# Assessing the determinants and consequences of safety culture in the maritime industry


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**A report based on the findings of research grant LP130100215**



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# PURPOSE

This report details the outcomes of a study conducted as part of the Collaborative research agreement for the Australian Linkage Council (ARC) project LP1301002015 (*Project: Assessing the determinants and consequences of safety culture in the maritime industry*) involving the University of Queensland (UQ), the University of Western Australia (UWA) and the Australian Maritime Safety Authority (AMSA).

This project is a deliverable for 14AMSA168 expenditure procurement approval.

Considering that Safety culture is an important determinant of safety behaviour, well-being, injuries and accidents; a systematic assessment was conducted to investigate its influence on safety behaviour on Australian and international commercial vessels operating in Australian waters. The purpose was to provide new insights into seafarers' safety and wellbeing by examining the influence of key organisational factors related to safety culture through a science based approach.

# EXECUTIVE SUMMARY

The purpose of this study was to provide new insights into seafarers' safety and wellbeing by examining the influence of key organisational factors related to safety culture. This report notes key findings and provides several recommendations based on the findings and expert input. A total of 1026 seafarers participated in this study (164 from the command team and 862 from the rest of the crew), and 23 flag States were represented in the sample. The sample was representative of the overall population of ships regularly coming into Australian ports. The key findings of this study were:

**Safety Culture**

- The majority of the participants (approximately 80%) reported an overall positive safety culture on their ship. However, they also reported a number of risk factors that could have a negative impact on safety. For example, the data indicates that work demands are high and negatively impact seafarers' recovery and long term wellbeing. Similarly, the negative types of safety compliance behaviours reported by participants are an indicator of reduced levels of safety culture.
- In this study, safety leadership was the strongest predictor of the development levels of a safety culture; a safety culture was likely to be more developed if seafarers perceived their immediate supervisors as valuing and rewarding safety-related outcomes and behaviours.

**Work Demands**: **Working Hours**

- More than 20% reported working more than 69 hours per week and that working hours were unpredictable.
- Long working hours were associated with mental ill health, sleep problems, and near-misses and injuries.

**Fatigue and Sleep**

- Approximately 12% of the participants reported experiencing **sleep problems.** Sleep problems were more likely for seafarers who experienced a combination of job insecurity and long working hours in uncertain operational conditions while required to maintain high levels of vigilance. However, **job resources** such as co-worker support and safety leadership can mitigate these negative effects and support better recovery.
- Close to 20% reported experiencing **chronic fatigue.** Seafarers were more likely to develop chronic fatigue if they experienced poor sleep, a lack of job resources, and high levels of work pressures (e.g. demands for vigilance). Similarly, 20% of seafarers reported experiencing high levels of **acute fatigue** at work. Seafarers were less likely to experience acute fatigue in the presence of high levels of job autonomy, safety leadership, job security, and the absence of work constraints.

**Organisational Priorities**

- Wellbeing and mental health were better when seafarers perceived that their organisations prioritised their safety and welfare over operational costs and performance. Prioritising safety and welfare over costs and performance was also related to a more developed safety culture, and lower levels of fatigue and sleep problems.
- However, results suggest that increasing an organisation's priority on safety and welfare is unlikely to improve seafarers' wellbeing. Instead, it is the balancing of the priority placed on costs and performance that will result in positive effects for the seafarers' safety and wellbeing.

**Mental Health**

- Around 40% of the participating seafarers reported experiencing **symptoms of mental ill health** (e.g. depression and anxiety) at least sometimes, and around 10% of them reported experiencing these symptoms often.
- Seafarers suffering from chronic fatigue and sleep problems, and working in high vigilance demands roles were more likely to experience mental ill health symptoms. In contrast, experiencing these symptoms was less likely in the presence of safety leadership and a stable crew (regularly working with the same crew members).

**Wellbeing**

- 90% of seafarers indicated positive levels of **psychological wellbeing** (e.g. good at managing responsibilities), 70% indicated positive levels of **social wellbeing** (e.g. have warm and trusting relationships), and 80% indicated positive levels of **hedonic wellbeing** (e.g. feeling happy).
- Seafarers experiencing chronic fatigue, acute fatigue, and sleep problems were more likely to report reduced psychological wellbeing and functioning.
- Results also suggest that high levels of trust in co-workers and in supervisors, crew stability, and safety leadership can improve seafarers' wellbeing. Due to decreasing crew stability, reduced job security and increased crew diversity, the quality of social processes designed to improve trust and support onboard ships is likely to be impaired.

**Safety Behaviours**.

- Close to 80% of seafarers reported high quality compliance to safety rules and procedures (i.e. thinking thoroughly about each rule/procedure and how it can be applied to the task at hand).
- However, more than 40% of participants also agreed that they sometimes just 'tick the boxes' without paying much attention to the actual procedures (i.e. comply only on the surface), and close to 20% agreed that they behave in non-compliant ways (e.g. skipping procedures to get the job done) while at work. This suggests that, even when overall compliance is high, there might be instances of non-compliance or surface compliance that have the potential to put safety at risk.

Taking the key findings listed above into consideration, this study drew on research evidence and experts' opinion to develop the following set of recommendations:

1. **Improving the Quality of Work Rules and Procedures** by incorporating the principles of seafarer involvement. Doing so will likely reduce the likelihood of poor compliance behaviours, and improve seafarers' performance and wellbeing.
2. **Fatigue Management** – In the maritime industry, where 1 in 5 seafarers reported experiencing some levels of acute fatigue and/or chronic fatigue, an effective fatigue management system that continuously monitors and manages the risk of fatigue is essential. Therefore, it was recommended that organisations incorporate fatigue management within the safety management systems.
3. **Work Design and Organisational Support** – While many of the work demands experienced by seafarers are inherent to the industry and hard to change, increases in job relevant resources might protect the seafarer from the negative effects of the work demands and foster improved seafarer safety and wellbeing. Therefore, it was recommended that organisations strive to increase the levels of support seafarers receive while onboard ships, to offer opportunities for their involvement in decision-making and the improvement of crew stability.

# 1. BACKGROUND

## 1.1. PROJECT BACKGROUND

The maritime industry plays a pivotal role in the global economy, carrying approximately 90% of world trade (International Maritime Organization, 2009) and employing more than one million seafarers from every corner of the globe. It is especially important to Australia, which, as an island nation, relies heavily on shipping to source and trade key goods and resources. Australia accounts for 10% of the world's sea trade and carries 99% of Australia's trade by volume. In 2013-2014, the value of exports and imports by sea totalled $441.7 billion, (Bureau of Infrastructure, Transport and Regional Economics, 2015). In 2015-16 alone, there were around 27,000 port calls from cargo vessels in Australia, with vessel activity at Australian ports forecast to grow by 34% over the next decade (BITRE, 2015; AMSA, 2017).

Despite the positive economic benefits derived from commercial shipping, maritime operations are extremely high-risk (Hetherington, Flin, & Mearns, 2006). Exposure to noxious substances, drowning, serious mechanical hazards (crush injuries), minor personal injuries (cuts, bumps, and slips), extreme weather events, fire and explosions, and collisions and groundings are but some of the hazards and risks typically faced by seafarers (Håvold, 2010). Serious and costly outcomes of accidents at sea include the loss of valuable cargo, the destruction of the pristine marine environment, and the serious injury or death of seafarers (Håvold, 2010). While financial losses from maritime accidents can be recovered through insurance claims, the environmental impact is often irreversible (International Maritime Organization, 2012).

The consequences of maritime accidents are equally severe for seafarers. With a reported average of 14.2 injuries per million working hours, seafarers are up to 27.8 times more likely to suffer work related fatal injuries compared to the general shore based workforce (Håvold, 2010). These figures are striking given that it is believed that maritime injury and accident statistics are underreported (Lützhöft, Grech, & Porathe, 2011). During 2015-16 the total compensation costs to cover seafarer injury claims on Australian ships amounted to around $11.6 million (Seacare, 2016). Worldwide figures show that in the last decade the frequencies of ship accidents generally increased (Eleftheria, Apostolos, & Markos, 2016). In addition, the global financial crisis of 2008 has left in its aftermath a large segment of international vessels (The Economist, 2015), with some trading in Australian waters operating under severe financial stress, potentially impacting safety.

There are several potential reasons for the high rate of accidents and incidents reported at sea. The harsh natural environment is inherently more risky compared to land based operations (Bloor, Thomas, & Lane, 2000; Hetherington, Flin, & Mearns, 2006; Roberts & Marlow, 2002, 2005; Rodryguez, 2007). Life at sea also means enduring ship motions, long and irregular working hours, which contribute to fatigue and added risk of injuries and accidents, as well as ill health (Grech, Horberry, & Koester, 2008). The remoteness of the work environment also means crew have limited social contact and may be isolated for long periods of time with little support, all of which can reduce performance, health and well-being (Oliver, Cheyne, Tomas, & Cox, 2002). Demanding conditions under which seafarers work is evident in the maritime literature with human error seen as last action in a series of contributing factors that results in accidents at sea (Grech et al., 2008). Traditionally, safety research has focussed on technical and engineering aspects of maritime operations, but more recently, research has focused on the role of organisational factors influencing safety, such as safety culture.

### 1.1.1. Safety Climate, Safety Culture, Behaviour and Outcomes

The term “safety culture” refers to the way that an organisation manages safety, and reflects the core beliefs and attitudes that guide behaviour and decision-making (Casey, Griffin, Flatau Harrison & Neal, 2017; Reason, 1998). In general, there are two broad elements of safety culture. The first are the policies, practices and procedures that the organisation has for managing safety. This first element is sometimes referred to as “safety climate” within the academic literature (Griffin & Neal, 2000; Neal, Griffin, & Hart, 2000; Zohar, 1980). The second are the values, priorities, norms and motives held by people in the organisation. These two elements reflect the distinction between safety culture as something that the organisation *has* (i.e., policies, practices & procedures) and safety culture as something that an organisation *is* (i.e., people with a shared set of values and beliefs: Reason, 1998). Whilst the academic literature makes a distinction between safety climate and safety culture, these terms are used inconsistently, and are often interchangeable. Indeed, measures of safety climate and culture are highly correlated, and are not distinguishable for practical purposes (Casey, et al., 2017). In this report, we use the term “safety culture” rather than “safety climate”, because it is a broader term, and is more widely recognized within the maritime industry.

In the last 30 years, there has been a wealth of research into safety culture. Three separate meta-analyses, drawing on more than 300 studies, show that employees who perceive that their organisation values safety and places greater importance on safety relative to other outcomes are more likely to comply with safety procedures and are less likely to be involved in incidents or injuries (Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2006; Nahrgang, Morgeson, & Hofmann, 2011). Research has also revealed that safety culture has a strong positive relationship with psychological wellbeing (Oliver et al., 2002). Whilst the majority of this research has been cross-sectional, at least one longitudinal study has demonstrated that safety culture at one point in time predicts subsequent changes in safety behaviour and outcomes (Neal & Griffin, 2006). These findings suggest that safety culture is an important determinant of safety behaviour, accidents and injuries in the workplace.

In a recent review, Lützhöft, et al. (2011) identified safety culture as a critical risk factor for the maritime industry. They argued that whilst most accidents at sea are caused by human error, these errors are attributable to conditions created by the organisation. Specifically, they argued that safety-related policies and practices relating to communication, commitment, trust, incident reporting, risk management and training play an important role in shaping behaviour, which can either directly or indirectly affect safety. According to Lützhöft et al. (2011) maritime safety culture is a concern, because shipping operators are under significant cost pressures.

While there is anecdotal evidence suggesting that maritime safety culture is a critical risk factor, research on maritime safety culture is limited and fragmented. Prior to the year 2000, no studies of safety culture within the maritime context had taken place (Håvold, 2000). However, recent work indicates that the relationship that exists between safety culture, safety behaviour and safety outcomes observed in other high-risk industries may also exist within the maritime industry. For example, Lu and Tsai (2010) found a significant positive relationship between safety culture and self-reported safety behaviour in a study of 608 seafarers. Specifically, the more positively seafarers perceived safety rules and policies (safety systems), management values, and supervisor safety behaviour, the more likely they were to report acting in a safe way while working, and vice versa (Lu & Tsai, 2010). Regarding safety outcomes, in a study of 31 vessels berthed at Kaohsiung Harbor (Taiwan), Lu and Tsai (2008) found that there was a significant relationship between safety culture and the number of crew fatalities. Specifically, more positive perceptions of management values, safety training, and the physical work environment, were related to fewer fatalities, and vice versa (Lu & Tsai, 2008). Further, within the same study it was found that there was a significant relationship between seafarers’

perceptions of the physical work environment and vessel failure, with more positive perceptions relating to fewer failures, and vice versa.

While this evidence is encouraging more is needed to clarify the role of safety culture in the maritime industry, particularly in relation to seafarers aboard vessels operating in Australian waters. There is a pressing need for rigorous research to identify the risk factors for companies or ships having a poor safety culture, and to establish the link between maritime safety culture and safety outcomes. In particular, there is a need to examine risk factors across different levels of analysis because maritime vessels operate within a complex and hierarchically structured system. Therefore, a broad range of factors at different levels can influence safety culture and outcomes.

## 1.2. RESEARCH AIMS

The overall aim of the present study was to determine how to improve safety and employee wellbeing on foreign flagged and Australian registered vessels operating in Australian waters.

More specifically, this study examined the causes and consequences of safety culture and their consequential effects on employee wellbeing.

This research aimed to examine factors at four distinct levels: a) the country in which the ship is flagged (referred to as “flag State”); b) the organisations that own and/or operate the ship; c) the ship itself; and d) the seafarers that work on board the ship. Unfortunately, due to the reduced number of Australian companies operating international vessels and logistical difficulties in involving international companies in the study, data at the organisational level was not collected. However, this level was assessed by measuring perceptions of company priorities and pressures at the lower levels of data collection.

The following sections of this report will focus mostly on the seafarers and ship levels. Insights provided by interviews with representatives of some maritime administrations were used in interpreting the findings at a more granular level.

# 2. RESEARCH METHOD

## 2.1. RESEARCH METHOD AND PROCEDURE

### 2.1.1. Measures

*2.3.3.1. Ship/seafarer level*

A survey questionnaire was designed by the research team to assess perceptions of safety culture on ships, as well as possible antecedents and consequences of safety culture (Appendix A). An overview of the measurement model is presented in figure 2.1. Unless otherwise stated, items were measured using a 5-point likert- scale.

Two versions of the survey were used, one for the crew members and one for the command team of the ship (master, chief mate, and chief engineer). Only a small number of measures differed between the two groups, and these differences will be mentioned when describing the scales used in the survey. Therefore, unless otherwise stated, identical measures were used in the two survey versions.

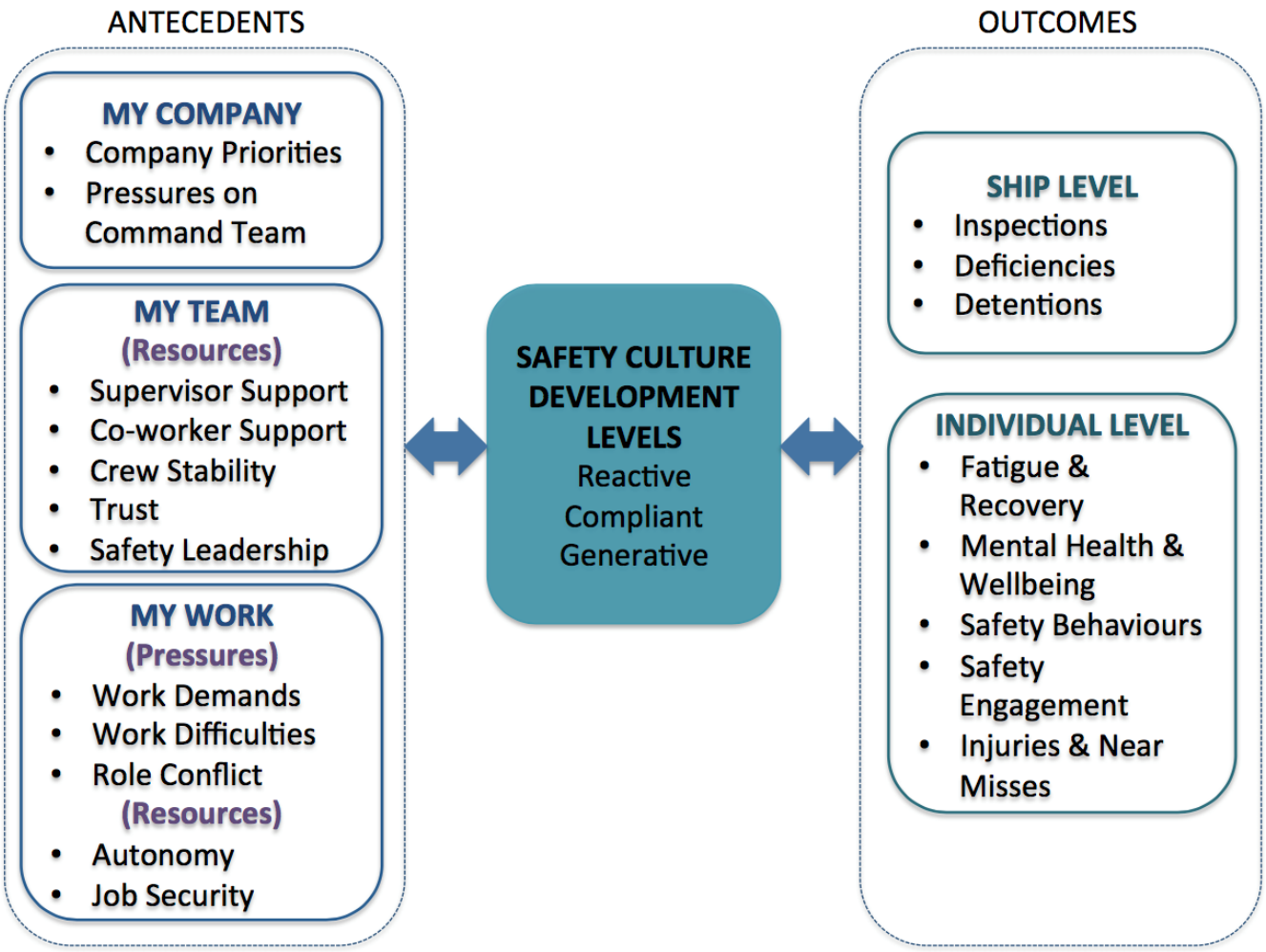



**Figure 2.1:** Overview of the overall measurement approach and variables included in this study.

Before launching into the data collection, the survey went through three pilots, the first one with an Australian crew (N=11) and a second one with an international crew (N=9). During these pilots, seafarers went through the survey questions during a one-on-one interview with investigators (from the research team) which provided detailed feedback about each section of the survey. This process led to a better selection of final measurements as well as minor adaptation in terms of the wording of the items to ensure a high level of face validity is achieved for the intended population. These changes were checked in a final third pilot with subject matter experts (AMSA inspectors) that helped finalise the survey.

*2.3.3.2. Safety culture development levels*

The *Developmental Safety Culture Survey* (DSCS) was put together by the research team aiming to measure different levels of safety culture development for the purpose of this study. The DSCS was developed to discriminate different levels of safety culture development based on existing theory (Hudson, 2001; Lawrie, Parker, & Hudson, 2006, Parker, Lawrie, & Hudson, 2006; Reason, 1997; Westrum, 1996) and validated during the study. Twelve items were developed to tap into the "Systems and Processes" and "People" aspects of safety culture. The aspects measured in the "Systems and Processes" section were:

- Safety policies and procedures,
- Safety training,

- Communication,
- Role definitions,
- Reporting systems, and
- Operational schedules.

The “People” aspects included:

- Safety Values,
- Norms, and
- Motives.

Based on the existing literature three specific descriptors were developed to reflect:

1. a dysfunctional/reactive safety culture;
2. a compliance oriented culture, and
3. a participative/generative safety culture.

Participants responded on a 5-point Likert scale, where values of 1 received descriptors that reflected a reactive safety culture. Participants indicated the value that best reflects the way each aspect was being managed on their ship.

*2.3.3.3. Antecedents of safety culture*

Several possible antecedents of safety culture were measured, situated at different levels: perceptions about my company, perceptions about my team, and perceptions about my work.

**My Company**


**Perceived company priorities:** To assess how company priorities are experienced at the ship and individual levels, a new measure was developed that asked how seafarers perceived the relative importance of safety and employee wellbeing compared with other priorities. Seafarers were asked to rate from 1 (*completely unimportant*) to 10 (*the most important*) how they perceived the company prioritised into six factors: two items asked about the priority on performance and costs (e.g. *Minimizing operational costs*), two items captured the importance of preserving the integrity of the fleet and merchandise (e.g. *Preventing damage to goods and/or cargo*) and other two items captured aspects of safety and wellbeing (e.g. *Ensuring the safety of the crew*).

**Perceived pressures on command team:** For the command team survey, perceived job pressures from the company level was also measured. Eleven items described job pressures that were raised frequently by participants in the interviews conducted for the project, such as: *Cut operational costs / operate with reduced budgets*. Internal consistency[1] for the overall scale was .86 in this sample.

[1] A scale’s internal consistency refers to how well the different items measure the same concept. It is measured using Alpha Cronbach indices that may vary between 0 and 1, with a value of at least 0.70 being considered acceptable.

**My Team**


Several aspects of the work team environment were measured in this survey. This research focused on positive aspects of team functioning that can constitute workplace resources for the seafarers. Workplace resources are those work related factors that have positive effects on employees by reducing existing job pressures and their associated physiological and psychological costs (Demerouti, Bakker, Nachreiner & Schaufeli, 2001; Nahgrang, Morgeson & Hoffman, 2011).

**Supervisor support and Co-worker support**: These aspects form part of the social support and were measured using four items adapted from Van Yperen and Hagedoorn, (2003). Two items measured **Supervisor Support**. The other two items measured **Co-worker Support**. An example item is: *I can rely upon my immediate supervisor when things get tough at work.* Internal consistency of this scale was .87 for this sample.

**Crew stability:** This was measured with one item developed for the purpose of this research, asking seafarers how likely it is for them to return to the same vessel after their next period of leave. This descriptive item was developed based on insight provided by seafarers in initial pilots of the survey, and the wording was checked in the second and third pilot of the survey development to ensure adequate face validity. Answers were provided on a 4-point likert scale, ranging from *extremely unlikely* to *very likely*.

**Trust in team and trust in leadership:** A direct measure adapted from Glendon & Litherland (2001) was used to assess trust relationships. An example item is: *I trust my supervisor to look after our safety and welfare.* Both reciprocal relationships were also measured, and the internal consistency for the overall scale was .90 for this sample.

**Safety Leadership:** Safety leadership was investigated using a measure developed by Griffin & Hu (2013). This instrument identifies four distinct leadership behaviours that are important to safety:

- Leverage (e.g. *Rewards safe behaviour*);
- Energise (e.g. *Places a high personal value on the team's safety*);
- Adapt (e.g. *Asks us to learn from our errors and mistakes*); and
- Defend (e.g. *Monitors teams to detect unsafe actions*).

Internal consistency for the 4 subscales ranged between .85 and .92 for this sample.

**My Work**


The survey covered two main categories of work related variables – work pressures and resources.

**Work pressures** represent those aspects of the work that require sustained physical and/or psychological effort or skills. Several aspects of work demands, workplace difficulties, and role conflict were included in the work pressures category of the survey.

**Work demands:** Participants were asked to report their typical working hours in a week as a measure of quantitative workload. Additionally, **time pressure** was

measured using four items from the Questionnaire on the Experience and Assessment of Work (Vragenlijst Beleving en Beoordeling van de Arbeid; VBBA, Van Veldhoven, & Meijman, 1994). An example item is: *I have to work very fast*. Internal consistency for this scale was .67 for the present sample.

Due to the importance of vigilance, with many seafarers having watchkeeping duties with increased monitoring duties at sea, **vigilance demands** were also measured as part of work demands using four items developed specifically for this research. Because monotony influences attention capacity such that when there is a necessity to perform a task that is perceived as boring, attention may deteriorate (Loukidou, Clarke & Daniels, 2009). Two items of this scale targeted the monotonous aspect of watch-keeping work (e.g. *I find the work boring and monotonous)* and the other two targeted the increased attentional demands (e.g. *I struggle to remain alert and vigilant*). Internal consistency of the overall scale was .73 for the present sample.

**Work Difficulties:** The term "work difficulties" refers to factors that make it difficult for seafarers to do their jobs. Three types of difficulties were examined:

- Physical environment - Nine items relevant to maritime operations, adapted from O*Net, were measured. An example item was: *Small workspaces.* Participants had to indicate how often the conditions described in the items were making it difficult for them to do their work.
- Technology and resources – This was measured using five items based on the existing literature on work constraints (Peters & O'Connor, 1980; Spector & Jex, 1998). An example item is: *Not having the supplies and resources you need*.
- Operational uncertainty – These difficulties were measured using 4 items developed by the research team. An example item is: *Poor planning (e.g. journey or load planning)*.

Internal consistency indices for the disturbance scales ranged between .89 and .90.

**Role Conflict:** For the Command Team survey, the work pressure measures were supplemented with an extra measure of role conflict adapted from Rizzo, House, & Lirtzman (1970). Three items measured Command Teams' perceptions of their own role conflict arising from their critical position as mediators between company and the crew. An example item is: *At work… I am given tasks that are difficult to achieve*. Internal consistency was .78 for this sample.

**Work Resources:** Additional to resources situated at the team level (see previous subsection), this survey investigated two resources at the work level: the level of work autonomy and job security**.**

**Autonomy:** This was measured using the 3 items from the Work Design Questionnaire (Morgeson & Humphrey, 2006) for decision-making authority. An example item is: *At work, I am… Able to use personal initiative or judgement in carrying out my work.* The internal consistency for this scale was .86 in the present sample.

**Job Security**: This was measured with an item adapted from Barling and Mendelson (1999) – *I am not really sure how long I will have a job with this company.* This item was reversed coded in order to reflect job security.

*2.3.3.4. Outcomes at the individual seafarer level*

**Individual level**


**Fatigue and recovery:** In terms of more proximal effects on wellbeing, seafarers' self-reported fatigue and sleep quality were measured. For fatigue, a selection of items developed by Winwood et al. (2005) to measure different types of fatigue were used:

- Chronic fatigue is cumulative, hardly responsive to recovery strategies and with serious maladaptive effects on employees overall functioning and long term health (Winwood et al., 2005), e.g. *I feel I don't get to do anything else in my life besides work*.
- Acute fatigue represents the normal levels of fatigue at the end of a single duty period or workday. It is seen as normal and adaptive, a direct result of work activities, e.g. *I have energy for my hobbies/relaxing activities in my spare time (while at sea)*.
- Inter-Shift Recovery (e.g. *I don't get enough time between shifts to recovery my energy fully*).

Internal consistency for the subscales of this measure ranged from .44 to .88 in the present sample. Due to reduced reliability of the Inter-shift Recovery scale it was decided to take out one reversed score item (internal consistency improved to .73).

