Near-miss Reporting as Seen from Seafarers' Perspective

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ABSTRACT: The maritime industry is a high-risk sector, and there is a large number of accidents its stakeholders need to reduce. Lessons learned from the near-miss analysis can prevent accidents and improve safety in the maritime sector. However, to be able to accomplish this task, near-miss events have to be identified and reported. Identification and reporting are dependent on seafarers. If they cannot identify or are unwilling to report a near miss, there will be no analysis, and valuable knowledge will be lost forever. Seafarers' knowledge, attitudes, and opinions on near-misses are important factors in determining the near-miss management system's effectiveness. The authors created a survey to gain insight into these factors. A total of 223 experienced seafarers participated in the survey. The results confirmed that near-misses are underreported and that seafarers do not report every observed near-miss because of reporting barriers. This paper reflects seafarers' perceptions of near-miss reporting and suggests measures to overcome reporting barriers.

1 INTRODUCTION

Although the maritime industry continuously develops and introduces new technologies and systems that increase ships' safety, accidents at sea are still happening. Marine accident is an extraordinary unintentional sequence of events that caused adverse outcomes that put human lives, property, and the marine environment in direct distress. Unlike accidents, near-miss could have caused harmful consequences for human lives, property, and the marine environment but did not [15, 16]. The adverse outcome was only inhibited by a fortuitous break in the chain of events. Injuries, marine pollution, or a negative business impact are examples of negative consequences of a near-miss that did not occur [10, 16, 22, 36]. A near-miss might include inadequate training, human error, defective or unsatisfactory design, management error, a flawed procedure or system, an unanticipated outcome, or any combination of the above [10].

The maritime sector is considered a high-risk sector, and its stakeholders need to minimize accident risks. Marine accidents are investigated and analyzed to discover immediate and root causes and implement corrective measures to reduce accidents. It presents an active approach in an attempt at accident reduction [14]. Nevertheless, lessons learned are based on accidents that have already occurred. Another tool for accident prevention is the implementation of an effective near-miss management system [14]. Near-miss reporting is the best practice in safety awareness, and it helps to identify hazards that may be caused by specific equipment or actions before they lead to an actual accident. Recurrence of accidents and near-misses that share root causes can be prevented by reporting them and implementing adequate corrective measures. Lessons learned from near-misses can be

used to prevent potential accidents [30]. Because near-misses are considered accident precursors, the near-miss analysis presents a proactive approach to reducing accidents [13]. Near-misses could be studied as leading indicators of a company's safety performance [39].

Many researchers dealt with near-miss reporting of near misses in the shipping industry. Erdogan [11] pointed out the best near-miss reporting systems and defined obstacles affecting a reduced number of reports. In his research, he assumed that near-misses in the shipping industry are not reported as they should and tried to find the reasons for this. The companies surveyed succeeded in increasing their safety levels and implementing a just culture through open communication onboard ships and learning from analyzed near-misses. Storgard et al. [33] argue that it is possible to prevent severe accidents by implementing lessons learned from the analysis of accidents and near-misses. The study aims to highlight best practices for near-miss reporting and better use of reported near-miss data. Preconditions for a functioning reporting system were defined, namely: the presence of a just culture, the commitment of management ashore to improve safety, adequate communication, feedback on reporting, and training on the use of the system. Oltedal & McArthur [26] analyzed shipboard reporting practices and singled out factors influencing reporting frequency. The research findings confirmed that higher reporting frequency was positively related to increased safety-related training, trusting relationships between crew members, safety-oriented shore management, and feedback on reported near-misses, and negatively related to lack of shore management safety attention and the demand for efficiency. Georgoulis and Nikitakos [12] interviewed 35 seafarers and four representatives of shipping companies' safety departments to uncover best practices in reporting near-misses. In addition, they aimed to investigate the seafarers' perspective on reporting near-misses. Some of the conclusions were that seafarers perceive reporting as an obligation to the legal framework and consider a just culture as a promoter of near-miss reporting instead of the blame culture. Bhattacharya in [5] analyzed the effectiveness of increased reporting of hazards, near-misses, and incidents onboard ships. He tried to investigate whether the increased number of hazardous occurrences reports results in a decrease of incidents/accidents at sea. Research results showed that an increased number of reports did not decrease near-misses or incidents/accidents. He concluded that the increase of reports to satisfy company requirements reduces the value of reporting process.

