. What should we report if there are no such cases? (As a result), the only way is to imagine something... (A chief officer)

In general, the response of the crew members on two ships in C2 showed that they did not take this requirement seriously in their work practice. During the field trips on board ships, some near misses were observed and noted down in the field notes:

It was a fine day sailing at sea. I participated in the crew's tank washing work. I saw deck ratings wearing only common yarn gloves. The washing required crew members to go down to the bottom of the tanks, which were more than 10 metres high, but they did not wear any protective apparatus. I could feel the pesticide-like smell from time to time...

However, these safety issues, which occurred in crew's day-to-day operations, were not reported to the shore management. Rather, 'self-digestion' was referred to by some crew members in dealing with safety-related problems on board ships, which meant that they might not report a problem until a significant consequence occurred. For example, a chief officer said:

It was rare (to report). If you reported (it) to the shore management, it would cause trouble. Usually, it would be digested on board unless it caused serious consequences.

Under such circumstances, 'self-digestion' of problems only meant that crew were aware of them and managed to deal with them on their own. It never meant an appropriate solution to the problems in the absence of substantial management support. As a consequence, some of them remained unresolved and could pose significant threats to crew's OHS as well as their working conditions.

## Fluid service, less caring

It is a common practice in shipping that ships are operated by fluid crew members, which means that they are not fixed to any particular ships but serve different ones for their next contracts. Such fluidity weakens the willingness on the part of crew members to report incidents. As stated previously, in C2, the majority of the crew members were employed on short-term contracts. They seemed reluctant to report incidents. For example, one senior bosun reflected on his thirty years of seafaring experience and said:

I met many occasions of near misses. In general I would not report. We are the free-lance seafarers. I worked in this company today, but I would leave it some day. Why should I care about it? It would not be reported until there is an accident.

In C1, although the crew members were likely to be employed on long-term contracts, they might not return to the same ships after their shore leaves. This also made crew members in C2 unwilling to report incidents. For example, a third officer from C1 said:

If you were only on board for a few months, you reported this and that, wanting to change everything, and then you were going to leave ... many people don't want to do it like that. Next time, I might change to another ship. I would not go to this ship again.

Therefore, although the crew members in both companies had differing contractual terms and conditions, there was no significant difference between them in terms of the practice of safety reporting. In general, the fluid nature of the crew's employment affected the crews' motivation to make safety-related reports.

## Conclusion

It has been argued that OHS indicators can be useful tools to manage and improve OHS as they are not only easy to measure but also provide valuable data for cross-time and cross-department comparisons (Armstrong and Armstrong, 2008; Hopkins, 2009; Wokutch and VanSandt, 2000). Employee reporting is at the heart of any OHS management system based on indicators.

However, under-reporting poses a challenge to the validity and usefulness of such indicators (Azaroff *et al.*, 2002; Hopkins, 2009; Nichols and Tucker, 2000; Shaw and Blewett, 2000). In this context, it is necessary to develop a good understanding of the role of OHS indicators in signifying the quality of OHS management and the reasons behind under-reporting so that strategies or policies could be designed to better contain the problem and to make the use of indicators more robust.

Building on the previous research on why crew members do not report (Bhattacharya, 2012; Kongsvik *et al.*, 2012; Lappalainen *et al.* 2011; Oltedal and McArthur, 2011; Van Der Schaaf and Kanse, 2004), this study reveals a number of economic and social factors that explain why they were reluctant to report. In line with the outcome of previous research both in the shipping industry and some other safety-critical industries (e.g. Azaroff *et al.* 2002; Bhattacharya, 2011 and 2012; Bhattacharya and Tang, 2013; Nichols and Tucker, 2000; Probst and Graso, 2013), the study indicates that one of the major factors was the concern for their self-interest, which included their income, future promotion, job insecurity, etc. As the breadwinner of a family, an employee's economic concerns may override their concern for OHS (Levenstein and Tuminaro, 1997).