Sleep quality was also measured using 4 items adapted from Parker, Hubinger, Green, Sargent & Boyd (1998) describing the most common sleep problems (e.g. *Have difficulty falling asleep*). Internal consistency was .88 in this sample.

**Mental health and wellbeing:** In terms of more general and long-term effects, both positive and negative aspects of seafarers' mental health were measured. Positive mental health was measured using MHC–SF (Lamers et al., 2011), which assesses: hedonic/emotional wellbeing (e.g. *Happy*); psychological wellbeing/ functioning (e.g. *Good at managing the responsibilities of your daily life*), and; social wellbeing/functioning (e.g. *That you had warm and trusting relationships with others*). Symptoms of mental ill health were measured using the negative mental health scale of PHQ–4 (Kroenke, Spitzer, Williams, & Lowe, 2009) (e.g. *Little interest or pleasure in doing things*). Cronbach's Alpha for the wellbeing subscales ranged from .87 to .91.

**Safety behaviours**: Safety-related behaviours were measured in two ways in this survey. First, overall levels of self-reported safety task performance, and safety participation were assessed using measures developed by Neal et al. (2000). Example items for the two subscales are: *I carry out my work in a safe manner*, and *I put in extra effort to improve the safety of the workplace*, respectively. Cronbach's Alpha for these two subscales was .90 and .86 respectively for the present sample. Additionally, safety innovation was measured using 3 items adapted from Hofmann et al. (2003) and refer to the safety onboard the ship. An example item is: *I try to change the way the job is done to make it safer.* Cronbach's Alpha in the present sample was .82.

Second, the specific nature of safety compliance was examined in more detail, by assessing four different types of safety compliance, using measures based on Griffin and Hu (2013). The measures differentiates between Deep compliance (e.g. *I focus on completing the task/procedure properly*); Surface compliance (e.g. *I do what the procedure says without thinking too much about it*); Non-compliance (e.g. *I skip parts of the procedure where ever I can*), and;

Adaptive compliance (*I use my experience and knowledge to come up with the safest way of doing the task*). Internal consistency ranged from .77 to .91 for the subscales of this measure.

**Safety engagement:** This was assessed using 5 items from the measure developed by Wachter and Yorio (2013). Cognitive engagement (e.g. *At work, I pay a lot of attention to the rules and procedures necessary to do my work safely*) and emotional engagement (e.g. *I am proud of the safety program)* were measured. Cronbach's Alpha was .90 and .84 respectively for the present sample.

For all safety behaviours and safety engagement measures, crew and members of the command teams had different referents. Crew members were required to report on their own work behaviours and safety engagement, while the command team members were required to provide an overall assessment of their subordinates' behaviours using the same items.

**Injuries and near misses:** A 4-item scale was developed to measure self-reported injuries and near misses. The self-reported injury item was adapted based on Zohar's measure of micro-accidents (2000): *In the past 6 months, how many times have you been injured at work?* Three additional items were developed to measure experienced or witnessed near misses: e.g. *In the past 6 months, how often have you observed/ witnessed an incident on this ship in which someone else narrowly escaped being injured?* All items were measured using a 7-point scale ranging from "*None*" to "*More than 5 times*".

*2.3.3.5. Outcomes at the ship level*

**Ship level**

In addition to self-reported safety outcomes, safety outcomes at the ship level were included using data collected by AMSA which included the total number of inspections, deficiencies and detentions recorded for each ship included in the survey (Source: AMSA) for the same years that the data was collected - 2015 and 2016. The data were identified and collated by AMSA based on the ship's IMO number reported by survey participants.

*2.3.3.6. Demographic questions*

In addition to the variables represented in Figure 1, the survey also included a series of individual and work demographic questions.

Individual demographic questions asked participants about their age, gender, country of nationality, and native language.

Work demographic questions asked participants about their ship's IMO number, number of nationalities on board the ship, current job role, tenure at sea, type of employing company, length of current contract, time onboard the ship, typical number of port-calls within a month, typical number of shore leaves in a month, and watchkeeping schedule.

## 2.1.2. Procedure

Participation in the study was voluntary and anonymity was guaranteed. Partnerships with various organisations who have direct contact with ships and seafarers were developed to increase survey reach. The survey was distributed to seafarers using different sources as follows:

1. Electronic survey: an electronic version of the survey was made available on the Centre for Safety (C4S) website (http://www.centreforsafety.com.au/seafarer-survey). The C4S is a research centre at the University of Western Australia that aims to bring together various research teams across the university that do research

in areas relevant to safety. Data collection was also advertised in project fliers, banners and relevant social media.

2. AMSA inspections: research assistants accompanied AMSA inspectors during their inspections in Fremantle and Brisbane ports and asked masters for permission to present the research and ask available seafarers to participate. Printed surveys were distributed to seafarers together with a prepaid return envelope and a project flier. If surveys were completed before the end of the inspection, the research assistant collected them, if not, seafarers had the option of mailing them directly to the research team at the next Australian port.
3. Pilots: Brisbane Marine Pilots assisted the project by distributing surveys to the ships they were piloting in Brisbane port and by collecting completed surveys.
4. Seafarers welfare centres: main seafarers and welfare centres in Fremantle and Brisbane - *The Flying Angel Club Fremantle, Apostleship of the Sea Brisbane, Brisbane Seafarers' Centre* - assisted in collecting data. The project was advertised within these locations and research assistants were hosted to present the project to seafarers and invite them to participate. Research assistants handed materials about the research and assisted willing participants to fill out the surveys.
5. Training providers: ERGT, a safety-training provider, provided access to seafarers enrolled in their trainings. A research assistant was present before their training session, presented the project to trainees, invited them to participate and handed them paper-pencil versions of the survey as well as fliers with the web address for the online version. Completed surveys were sealed in an anonymous prepaid envelope and collected in a box available in the training facility. ERGT mailed all envelopes back to the research team. An overview of the different sources for data collection is presented in the figure below:

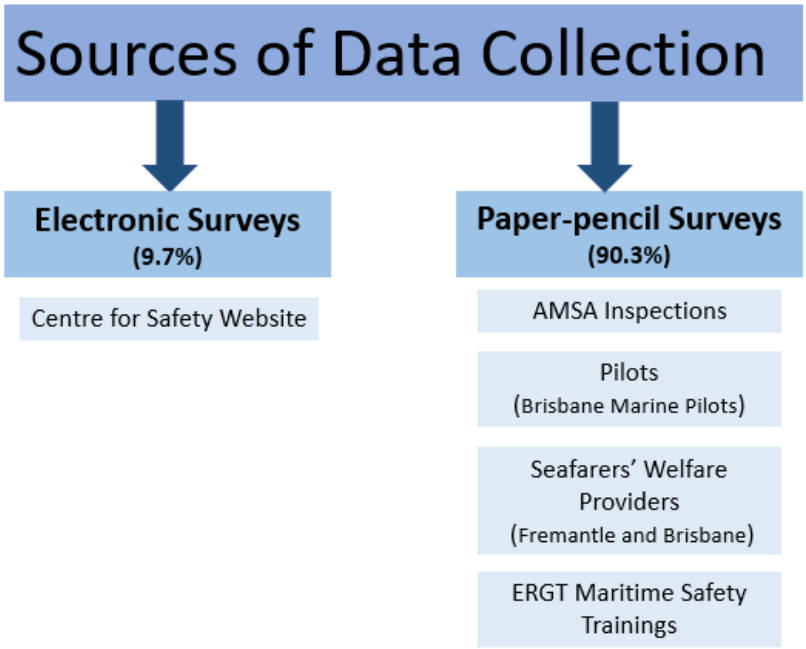



**Figure 2.2.** Overview of the sources of data collection used in this study.

## 2.1.3. Participants

### *2.3.2.1. Individual seafarers*

The final sample consisted of 1026 seafarers. 164 participants completed the command team survey and 862 participants filled in the survey for the rest of the crew.

97.9% of the participants were male with an average age of 34.7 years (*SD*=10.4 years). The age range for 57.8% of the participants was between 18 to 37 years.

Participants were mostly experienced seafarers, with an average overall tenure at sea of around 10 years (*M*=9.76, *SD*=8.78 years at sea).

Figure 2.3 shows participants categorised according to shipboard roles, with a good distribution across the ranks.

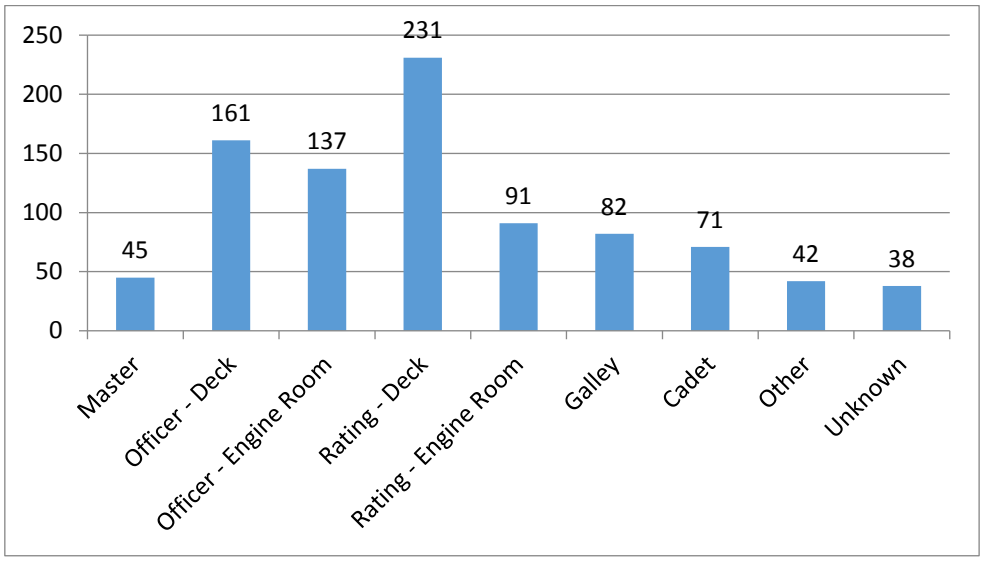



**Figure 2.3.** Participants in this survey categorised according to shipboard roles.

Most participants worked long contracts – in the region of 9 months to 1 year, especially evident for the officers and ratings. The majority of the command teams (which includes master, chief mate and chief engineer) tended to report shorter contracts (Figure 2.4.). When examining contract length across the different ships types, on average, participants working on specialised vessels (i.e. offshore support vessels, FPSOs, MODU), reported longer contracts (*M*=11.67; *SD*=9.01) while respondents working on coaster vessels reported the shortest contracts (*M*=6.17; *SD*=1.60).

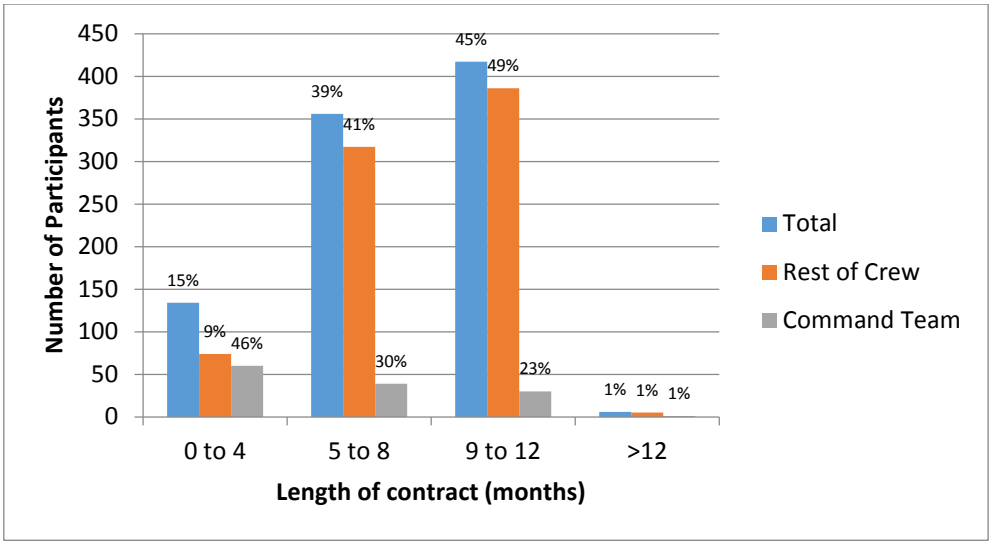



**Figure 2.4.** Length of contract (months) reported by participants.

Most participants reported 4 months or less onboard the ship, with very few having been onboard for more than 9 months Figure 2.5). Across the ship types, participants working on specialised vessels tended to report longer periods on board (*M*=234.36 days / 7.68 months; *SD*=177.5 / 5.81 months), while seafarers working on passenger ships reported having been on board for shorter periods (*M*=97.7 days /3.2 months; *SD*=61.78 / 2.02 months).

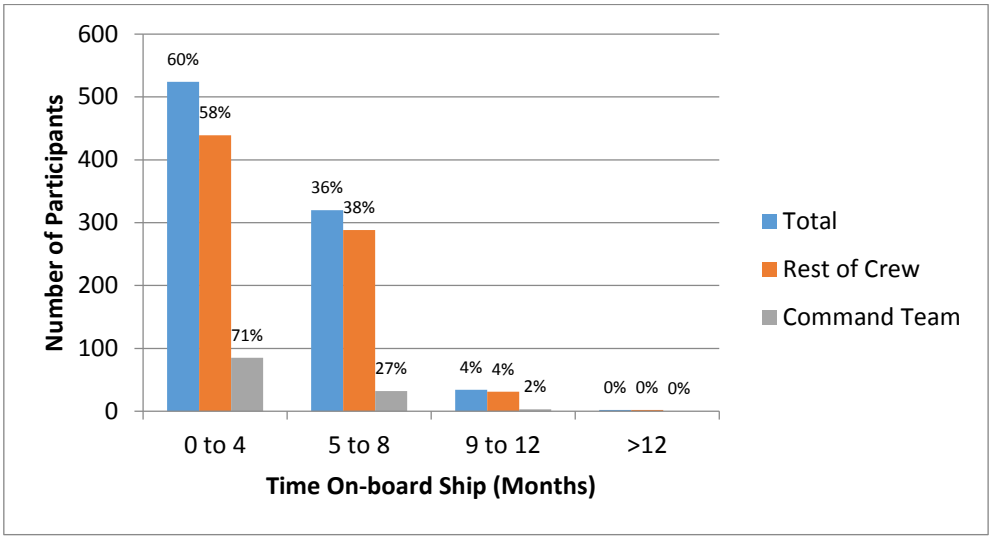
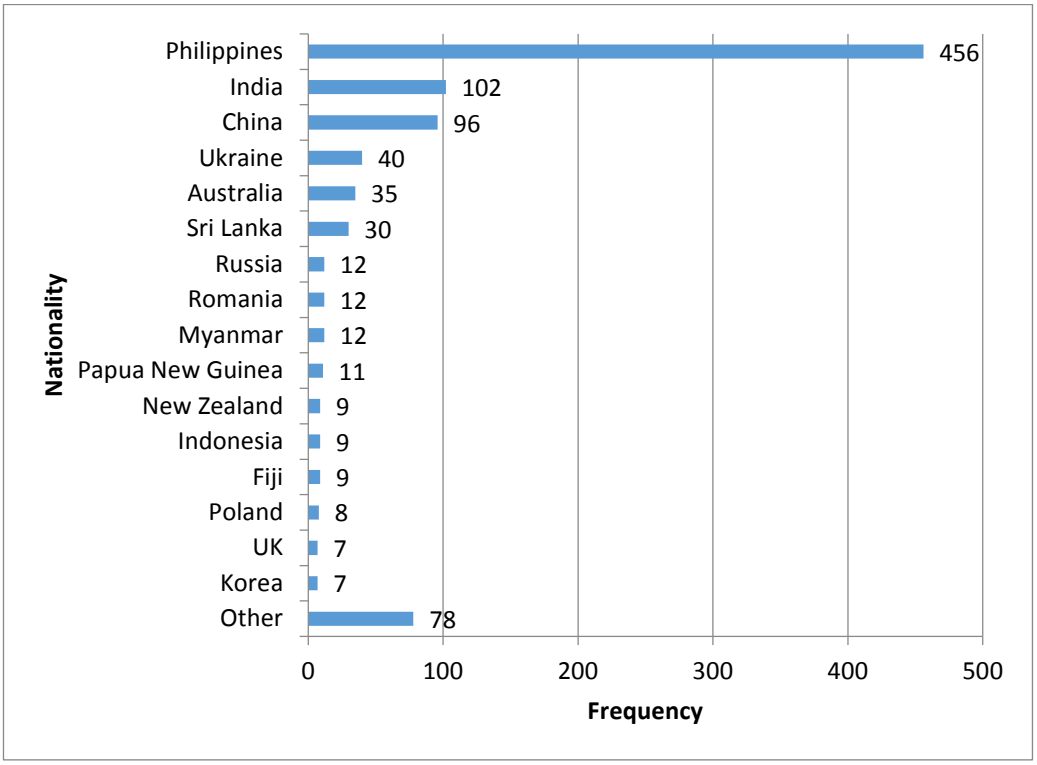



**Figure 2.5.** Time spent on board the ship in this present contract (in months).

Figures 2.6 and 2.7 present the different nationalities of participants in the sample. The frequencies shown in Figure 2.6 present a diverse, international sample, with the majority of participants coming from the Philippines.




Note: 'Other' includes Sweden, Vietnam, Hong Kong, Scotland, Croatia, Greece, Singapore, Turkey, France, Germany, Lithuania, Bangladesh, Ethiopia, Italy, Malaysia, Montenegro, Norway, Pakistan, Panama, South Korea, USA, Chile, Cyprus, Denmark, Ghana, Grenada, Hungary, Latvia, New-Caledonia, Portugal, South Africa, Syria, Taiwan, Tanzania and Thailand, all of which had 6 or fewer people.

**Figure 2.6.** Nationality of participants.

Participants were also asked to report how many different nationalities were on board their ship and their responses indicated the presence of highly diverse crews in terms of nationality (Figure 2.7.). On average, participants indicated that there were about 4 different nationalities on board the ship they were working on, although homogenous crews in terms of nationality were also reported.

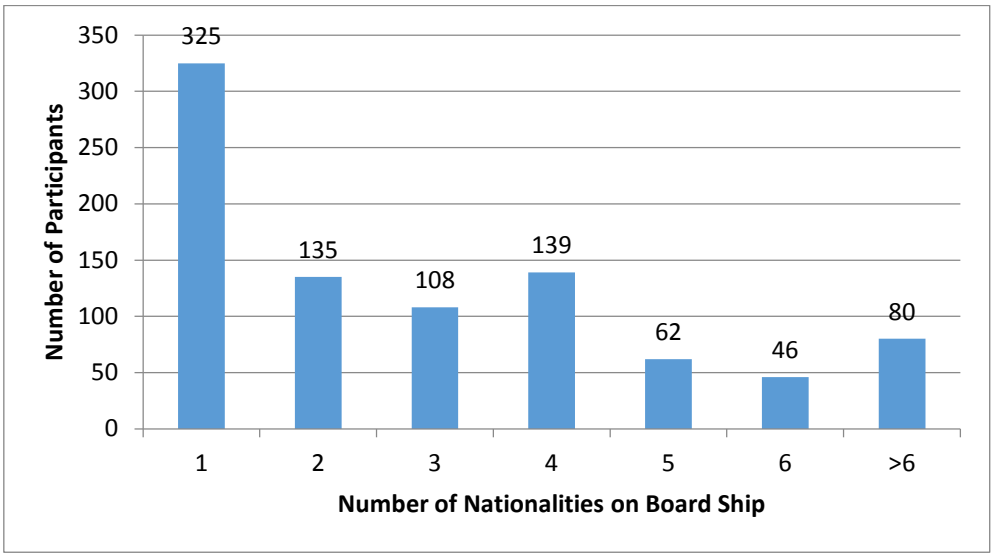



**Figure 2.7.** Number of nationalities present on board of each ship.

### *2.3.3.2. Ship level data*

To obtain the ship level sample, individual level data were aggregated based on ship IMO numbers reported by participants. That is, all responses from seafarers on the same ship, identified by its IMO number, were averaged to obtain an overall score for the ship. This step produced results for 195 distinct ships across the sample. The ships were then categorised into the following ship types (Figure 2.8).

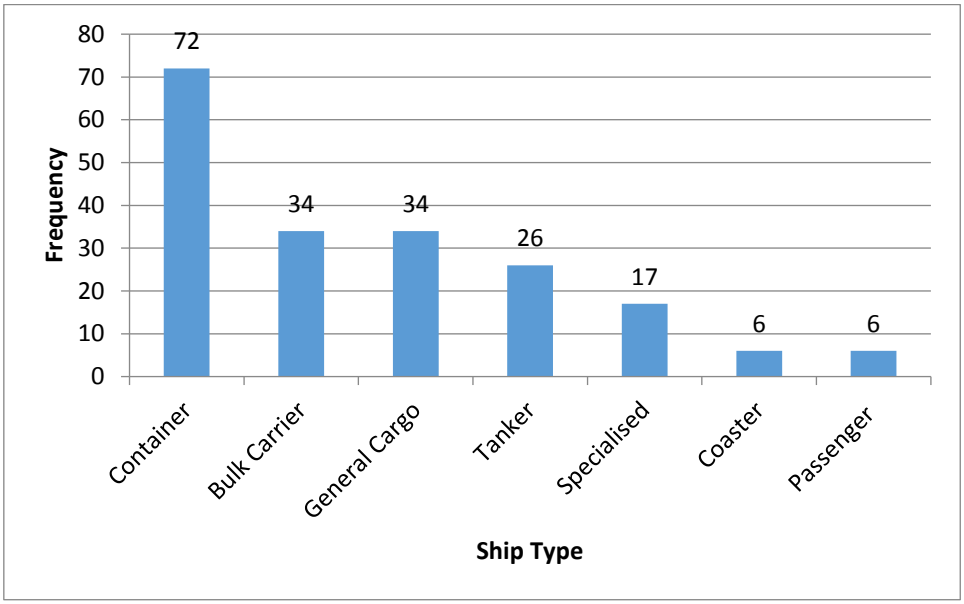
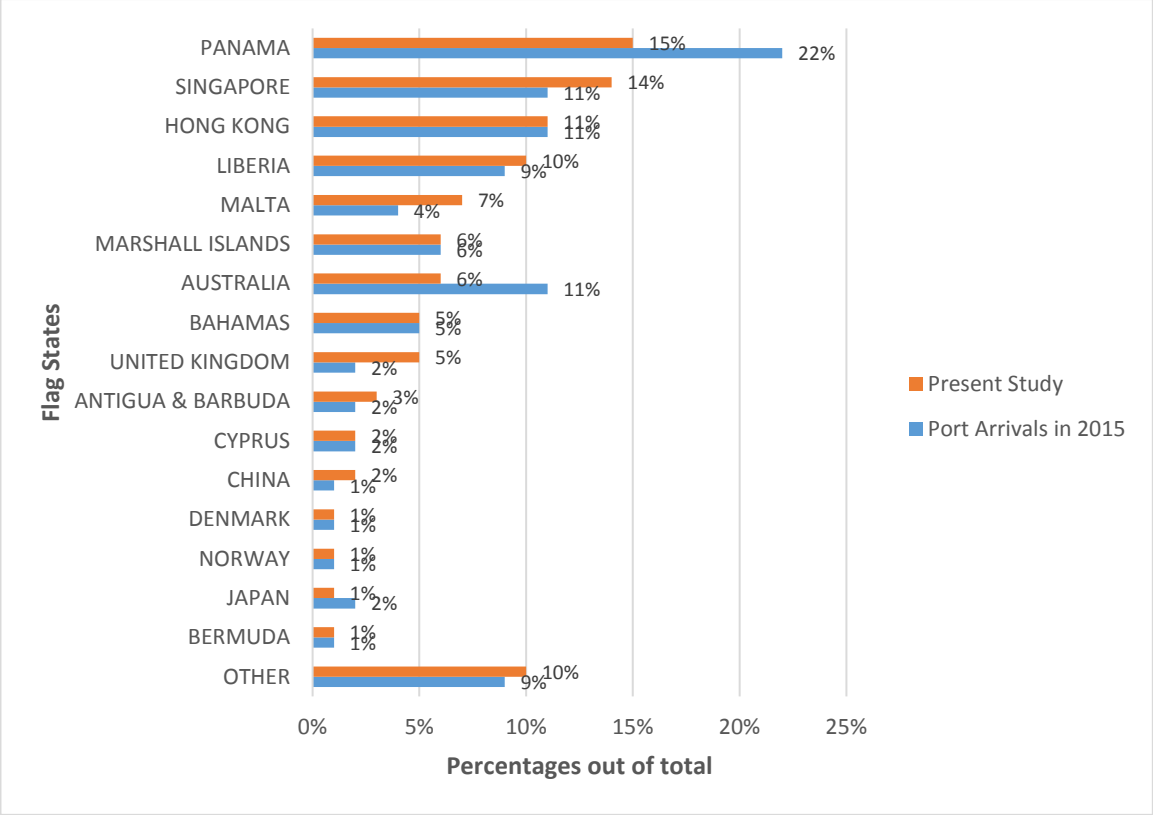



**Figure 2.8.** Type of ships surveyed.

Figure 2.9 shows the list of Flag States represented in this sample. Panama (*N*=30) was the most frequently represented, followed by Singapore (*N*=27), Hong Kong (*N*=22), Liberia (*N*=20), Malta (*N*=13), Marshall Islands (*N*=12), Australia (*N*=11) and Bahamas (*N*=10). This breakdown was fairly consistent with the flag state population of vessels coming into Australian ports during the same year this survey was conducted (based on AMSA ship voyage data for 2015). As illustrated below, Panama and Australia were slightly underrepresented, while Singapore, Malta, and UK were slightly overrepresented. Given the opportunistic nature of the data collection and the fact that the majority of data were collected in only two of the Australian ports, the overall sample approximates fairly well the flag states that regularly come to Australian ports.




Note: 'Other' includes Tanzania, St Vincent & Grenadines, Saudi Arabia, Italy, Greece, Gibraltar and Cook Islands, all of which had only one ship represented in our sample.

**Figure 2.9.** Flag states represented in this study compared to flag states represented in the overall port arrivals in Australia for 2015.

### 2.1.4. Data analysis and reporting

The data were analysed at two distinct levels. First, an analysis was carried out at the individual level, taking into consideration the main differences and associations between responses offered by individual seafarers. Then, data were analysed at the ship level by aggregating all individual responses from the same ship. Cross-level interactions were also investigated in order to identify the effects of broader (ship level) factors on individual outcomes.

Descriptive data are presented and analysed first showing the main variables measured. These results highlight the strengths and weaknesses of safety culture, as well as its possible antecedents and consequences within the sample. This analysis is followed by the presentation of relationships among measured variables to identify the main predictors for key outcomes. The findings section presents a multi-level analysis investigating how factors/conditions perceived to occur at the ship level might influence individual outcomes in terms of safety and wellbeing.