Previous research shows that specific elements either enhance reporting or hamper it and act as an obstacle. Another serious problem is that near-misses are underreported, resulting in the loss of valuable data. Although most companies have written near-miss management procedures, it has also been shown that they did not help to improve reporting practices onboard ships [28, 29, 36]. Seafarers have not adopted near-miss reporting well despite IMO recommendations and company policies requiring reporting. Indicators of the inadequate near-miss management system are [32]:

– Seafarers take reporting as a standard checklist,
– There are many insignificant reports,
– Seafarers feel that safety cannot be improved by reporting,
– Fear of punishment for reporting,
– Seafarers see reporting as unnecessary extra work.

Another practical problem is the unwillingness of lower-ranking crewmembers to report [32, 33]. It is a serious problem because they carry out most of the physical job onboard during which near-misses occur [16]. Some seafarers stated that they do not have time to report and that the ship's officers should do it. In their opinion, too many "minor" near-misses happen every day during everyday tasks, and it would take too long to report them all. Some lower-ranking seafarers believe that reporting is not part of the maritime culture, and therefore do not do it. Some of the reasons why lower-ranking crew members usually do not report are ignorance of the near-miss concept, fear of blame and punishment, cultural differences, and the complexity of the near-miss report form [14, 20].

Reporting near misses, analyzing them, and implementing appropriate corrective actions will prevent severe accidents and other adverse events in the future [8, 18, 35]. ISM Code (Section 9) requires reporting accidents and near- misses to determine the root causes [16]. However, there is inconsistent approach and analysis and inadequate reporting and investigation of near-misses in the maritime industry. It is up to ships' masters and shore-based management to improve the reporting of every actual near-miss because, as can be seen from the available literature [14, 28, 29, 36], seafarers do not report all the near-misses they observe. It is necessary to find appropriate solutions and implement them in the Safety Management System (SMS). Reporting is of utmost importance to analyze and learn lessons from near misses.

Since reporting near-misses is a proactive approach to reduce accidents and is much cheaper than reporting accidents because no harm has been done, it can be considered a cost-effective and appropriate tool to improve safety at sea [14]. For the adequate implementation of near-miss reporting in the maritime industry, it is crucial to gain insight into seafarers' opinions and attitudes on near-miss reporting as they are the ones who report, and based on this, corrective measures are derived and new knowledge is gained. The purpose of this paper is to analyze seafarers' knowledge, opinions, and attitudes on near-miss reporting, identify the most common barriers to reporting, and propose measures and solutions that could improve near-miss reporting systems in the maritime industry. The research instrument was a survey.

2 METHODOLOGY

The authors prepared a survey based on their expert opinions and literature review. The analysis of the data obtained was to reveal the seafarers' views on near-miss reporting in the maritime industry. The authors served as senior officers on several types of

ships and dealt with near-miss reporting system during their service. A tool used to validate the survey questions was the expertise of the authors. All questions were worded as neutrally as possible to avoid stereotype bias. A pilot survey was conducted prior to administering the final survey to avoid response bias. The authors contacted several crewing agencies and requested them to share a link to the online survey to their employees to redistribute to other seafarers. The survey was available online, and the authors used a virtual snowball method. Seafarers were free to choose whether or not to participate in the survey. The survey was anonymous and confidential to avoid biased participation.