Largely, crew concern for their self-interest mainly originated from management's power over their performance evaluation, as was shown in the data. It was pointed out that the division of labour in an organization leads to power differences between management and employees (Pfeffer, 1992). In a shipping company, shore management, situated at a higher hierarchical level, is entitled to exert dominant power over the shipboard OHS management practice and crew's employment. In both companies, the managers had decisive power on the appraisal of crew's performance as well as the appointment of individual crew, particularly those of senior ones. In this context, being evaluated by one's employer as a good performer was very important for individual crew, since it was closely linked to promotion and job security. Situated in such power relations, crew also tended to protect themselves and their colleagues and tried not to offend managers. In general, this perception of the presence of management's dominant power over ship management and crew performance could not be helpful in facilitating crew safety reporting that was conducive to the improvement of workplace OHS management.

As a complement to the previous research, this article also revealed a number of social factors. The study showed that reputation, solidarity among crew, and the fluidity of crew's employment, all contributed to under-reporting. The first two may be more salient in Chinese culture (Fang, 1999; Lu, 1991). However, they are unlikely to be exclusive to Chinese culture, saving or losing face and solidarity are concepts also known in other cultures (Bhattacharya, 2012; Rossignol,



2015). In addition, fluidity of employment is certainly a common practice in the shipping industry. Therefore, these findings are helpful for those who employ crews and operate ships globally.

The economic and social factors identified in this study contributed to under-reporting as well as biased reporting. Given the mandatory requirements of safety reporting, in particular the near-miss reporting, the requirements could not make any noticeable improvement, and crew reporting practices remained unchanged. Thus, the shore management's evaluation of the paper logs reported by crews was of limited value for OHS management on board ships. Accordingly, crew safety reporting practices revealed the limited role of OHS indicators, which undermined the value of OHS management.

Both under-reporting and biased reporting threaten the validity of OHS indicators. From the perspective of shipping companies, if employers are serious about using OHS indicators as a tool to manage and improve safety, they should be aware of the underlying influential factors that affect crew safety reporting, and address them properly. From the perspective of academic as well as industrial researchers who use OHS indicators to evaluate the outcome of the OHS management of shipping companies or the shipping industry, they may need to exercise caution in interpreting such data.

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## SUMMARY

### Occupational Health and Safety Indicators and Under-Reporting: Case Studies in Chinese Shipping

An index-based approach to indicate the outcome of Occupational Health and Safety management has been commonly used in the implementation of the *International Safety Management Code* and the operation of Occupational Health and Safety management systems in the international shipping industry. Although the index-based approach is asserted to be a convenient way to measure and quantify the outcome of Occupational Health and Safety management, it is not justified in the wider literature and further empirical research is suggested by various authors. The aim of this study is to explore the role of an index-based approach in managing Occupational Health and Safety in the shipping industry.

This article investigates the effectiveness of indicators in Occupational Health and Safety management in two Chinese chemical shipping companies. A qualitative approach is applied to examine the views of seafarers on safety reporting practice. The study reveals that, although the need for reporting is understood by most of the crew members, the reporting practice is significantly affected by different factors such as the crew's concerns for their own interests, Chinese cultural factors and management's dominant power over the crew's performance evaluation. The findings suggest that there is a significant gap between what is required by the rules and what really occurs in terms of safety reporting practice. The study highlights the emerging problems of using Occupational Health and Safety indicators as benchmark for measuring the outcome of Occupational Health and Safety management in Chinese shipping. The conclusion is drawn in a Chinese context, and although the findings may not be similar to other industries or the shipping industry in other countries, they provide valuable indications for re-thinking and re-shaping maritime regulatory strategies.

**KEYWORDS:** Occupational Health and Safety management, OHS indicators, case study, under-reporting, underlying factors.

## RÉSUMÉ

### Indicateurs en santé et sécurité au travail et sous-déclaration d'incidents: études de cas dans les transports maritimes chinois

Dans l'application de l'actuel *Code international de gestion en matière de sécurité*, ainsi que dans l'opération des systèmes de gestion en santé et sécurité au travail dans l'industrie du transport maritime international, il est habituellement fait usage d'une approche basée sur des indicateurs pour faire part des résultats en gestion de la santé et de la sécurité au travail. Bien qu'une telle approche soit considérée comme un moyen pratique pour mesurer et quantifier les résultats de la gestion en santé et sécurité au travail, elle n'est pas supportée dans la littérature en général et divers auteurs ont suggéré de mener des recherches empiriques supplémentaires sur le sujet. Le but de cette étude est d'explorer le rôle d'une approche par indice dans la gestion de la santé et de la sécurité au travail dans le secteur du transport maritime.