### 2.1.5. Workshop with AMSA maritime experts

Following the data collection and analysis, a workshop was conducted at AMSA offices in Canberra with subject matter experts from a variety of backgrounds.

The objective of the workshop was to present the study findings and obtain experts' input about the potential implications and recommendations. A partner investigator and a research assistant on the project facilitated the workshop. They started by presenting the main findings of the current survey to participants. After each section of

findings was presented, AMSA participants were asked about the main implications and recommendations that can be derived based on the findings.

Information gathered from the workshop was compiled and informed the recommendations section of this report. This process ensured that the recommendations supplemented research findings with the pool of practical knowledge provided by the experts.

# 3. FINDINGS

## 3.1. DESCRIPTIVE DATA

### 3.1.1. Safety Culture Development Levels (SCDL)

Figure 3.1 shows that safety culture across ships was evaluated positively. This overall finding should be tempered by two considerations. First, there were a number of cases for which safety culture was reported within the reactive – compliance based spectrum. The *Planning and Scheduling* dimension specifically is where most cases of reactive or compliance focused cultures can be seen. At the other end of the spectrum, aspects that were most positively evaluated were those related to seafarers' perceived personal responsibility towards safety: *responsibilities and motives*.

Second, ships in the study are required to meet the requirement of the International Safety Management (ISM) code, which includes having a safety management system in place. These formal requirements are expected to have a positive impact on the evaluation perception of systems and processes. However, it is also important to understand how these formal systems have an impact on safety behaviour and wellbeing of seafarers. Further results drill down into these issues.

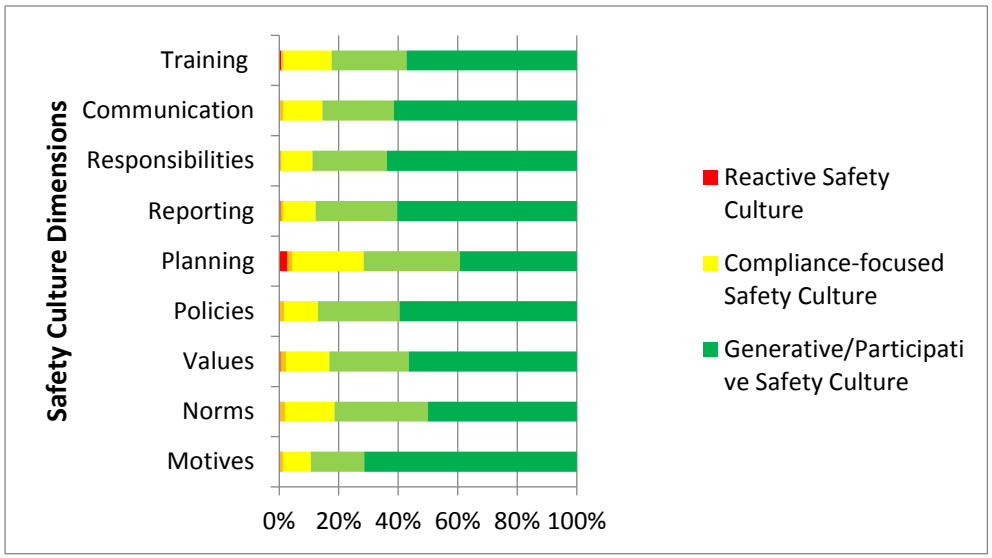



**Figure 3.1.** Breakdown of participants' responses on the SCDS dimensions.

Figure 3.2 presents a breakdown of the mean scores of the safety culture dimensions across the command team participants and the rest of the crew. There was an overall tendency for the command team participants to report higher scores across most of the safety culture dimensions. Further analyses showed that these differences are statistically significant.

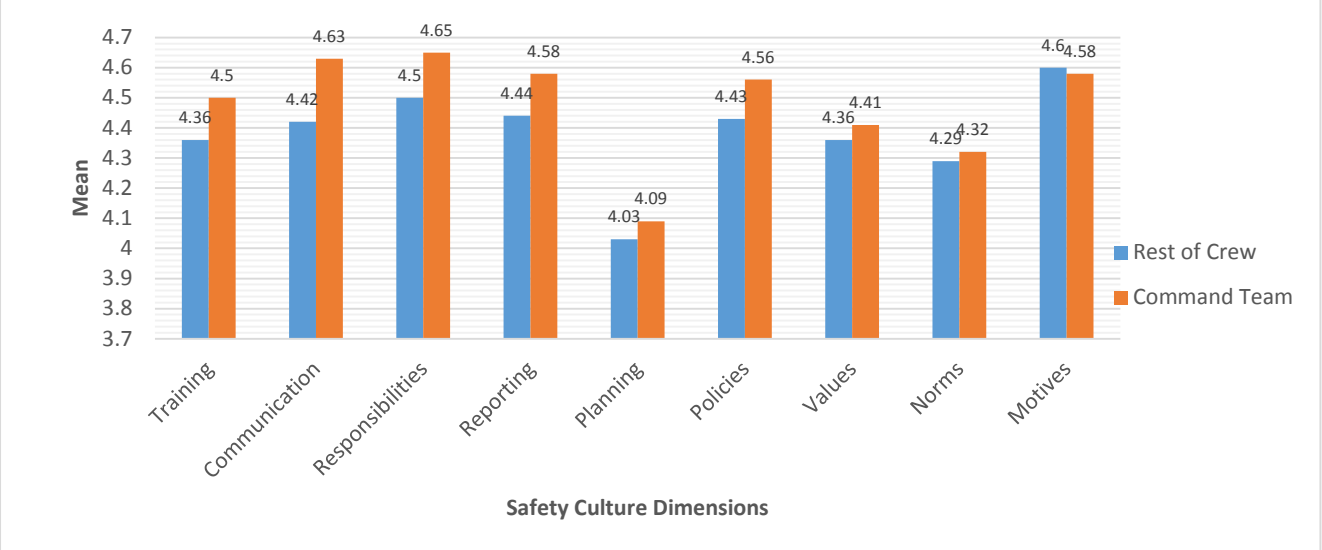



**Figure 3.2.** Mean scores for the SCDS dimensions across the command team participants and the rest of the crew.

Figure 3.3 presents the breakdown of the mean scores of safety culture's dimensions across ship types. A consistent pattern observed is that participants working on bulk, container, and general cargo ships tend to rate the safety culture dimensions higher compared to the other ship types in this sample.

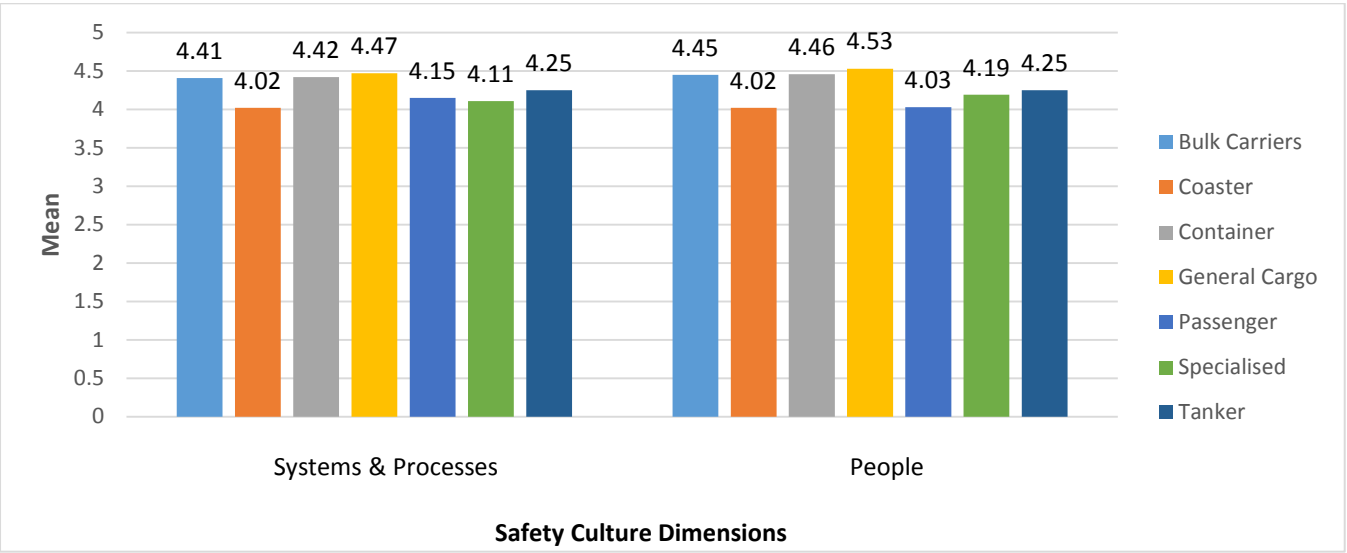



**Figure 3.3.** Mean scores for the SCDS dimensions across the different ship types.

## 3.1.2. Antecedents of safety culture

### *3.1.2.1. Company priorities (My Company)*

Figure 3.4 presents an overview of how company priorities are perceived by the crewmembers. Overall, seafarers perceive that companies place a great importance on preventing damage to the ship and cargo, as well as on the safety of the crew. However, about 20% of seafarers perceive that the company they work for places little or moderate importance on their welfare.

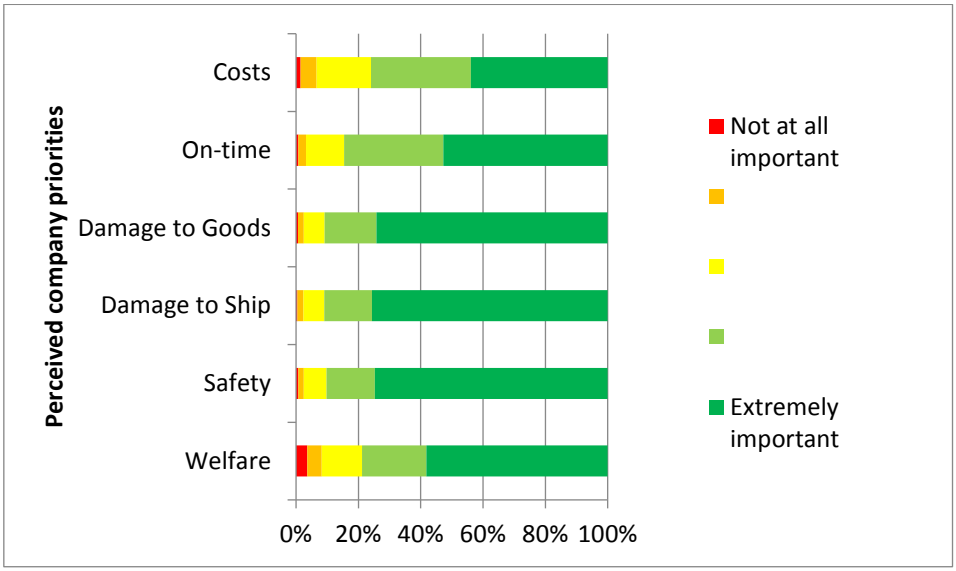



**Figure 3.4.** Breakdown of participants' responses on perceived company priorities items.

Figure 3.5 provides a further breakdown of the mean scores for company priorities perceived by the command team and the rest of crew. Overall, command team members assessed almost all priorities higher (with the exception of the priority on costs), and the difference was larger for priorities related to preserving the integrity of ships and cargos. Further analyses showed that the difference in the mean scores between crew participants and command team participants regarding the priorities on preventing damage (ship and goods) are statistically significant.

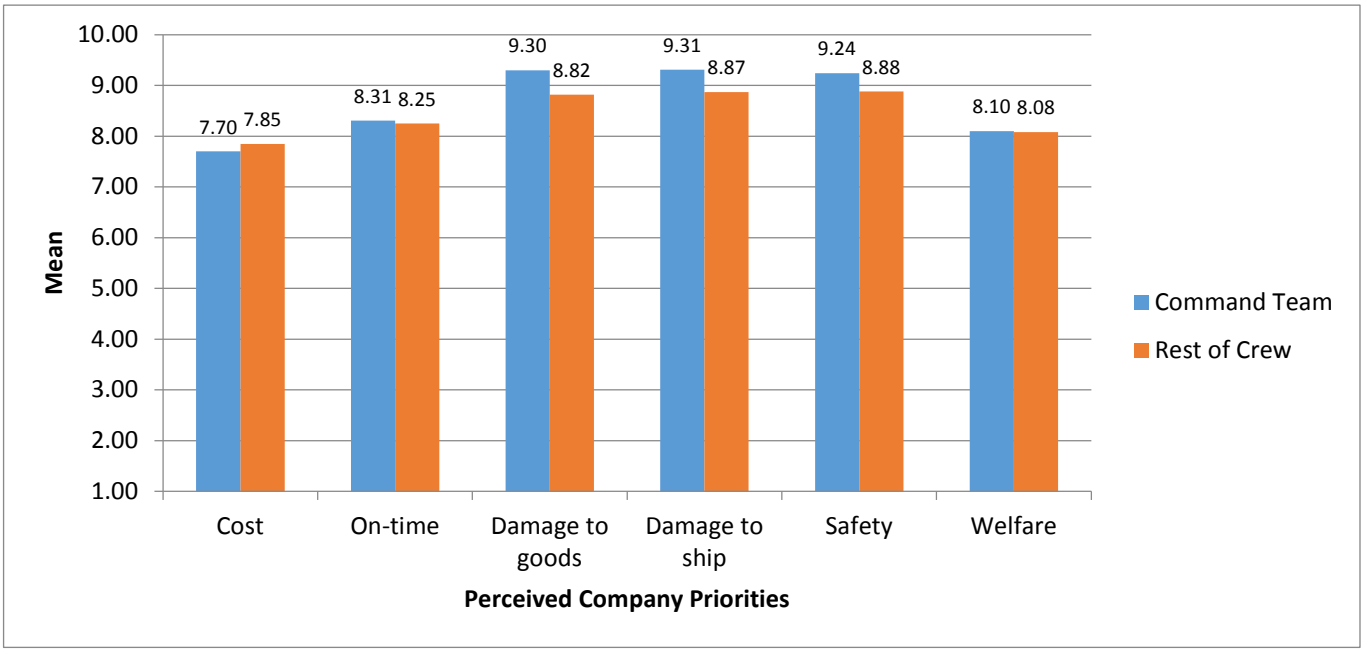



**Figure 3.5.** Breakdown of means scores for perceived company priorities across the command and the rest of crew.

Figure 3.6, Figure 3.7, and Figure 3.8 present a further breakdown of the means scores for company priorities based on ship type. Some emerging patterns should be noted. Seafarers working on specialised vessels and general cargo report some of the highest values for all priorities. However, when comparing scores for each of these ship types, general cargo ships show lower scores on performance related priorities (cost and being on time) while specialised vessels show lower scores on performance and preventing damage. In contrast, seafarers on board coasters and passenger ships consistently tend to report lower scores for all priorities.

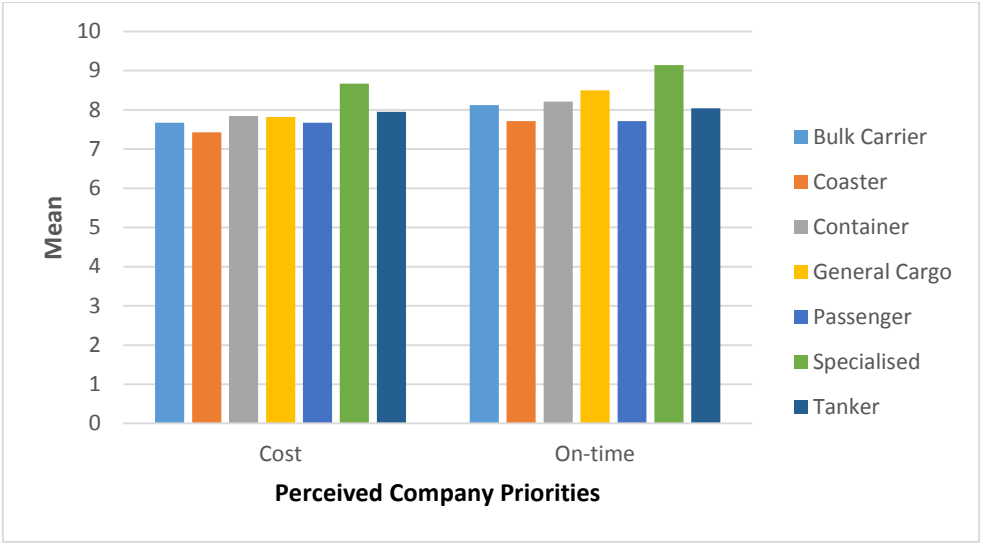



**Figure 3.6.** Breakdown of mean scores for perceived company priorities on costs and on-time performance, across ship types.

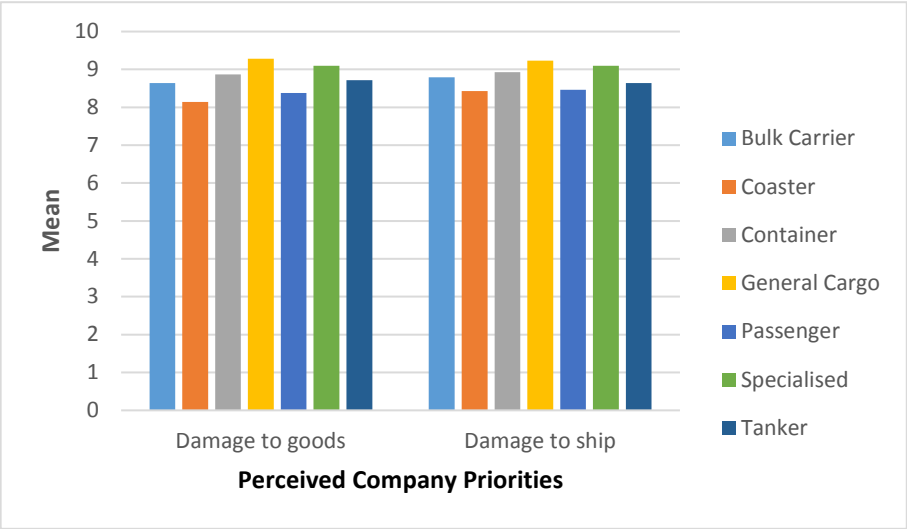



**Figure 3.7.** Breakdown of mean scores for perceived company priorities on preventing damage to goods and ship, across ship types

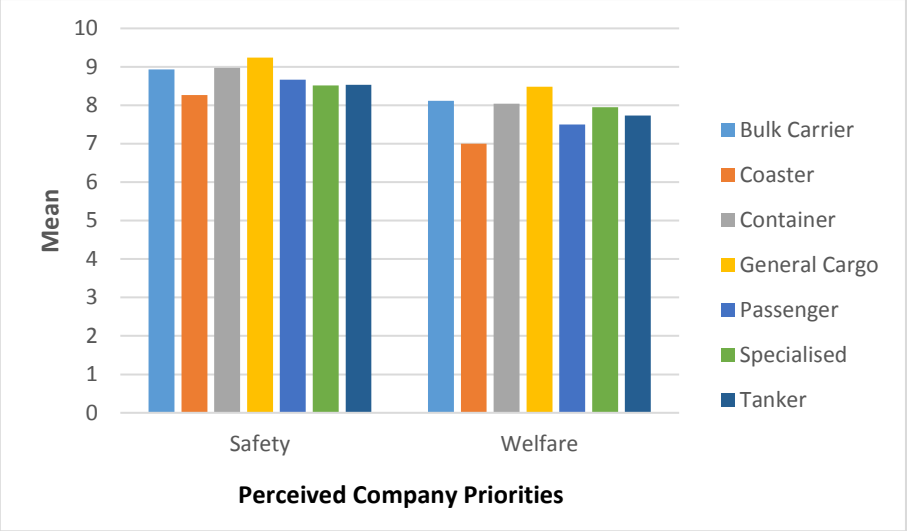



**Figure 3.8.** Breakdown of means scores for perceived company people priorities across ship types

### *3.1.2.2. Work demands (My Work)*

**Quantitative workload.** Participants reported working 61.28 hours per week on average, with a standard deviation of 13.06 hours. Figure 3.9 presents a breakdown of working hours in several categories and indicates that a high proportion (almost 30%) of the participants are working long hours, exceeding 69 hours/week.

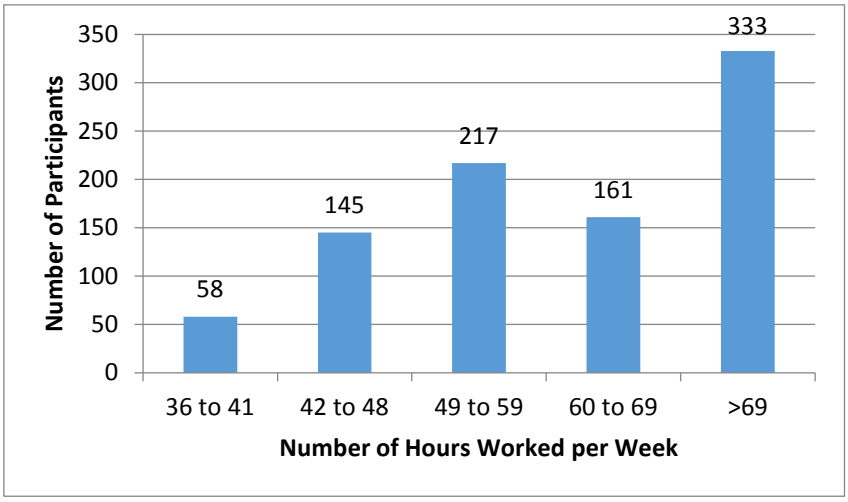



**Figure 3.9.** Number of hours worked per week on average.

**Qualitative workload.** Long working hours appear to be also coupled with increased qualitative demands. More than 20% of participants reported that their working hours are unpredictable (Figure 3.10).

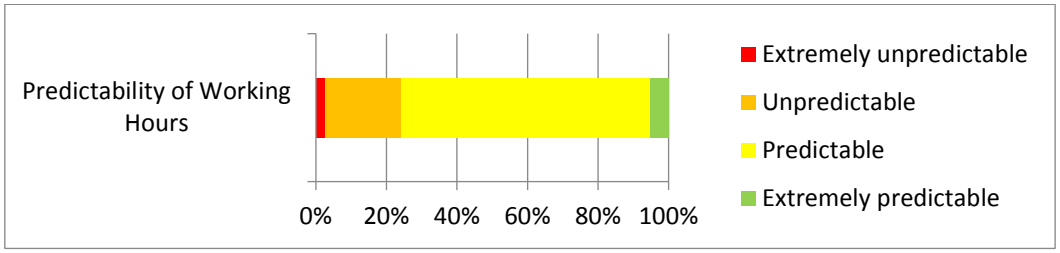



**Figure 3.10.** Breakdown of participants' responses regarding predictability of working hours.

Similarly, approximately 40% of participants reported working under time pressure, and about half of them reported experiencing high demands for vigilance at least sometimes in their work (Figure 3.11).

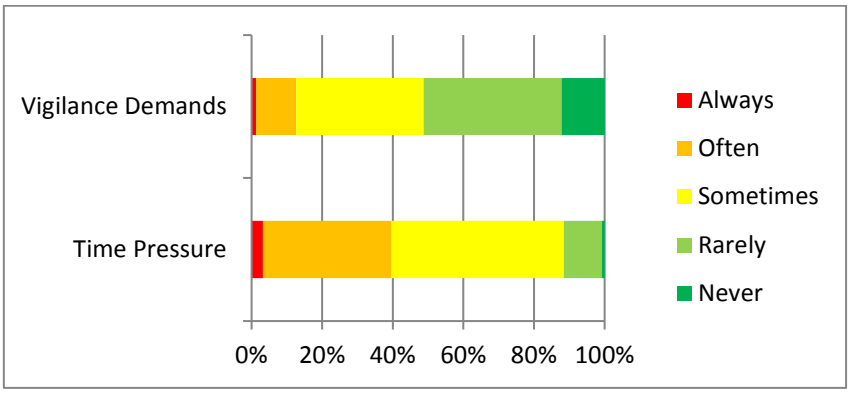



**Figure 3.11.** Breakdown of participants' responses for experienced time pressure and vigilance demands in their work.

### *3.1.2.3. Work difficulties (My Work)*

This section presents descriptive data on the three types of shipboard conditions (work difficulties) that might affect safety culture and safety outcomes: physical conditions, technology and resources, and operational uncertainty.

Two categories of physical conditions were measured: external and internal conditions. Approximately 40% of participants reported that bad weather often caused difficulties in performing their work. Additionally, more than 20% of participants reported that poor visibility and ship motion often created difficulties for them in performing their work (Figure 3.12). An examination of differences across ship types or level (command team versus rest of the crew) did not reveal any notable trends in the reported data.

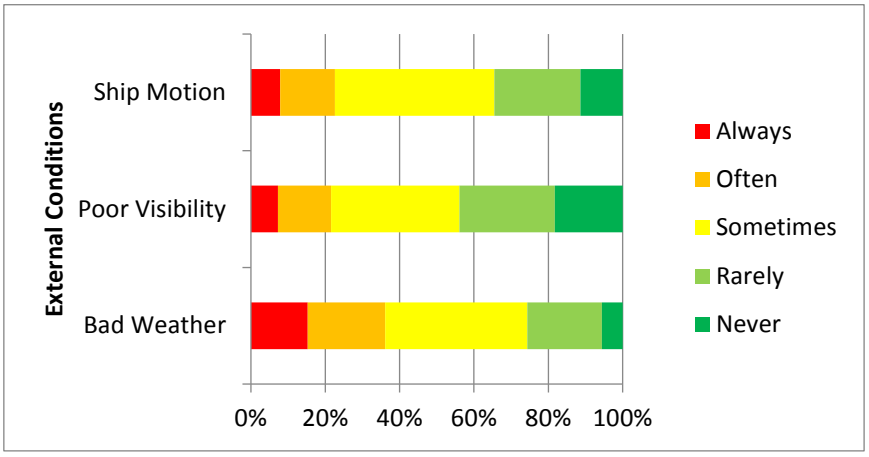



**Figure 3.12.** Breakdown of participants' responses evaluating how often external physical conditions are creating difficulties for them in their work.

Results for internal physical working conditions were similar (Figure 3.13), with loud noise and cramped workspaces being reported as a source of frequent disturbance by a higher proportion of participants.