The survey included 45 questions to gain insight into seafarers' opinions and attitudes on near-miss reporting, shipboard reporting practices, and opinions on the suitability of applied near-miss management systems. A total of 28 questions (7 demographic questions and 21 questions from the second part) out of the 45 are used in this study because they are closely related to the study's topic. The survey questions were predominantly closed-ended: demographic questions, simple yes/no/I do not know questions, and ranking questions (measured on a five-point Likert scale). Open-ended questions were used when asked to define near-miss and for comments on the survey.

A total of 223 seafarers responded to the survey. There were 15 nationalities represented, the majority being from Croatia (73.4%), followed by Indonesia (12.1%) and the Philippines (4.3%). There were 69.5% of seafarers under 42 years of age. A total of 57% of the respondents reported being educated at a maritime college, and 78.4% of them served at sea for more than five years. Senior ranking officers made just over 50% of the respondents. Respondents served in different shipping sectors, including tankers, cruise ships, bulk carriers, and container ships.

The survey is part of a doctoral research project looking at improving the safety culture in shipping by implementing a near-miss management system.

3 SURVEY RESULTS AND DISCUSSION

The authors grouped the survey questions to facilitate understanding and presentation of the results. Knowing the definition of a near-miss is a prerequisite for identifying it. If there is no identification, there is no reporting, and without it, there is no analysis and lessons learned. The survey question "What is a near-miss?" (Q1) was the only one that stood on its own. A total of 22% of responses were acceptable (definition described or recounted). From the further analysis of the question data, conclusions that lower-ranked seafarers were unaware of the definition of near-miss could be made. Instead of defining a near-miss, they gave an example from practice closely related to their work aboard a ship. These seafarers would most likely not be competent to recognize the near-miss event if it had happened in another ship's department.

In addition to knowing the definition of near-miss definition, seafarers should also know about their ship's near-miss management system. Knowledge of

near misses includes questions about the "why," "how," "when," and "outcome" of reporting, as well as how to conduct training on near-misses. A group of questions on knowledge about management of near-misses on respondents' ships is shown in Table 1.

Table 1. The knowledge about the near-miss management

Question No.	
Q2	Are you familiar with Near-miss Management System in your Company?
Q3	Have you received any Near-miss Management training?
Q4	Do you think that Near-miss management training should be mandatory?

Descriptive statistics on knowledge of near-miss management onboard participants' ships is presented in Table 2.

Table 2. The knowledge about the near-miss management – descriptive statistics

Question No.	Yes (%)	No (%)	I do not know (%)
Q2	94.6	2.7	2.7
Q3	60.8	37.4	1.8
Q4	62.6	28.8	8.6

As shown in Table 2, many respondents believe that they are aware of the systems in place to manage near-misses on their ships (Q2), and more than half of them have received training on near-miss management and believe that such training should be mandatory (Q3 and Q4). One respondent made the following comment: "Reporting and analyzing near-misses onboard is essential to improve safety culture onboard but for reducing the number of incidents more critical is proper education and shore-based training as well as common sense."

Seafarers' attitudes towards reporting are a key indicator of whether reporting is working properly onboard a ship. A group of questions on attitudes towards near-miss reporting is shown in Table 3, and descriptive statistics are shown in Table 4.

Table 3. Near-miss reporting attitude

Question No.	
Q5	Do you think that near-misses should be reported?
Q6	Have you ever reported a near-miss?
Q7	Do you regularly report near-misses?
Q8	Do you report every near-miss that you see?
Q9	Do you think that near-miss reporting is just additional paperwork and that it should be avoided to report near-misses?

Table 4. Near-miss reporting attitude – descriptive statistics

Question No.	Yes or 1 (%)	No or 2 (%)	I do not know or 3 (%)	4 (%)	5 (%)	Mean	Std
Q5	95.5	3.6	0.9				
Q6	82.9	17.1					
Q7	61.7	36.5	1.8				
Q8	38.5	59.7	1.8				
Q9	42.8	28.4	20.7	4.5	3.6	1.98	1.07

Q5 through Q8: yes, no, I do not know. Q9: 1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, and 5=strongly agree.