L'article examine l'efficacité d'indicateurs de gestion en santé et sécurité au travail dans deux entreprises chinoises de transport maritime de produits chimiques. Une approche qualitative est utilisée pour examiner le point de vue des marins sur la pratique en matière de déclaration d'incidents se rapportant à la santé et la sécurité au travail. L'étude révèle que, bien que la plupart des membres d'équipage comprennent le besoin de rendre compte d'incidents, la pratique en matière de déclarations d'incidents est affectée de manière significative par différents facteurs tels que les préoccupations des membres d'équipage envers leurs propres intérêts, des facteurs propres à la culture chinoise et le pouvoir dominant de la direction sur l'évaluation de la performance de l'équipage. Les résultats suggèrent qu'il existe un écart important entre ce qui est requis par les règles et ce qui se passe réellement en pratique en matière de déclaration d'incidents. L'étude met en évidence les problèmes émergents liés à l'utilisation d'indicateurs en santé et sécurité au travail en tant que références pour mesurer les résultats de la gestion de la santé et de la sécurité au travail dans les transports maritimes chinois. Cette conclusion reste toutefois valable dans le contexte chinois et, bien que nos résultats pourraient ne pas s'appliquer au cas de d'autres industries ou à l'industrie du transport maritime dans d'autres pays, ils fournissent de précieuses indications pour repenser et remodeler les stratégies de réglementation maritime.

**MOTS-CLÉS:** gestion de la santé et de la sécurité au travail, indicateurs de SST, étude de cas, sous-déclaration, facteurs sous-jacents.

## RESUMEN

### Indicadores de Salud y seguridad ocupacional y declaración subestimada de incidentes: estudios de caso en los transportes marítimos chinos

En la aplicación del Código internacional de gestión en materia de seguridad vigente así como en la operación de sistemas de gestión en salud y seguridad ocupacional en la industria del transporte marítimo internacional, se acostumbra utilizar un enfoque basado en indicadores para indicar los resultados en gestión de la salud y seguridad ocupacional. Aunque dicho enfoque sea considerado como un medio práctico para medir y cuantificar los resultados de la gestión en salud y seguridad ocupacional, el no encuentra fundamento en la literatura general y diversos autores han sugerido de realizar investigaciones empíricas suplementarias sobre el sujeto. El objetivo de este estudio es de explorar el rol de un enfoque por índices en la gestión de la salud y seguridad ocupacional en el sector del transporte marítimo.

El artículo examina la eficiencia de indicadores de gestión en salud y seguridad ocupacional en dos empresas chinas de transporte marítimo de productos químicos. Se utiliza un enfoque cualitativo para examinar el punto de vista de los marinos respecto a la práctica en materia de declaración de incidentes relacionados a la salud y seguridad ocupacional. El estudio revela que, a pesar que la mayoría de miembros del equipaje comprenden la necesidad de rendir cuenta de los incidentes, la practica en materia de declaraciones de incidentes está afectada de manera significativa por diferentes factores tales como las preocupaciones de los miembros del equipaje respecto a sus propios intereses, factores propios a la cultura china y el poder dominante de la dirección sobre la evaluación del rendimiento del equipaje. Los resultados sugieren que existe una brecha importante entre lo que requieren las reglas y lo que realmente ocurre en la práctica en materia de declaración de incidentes. El estudio pone en evidencia los problemas emergentes vinculados a la utilización de indicadores en salud y seguridad ocupacional como punto de referencia para medir los resultados de la gestión de la salud y seguridad ocupacional en los transportes marítimos chinos. Esta conclusión es válida en el contexto chino y, aunque nuestros resultados podrían no aplicarse al caso de otras industrias o a la industria de transporte marítimo en otros países, la conclusión conlleva implicaciones preciosas para repensar y remodelar las estrategias de reglamentación marítima.

**PALABRAS CLAVES:** gestión de la salud y seguridad ocupacional, indicadores de salud y seguridad ocupacional, estudios de casos, declaración subestimada, factores subyacentes.