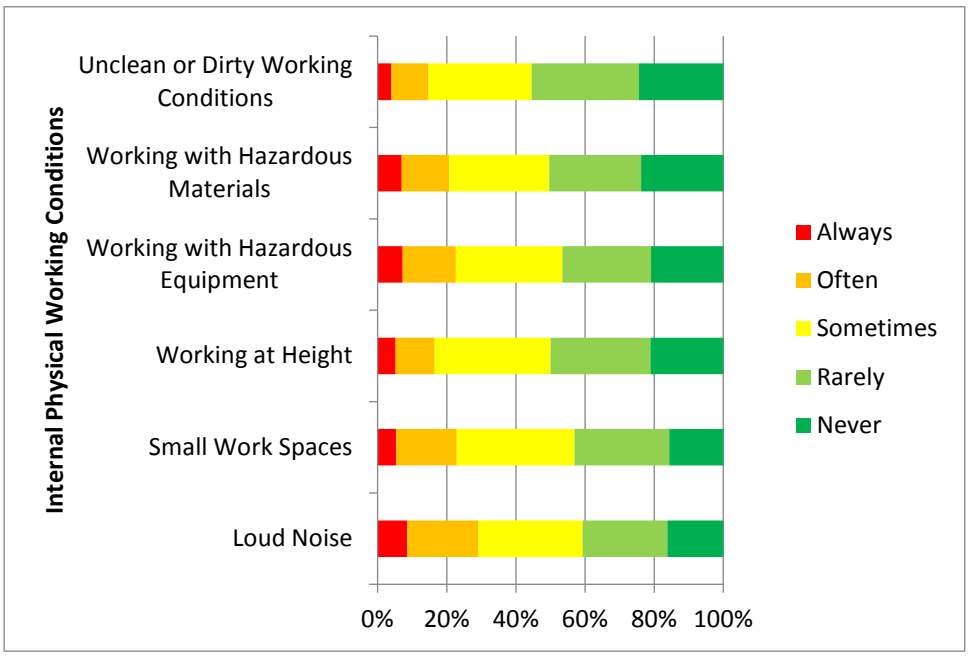



**Figure 3.13.** Breakdown of participants' responses evaluating how often internal physical conditions are creating difficulties for them in their work.

Scores for difficulties related to technology and resources were relatively homogenous. However, more participants (around 20%) reported that not having the needed supplies and maintenance problems often created difficulties in performing work (Figure 3.14).

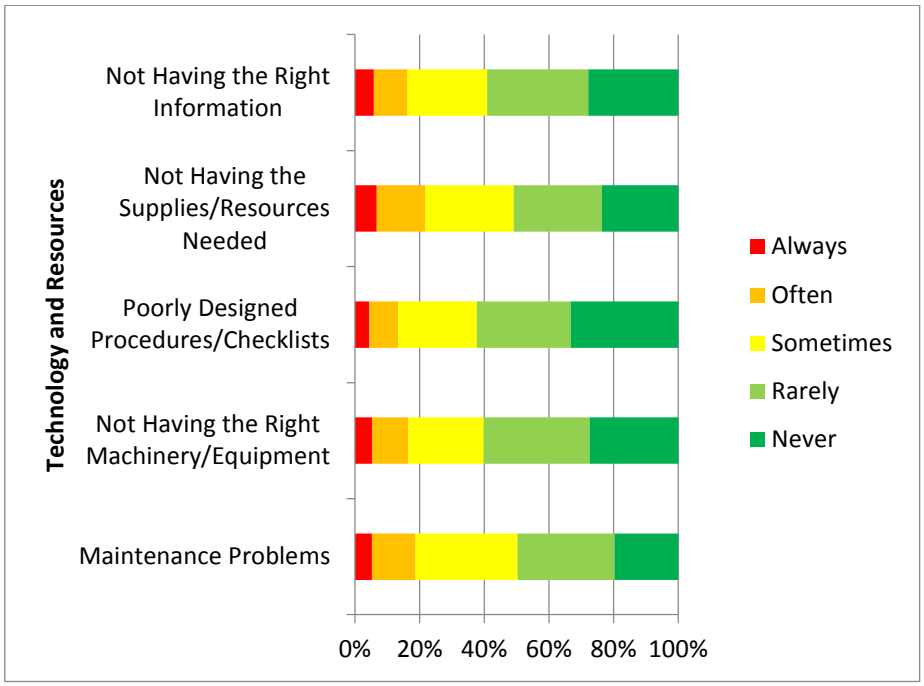



**Figure 3.14.** Breakdown of participants' responses evaluating how often conditions related to available technology and resources are creating difficulties for them in their work.

Approximately 40% of the sample reported difficulties related to operational uncertainty at least sometimes in their work. Scores are relatively homogenous across the factors measured, but frequent changes to schedule and manifest as well as disruptions or delays appear to be more common forms of difficulties (Figure 3.15).

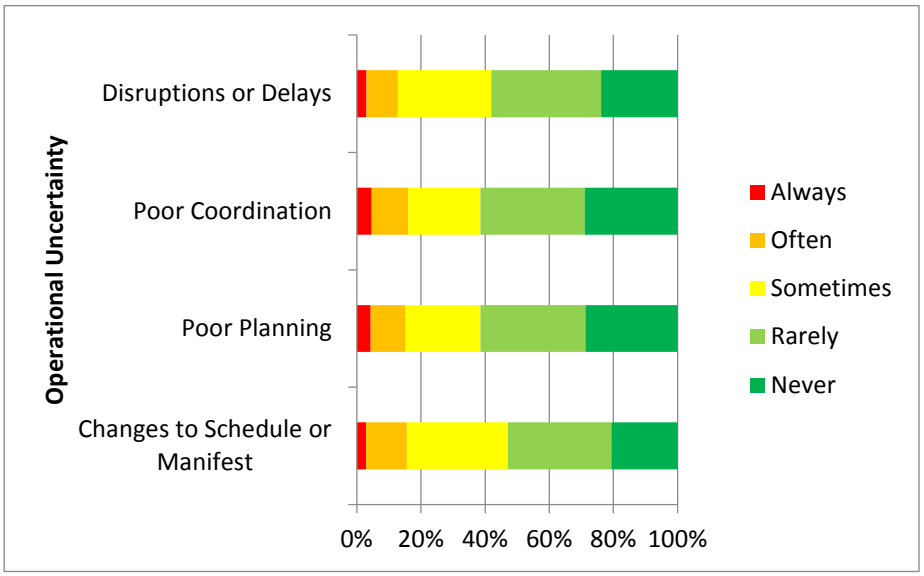



**Figure 3.15.** Breakdown of participants' responses evaluating how often conditions related to operational uncertainty are creating difficulties for them in their work.

### *3.1.2.4. Work resources (My Work and My Team)*

In this descriptive part, the results for the work resources that are highlighted in the research literature as the most powerful predictors of safety and wellbeing outcomes are presented. These resources are autonomy (**My work)**, social support and safety leadership (**My team**). In the more in-depth analysis the influence of all work resources on outcomes of interest was tested.

**Work Autonomy and Social Support**

Figure 3.16 indicates that the majority of participating seafarers (above 80%) agreed that they are able to rely on their immediate supervisor and co-workers for support. Additionally, more than half reported that they had high levels of autonomy in their work.

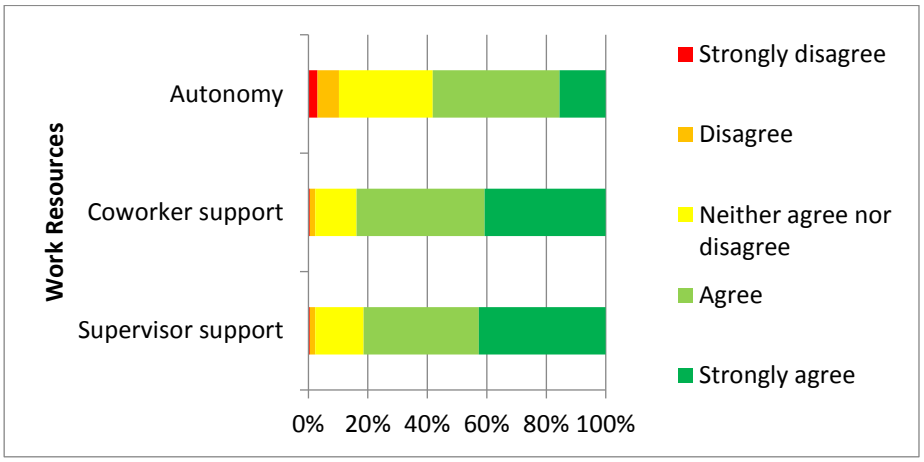



**Figure 3.16**. Breakdown of participants' responses regarding available work resources.

A more in-depth examination of the differences between the means scores for crew and command team members is presented in Figure 3.17. As expected, command team members consistently reported higher levels of work resources being available. However, the differences between crew and command team was statistically significant only for autonomy.

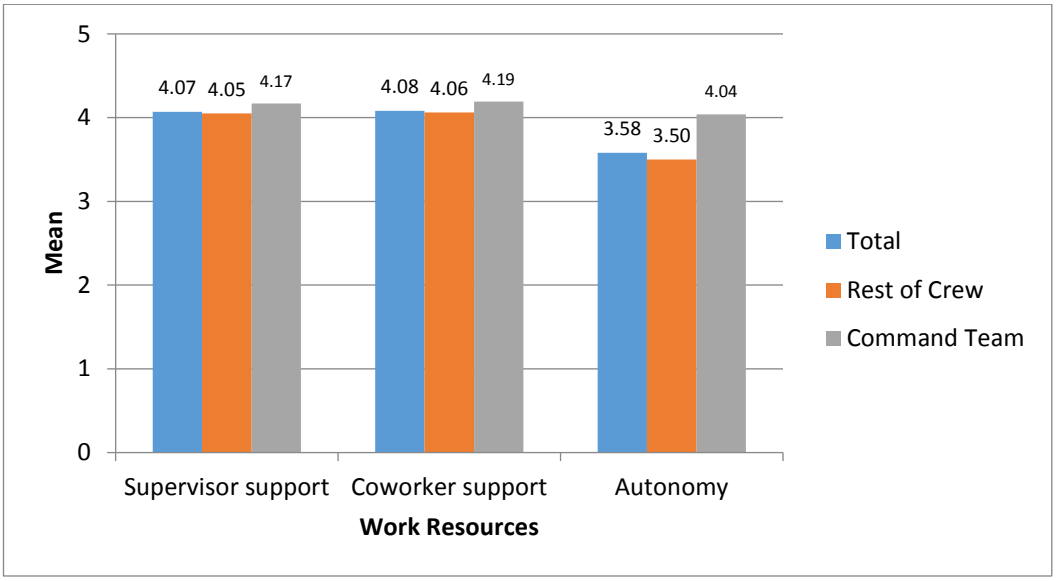



**Figure 3.17.** Breakdown of average scores for available work resources across the command team sample and rest of the crew.

The analysis of the data based on the ship type did not reveal any clear patterns (refer to Figure 3.18). However, it is worth noting that while seafarers on coaster vessels reported receiving less social support (both co-worker and supervisor support), they also report higher levels of autonomy in their work, relative to participants working on other types of vessels.

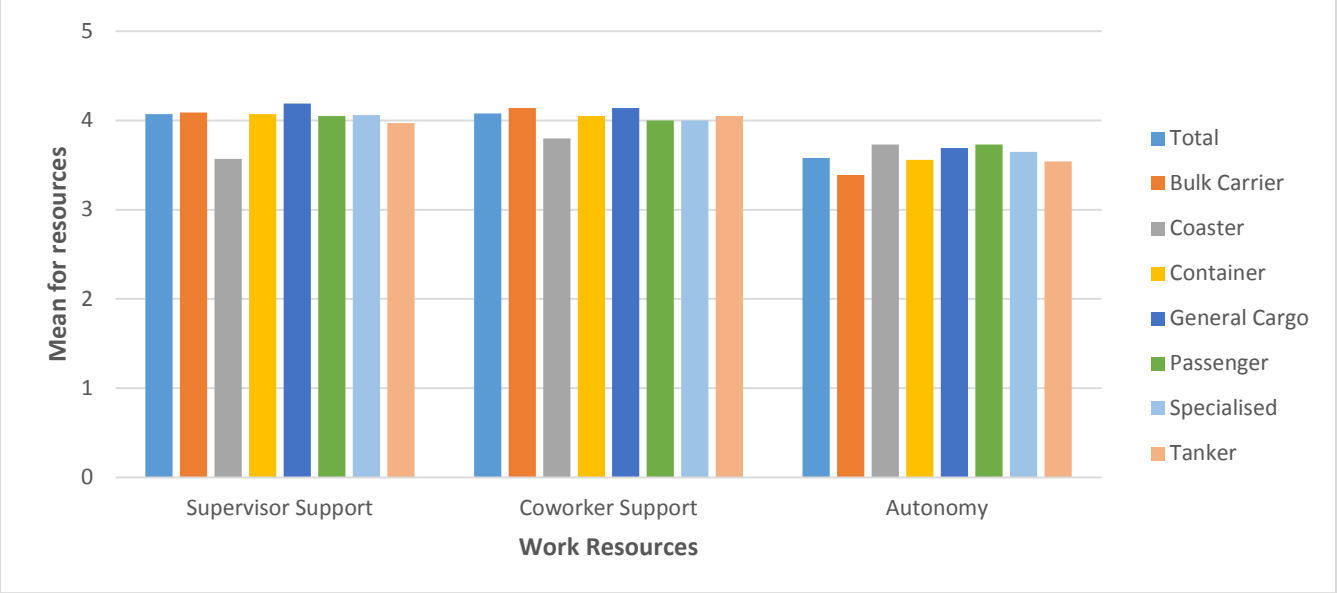



**Figure 3.18.** Breakdown of average scores for available work resources across different types of vessels.

**Safety Leadership**

Safety leadership, and especially the way leaders reflect and communicate safety goals, represents another type of work resource that might play an important role in health and safety outcomes. As indicated, four different aspects of safety leadership were measured: *leverage*, *energise*, *adapt* and *defend*.

Figure 3.19 provides an overview of safety leadership behaviours displayed by immediate supervisors as perceived by their subordinates. Overall, all aspects of safety leadership received positive evaluations, with over 80% of participants agreeing that their supervisors exhibit all four of the surveyed safety leadership behaviours.

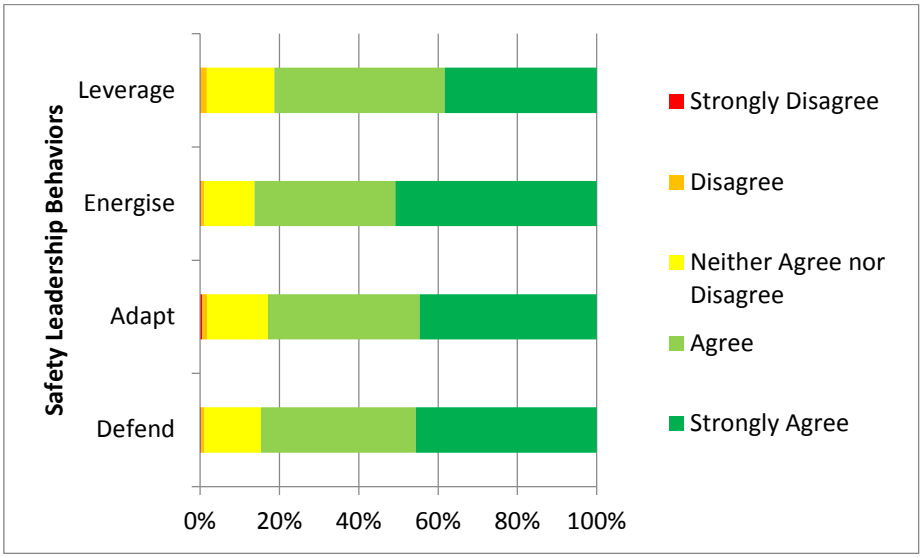



**Figure 3.19.** Breakdown of participants' responses regarding perceived safety leadership behaviours of their direct supervisors.

When comparing safety leadership perceived by the command team versus the rest of the crew (all referring to their direct supervisors), members of the command team consistently provided higher evaluations of their direct supervisors' leadership behaviours (Figure 3.20). These differences appeared to be more pronounced and statistically significant for *energise* and *defend* type of behaviours.

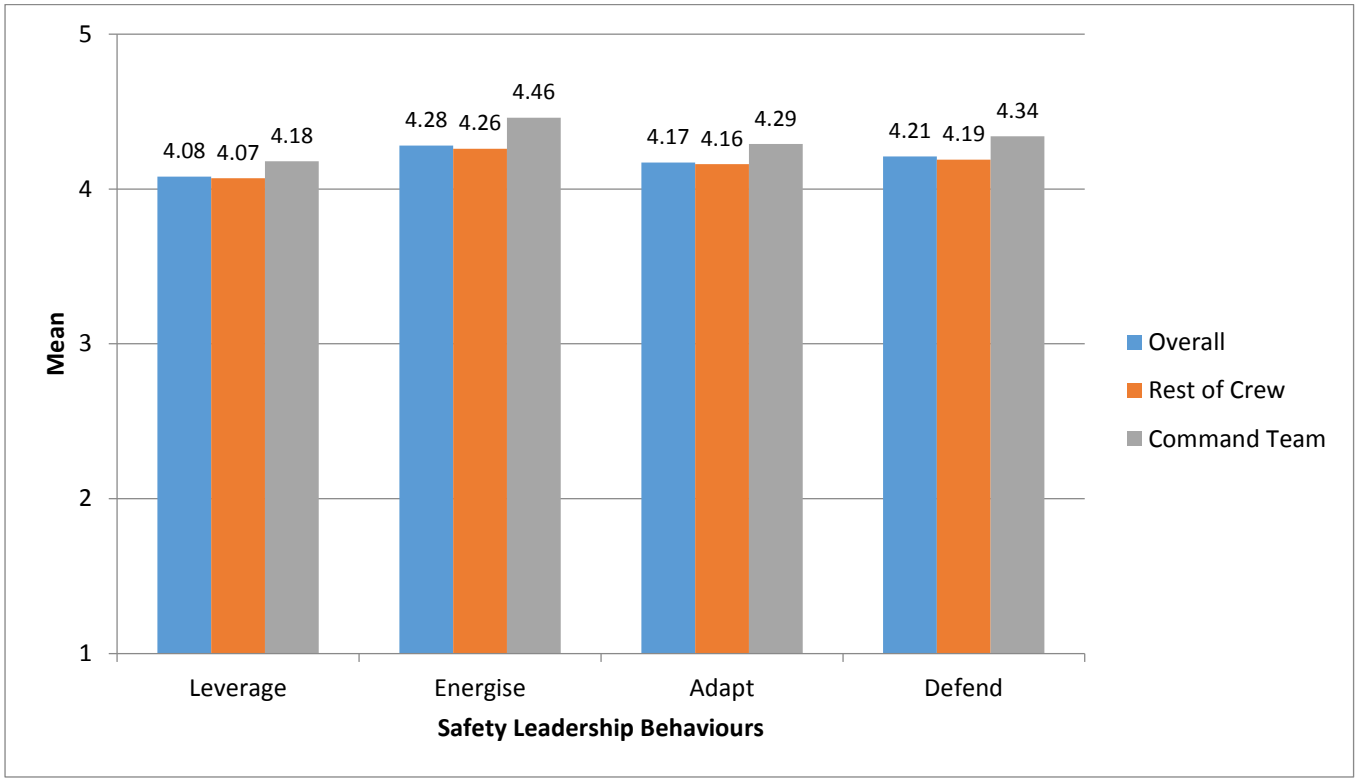



**Figure 3.20.** Breakdown of average scores for perceived safety leadership behaviours across the command team sample and rest of the crew.

## 3.1.3. Outcomes - Individual level

### *3.1.3.1. Fatigue and Recovery*

Several aspects of seafarers' fatigue and recovery were measured. First, participants' quality of sleep was assessed by asking whether they experienced sleep problems onboard the ship. As indicated in Figure 3.21, approximately 12% of the participants experienced sleep problems, while close to half of the participants reported no sleep-related difficulties.

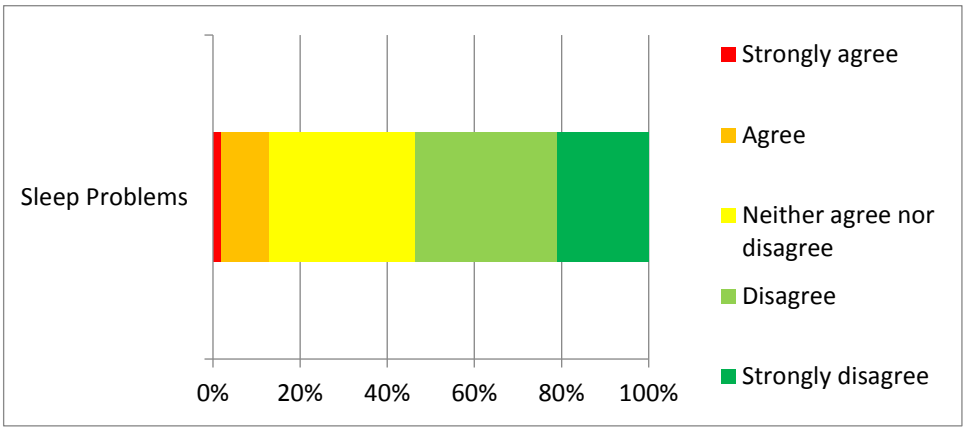



**Figure 3.21.** Breakdown of participants' responses regarding whether they experienced sleep problems while on board the vessels.

A similar pattern is observed in the participants' fatigue data (Figure 3.22). Approximately half of the participants reported experiencing low levels of fatigue, while close to 20% of the participants reported experiencing increased or high levels of fatigue, more notably, chronic fatigue.

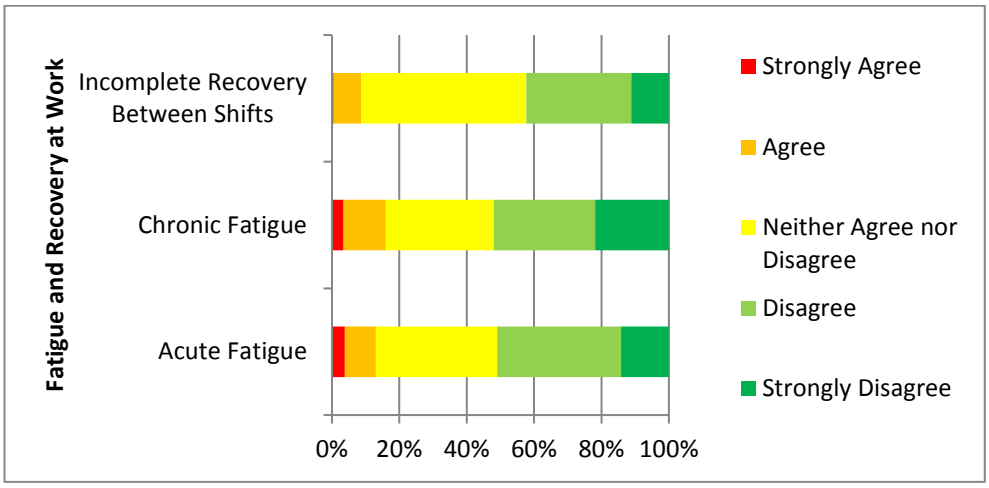



**Figure 3.22.** Breakdown of participants' responses regarding experienced levels of fatigue at work.

More than 20 % of participants reported high levels of strain due to being away from immediate family (Figure 3.23).

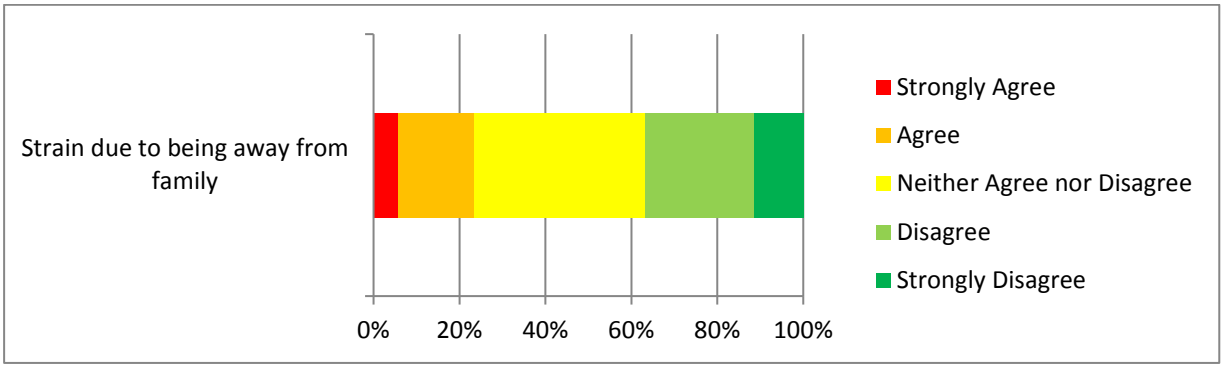



**Figure 3.23.** Breakdown of participants' responses regarding experienced levels of strain due to being away from their families.

### *3.1.3.2. Mental health and wellbeing*

Figure 3.24 presents an overview of mental health and wellbeing. Three aspects of wellbeing were measured: *hedonic*, *psychological* and *social* wellbeing. A measure of mental health was included to provide insights into symptoms of mental illness that seafarers might experience at work. Almost 40% of the participating seafarers reported experiencing negative symptoms at least sometimes, and around 10% of them reported low levels of mental health (frequent symptoms of mental ill health – depression and anxiety). In terms of overall wellbeing, responses were more positive. However, the lowest percentages of good levels of wellbeing were found for social wellbeing. Not surprisingly, social wellbeing is the aspect of wellbeing that is more likely to be impacted by the working arrangements in the maritime industry.

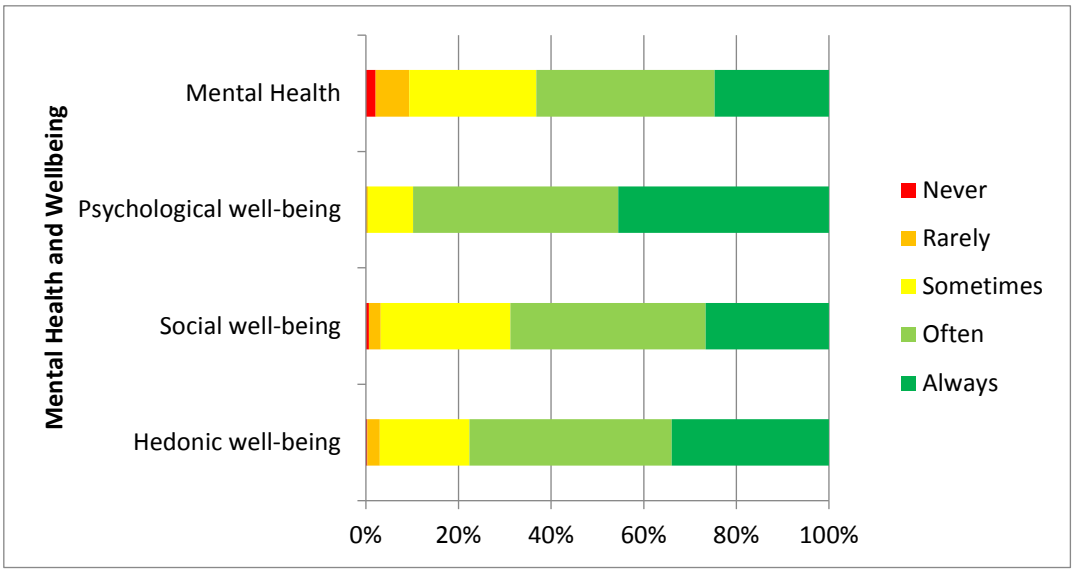



**Figure 3.24.** Breakdown of participants' responses regarding mental health and wellbeing.[2]

[2] Mental Health was measured by asking respondents how frequently they had experienced symptoms of depression and anxiety in the past month. Then, for this particular graph, the responses were reversed to align with the direction of the other 3 scales. Answers like *never/rarely* reflect poor mental health and *often/always* reflect good levels of mental health.