A large number of participants (95.5%) believe that near-misses should be reported, but only 38.5% of them report every observed near-miss, which corroborates the results of the literature reviewed and implies that a large number of near-misses are not reported. It could be concluded is that seafarers have realized the importance of reporting near-misses but do not report every near-miss they observe due to various reporting barriers. One seafarer commented as follows: "I think that significant near-misses and accidents must be reported to the company. Minor near-misses should be discussed only onboard the vessel, not send to the company. Because they do not report their near misses to us, neither should we to them".

Knowing the definition of near-miss is a key factor in the reporting culture aboard a ship. If a crewmember is not familiar with the definition, he will not know what a near-miss is, so he will not report it or possibly report something that was not a near-miss. For the system to be effective, all crewmembers must be familiar with the definition of near-miss and other reporting concepts. The survey results confirmed that only a minority of the seafarers surveyed could define near-miss, but most believe they are well versed in the near-miss management system. One solution is to include the definition and management of near-misses in the maritime students' education and the shore- and ship-based training of existing seafarers. Good knowledge of the subject would significantly increase reporting behaviour and awareness of the importance of near-misses onboard ships.

A report form is a means of reporting near-misses. It can be in paper or electronic form. According to some research [25], it is not only easier for seafarers to report by computer, but it is also easier to check feedback on the report [7]. However, some seafarers have difficulty using computers, so it is easier for them to prepare and check reports and feedback in paper form [11]. The report form must contain all the essential data about the near-miss event as its content is crucial for root cause analysis. In preparing a report form, the company must make the following efforts [38]:
–   The forms should be easy to read and understand,
–   The company should provide multilingual forms if required,
–   The report forms should be short and straightforward,
–   The forms should be easily accessible to crewmembers,
–   They should be designed to help solve the problem.

The shorter and more precise the report form questions, the more likely seafarers will report the near-miss. Therefore, it is critical to tailor the reporting form to the seafarer. The near-miss report form can be complicated or straightforward. If the form is complicated, it is expected that many crewmembers will not report near-misses or will report fewer observed near-misses [1, 9, 12, 37, 38]. When designing the form, attention must be paid to the content to increase the willingness to report. Table 5 provides a group of questions on near-miss report forms, and Table 6 provides descriptive statistics

Many respondents (92.3%) have a near-miss report form on their ship, and 63.4% have it in electronic form. Most of the seafarers interviewed believed that the reporting form was relatively simple and reported no problems completing it.

Table 5. Near-miss report form

Question No.	
Q10	Do you have a near-miss report form on your vessel?
Q11	If you have a near-miss report form on your vessel, is it a paper form or electronic form?
Q12	If you have a near-miss report form on your vessel, please rate the difficulty of filling it

Table 6. Near-miss report form – descriptive statistics

Question No.	Yes or paper form or 1(%)	No or electronic form or 2(%)	I do not know or 3(%)	4 (%)	5 (%)	Mean	Std
Q10	92.3	5	2.7				
Q11	36.6	63.4					
Q12	22.2	35.4	29.2	12.3	0.9	2.35	0.99

Q10: yes, no, I do not know; Q11: paper form, electronic form; Q12: 1=very simple; 2=simple; 3=nor simple nor difficult; 4=difficult; 5=very difficult

The existence of a blame culture onboard a ship is one of the factors preventing reporting. Seafarers should not be ashamed to report, nor should they fear being blamed and punished for doing so. The absence of a blame culture is reflected in the fact that the individual is seen as a means to improve safety rather than someone who can be held responsible for a mistake [3]. According to the available literature, seafarers who feel ashamed, fear blame and punishment, are not inclined to report near-misses [2, 19, 27, 37]. The seafarers who are not reporting a near-miss because of feeling shame believe that their colleagues onboard a ship will later make fun of them for not being able to perform the task and being incompetent [11]. In a survey conducted by Erdogan [11], some senior officers said blame culture does not exist in the company, but it still exists on some ships. Crewmembers may feel ashamed if they make a mistake at work [21, 33, 36]. According to [21], seafarers are reluctant to report near-misses involving their colleagues because they think it may be a problem. However, reporting near-misses involving another ship and its crew is not considered a problem. Fear of blame and criticism is an obstacle that the shipboard leadership must overcome to increase the number of near-misses reported [4, 9, 16, 21, 24, 31, 37]. A blame culture may be present onboard a ship and prevent reporting or may not be present and not create barriers to reporting. Table 7 shows seafarers' opinions on blame culture onboard their ships, and Table 8 provides descriptive statistics.