Figure 3.25 presents the breakdown of mental health and wellbeing across the command team and the rest of the crew. Further analyses found that there were no significant differences between crew and command team across mental health and types of wellbeing except for psychological wellbeing, with command team participants reporting slightly higher levels of psychological wellbeing compared to the rest of the crew.

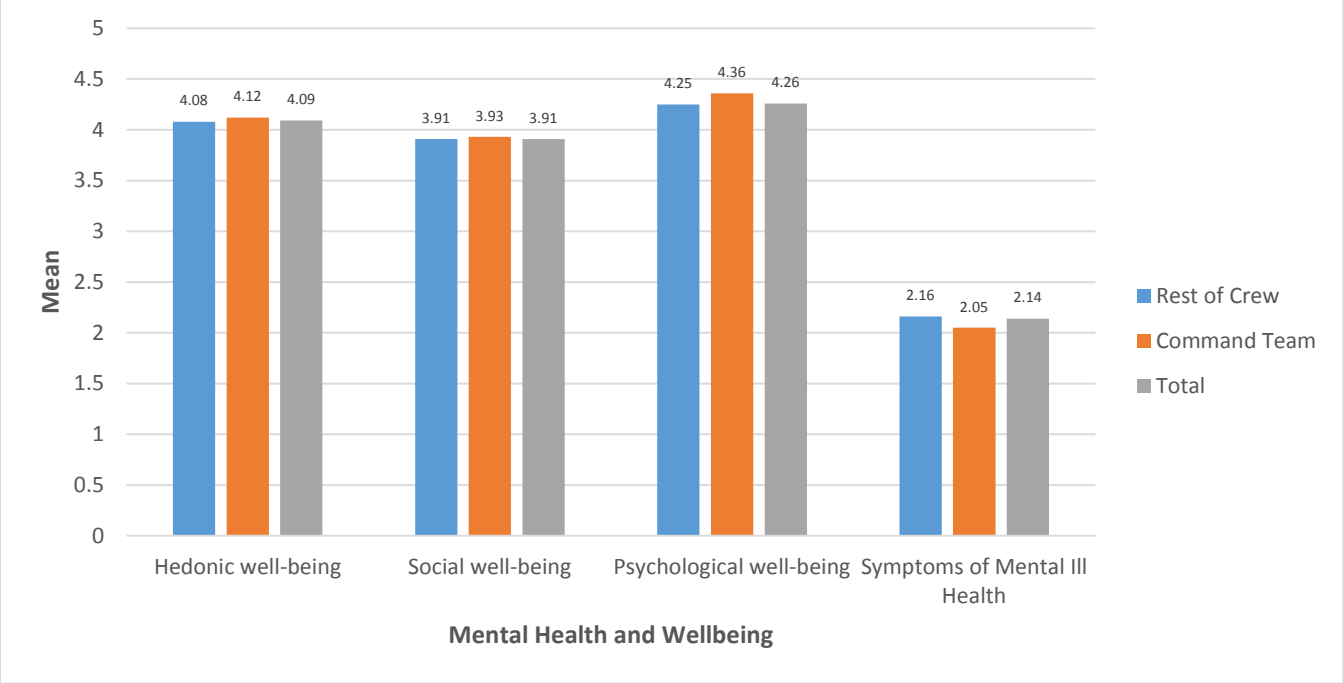



**Figure 3.25.** Breakdown of mean scores for mental health and wellbeing across the command team participants and rest of the crew.

Figure 3.26 presents the breakdown of mental health and wellbeing across different types of participating ships. Analyses indicate that there were some significant differences between different types of vessels, but only for social wellbeing and mental ill health.

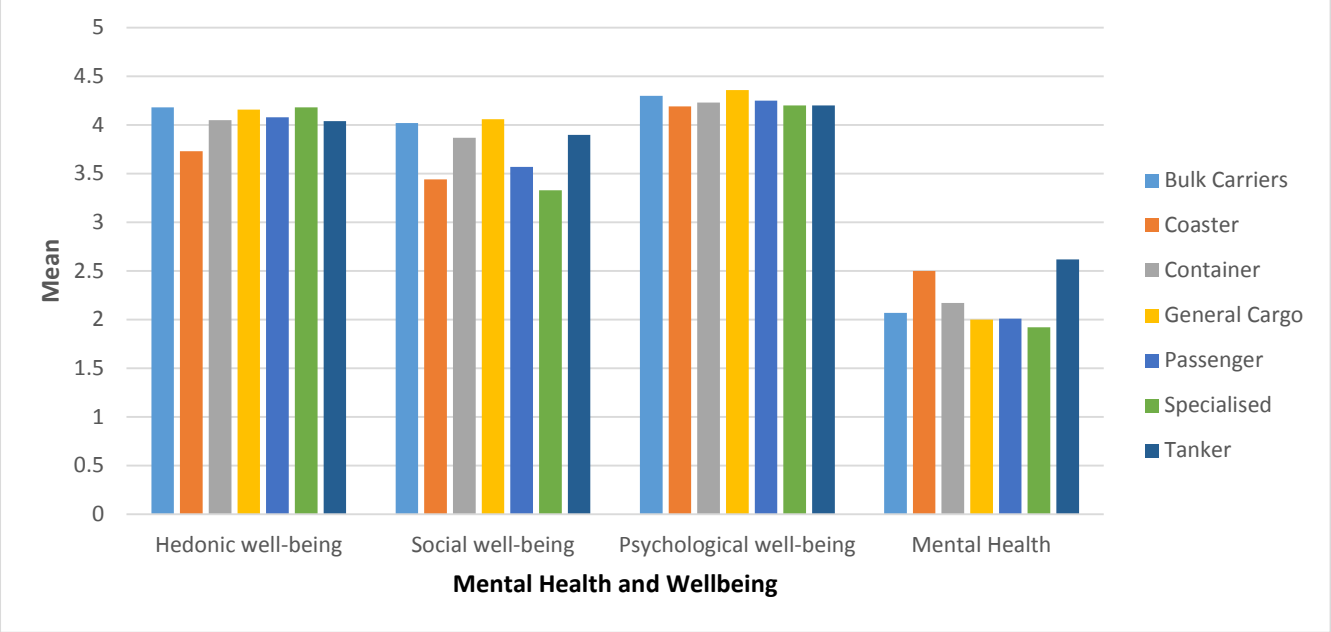



**Figure 3.26.** Breakdown of mental health and wellbeing scores across different types of participating ships.

Most notably, for social wellbeing, seafarers working on specialised vessels tend to report the lowest scores, and the difference is significant especially when compared with the scores of seafarers working on bulk carriers, container ships, general cargo ships and tankers. In terms of mental health, seafarers working on tankers presented the highest scores for symptoms of mental ill health. The difference was significant when compared with specialised vessels, bulk carriers and general cargo ships. Further investigation is needed to understand some of the working conditions across these vessels that would explain these differences in mental health and wellbeing.

### *3.1.3.3. Safety Behaviours*

**Overall Safety Behaviours**

Overall safety behaviours were measured in terms of *safety task performance*, *safety participation* and *safety innovation*. Figure 3.27 indicates high levels of these behaviours being reported, especially for safety task performance. The positive results for safety compliance do not necessarily reflect mature levels of participative/generative safety on board the participating ships. Participative/generative safety cultures are usually associated with less emphasis on overall compliance (safety task performance) and more safety participation and innovation. While safety participation and innovation levels were relatively high in this sample, levels of safety task performance reported were even higher indicating a strong emphasis on compliance.

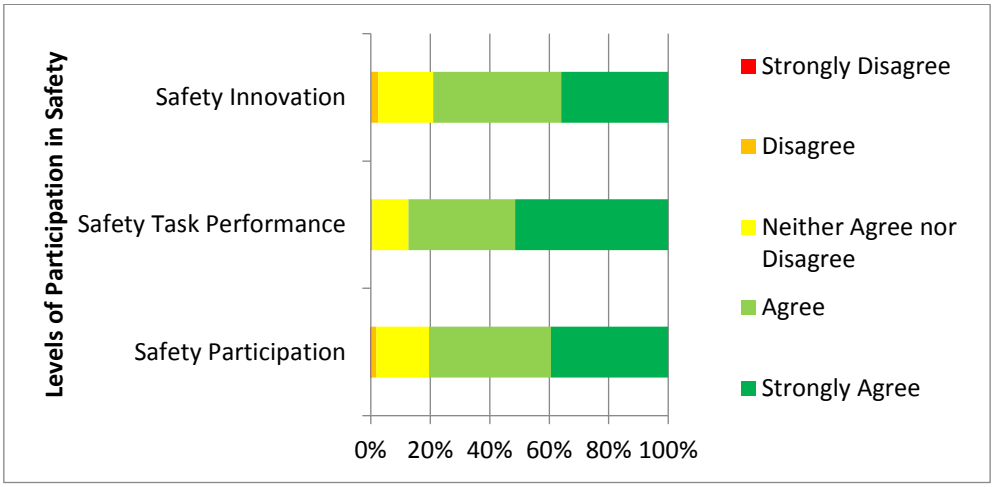



**Figure 3.27.** Breakdown of participants' responses regarding different levels of safety participation.

**Types of Safety Compliance**

As recent literature is starting to emphasize that the ways in which employees comply might be more relevant than their overall compliance levels (Griffin & Hu, 2013), special attention was given to different ways in which seafarers comply with safety rules and procedures. Beyond the general measures of compliance, the quality of these behaviours were analysed by looking at two types of positive compliance behaviours: *adaptive compliance* and *deep compliance*; and two types of negative safety behaviours: *surface compliance* and *non-compliance*.

Figure 3.28 presents the results for positive compliance behaviours. The results suggest a high level of positive compliance. Most of the participants (approximately 80%) reported trying their best to apply the correct procedures to the task (deep compliance) and being adaptive, such as drawing on knowledge and experience to come up with a solution to complete the task safely when circumstances make existing procedures not appropriate (adaptive compliance).

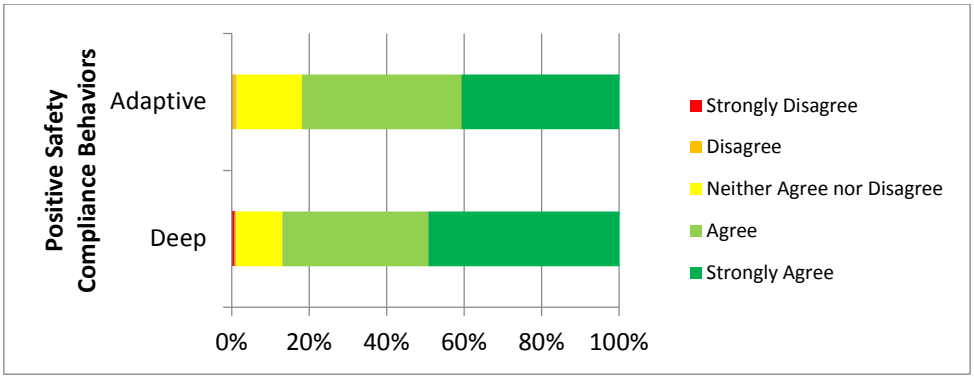



**Figure 3.28**. Breakdown of self-reported positive safety compliance behaviours.

However, when negative safety compliance behaviours are taken into account (Figure 3.29), the results indicate that non-compliance, and especially surface compliance, are also manifested by participants. Notably, more than 40% of participants reported that they sometimes just "tick the boxes" without paying too much attention to the actual procedures; and almost 20% reported some level of non-compliant behaviours (e.g. skip the procedures to get the work done).

The results for positive and negative safety behaviours might appear contradictory at first glance. However, there are potential explanations for this pattern of findings. In particular, there are multiple procedures in place on any vessel, and seafarers might comply with some but not others. Even when overall compliance is positive, there might be situations of non-compliance or surface compliance that have the potential to put safety at risk.

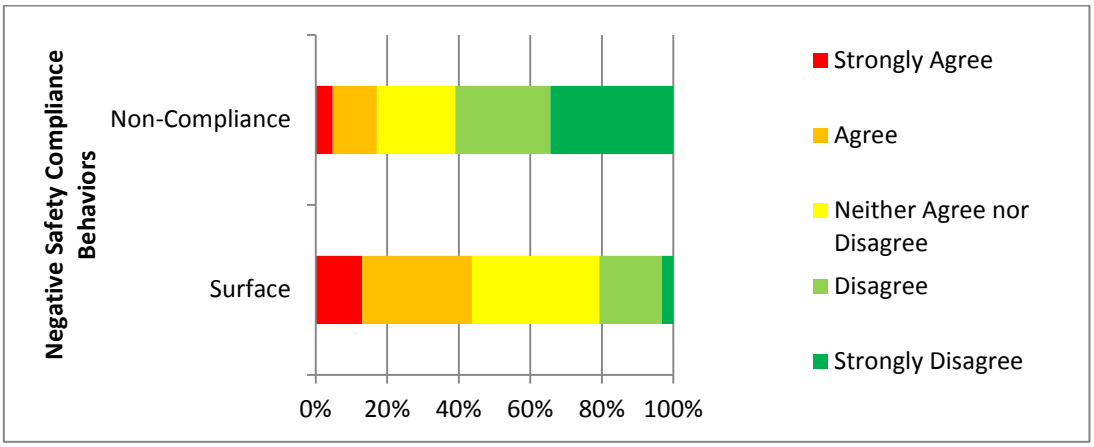



**Figure 3.29**. Breakdown of self-reported negative safety compliance behaviours.

**Safety Engagement**

Seafarers also reported high levels of cognitive and emotional engagement with the safety programs on board their vessels (Figure 3.30).

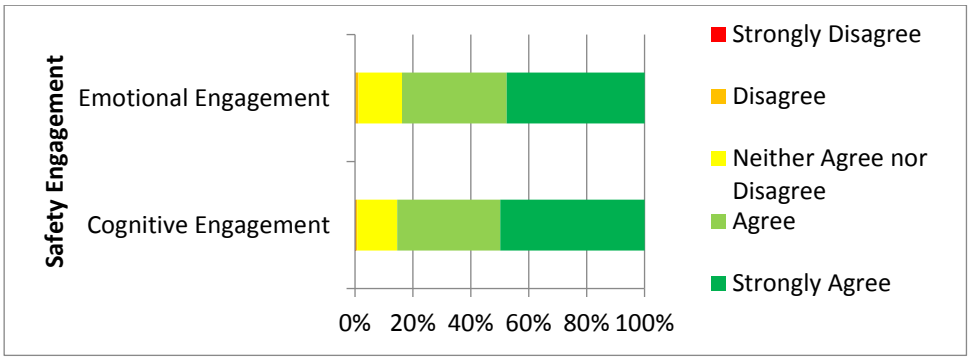



**Figure 3.30.** Breakdown of participants' responses regarding their engagement with safety programs on board their vessels.

### *3.1.3.4. Injuries and near misses*

Figure 3.31 presents the number of participants who self-reported having experienced injuries and near misses, with the majority of the participants experiencing no injuries or a near miss in the past 6 months. However, it is important to note that more than 100 participants did experience an injury and/or a near miss within this time frame.

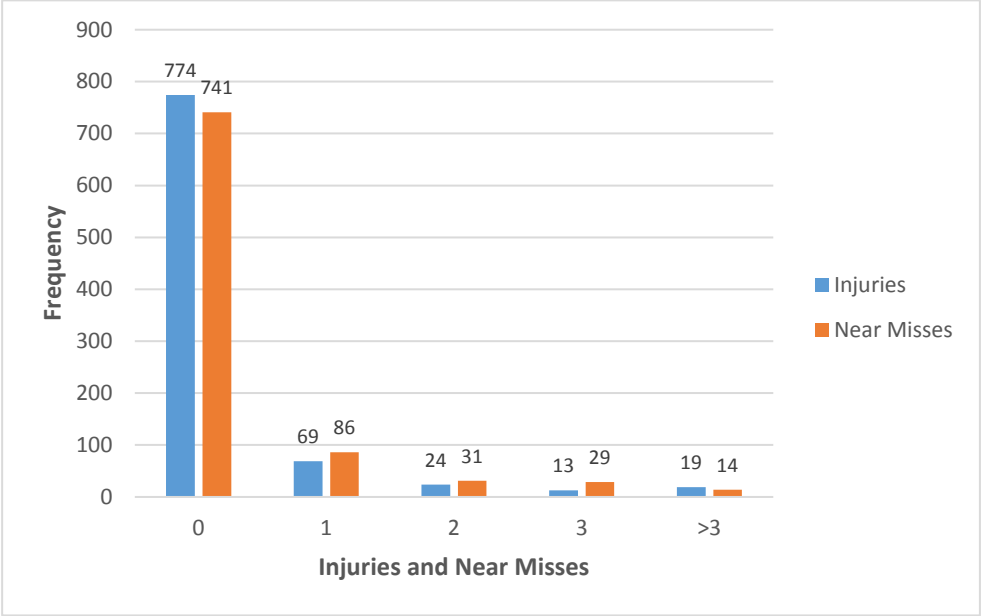



**Figure 3.31.** Incidents and near misses experienced by participants in this study.

To obtain a broader view of injury and near miss frequencies onboard the vessels, the study also asked how often participants observed others experiencing injuries and/or near misses in the past 6 months (Figure 3.32). Similar to the previous graph, most of the participants reported not observing an injury or a near miss in the past 6 months. However, the number of observed injury and near misses were noticeably higher than the experienced injuries/near misses.

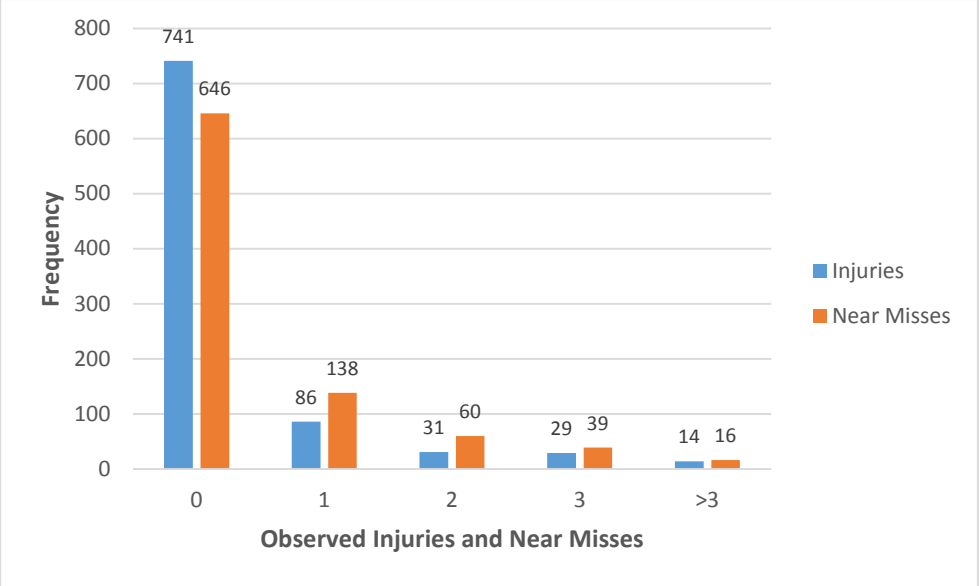



**Figure 3.32.** Incidents and near misses observed by participants in this study.

Figure 3.33 provides an overview of all the cases of near misses reported (experienced and observed) across the command team and the rest of the crew. While 63% of participants reported 0 frequencies for all types of near-misses, 19% of participants reported at least 1 near miss, 10% reported 3 to 4 near-misses experienced or witnessed and 8% report more than 4 near-misses experienced or witnessed in the past 6 months. Most of the participants who reported higher numbers of injuries and near misses are crew members who do not form part of the command team. More command team members report near misses, but most of them are around the low frequency of up to 2.

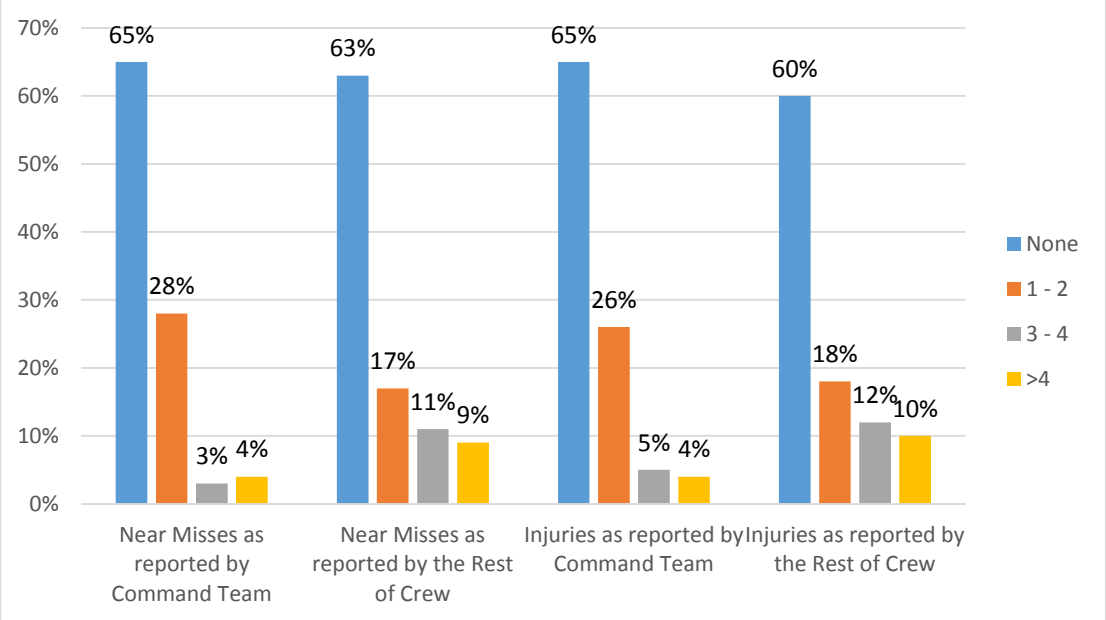



**Figure 3.33.** Breakdown of incidents and near misses reported (experienced and observed) across the command team and the rest of the crew.

## 3.1.4. Outcomes - Ship level

### *3.1.4.1. Inspections, Deficiencies and Detentions*

The overall pattern of the ship level data reflect the safety outcomes reported at the individual level, with very few of the participating ships having been detained or having deficiencies registered during 2015 and 2016 (Figure 3.34).

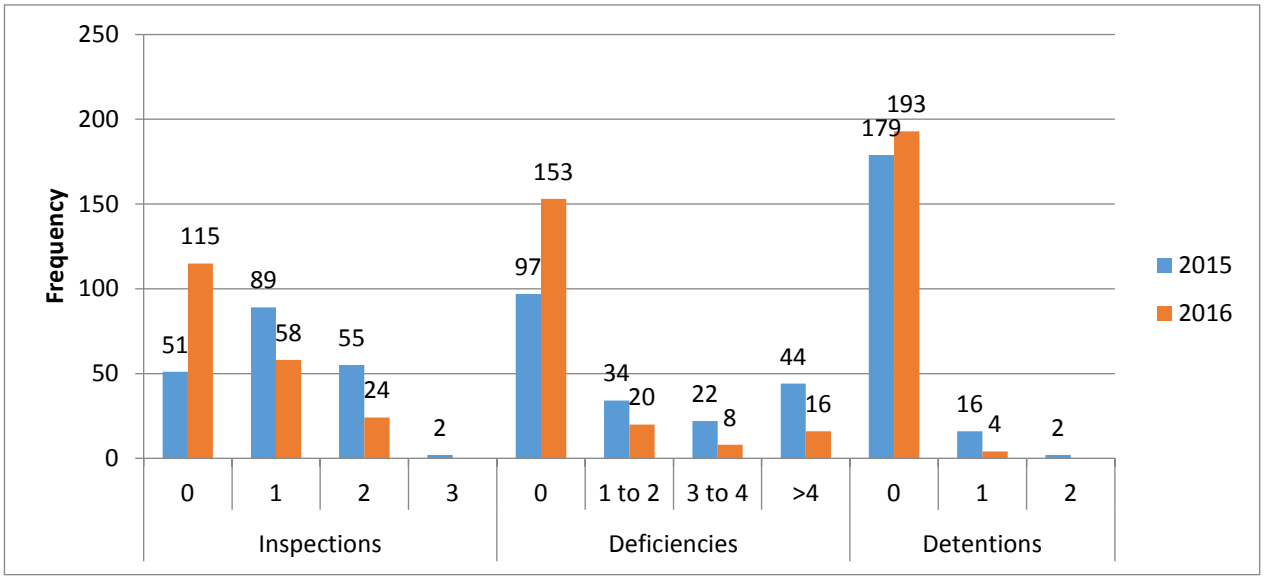



**Figure 3.34.** Inspections, deficiencies and detention data for the participating ships (Source: AMSA).

## 3.2. ASSOCIATIONS BETWEEN THE MAIN VARIABLES IN THE STUDY

This section reports correlations and relationships among the main variables measured in this study. The findings of these correlations are further explored and supported through predictive modelling in the last part of this report.

### 3.2.1. Associations between work demographics and outcomes.

Table 3.1 presents associations between a few work demographic items included in the study and outcomes.

[3]Note that participants who spent a longer number of days onboard the ship reported less developed levels of safety culture, and higher rates of near misses and injuries. These correlations suggest that prolonged contracts may have negative implications, not only for overall safety of seafarers but also their levels of psychological wellbeing and mental health.

It is notable that the higher frequencies of shore leave are associated with a reduced need for recovery. Even when extended contracts cannot be avoided, companies could strive to improve resources such as ensuring adequate shore leaves that might buffer the negative effects on safety and wellbeing.

[3] Findings discussed for each table are highlighted and bolded for ease of reference.

**Table 3.1.** Correlations between work demographics and individual and ship level outcomes.

| | Safety Culture | Psych. Wellbeing | Symptoms of Mental Ill Health | Chronic Fatigue | Acute Fatigue | Incomplete Recovery | Sleep Problems | Deep Compliance[1] | Non-Compliance[1] | Near misses | Near Misses & Injuries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Overall Tenure (years)** | .059 | .045 | -.036 | -.057 | .021 | .006 | -.033 | .009 | -.042 | .002 | -.015 |
| **Time spent on board the ship - (days)** | **-.092**** | -.066 | .024 | .037 | .004 | .041 | .029 | -.065 | .048 | **.103**** | .083* |
| **Port calls (in a month)** | .108** | .051 | -.054 | -.061 | .01 | .009 | -.12** | .043 | -.051 | -.019 | -.008 |
| **Shore leaves (in a month)** | -.024 | .051 | -.066 | -.056 | .00 | **-.121***** | -.048 | .037 | -.063 | .001 | -.007 |

Note: *** = p<.001; ** = p<.01; * = p < .05. (this implies significance of results – with three stars representing a stronger correlation which can be either negative or positive).
[1] = Deep compliance/non-compliance with safety rules and procedures

### 3.2.2. Associations between work demands and outcomes

A consistent pattern can be observed in Table 3.2 showing the associations of different work-related demands with safety and wellbeing outcomes. Higher levels of work-related demands and difficulties are significantly associated with negative outcomes.

As the number of working hours per week increases, participating seafarers experienced higher levels of negative mental health symptoms and sleep problems, and increased frequencies of near misses. Additionally, participants working a higher number of hours tended to report lower levels of safety culture development.

Note that there are stronger associations between these variables compared with the previous demographics, indicating that the intrinsic quality of the work and conditions surrounding the work might be more strongly associated with outcomes of interest.

For example, seafarers who experience higher levels of work-related difficulties and operational uncertainty may have lower levels of safety culture development on board their ships, experience increased symptoms of mental ill health, chronic fatigue, sleep problems, and an increased need for recovery between shifts. They also tend to report more experienced/observed near misses and injuries.

Taken together, these findings suggest that investing resources and effort into finding ways to reduce or better manage work-related difficulties, vigilance demands and work pressure can lead to improved safety culture and wellbeing.

**Table 3.2.** Correlations between work demands and safety/wellbeing outcomes.

| | Safety Culture | Psych. Wellbeing | Symptoms of Mental Ill Health | Chronic Fatigue | Acute Fatigue | Incomplete Recovery | Sleep Problems | Deep Compliance[1] | Surface Compliance [1] | Non-Compliance [1] | Near Misses | Near Misses & Injuries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Quantitative Workload- Hours worked / week** | **-.143*** ** | -.066 | **.115** ** | .048 | .054 | .046 | **.098** ** | .007 | -.002 | **.095** ** | **.091** ** | |
| **Qualitative Workload - Predictability of working hours** | .136*** | .045 | -.085* | -.069* | -.060 | -.078* | -.097** | .071 | -.002 | -.062 | -.061 | -.055 |
| **Qualitative Workload - Time Pressure** | -.155*** | -.087* | .279*** | .297*** | -.013 | .213**** | .285*** | -.010 | .116** | .161*** | .113** | .118*** |
| **Qualitative Workload - Vigilance Demands** | -.268*** | -.226*** | .419*** | .473*** | .027 | .366*** | .411*** | -.188*** | .144*** | .299*** | .180*** | .192*** |
| **Work Difficulties - Physical Environment** | **-.190*** ** | -.094** | **.264*** ** | **.231*** ** | -.067* | **.291*** ** | **.309*** ** | -.095** | .154*** | .184*** | .171*** | **.173*** ** |
| **Work Difficulties - Technology and Resources** | **-.304*** ** | -.131*** | **.272*** ** | **.283*** ** | .023 | **.338*** ** | **.332*** ** | -.157*** | .128*** | .248*** | .223*** | **.220*** ** |
| **Work Difficulties - Operational Uncertainty** | **-.284*** ** | -.171*** | **.285*** ** | **.279*** ** | .048 | **.331*** ** | **.321*** ** | -.173*** | .097** | .233*** | .244*** | **.231*** ** |

Note: *** = p<.001; ** = p<.01; * = p < .05.

[1] = Deep compliance/ surface compliance/ non-compliance with safety rules and procedures

### 3.2.3. Associations between work resources and outcomes

Table 3.3 shows strong associations between all the resource-type elements of work – at the team and work level - and this study's outcomes of interest.

Seafarers who have more autonomy, job security, trust, and support at work report higher levels of wellbeing and compliance to safety rules and procedures, a more developed safety culture, and fewer near misses and injuries.

Importantly, participants experiencing higher levels of crew stability – returning to the same vessel and working with the same people – saw more developed levels of safety culture onboard their vessels, and reported more deep compliance and better psychological wellbeing. Furthermore, higher levels of crew stability were associated with reduced likelihood of experiencing negative mental health symptoms, chronic fatigue, acute fatigue, need for recovery, sleep problems, non-compliance to procedures, and near-misses and injuries. These findings suggest that improving crew stability can lead to various beneficial outcomes, due to the social processes and resources that can be generated within crews with high levels of stability and adequate recovery from work.

Furthermore, increased job security is related to lower levels of surface compliance and non-compliance behaviours. Interestingly, higher levels of job security are associated with higher levels of acute fatigue. A possible reason is that when seafarers feel their job is at risk, they might disengage from work and put less effort into their jobs (e.g. as indicated by increased surface compliance levels), but when their jobs are secure they strive and work harder. Therefore, increased job security might bring also a productivity advantage to the employing company.

Resources generated through social interaction (support, trust, leadership) have stronger associations with both individual wellbeing outcomes and safety outcomes. Taken together, this data suggest that a good social environment and good leadership not only supports better wellbeing and recovery for seafarers, but also a better safety culture and more positive safety behaviours that benefit the company overall.

**Table 3.3.** Correlations between work resources and safety/wellbeing outcomes.

| | Safety Culture | Psych. Wellbeing | Symptoms of Mental Ill Health | Chronic Fatigue | Acute Fatigue | Incomplete Recovery | Sleep Problems | Deep Compliance [1] | Surface Compliance [1] | Non-Compliance [1] | Near Misses | Near Misses & Injuries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Autonomy** | **.093**** | **.251***** | -.107** | -.109** | -.220*** | -.074* | -.096** | **.283***** | .047 | -.056 | **-.115**** | **-.121***** |
| **Job security** | **.232***** | **-143***** | -.350*** | -.474*** | **.068*** | -.307*** | -.457*** | .057 | **-.115**** | **-.207***** | **-.226***** | **-.211***** |
| **Supervisor Support** | **.345***** | **.430***** | -.356*** | -.303*** | -.245*** | -.292*** | -.325*** | **.374***** | .013 | -.220*** | **-.208***** | **-.215***** |
| **Co-worker Support** | **.301***** | **.451***** | -.307*** | -.277*** | -.251*** | -.314*** | -.309*** | **.392***** | -.001 | -.189*** | **-.218***** | **-.220***** |
| **Crew stability** | **.216***** | **.096**** | **-.203***** | **-.133***** | **-.071*** | **-.12**** | **-.111**** | **.132***** | -.028 | **-.132***** | -.065 | **-.078*** |
| **Trust in Co-workers** | **.359***** | **.515***** | -.332*** | -.249*** | -.268*** | -.274*** | -.307*** | **.369***** | .009 | -.129*** | **-.243***** | **-.238***** |
| **Trust in Supervisors** | **.372***** | **.489***** | -.367*** | -.244*** | -.281*** | -.284*** | -.299*** | **.389***** | .032 | -.189*** | **-.245***** | **-.246***** |
| **Safety Leadership - Leverage** | .502*** | .513*** | -.341*** | -.283*** | -.243*** | -.308*** | -.313*** | .425*** | .039 | -.224*** | -.277*** | -.277*** |
| **Safety Leadership - Energise** | .496*** | .580*** | -.344*** | -.253*** | -.299*** | -.296*** | -.307*** | .463*** | .103*** | -.173*** | -.252*** | -.250*** |
| **Safety Leadership - Adapt** | .494*** | .585*** | -.364*** | -.276*** | -.285*** | -.280*** | -.317*** | .458*** | .088* | -.179*** | -.263*** | -.259*** |
| **Safety Leadership - Defend** | .468*** | .556*** | -.327*** | -.262*** | -.269*** | -.309*** | -.323*** | .445*** | .085* | -.176*** | -.288*** | -.278*** |

Note: *** = p<.001; ** = p<.01; * = p < .05.
[1] = Deep compliance/ surface compliance/ non-compliance with safety rules and procedures

### 3.2.4. Associations between organisational priorities and outcomes

Participants reported the priority that they perceive the company place on a series of outcomes, such as safety, employee welfare, minimising costs or maximising operational performance. These perceptions were analysed in a few ways, but one way that was most revealing was the analysis of the relative importance of priorities.

Table 3.4 presents the results for the relative importance of Safety and Welfare priorities. We analysed perceived priorities toward safety and seafarers' wellbeing by comparing them with other competing company priorities like costs and performance.

Results obtained in this study suggest than when seafarers perceive that their organisations prioritise their safety and welfare over costs and operational performance, they also report a more mature safety culture on board the ship, higher levels of psychological wellbeing and lower levels of mental ill health symptoms, fatigue, and sleep problems. Additionally, they are more likely to demonstrate compliance to safety rules and procedures. The fact that fatigue and inadequate recovery are strongly associated with these relative priorities while safety behaviours are not suggest that the mechanisms by which relative priorities might be associated with safety outcomes may be related to fatigue and inadequate recovery from fatigue.

Overall, this data suggests that the effects of communicating a focus on safety and seafarers welfare will always be dependent on other competing priorities that are also communicated to seafarers. Only when safety is seen as important as, or even more important than other competing priorities, will this lead to positive effects for safety and wellbeing.

**Table 3.4.** Correlations between the relative scores for perceived company priorities and outcomes of interest.

| | Safety Culture | Psych. Wellbeing | Symptoms of Mental Ill Health | Chronic Fatigue | Acute Fatigue | Incomplete Recovery | Sleep Problems | Deep Compliance[1] | Surface Compliance [1] | Non-Compliance [1] | Near Misses | Near Misses & Injuries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prioritising Safety Relative to Cost** | **.332*** ** | **.147*** ** | **-.162*** ** | **-.113** ** | **-.090** ** | **-.157*** ** | **-.174*** ** | **.097** ** | -.011 | -.051 | -.228*** | -.216*** |
| **Prioritising Welfare Relative to Cost** | **.379*** ** | **.178*** ** | **-.140*** ** | **-.104** ** | **-.131*** ** | **-.154*** ** | **-.177*** ** | **.081* ** | .072 | .062 | -.187*** | -.169*** |
| **Prioritising Safety Relative to Operational Performance** | **.291*** ** | **.119** ** | **-.142*** ** | **-.090** ** | **-.070* ** | **-.140*** ** | **-.140*** ** | .042 | -.016 | -.040 | -.209*** | -.198*** |
| **Prioritising Welfare Relative to Operational Performance** | **.343*** ** | **.152*** ** | **-.115** ** | **-.080* ** | **-.122*** ** | **-.136*** ** | **-.142*** ** | .034 | .078* | .085* | -.154*** | -.137*** |
| **Prioritising Safety Relative to all Other Priorities** | **.213*** ** | .057 | -.108** | -.069* | -.029 | -.113** | -.093** | .017 | -.052 | -.062 | -.176*** | -.170*** |
| **Prioritising Welfare Relative to all Other Priorities** | **.307*** ** | .135*** | -.083** | -.065 | -.116** | -.118** | -.115** | .016 | .103** | .131*** | -.110** | -.091** |

Note: *** = p<.001; ** = p<.01; * = p < .05.
[1] = Deep compliance/ surface compliance/ non compliance with safety rules and procedu

## 3.3. PREDICTIVE MODELS

The last section of the results focuses on identifying the most important relationships among the variables measured in this study. In the previous section we focused on simple (zero order) correlations. These correlations provide valuable insights into several processes and relationships related to safety culture as well as safety and wellbeing outcomes. However, a more detailed analysis helps identify the strongest drivers for specific outcomes. The drivers with unique effects on outcomes can better inform practical recommendations and future interventions.

### 3.3.1. Predicting Safety Culture

Figure 3.35, shows that, in combination, an organisation's priorities, work pressures and work resources predicted 41.1% of the variance in safety culture's development level. Elaborating earlier results, these findings indicate that when organisations prioritise safety and welfare over operational cost, operation schedule, and damage to goods and ship, safety culture is likely to be more mature. Additionally, when supervisors reward safety behaviours (leverage) and when crew stability is high, the safety culture is more likely to be a mature/generative one. In contrast, work conditions that leave seafarers struggling to concentrate and stay vigilant during work hours, or constantly having to deal with changes to schedules and manifest, poor planning, and disruptions to operations, are likely to lead to a less mature safety culture.

It is noteworthy that safety culture development level is best explained by work resources such as crew stability and behaviours of direct supervisors: – the more stable are the teams, and the more supervisors recognise and reward safety on board the ship, the better the safety culture. Therefore, interventions that improve crew stability and safety leadership of supervisors are likely to deliver positive outcomes for safety culture on board ships.

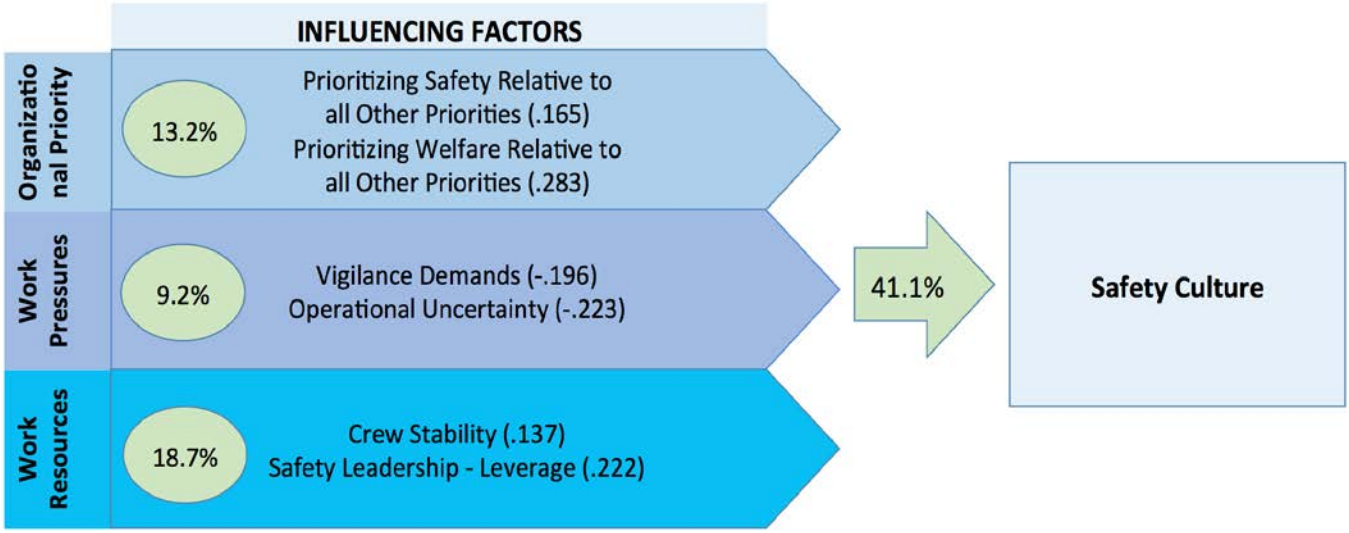



**Figure 3.35.** Overview of hierarchical regression analysis results that identify main drivers of safety culture levels on board participating ships.

### 3.3.2. Predicting Seafarers' Psychological Wellbeing

Figure 3.36, shows that wellbeing is reduced by work-related pressures, fatigue, sleep problems, and improved by work resources such as trust in co-workers and the supervisor's safety leadership behaviour. Taken together, these factors explained almost half of the variance of the psychological wellbeing scores (45.8%). Seafarers experiencing chronic fatigue, acute fatigue, and sleep problems will feel reduced psychological wellbeing and functioning in terms of resilience, self-worth, and competence. On the other hand, having a good social environment, with high levels of trust in co-workers, with immediate supervisors placing high value on crew's safety (Energise) and encouraging new ways of thinking about safety (Adapt) can buffer the negative effects and improve seafarers' psychological wellbeing.

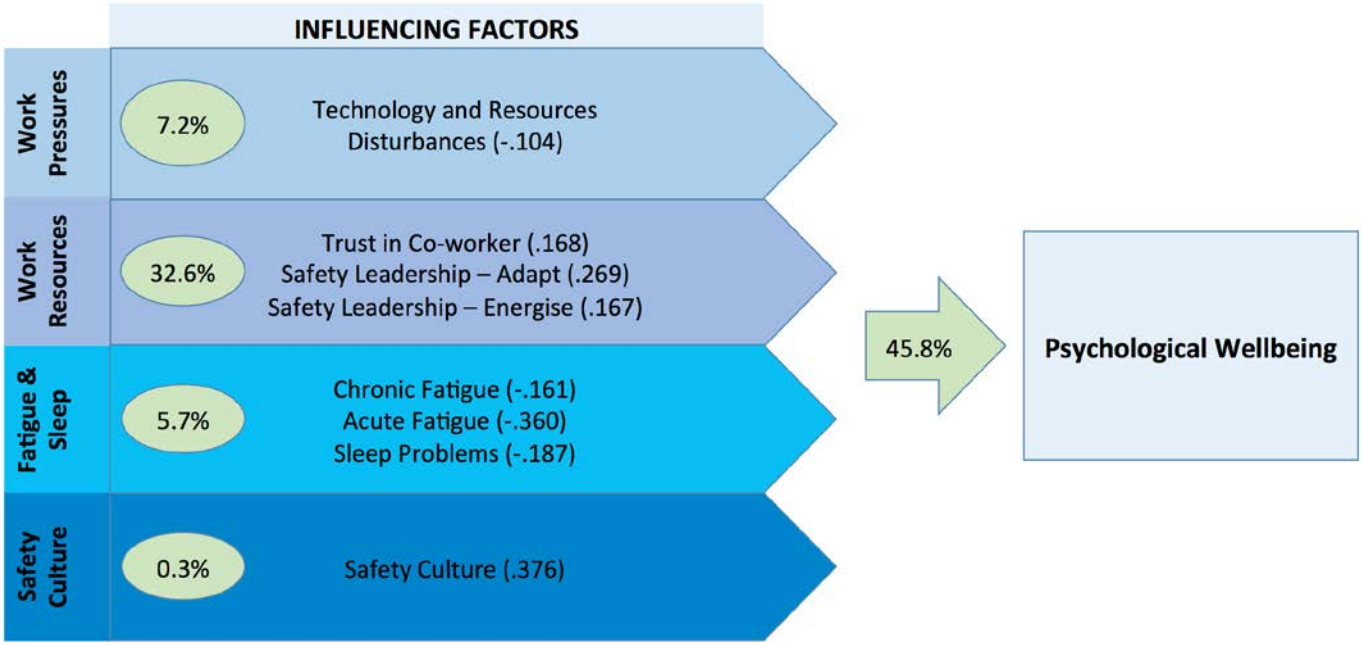



**Figure 3.36**. Overview of hierarchical regression analysis results that identify main drivers of psychological wellbeing on board participating ships.

Psychological wellbeing was strongly predicted by levels of resources available in the work environment, a key component being trust in co-workers. This finding underlines the importance of the social processes and psychological safety in supporting employees' psychological wellbeing in the maritime industry. These important social support mechanisms onboard ships are likely to be impaired by increasingly less stable crews, reduced job security, and increased diversity of crews.

### 3.3.3. Predicting Symptoms of Mental Ill Health

Figure 3.37 shows that 49.7% of mental ill health symptoms (e.g., depression and anxiety) could be attributed to high vigilance demands at work, chronic fatigue and sleep problems. Mental ill health symptoms were less likely if seafarers trusted their supervisors regarding safety issues, if the level of crew stability was high, and if their supervisors were adaptive safety leaders.

It is worth noting here that most of the variance in the symptoms of mental ill health was explained by vigilance demands of work and fatigue (sleep problems and chronic fatigue). Therefore, consideration should be given to the impact of vigilance demands and other work structures and demands that might contribute to chronic fatigue. This recommendation is especially relevant for international shipping where there is a tendency to consider deep-sea

sailing periods as opportunities for recovery. To the contrary, increased demands for vigilance during these periods might be equally fatiguing and not contribute as expected to recovery, and actually increase fatigue levels due to reduced quality of sleep. Table 3.2 also shows that increased vigilance demands were positively associated with incomplete recovery between shifts ($r$=.37, $p$<.001), as well as with experiencing sleep problems ($r$=.41, $p$<.001).

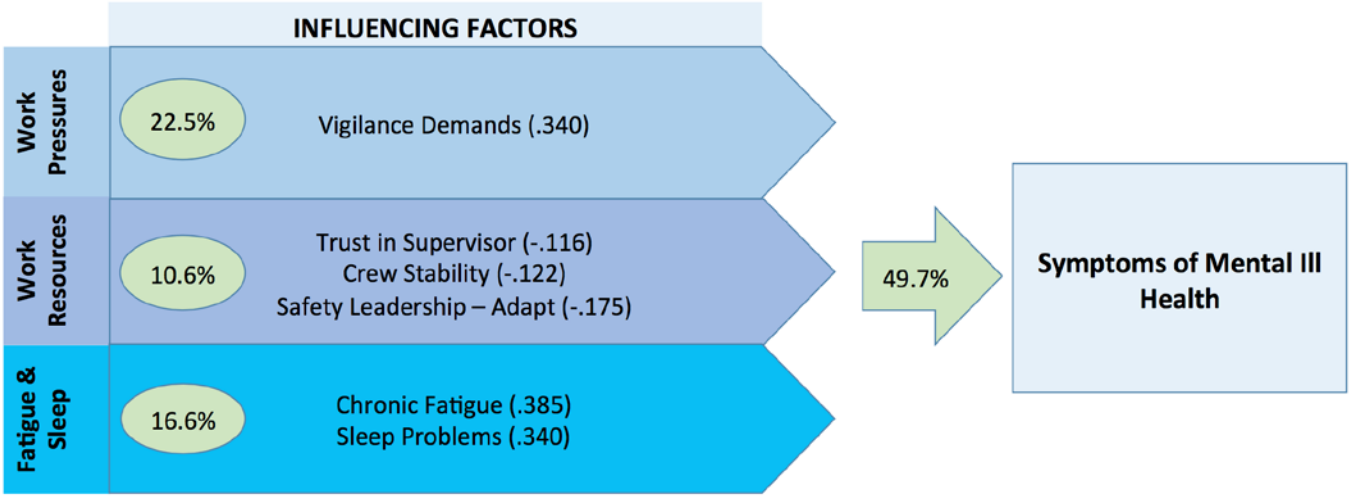



**Figure 3.37.** Overview of hierarchical regression analysis results that identify main drivers of symptoms of mental ill health among participating seafarers.

### 3.3.4. Predicting Sleep Problems

Figure 3.38 shows that seafarers' experience of sleep problems is increased by work-related pressures, and decreased by work resources such as job security and the supervisors' safety leadership behaviour. As expected, the combination of high number of working hours per week in uncertain operational conditions, and increased vigilance demands resulted in seafarers experiencing increased sleep problems. Similar to the previous section, it appears that the effect is stronger for vigilance demands, not the quantitative demands of work (actual work hours). Also, the variance explained by job security is relatively high, suggesting that actions to improve seafarers' perceptions on the stability of their current job could result in improved sleep and recovery. It is also worth noting that having immediate supervisors that are alert of and guide safe behaviours (Defend) can reduce the likelihood of sleep problems, probably due to better adherence to work and rest requirements.

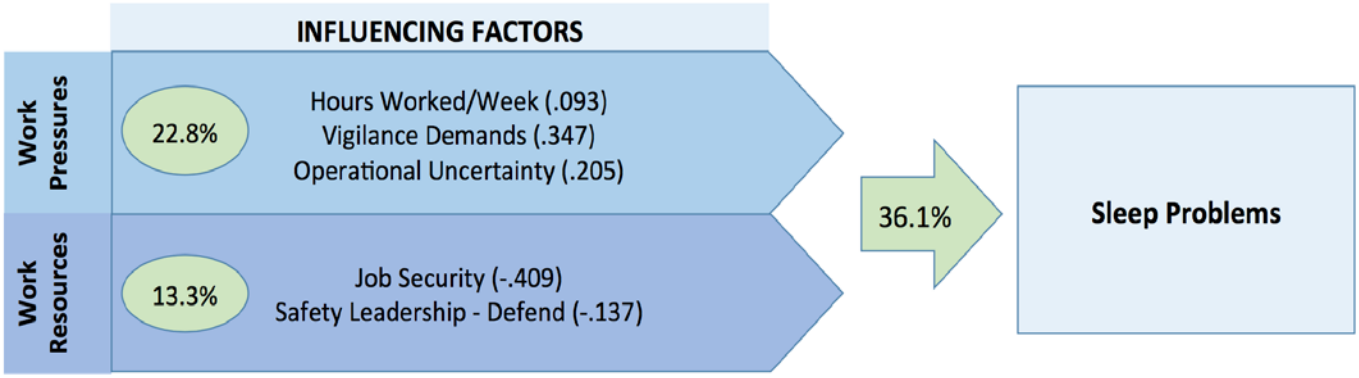



**Figure 3.38.** Overview of hierarchical regression analysis results that identify main drivers of safety culture levels on board participating ships.

### 3.3.5. Predicting Acute Fatigue

Figure 3.39 suggests that seafarers are less likely to feel fatigued at the end of a duty period or workday if they are given the authority to use personal judgement in carrying out work (autonomy), when their immediate supervisor places a high value on team's safety (Energise), when they trust their supervisors to look after their safety, when they have high levels of job security, and when they don't work in environments that present difficulties (e.g. small work space, dirty working environment, hazardous equipment, material).

The most surprising result presented in this table is the importance of work resources relative to demands. The main drivers of acute fatigue were not typical demands as might be expected. This result might occur because these demands generate similar levels of fatigue for everyone involved. In contrast, the presence of resources such as autonomy, job security, trust, leadership and culture markedly alleviate the fatiguing nature of work activities and actually reduce the amount of fatigue experienced as a result of work. An explanation of this powerful effect is that these resources enable seafarers to organise their work in such a way that they can better recover during work.