Table 7. Existence of blame culture

Question No	
Q13	Do you feel free to report a near-miss on your company?
Q14	Do you feel embarrassed once reporting a near-miss on your vessel?
Q15	Do you think that you might get someone into trouble if you report a near-miss?
Q16	Do you feel guilt once reporting a near-miss on your vessel?
Q17	Do you think that you will be blamed if you report a near-miss?

Table 8. Existence of blame culture – descriptive statistics

Question No.	Yes or 1 (%)	No or 2 (%)	I do not know or 3 (%)	4 (%)	5 (%)	Mean	Std
Q13	88.7	7.2	4.1				
Q14	51.6	26.7	10.9	5.9	5	1.86	1.14
Q15	38.9	28.5	20.4	9	3.2	2.09	1.11
Q16	57.2	26.1	12.6	2.7	1.4	1.65	0.9
Q17	49.5	27	14.9	5.9	2.7	1.85	1.05

Q13: yes, no, I do not know; Q14 through Q17: 1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, and 5=strongly agree.

It can be concluded that a blame culture presents a reporting barrier to the minority of surveyed seafarers. It seems that just culture is successfully implemented and instilled in the maritime sector. One comment on a survey was: "Any near-miss reporting should not be the tool for the company to use as a blame culture and finger-pointing but as a learning tool. "Another crewmember's comment was: "Scared from Company response after reporting near miss. "

The presence of a blame culture on ships is a barrier that prevents reporting and degrades a maritime safety culture. Crew members could blame each other when they report a near-miss, making the reporters feel uncomfortable and disrupting teamwork onboard a ship. The absence of a blame culture increases reporting. Some companies have made it clear in their safety management or near-miss management policies that seafarers will not be blamed for reported near-misses unless they have been committed by negligence, gross negligence, or willful misconduct. Seafarers who do not have a straightforward reading of the policies and do not have in writing how they will be treated after reporting near-miss are in fear of punishment, and thus the likelihood of reporting is reduced. Therefore, it is suggested that companies make clear in their safety (or near-miss) management systems that blame culture does not apply to the company, and that crew members will not be blamed for reported near-misses if they were not due to negligence, gross negligence, or intentional misconduct. It is further suggested that, when familiarizing with near-miss management, this should be clearly explained to all crew members to provide a ship environment in which the seafarer can report the near-miss without fear (just culture and reporting culture).

The leadership style onboard a ship influences crewmembers' behaviour. If the master has a negative attitude towards near-miss reporting, the crew will likely not report them [23]. The master should be a role model to crew members in everything, including near-miss reporting [17, 34]. A high level of safety onboard a ship cannot be achieved without teamwork, and in order to achieve this, the traditional hierarchical order onboard must be replaced by leadership that will introduce a safety culture. The master should strike a balance between his authority and the initiative of the crew members. The master must avoid a blame culture and encourage reporting on accidents, near-misses, and non-conformities from the crew, without fear of punishment for reporting [6]. Leadership style can be an impetus or obstacle to developing a safety culture and, thus, near-miss

reporting [2, 26]. Safety leadership is an essential instigator to near-miss reporting. Table 9 shows seafarers' opinions on safety leadership onboard their ships.

Table 9. Safety leadership

Question No	
Q18	Do you discuss near-misses onboard your vessel (for example, during safety meetings)?
Q19	Do you receive follow-up reports from Company or Master regarding near-misses on your vessel?

Safety leadership descriptive statistics are presented in Table 10.

Table 10. Safety leadership – descriptive statistics

Question No	Yes (%)	No (%)	I do not know (%)
Q18	96.4	2.7	0.9
Q19	89.2	3.6	3.6

According to the survey data, senior officers share all information on near-misses with crewmembers to no small degree and thus encourage reporting on their ships. Companies' safety departments should closely monitor each ship's performance and guide master, and senior officers were needed.

From the authors' experience, some shipping companies award "best "near-misses reported during the month. The number of reports is undoubtedly more extensive than on ships where the award is not given, but the problem of the made-up report arises. Because of those reports, false conclusions can be made, and wrong and inadequate corrective measures implemented. To examine seafarers' opinions on the incentive for near-miss reporting, we prepared two questions presented in Table 11. Table 12 presents descriptive statistics on incentives for reporting.

Table 11. An incentive for near-miss reporting

Question No.	
Q20	Do you get awarded for reported near-miss on your company?
Q21	Do you think that near-miss reporting should be awarded?

Table 12. An incentive for near-miss reporting – descriptive statistics

Question No	Yes (%)	No (%)	I do not know (%)
Q20	16.2	76.6	7.2
Q21	31.1	64	5

As shown in Table 12, many respondents are not rewarded for near-miss reporting, but almost one-third of respondents consider reporting awards as a fair reimbursement for their effort.

Unfortunately, false reports are unavoidable because some companies have prescribed a fixed number of near-miss reports they want to receive monthly. Following was a comment of one seafarer: "The biggest problem with near-miss matter is the fixed number (minimum number) of cases to be reported per vessel per month. I would say that 80% of reported near-misses are made up to fulfil the minimum required number of reports. Out of the 20% left, at least a half are repeated near-misses ". Another respondent gave the following comment: "The

reporting of near misses should be more straightforward, and you cannot define a minimum number of near misses to be reported every month on each ship, just based on the average number. There can be fewer near-misses than required. This way you have to make up stories which can lead to corrective actions for events that did not occur ". As Bhattacharya concluded in his study [5], safety cannot be improved with just an increasing number of near-miss reports; without implementing adequate corrective measures based on lessons learned, safety will remain at the same level.

4 CONCLUSION

Research gave insight into seafarers' attitudes and opinions on near-miss reporting in the shipping sector. Survey results confirmed that near-misses in shipping are not reported as they should be due to the barriers. Seafarers' perspective on near-miss reporting is an essential factor for successful safety improvements onboard ships. Maritime sector stakeholders should react and work on minimizing the effects of reporting barriers and overcoming them to improve shipboard safety. Seafarers' answers can be used as guidance for proposed measures and actions which could eventually improve near-miss management systems in shipping.

Authors believe that identified barriers can be overcome by introducing the near-miss topics in education for seafarers as well as shore- and ship-based near-miss training for existing seafarers. Another aspect for successful and effective near-miss reporting is adequate safety leadership that will instil just culture and reporting culture. Maritime sector stakeholders should ensure that senior shipboard officers are well trained and acquainted with the subject to increase maritime safety. According to survey data, near-miss report forms are simple and easy to fill out, so they should be in the future. A possible solution could be the standardization of report forms, which could facilitate near-miss reporting and enable easier data handling. Another possible reporting problem could be reporting incentives. Giving near-miss reporting incentives could also be one of the barriers and the wrong approach. Many seafarers report imaginary events, thus leading analysis and conclusions to the wrong side because of the rewards. As per the authors' opinion, the fixed monthly number of near-miss reports could be considered the wrong requirement. To comply with the company's instructions, senior officers usually demand their subordinates to report near-miss events. If such events did not occur, they would be imagined and reported as real to comply with the demand. Such an approach should be tried to be avoided for obvious reasons.

Near-miss reporting is only part of the near-miss management system, and a first step towards improving safety and further research will seek to determine the overall management model. Future research will try to identify all near-miss reporting barriers and build a reporting model applicable in the maritime sector.

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