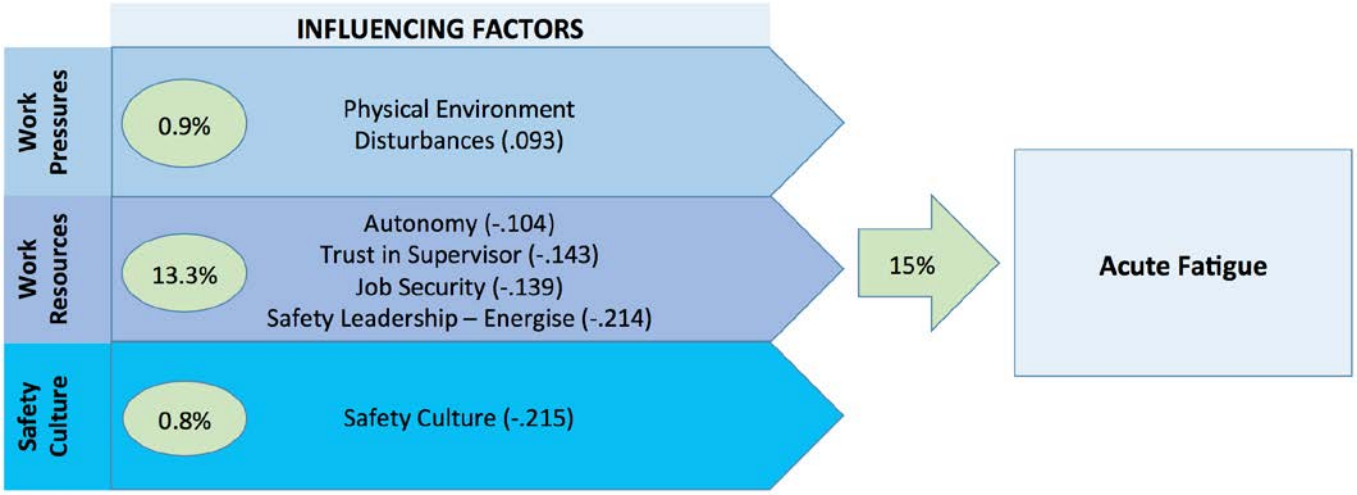



**Figure 3.39.** Overview of hierarchical regression analysis results that identify main drivers of acute fatigue among participating seafarers.

### 3.3.6. Predicting Chronic Fatigue

As shown in Figure 3.40, the risk of seafarers developing chronic fatigue is partly determined by work pressures, lack of job security, acute fatigue and impaired recovery (49.2% of variance explained). As expected, seafarers are more likely to develop chronic fatigue if there is inadequate recovery between multiple duty periods or days. Chronic fatigue is cumulative and gets worse after extended periods of time of incomplete recovery. It is noteworthy that work pressures such as increased demands for vigilance as well as the lack of job resources such as job security are contributing quite substantially to the variance of chronic fatigue scores.

Therefore, these results suggest that more attention should be given to demands for vigilance as well as to ways in which more effective recovery between work periods can be achieved in order to prevent chronic fatigue.

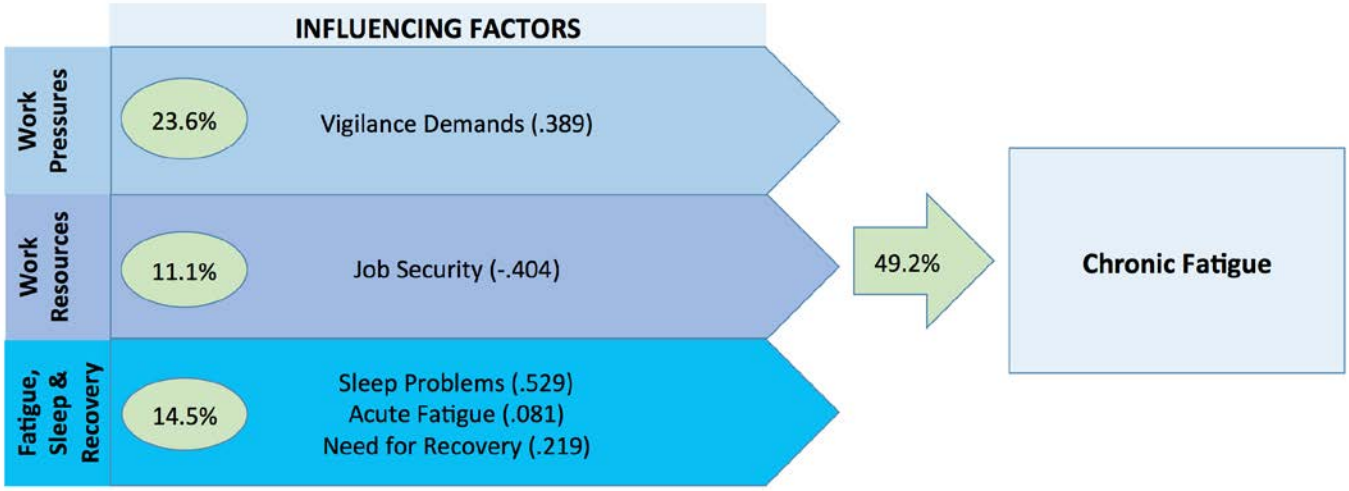



**Figure 3.40.** Overview of hierarchical regression analysis results that identify main drivers of chronic fatigue among participating seafarers.

### 3.3.7. Predicting Seafarers' Need for Recovery

Figure 3.41 presents the main drivers of incomplete recovery in this study. As expected, seafarers are more likely to feel that they lack sufficient recovery between duty periods when they are constantly faced with operational uncertainty and when they are required to maintain high levels of vigilance. Taken together, these work pressures explain the most variance in feeling a need for recovery. However, work resources such as co-worker support, job security, and safety leadership can mitigate these negative effects and support better recovery.

In terms of leadership, it appears that seafarers whose supervisors monitor the team to detect unsafe actions (Defend) are more likely to feel rested between duty periods, probably due to increased adherence to rest and work guidelines and schedules.

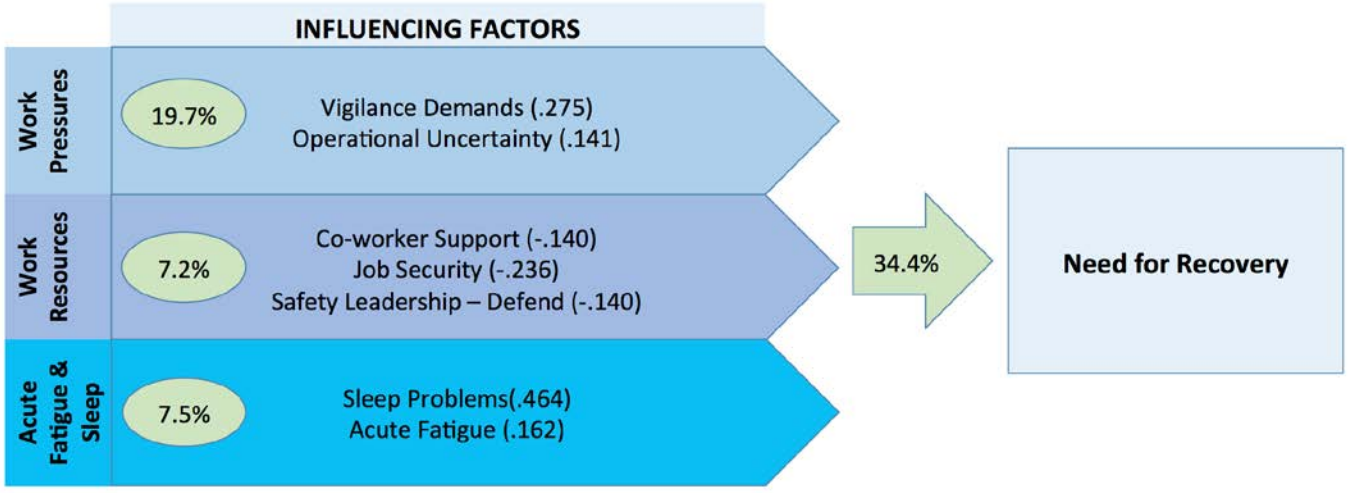



**Figure 3.41.** Overview of hierarchical regression analysis results that identify main drivers of need for recovery among participating seafarers.

### 3.3.8. Multi-level analysis

#### 3.3.8.1. Perceived operational uncertainty, company priorities, and safety in relation to wellbeing and safety compliance outcomes.

Due to increased pressures and uncertainty in the industry and the possible increased relevance of priorities communicated by companies, a multi-level analysis was performed to investigate more closely the way perceptions of company priorities and operational uncertainty at the command team level might explain safety and well-being outcomes for the rest of the crew onboard the ship. The main interest was on the interplay between priority on safety and costs, but operational uncertainty was also added to the model. An overview of the predictors used in this analysis is presented in Figure 3.42.

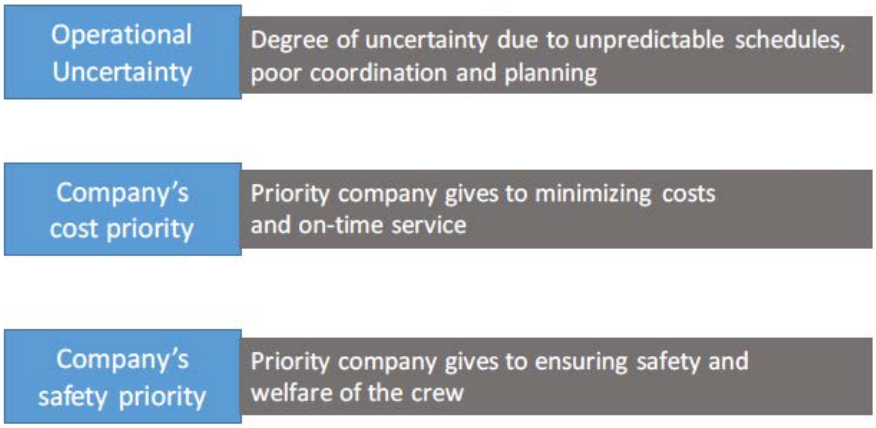



**Figure 3.42**. Overview of main predictors used in the multi-level analysis on priorities, operational uncertainty and their effects on safety and wellbeing.

At the ship level of the multi-level model, we included priorities and operational uncertainty as perceived by members of the command team. The reasoning was twofold. First, company priorities are usually communicated to seafarers by the command team onboard the ship and heavily inform their decisions and management of the crew. Second, from a methodological perspective, using two different sources for the different data: the command team for priorities and operational uncertainty, and the rest of the crew for wellbeing and safety outcomes ensures more robust results.

An overview of the analysis is provided in Figure 3.42 and results (Figure 3.43) indicate that a priority on safety perceived at the command team level is not related to either wellbeing or safety compliance at the crew level. However, operational uncertainty and especially a company's priority on costs translate into negative outcomes for seafarers' wellbeing and safety compliance. As in the previous analysis, these results converge toward the conclusion that prioritising costs and increased operational uncertainty might damage both safety and wellbeing, and a sole focus on safety would not be sufficient to counteract these effects.

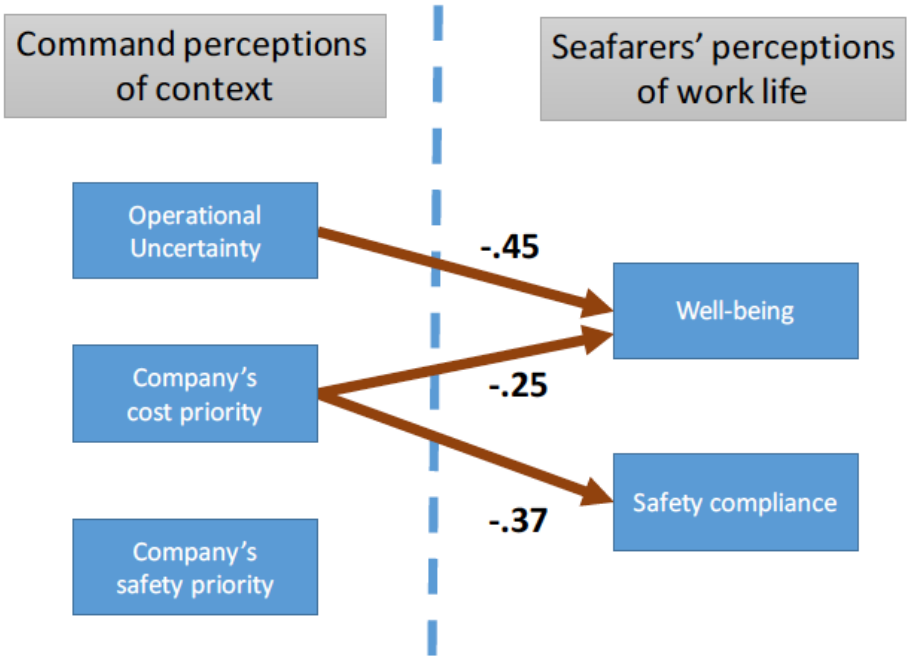



**Figure 3.43.** Overview of the multi-level analysis of the effects of perceptions of the overall context at the command team level on safety and wellbeing outcomes for the rest of the crew.

## 3.4. SUMMARY OF FINDINGS

### Safety Culture:

- Supervisor behaviour is a strong predictor of safety culture development level – seafarers report the presence of a more mature safety culture when supervisors recognise and reward safety onboard the ship
- Therefore, interventions that will improve safety leadership among supervisors are likely to deliver positive outcomes for safety culture onboard

### Psychological wellbeing:

- Psychological wellbeing is worse for seafarers experiencing chronic fatigue, acute fatigue, and sleep problems.
- A good social environment, with high levels of trust in co-workers, and supervisors who value safety (Energise) and encourage new ways of thinking about safety (Adapt) can improve levels of psychological wellbeing.
- Trust in co-workers is a particularly strong predictor of psychological wellbeing
- These findings underline the importance of the social processes and psychological safety in supporting employees' psychological wellbeing in this industry. However, with increasingly less stable crews, reduced job security and increased diversity of crews, these quality, trusting and supporting social processes onboard the ships might be impaired

### Symptoms of Mental Ill Health:

- Seafarers who are required to maintain high levels of vigilance at work, and are suffering from fatigue and sleep problems are more likely to experience negative mental health symptoms, such as depression and anxiety.
- Experiencing mental ill health symptoms is less likely if seafarers can trust their immediate supervisors regarding safety issues, if the level of crew stability is high, and if their immediate supervisors exhibit adaptive safety leadership behaviours
- Notably, the strongest predictors of mental ill health were vigilance demands of work and fatigue (sleep problems and chronic fatigue)
- Therefore, consideration should to be given to the effects of vigilance demands and other work structures and demands that might contribute to chronic fatigue. With an increased focus on periods of intense watch-keeping as increased demands for vigilance during these periods might be equally fatiguing and not contribute as expected to recovery, but on the contrary – increase fatigue levels due to reduced quality of sleep

### Recovery and Fatigue:

- The combination of job insecurity and long working hours, in uncertain operational conditions, while required to maintain high levels of vigilance resulted in seafarers experiencing increased sleep problems
- The impact of job insecurity is relatively high, suggesting that actions to improve seafarers' perceptions on the stability of their current job could result in improved sleep and recovery
- Immediate supervisors who are alert to and guide safe behaviour (Defend) can reduce the likelihood of sleep problems, probably due to better adherence to work and rest guidelines and schedules

## Chronic Fatigue:

- Seafarers are more likely to develop chronic fatigue if they are fatigued at the end of work and their recovery mechanisms are impaired through reduced quality of sleep and incomplete recovery between duty periods
- Work pressures such as increased demands for vigilance as well as the lack of work resources such as job security are contributing quite substantially to chronic fatigue
- More attention should be given to demands for vigilance as well as to ways in which more effective recovery between work periods can be achieved in order to prevent chronic fatigue

## Acute Fatigue:

- Seafarers are less likely to develop acute fatigue when they are given the authority to use personal judgement to make decisions in their work (autonomy), when their immediate supervisor places a high value on team's safety (Energise), when they trust their supervisors to look after their safety, when they have high levels of job security, and when work difficulties are low

## Recovery between work periods:

- Seafarers are more likely to feel that they lack sufficient recovery between shifts when they are constantly faced with operational uncertainty and when they are required to main high levels of vigilance.
- Job resources such as co-worker support and having security can mitigate these negative effects and support better recovery

## How can we link all these elements together?

- Less mature levels of safety culture activate a safety prevention type of process in which work demands remain relatively high and lead to increased fatigue and reduced situational awareness, which in turn support compliance, but a surface level one
- Mature safety cultures onboard ships activate a safety promotion type of process by which more resources are built into the work environment, leading not only to improved psychological wellbeing, but also to more active participation in safety

# 4. RECOMMENDATIONS

The following recommendations were developed based on information gathered from this study, the research literature and workshops with subject matter experts from the Australian Maritime Safety Authority (AMSA). The purpose is to propose research-based practices designed to manage the implications associated with this study's findings.

The recommendations are split up into the following sections:

- Work and Procedures
- Fatigue Management
- Work Design and Organisational Support

## 4.1 WORK AND PROCEDURES

Approximately 40% of this study's sample indicated that they experienced difficulties in performing their tasks due to factors related to technology and resources, such as "poorly designed procedures/checklists" and "not having the right information". Similarly, conversations between seafarers and researchers during data collection revealed that a frequent complaint by seafarers was that there were too many procedures and many were too complicated for effective use. The risks associated with poorly designed procedures might go beyond reducing seafarers' overall performance, they might also encourage negative types of compliance with safety rules and procedures, such as surface compliance or even non-compliance, which are likely to negatively impact overall safety (Fenstad, Dahl & Kongsvik, 2016).

To encourage positive safety behaviours (e.g. deep compliance to safety rules and procedures), seafarers must have the necessary safety knowledge and motivation to perform their task safely, and this is determined, partly, by the degree of clarity and quality of the work procedures (Lawton, 1998). For example, seafarers who have safety knowledge (knowing how to perform the task safely) are more likely to adopt safety behaviours (Christian et. al., 2009; Neal & Griffin, 2006). The important role of the quality of work procedures in predicting compliance is evidenced in studies that show that procedures that were perceived as vague, inappropriate, poorly written or difficult to access were more likely to result in poor compliance (Dahl, Fenstad & Kongsvik, 2014; Lawton, 1998; Oltedal & Engen, 2011).

Hence, a focus on developing and ensuring high-quality work rules and procedures that are easily understood and are perceived as valid by those to whom they are addressed is critical.

The following basic principles for developing procedures can be used as a guide (Simpson, Horberry & Joy, 2009):

- Functional Simplicity: procedures should be as simple as possible to achieve their function. Research has shown that they are different formats used for presenting information (Bailey, 2009).
- Tailoring by defining the target audience
    - If the audience of the procedure is not carefully defined, assumptions may be made which could significantly reduce the effectiveness of the instructions.
- Using plain, positive language
    - (For example, "No Smoking Regulations Apply Here" could be interpreted in two different ways: (1) no regulations on smoking here (you can smoke) or (2) there are smoking regulations in place here (you cannot smoke). Instead, use "No Smoking Here").

- User Involvement: providing users the opportunity to contribute to the development, modification, and improvement of work procedures
    - User involvement is one of the most important drivers of employee engagement (Markos & Sridevi, 2010). Benefits associated with increased levels of employee engagement include: increased organisational performance and commitment, knowledge sharing, trust in organisation's management and compliance to organisational rules and procedures (Han, Chiang & Chang, 2010; Markos & Sridevi, 2010; Mayer & Gavin, 2005; Renzl, 2008), all of which are particularly important for organisations to successfully adapt to the ever-changing maritime industry.
    - User involvement can occur at various stages of procedure development
    - Engage users from all levels (e.g. subject matter experts, supervisors, and task operators) to participate in the development of work procedures. While subject matter experts and supervisors can provide important information regarding task performance, involving the task performers allows for valuable input coming from the perspective of an employee responsible for following such procedures to complete tasks
- Ensuring procedures are up-to-date
    - The changing maritime environment, especially the introduction of new technology, is significantly altering aspects of the seafarers' work. For example, new technology might render a previously approved work procedure inapplicable or, in the worst-case scenario, unsafe. Hence, organisations need to consider the development of measures to frequently assess and update work procedures based on seafarers' feedback.
    - The review and update of work procedures relies on ensuring that seafarers are provided the opportunity to give constructive feedback to management.

## 4.2 FATIGUE MANAGEMENT

More than 20% of participants reported working more than 69 hours per week and that working hours were unpredictable. Approximately 12% of the participants reported experiencing sleep problems and 20% agreed that they experience some level of chronic and similarly 20% indicated experiencing acute fatigue. Further analyses revealed that chronic fatigue leads to reduced levels of psychological wellbeing that may impact on the overall functioning of employees. Hence, organisations need to develop fatigue management interventions that continuously monitor and manage fatigue risks to prevent fatigue-related incidents or impaired psychological wellbeing.

Managing the risk of fatigue requires a combination of intervention strategies with some being more effective than others. The International Maritime Organization is currently reviewing the *Guidelines on fatigue management and mitigation*, which will provide a comprehensive compendium for managing the risk of fatigue at sea. This includes interventions at both individual and company levels (Lamontagne et al., 2007). A recommended approach is to consider a combination of intervention strategies, which can be effectively implemented depending on the nature of operations. Some approaches to consider are mentioned below:

1. Proactive interventions that aim to prevent or reduce exposure to sources of fatigue amongst seafarers. Examples include:
    a. Changing work schedules to ensure seafarers gain sufficient sleep and recovery. The Maritime Labour Convention (MLC, 2006) specifies a minimum of 10 hours of rest within 24 hours. It also allows this to be split up into two periods with one period not being less than 6-hours. It is important to note that work schedules that are aligned with the convention do not necessarily equate to an

effective fatigue-management work schedule. For example, a work schedule that consists of two 6-hours rest periods is considered high risk despite allowing for 12 hours of rest within 24 hours. This is because, according to sleep research, individuals require rest periods that allow for at least 7 to 9 hours of continuous sleep. Work schedules that do not allow for adequate sleep lead to sleep debt. Sleep debt especially across a number of days leads to changes to employees' immune system, physiological functioning (e.g. inattentiveness and reduced cognitive capacity) and mental wellbeing (e.g. depression, Banks & Dinges, 2007).

   b. Improving the design of the vessel's crew quarters to facilitate fatigue recovery (Ellis, 2009). General and easily implementable recommendations include introducing roll-out netting that acts as a guard against rolling out of the bunk when the vessel rolls, more comfortable mattresses, black-out curtains, and reduction of noise in accommodation areas. However this approach works best when the aspect of fatigue is considered early in the ship design process with a human centred design approach being necessary.
   c. Fatigue management training. This is important as it provides the knowledge base to seafarers, and company staff designing work schedules to manage the risk of fatigue.

2. Reactive interventions: the following Interventions are reactive in nature, aiming to minimise the effects of fatigue-related problems once they have occurred, through management or treatment of symptoms (Lamontagne et al., 2007).
   a. On board reporting mechanisms to capture fatigue related events to prevent re-occurrence and ensure control measures are working effectively.
   b. Strategies to maintain operational safety when seafarers are fatigued. For example, clear policies regarding seafarers' conditions of return to work, especially for seafarers who have chronic sleep problems that increase the risk of fatigue-related accidents.
   c. Employee assistance programs to provide psychological and psychosocial counselling.

## 4.3 WORK DESIGN AND ORGANISATIONAL SUPPORT

More than 40% of this study's sample indicated that they experienced high demands for vigilance in their work (i.e. monotony and attentional demands). Data from this study indicated that this is in turn associated with increased symptoms of mental ill health, chronic fatigue, sleep problems, non-compliance to safety rules and regulations, and need for recovery. This adds to other work demands reported by participants in this survey such as high workloads and increased levels of unpredictability in terms of their workload.

Research has consistently found that work demands, which refers to the physical, social or organisational aspects of the work that require sustained physical or mental effort (Demerouti, Bakker, Nachreiner & Schaufeli, 2001), are negatively associated with employee wellbeing (Bakker & Demerouti, 2007). More specifically, monotonous and unstimulating tasks (e.g. watchkeeping) can often lead to workers experiencing underload, the opposite of working under time pressure, which in turn leads to increased levels of fatigue as workers expend additional compensatory effort to maintain high levels of alertness required to perform the task (Grech et al., 2009; Sonnentag & Zijlstra, 2006).

In addition to increased fatigue and reduced psychological wellbeing, monotony influences attention capacity such that when there is a necessity to perform a task that is perceived as boring attention will deteriorate, leading to reduced task performance (e.g. increase in accidents and errors) (Loukidou, Clarke & Daniels, 2009). Furthermore, when exposed to novel events or information, a lack of attention significantly reduces an individual's capacity to respond effectively (Dyer-Smith & Wesson, 1995). This is further exacerbated by the increased levels of fatigue and the work

demands that seafarers are exposed to and presents challenges when the need arises to switch quickly between working on boring, monotonous tasks to extremely demanding remedial tasks. Organisations need to consider practices aimed at managing or mitigating the effects of monotony.

Monotony in some shipboard work is inevitable as it is inherent in the task. However, the negative effects of work demands can be buffered by the introduction of relevant job resources, which refers to physical, psychological, social or organisational aspects of the job that reduce work demands and the associated physiological and psychological costs (Bakker & Demerouti, 2007).

The following strategies are proposed:

### 4.3.1 Fostering Seafarers' Organisational Support

Employees' perception of a supportive organisational environment is a job resource that has been found to be consistently effective at mitigating the effects of work demands on safety outcomes (Nahrgang et al., 2011).

Employees' perceptions of organisational support are developed through positive interactions with people in higher-level roles in that organisation, such as supervisors. These interactions influence employees' beliefs concerning the extent to which the organisation they work for values their contributions and cares about their well-being (Rich, Lepine & Crawford, 2010). Research has shown that employees who perceived their organisation as being supportive were more likely to be engaged in their job, leading to improved job performance (e.g. more likely to maintain vigilance and perform task diligently) and increased organisational citizenship behaviour (beneficial behaviours outside of role description, Rich, Lepine & Crawford, 2010; Nahrgang et al. 2011).

In the maritime industry, which today faces a particularly volatile labour market that threatens to erode the relationship between the organisation and its employees, it is important to consider investing in organisational practices and policies that are effective in fostering employees' perceptions of organisational support.

Furthermore, increasing employees' perceptions of organisational support is an effective approach to reducing employees' job insecurity and its associated negative consequences (Lee & Peccei, 2007). This issue was highlighted in this study with approximately 30% of participants indicating having low levels of job security.

The following strategies have been shown to be effective in enhancing employees' perceptions of organisational support:

- Safety Leadership
    - Seafarers' perceptions of organisational support manifest through daily interactions with the management team. Therefore, the safety leadership behaviours demonstrated by the seafarers' immediate supervisors are essential for fostering perceptions of organisational support.
    - Communicating a consistent set of organisational values that promotes safety behaviour. When supervisors demonstrate behaviours that align with the organisation's safety values (e.g. expressing concern for employee safety), employees develop the belief that their organisation values their safety, which in turn increases the probability that employees will participate in safety-related activities (Griffin & Neal, 2000). In contrast, promoting safety values while supervisors emphasise work-related outcomes (e.g. time and cost) over employee safety can result in employees engaging in unsafe work behaviours (e.g. non-compliance to safety rules and procedures).
    - Implementing threat and error management approaches that promote an effective proactive approach to safety (Clarke, 2013).

        - Proactive error management by monitoring employees' behaviour and providing feedback to manage errors before they lead to problems.
            - Doing so promotes the importance of safety by paying close attention to employees' compliance with safety rules and regulations.
            - Emphasising that everybody makes errors. Most errors are captured early by the employees and are inconsequential but having the awareness that some may be a threat and lead to consequential events if not managed appropriately.
- Effective Safety Feedback
    - Providing seafarers onboard ships with the opportunity to highlight safety issues to managers onshore without fear of repercussions. However, the effectiveness of the feedback system is dependent on perceptions of organisational support. Employees who do not perceive their organisation as being concerned about their safety would not utilise the feedback system even if it is implemented.

### 4.3.2 Increasing Levels of Employee Involvement in Decision-making

Organisational practices that encourage the involvement of employees in decision-making have been found to be effective job resources in buffering the effects of work demands (Bakker & Demerouti, 2007).

### 4.3.3 Enhancing Co-worker Support

Co-worker support refers to the extent to which employees believe their co-workers are willing to provide them with work-related assistance (Susskind, Kacmar & Borchgrevink, 2003). Examples of co-worker support include providing emotional support and work-related advice.

Research has found that employees who perceived themselves as receiving high levels of co-worker support possess more job resources to deal with work-related difficulties resulting in increased task persistence and performance (Bakker, Demerouti & Schaufeli, 2005; Tsai, Chen & Cheng, 2009). Additionally, co-worker support might play an important role in improving safety by facilitating confidence in employees to voice their concerns or to report unsafe conditions (Tucker et al., 2008).

Improving crew stability (the likelihood of returning to the same vessel and working with the same people) presents another potentially effective approach to enhancing seafarers' perception of co-worker support. The current study found that crew stability was associated with co-worker support and other important outcomes (e.g. well-being, safety behaviour and fatigue). A possible explanation for these findings is that only in the presence of high levels of crew stability can social processes and resources be generated within the crews. For example, if seafarers are unlikely to continue working with the same co-workers in the long-term, the likelihood of establishing a connection necessary for co-worker support is much lower compared to seafarers who consistently work with the same group of co-workers.

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# 6. APPENDIX A

## 6.1 AMSA SURVEYS

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

THE UNIVERSITY OF WESTERN AUSTRALIA

# Safety Culture in the Maritime Industry

## Crew Survey

*This survey is for research purposes only, it is not part of inspection procedures! Responses are sent directly to the universities where they will be analysed and summarised to inform industry.*

## Information Sheet

**What is this survey?**
You are invited by researchers at The University of Queensland and The University of Western Australia to participate in a study examining safety on-board ships operating in Australian waters.

The aim is to improve safety and wellbeing of crew and prevent accidents and incidents on ships.

**Participation**
Completion of this survey is completely voluntary. If you get part way through the survey, and decide that you do not wish to complete it, then you do not have to return it. You do not have to answer every question, and can stop at any point during the survey.

**How long will this survey take?**
The survey should take approximately **30 minutes** to complete.

**What will happen to my responses?**
Your responses will remain anonymous. You will not be identifiable in any reports or publications coming from this project.

Although we require the name of the ship to be able to analyse all surveys coming from the same ship together, names of ships will also remain anonymous and won't be identifiable in any reports or publications.

**What should I do?**
Please follow the instructions to complete the survey. When you have finished, place the survey in the prepaid envelope attached to this survey and return it to the person that gave it to you or mail it to us at your stop in an Australian port. Don't forget to seal the envelope. The completed surveys will be mailed back to the research team at The University of Queensland or at The University of Western Australia.

You can also fill this survey online by accessing the following link: www.centreforsafety.com.au/seafarer-survey

Thank you for your participation in this research.

*This study adheres to the guidelines of the ethical review process of The University of Queensland and the National Statement on Ethical Conduct in Human Research. While you are free to discuss your participation in this study with project staff, if you would like to speak to an officer of the University not involved in the study, you may contact the Ethics Coordinator on +617 3365 3924.*

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1

**DEMOGRAPHICS AND WORK STRUCTURE: We will start with a few general questions about yourself , your job and the way your work is organised**

1. My ship IMO number (or ship name if you don't know the IMO number): _____

2. Age: _____ years

3. Gender : □ Male □ Female

4. Country of nationality: _____

5. Native Language: _____

6. How many different nationalities work on board this ship? _____

7. In what rank/position/job role do you serve on the current vessel? _____

8. Approximately how many years have you served at sea? _____ years

9. What company are you working for? _____

10. The company you work for is: □ The Ship Owner □ A Ship Management Company

11. How long is your current contract for this ship? _____

12. How long have you served on this vessel since you started this contract? _____

13. How many port calls does this ship usually make in one month? _____

14. How many times do you usually go on shore in one month? _____

15. What is your watch schedule while at sea and while in port? Please provide your answer in a Hours ON/Hours OFF format. (eg. 4 Hours ON/4 Hours OFF).

□ AT SEA: ___Hours ON/ ___Hours OFF

□ IN PORT: ___Hours ON/ ___Hours OFF

□ I don't have watch-keeping duties

16. On average, how many hours do you usually work in a week? _____ total hours worked in a week

17. How predictable are your working hours?

□ Extremely unpredictable □ Unpredictable □ Predictable □ Extremely predictable

18. On average how many hours of uninterrupted sleep do you normally get per 24 hour period while at sea? _____ hours

19. How likely are you to work on the same vessel when you return from your next period of leave?

□ Extremely unlikely □ Unlikely □ Likely □ Very likely

**COMPANY PRIORITIES**

| How much importance do you feel your company gives to each of the following aspects? | | Not at all important to my company | | | | | | | | | Extremely important to my company |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Minimising operational costs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2. | Ensuring on-time performance (operational availability) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. | Preventing damage to goods and/or cargo | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. | Preventing damage to the ship and equipment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5. | Ensuring the safety of the crew | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 6. | Ensuring the welfare of the crew | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**SAFETY CULTURE: This section of the survey seeks to understand how safety is managed on this ship**

There are nine questions below. Each question asks about a different aspect of safety. For each question we describe three ways of managing that aspect of safety. The descriptions are on a scale from 1 (worst) to 5 (best). The mid-point of the scale (3) represents the minimum standard that companies are expected to comply with under international regulations.

For each question circle the number that best describes how that aspect of safety is managed.

### 1. How is training managed on this ship?

| | | | | |
|---|---|---|---|---|
| Crew is not trained to use the correct procedures and operate equipment safely. | 1 | 2 | Crew is given the minimum training that is needed to ensure they are certified to do their jobs and comply with international requirements. | 3 | 4 | 5 Training is comprehensive and covers both technical and non-technical aspects of safety (e.g. recognise unsafe situations, communicate with co-workers and work as a team). |

### 2. How is communication managed on this ship?

| | | | | |
|---|---|---|---|---|
| There is no communication about safety. The information crew need to do their jobs safely is not available or accessible. | 1 | 2 | The information the crew need to do their job safely is available, but it is the crew's job to go find it if they need it. | 3 | 4 | 5 Crew are given all the information they need to do their jobs safely and discuss any concerns they have with their supervisors. |

### 3. How are safety responsibilities managed on this ship?

| | | | | |
|---|---|---|---|---|
| Safety responsibilities have not been defined. Nobody takes responsibility for safety. | 1 | 2 | The crew's safety responsibilities are to comply with safety requirements and to do as they are told. Ultimately, the safety of the ship is the master's responsibility. | 3 | 4 | 5 Everyone takes ownership for safety and safety is a shared responsibility. Crew all look out for each other, speak up and raise safety concerns. |

### 4. How is hazard/incident reporting managed on this ship?

| | | | | |
|---|---|---|---|---|
| Safety incidents are not reported. Investigations only take place after serious accidents, and focus on finding someone to blame. | 1 | 2 | The company has a formal system for reporting incidents and accidents because it's a compliance requirement. Reports are not always acted on or taken seriously. | 3 | 4 | 5 Everyone takes reporting seriously. Hazards are reported before incidents occur and reports are acted on. The focus is on learning how to do things better. |

**5. How are planning and scheduling managed on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| The schedule is put above safety. The crew is forced to breach regulations regarding rest and duty hours to keep to schedule. | | There is pressure on the ship to keep to schedule but officers make sure regulations regarding rest and duty hours are not breached. | | The schedule is never put above safety. The crew is not put under pressure when delays occur and always gets adequate rest. |

**6. How are policies and procedures managed on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Safety policies and procedures are not documented, or are not enforced. | | Safety policies and procedures are documented and are enforced but they are not tailored to crew's work (e.g. too complex or hard to follow). | | There is a comprehensive set of safety policies and procedures. They are tailored to crew's work and are constantly updated and improved. |

**7. What does the company value?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| The company does not care about meeting its legal obligations for health and safety. | | The company cares more about meeting its legal obligations than about crew's health and safety. | | The company genuinely cares for crew's health and safety. |

**8. What are the norms on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Most people on the ship think it's acceptable to break safety rules and procedures. | | Most people on the ship accept that it is necessary to follow the safety rules and procedures. | | Most people on the ship expect everyone to do more than just follow the rules: everyone needs to show initiative and help improve safety. |

**9. Why do people care about safety on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Most people on the ship don't care about safety because they think it's not worth the effort. | | Most people on the ship follow safety procedures because it's a requirement of their role. | | Most people on the ship want to make it as safe as possible, because they really believe safety is important. |

**WORK DEMANDS:** In this section we will ask you a few questions about your work and the difficulties you encounter at work

| | Thinking about your own job, how often do the following situations occur? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | I have to work very fast | 1 | 2 | 3 | 4 | 5 |
| 2. | I have too much work to do | 1 | 2 | 3 | 4 | 5 |
| 3. | I do not have enough work to do | 1 | 2 | 3 | 4 | 5 |
| 4. | I have to hurry to get things done | 1 | 2 | 3 | 4 | 5 |
| 5. | I struggle to remain alert and vigilant | 1 | 2 | 3 | 4 | 5 |
| 6. | I find it difficult to concentrate | 1 | 2 | 3 | 4 | 5 |
| 7. | I find the work boring and monotonous | 1 | 2 | 3 | 4 | 5 |
| 8. | Time passes slowly | 1 | 2 | 3 | 4 | 5 |

| | How often do the following conditions make it difficult to do your job? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Bad weather | 1 | 2 | 3 | 4 | 5 |
| 2. | Poor visibility | 1 | 2 | 3 | 4 | 5 |
| 3. | Loud noise | 1 | 2 | 3 | 4 | 5 |
| 4. | Small work spaces | 1 | 2 | 3 | 4 | 5 |
| 5. | Working at height | 1 | 2 | 3 | 4 | 5 |
| 6. | Working with hazardous equipment (e.g. machinery with exposed moving parts) | 1 | 2 | 3 | 4 | 5 |
| 7. | Working with hazardous materials (e.g. flammable material, explosives, chemicals, etc.) | 1 | 2 | 3 | 4 | 5 |
| 8. | Ship motion | 1 | 2 | 3 | 4 | 5 |
| 9. | Unclean or dirty working conditions | 1 | 2 | 3 | 4 | 5 |
| 10. | Maintenance problems (e.g. machinery and equipment breaking down) | 1 | 2 | 3 | 4 | 5 |
| 11. | Not having the right machinery or equipment | 1 | 2 | 3 | 4 | 5 |
| 12. | Poorly designed procedures or checklists | 1 | 2 | 3 | 4 | 5 |
| 13. | Not having the supplies and resources you need | 1 | 2 | 3 | 4 | 5 |
| 14. | Not having the right information | 1 | 2 | 3 | 4 | 5 |
| 15. | Changes to the schedule or manifest | 1 | 2 | 3 | 4 | 5 |
| 16. | Poor planning (e.g. journey or load planning) | 1 | 2 | 3 | 4 | 5 |
| 17. | Poor coordination (e.g. between ship and shore, or between different departments) | 1 | 2 | 3 | 4 | 5 |
| 18. | Disruptions or delays | 1 | 2 | 3 | 4 | 5 |

| | How often do work difficulties cause the following to occur? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | You don't have the information you need | 1 | 2 | 3 | 4 | 5 |
| 2. | You find it difficult to see or hear things properly | 1 | 2 | 3 | 4 | 5 |
| 3. | You miss or overlook information | 1 | 2 | 3 | 4 | 5 |
| 4. | You are given the wrong information | 1 | 2 | 3 | 4 | 5 |
| 5. | You don't know what is happening around you | 1 | 2 | 3 | 4 | 5 |
| 6. | You have trouble understanding things | 1 | 2 | 3 | 4 | 5 |
| 7. | You feel confused | 1 | 2 | 3 | 4 | 5 |
| 8. | You feel unsure if you've missed something | 1 | 2 | 3 | 4 | 5 |
| 9. | You don't know what to do next | 1 | 2 | 3 | 4 | 5 |
| 10. | You are surprised by how events unfold | 1 | 2 | 3 | 4 | 5 |
| 11. | You feel unprepared | 1 | 2 | 3 | 4 | 5 |
| 12. | You are not able to spot problems before they occur | 1 | 2 | 3 | 4 | 5 |

## LEVEL OF AUTHORITY YOU HAVE AT WORK

| | At work, to what extent are you.... | To a very small extent | | | | To a very large extent |
|---|---|---|---|---|---|---|
| 1. | Able to use personal initiative or judgement in carrying out your work | 1 | 2 | 3 | 4 | 5 |
| 2. | Able to make a lot of decisions on your own in your work | 1 | 2 | 3 | 4 | 5 |
| 3. | Given the authority to make your own decisions | 1 | 2 | 3 | 4 | 5 |

## MY TEAM: The following questions will explore how you feel about the team you work with

| | How much do you agree with the following statements? | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I can rely upon my immediate supervisor when things get tough at work | 1 | 2 | 3 | 4 | 5 |
| 2. | If necessary, I can ask my immediate supervisor for help | 1 | 2 | 3 | 4 | 5 |
| 3. | I can rely upon my co-workers when things get tough at work | 1 | 2 | 3 | 4 | 5 |
| 4. | If necessary, I can ask my co-workers for help | 1 | 2 | 3 | 4 | 5 |
| 5. | I trust my immediate supervisor on this ship to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |
| 6. | My immediate supervisor on this ship trusts me to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |
| 7. | I trust crew members on this ship to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |
| 8. | Crew on this ship trust me to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |

## MY SUPERVISOR: The following questions will explore how your immediate supervisor promotes safety

| | Please state how much you agree with each of the following statements:<br>On this ship, my immediate supervisor.... | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | Explains the consequences of unsafe behavior | 1 | 2 | 3 | 4 | 5 |
| 2. | Rewards safe behaviour | 1 | 2 | 3 | 4 | 5 |
| 3. | Communicates safety expectations clearly to crew members | 1 | 2 | 3 | 4 | 5 |
| 4. | Provides advice if people make mistakes | 1 | 2 | 3 | 4 | 5 |
| 5. | Sincerely encourages crew members to speak about safety concerns | 1 | 2 | 3 | 4 | 5 |
| 6. | Places a high personal value on the crew's safety | 1 | 2 | 3 | 4 | 5 |
| 7. | Inspires crew members to support safety at work | 1 | 2 | 3 | 4 | 5 |
| 8. | Presents a positive image of safety for the crew | 1 | 2 | 3 | 4 | 5 |
| 9. | Encourages new ways of thinking about safety | 1 | 2 | 3 | 4 | 5 |
| 10. | Asks us to learn from our errors and mistakes | 1 | 2 | 3 | 4 | 5 |
| 11. | Acts quickly to correct safety problems | 1 | 2 | 3 | 4 | 5 |
| 12. | Changes plans or schedules when safety problems happen | 1 | 2 | 3 | 4 | 5 |
| 13. | Is alert for unsafe behaviour in the crew | 1 | 2 | 3 | 4 | 5 |
| 14. | Monitors crew to detect unsafe actions | 1 | 2 | 3 | 4 | 5 |
| 15. | Ensures the crew follows safety procedures at all times | 1 | 2 | 3 | 4 | 5 |
| 16. | Never ignores safety rules, not even when work falls behind schedule | 1 | 2 | 3 | 4 | 5 |

**MY WELLBEING:** In this section we will ask you some questions regarding your general well being, health and sleep quality

| | Over the past MONTH, how often you have felt the following: | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Happy | 1 | 2 | 3 | 4 | 5 |
| 2. | Interested in life | 1 | 2 | 3 | 4 | 5 |
| 3. | Satisfied with life | 1 | 2 | 3 | 4 | 5 |
| 4. | Useful to your community/ society | 1 | 2 | 3 | 4 | 5 |
| 5. | That you are part of a community (group/ neighbourhood) | 1 | 2 | 3 | 4 | 5 |
| 6. | That the world is becoming a better place for all people | 1 | 2 | 3 | 4 | 5 |
| 7. | That people are basically good | 1 | 2 | 3 | 4 | 5 |
| 8. | That the way the world works makes sense to you | 1 | 2 | 3 | 4 | 5 |
| 9. | That you felt good about yourself | 1 | 2 | 3 | 4 | 5 |
| 10. | That you were dealing with your responsibilities or problems well | 1 | 2 | 3 | 4 | 5 |
| 11. | That you had good relationships with other people | 1 | 2 | 3 | 4 | 5 |
| 12. | That you were interested in learning new things and improving yourself | 1 | 2 | 3 | 4 | 5 |
| 13. | Confident to think or communicate your own ideas and opinions | 1 | 2 | 3 | 4 | 5 |
| 14. | That you live a good and meaningful life | 1 | 2 | 3 | 4 | 5 |

| | Over the past MONTH, how often have you experienced the following? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Lonely | 1 | 2 | 3 | 4 | 5 |
| 2. | Depressed or hopeless | 1 | 2 | 3 | 4 | 5 |
| 3. | Upset or sad | 1 | 2 | 3 | 4 | 5 |
| 4. | Always worrying about something | 1 | 2 | 3 | 4 | 5 |

| | When working at sea.... | Strongly disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I often fear waking up to another day onboard | 1 | 2 | 3 | 4 | 5 |
| 2. | I often wonder how long I can keep working at sea | 1 | 2 | 3 | 4 | 5 |
| 3. | I feel I don't get to do anything else in my life besides work | 1 | 2 | 3 | 4 | 5 |
| 4. | My job at sea takes all my energy from me | 1 | 2 | 3 | 4 | 5 |
| 5. | I usually have lots of energy to talk to my colleagues or to my family back home | 1 | 2 | 3 | 4 | 5 |
| 6. | I have energy for my hobbies/relaxing activities in my spare time (while at sea) | 1 | 2 | 3 | 4 | 5 |
| 7. | I have plenty of reserve energy when I need it | 1 | 2 | 3 | 4 | 5 |
| 8. | I don't get enough time between shifts to recovery my energy fully | 1 | 2 | 3 | 4 | 5 |
| 9. | I can't recover my energy completely between shifts | 1 | 2 | 3 | 4 | 5 |
| 10. | I am fully rested at the start of each work shift | 1 | 2 | 3 | 4 | 5 |
| 11. | I feel stressed about not being able to adequately support my family | 1 | 2 | 3 | 4 | 5 |
| 12. | It worries me that something might happen with my family while I am at sea | 1 | 2 | 3 | 4 | 5 |
| 13. | I am stressed by the long separation from my family | 1 | 2 | 3 | 4 | 5 |
| 14. | I am not really sure how long I'll have a job with this company | 1 | 2 | 3 | 4 | 5 |

| | When I am on board the vessel I often.... | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | Have difficulties falling asleep | 1 | 2 | 3 | 4 | 5 |
| 2. | Have difficulties in staying asleep | 1 | 2 | 3 | 4 | 5 |
| 3. | Have difficulties staying awake (during work) | 1 | 2 | 3 | 4 | 5 |
| 4. | Have restless or disturbed sleep | 1 | 2 | 3 | 4 | 5 |

**MY OWN SAFETY:** In this section we will ask you some questions regarding safety at work

**Please state how much you agree with each statement.**
**When doing a task which requires a work procedure...**

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I focus on completing the procedure and task properly | 1 | 2 | 3 | 4 | 5 |
| 2. | I try my best to apply the procedure correctly to the task | 1 | 2 | 3 | 4 | 5 |
| 3. | I concentrate on following the procedure correctly | 1 | 2 | 3 | 4 | 5 |
| 4. | I do what the procedure says without thinking too much about it | 1 | 2 | 3 | 4 | 5 |
| 5. | I put in the minimum effort needed to complete the procedure | 1 | 2 | 3 | 4 | 5 |
| 6. | I just follow the rules without worrying too much about the task | 1 | 2 | 3 | 4 | 5 |
| 7. | I don't think about what is required and just get the job done | 1 | 2 | 3 | 4 | 5 |
| 8. | I ignore the procedure and do the task as we always do | 1 | 2 | 3 | 4 | 5 |
| 9. | I skip parts of the procedure to save time | 1 | 2 | 3 | 4 | 5 |

**When I believe a procedure is not appropriate (in general or for myself)....**

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I think about the risks/hazards and assess whether the standard procedure will work | 1 | 2 | 3 | 4 | 5 |
| 2. | I use my experience and knowledge to come up with a solution to do the task safely | 1 | 2 | 3 | 4 | 5 |
| 3. | I ask my supervisor for help | 1 | 2 | 3 | 4 | 5 |

**How much do you agree with the following statements?**

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I make suggestions to improve the safety of ship | 1 | 2 | 3 | 4 | 5 |
| 2. | I always try to improve safety procedures on this ship | 1 | 2 | 3 | 4 | 5 |
| 3. | I try to change the way the job is done to make it safer | 1 | 2 | 3 | 4 | 5 |
| 4. | I use all the necessary safety equipment to do my job | 1 | 2 | 3 | 4 | 5 |
| 5. | I use the correct safety procedures for carrying out my job | 1 | 2 | 3 | 4 | 5 |
| 6. | I carry out my work in a safe manner | 1 | 2 | 3 | 4 | 5 |
| 7. | I promote the safety programs on board the ship | 1 | 2 | 3 | 4 | 5 |
| 8. | I put in extra effort to improve the safety of the workplace | 1 | 2 | 3 | 4 | 5 |
| 9. | I voluntarily carry out tasks or activities that help to improve workplace safety | 1 | 2 | 3 | 4 | 5 |
| 10. | I am proud of the safety program on this ship | 1 | 2 | 3 | 4 | 5 |
| 11. | I am very interested in the safety program on this ship | 1 | 2 | 3 | 4 | 5 |
| 12. | I focus on how to do my job in the safest possible way | 1 | 2 | 3 | 4 | 5 |
| 13. | I pay a lot of attention to the rules and procedures necessary to do my work | 1 | 2 | 3 | 4 | 5 |
| 14. | I concentrate on the safety aspects of my work | 1 | 2 | 3 | 4 | 5 |

**INCIDENTS AND ACCIDENTS:** The following questions ask about incidents and accidents on board this ship

**In the past 6 months, how many times have the following happened to you at work?**

| | | Number of times | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. | I have been involved in an incident in which I narrowly escaped being injured | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |
| 2. | I have observed/witnessed an incident in which someone else narrowly escaped being inured | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |
| 3. | I have observed/witnessed an incident that had the potential to harm the ship or the environment | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |
| 4. | I have been injured at work | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |

Lastly, please note down the date you filled in this survey to help us keep track of the timing of the data collection: ____/ ____/ _____

THANK YOU VERY MUCH FOR YOUR SUPPORT!

# Safety Culture in the Maritime Industry

## Master, Chief Officer, and Chief Engineer Survey

*This survey is for research purposes only, it is not part of inspection procedures! Responses are sent directly to the universities where they will be analysed and summarised to inform industry.*

## Information Sheet

**What is this survey?**
You are invited by researchers at The University of Queensland and The University of Western Australia to participate in a study examining safety on board ships operating in Australian waters.

The aim is to improve safety and wellbeing of crew and prevent accidents and incidents on ships.

**Participation**
Completion of this survey is completely voluntary. If you get part way through the survey, and decide that you do not wish to complete it, then you do not have to return it. You do not have to answer every question, and can stop at any point during the survey.

**How long will this survey take?**
The survey should take approximately **30 minutes** to complete.

**What will happen to my responses?**
Your responses will remain anonymous. You will not be identifiable in any reports or publications coming from this project.

Although we require the name of the ship to be able to analyse all surveys coming from the same ship together, names of ships will also remain anonymous and won't be identifiable in any reports or publications.

**What should I do?**
Please follow the instructions to complete the survey. When you have finished, place the survey in the prepaid envelope attached to this survey and return it to the person that gave it to you or mail it to us at your next stop in an Australian port. Don't forget to seal the envelope. The completed surveys will be mailed back to the research team at The University of Queensland or at The University of Western Australia.

You can also fill this survey online by accessing the following link: www.centreforsafety.com.au/seafarer-survey

Thank you for your participation in this research.

*This study adheres to the guidelines of the ethical review process of The University of Queensland and the National Statement on Ethical Conduct in Human Research. While you are free to discuss your participation in this study with project staff, if you would like to speak to an officer of the University not involved in the study, you may contact the Ethics Coordinator on +617 3365 3924.*

Prof. Andrew Neal
07 3365 6372
andrew@psy.uq.edu.au

Daniela Andrei, PhD.
08 6488 4313
Daniela.andrei@uwa.edu.au

**DEMOGRAPHICS AND WORK STRUCTURE: We will start with a few general questions about yourself, your job and the way your work is organised.**

1. My ship IMO number (or ship name if you don't know the IMO number): _____

2. Age: _____ years

3. Gender: □ Male □ Female

4. Country of nationality: _____

5. Native Language: _____

6. How many different nationalities work on board this ship? _____

7. In what rank/position/job role do you serve on the current vessel? _____

8. Approximately how many years have you served at sea? _____ years

9. What company do you work for? _____

10. The company you work for is: □ The Ship Owner □ A Ship Management Company

11. How long is your current contract for this ship? _____

12. How long have you served on this vessel since you started this contract? _____

13. How many port calls does this ship usually make in one month? _____

14. How many times do you usually go on shore in one month? _____

15. What is your watch schedule while at sea and while in port? Please provide your answer in a Hours ON/Hours OFF format. (eg. 4 Hours ON/4 Hours OFF).

□ AT SEA: ___Hours ON/ ___Hours OFF

□ IN PORT: ___Hours ON/ ___Hours OFF

□ I don't have watch-keeping duties

16. On average, how many hours do you usually work in a week? _____ total hours worked in a week

17. How predictable are your working hours?

□ Extremely unpredictable □ Unpredictable □ Predictable □ Extremely predictable

18. On average how many hours of uninterrupted sleep do you normally get per 24 hour period while at sea? _____ hours

19. How likely are you to work on the same vessel when you return from your next period of leave?

□ Extremely unlikely □ Unlikely □ Likely □ Very likely

**JOB PRESSURES: The following items look at the types of pressures you may be experiencing at work**

| | Thinking about your own job, to what extent do you feel pressure to... | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Comply with shore based orders regarding the operation of your ship | 1 | 2 | 3 | 4 | 5 |
| 2. | Cut costs or operate with reduced budgets | 1 | 2 | 3 | 4 | 5 |
| 3. | Work with technology that is not fit for purpose or difficult to use | 1 | 2 | 3 | 4 | 5 |
| 4. | Work with less competent crews | 1 | 2 | 3 | 4 | 5 |
| 5. | Work hours that extend beyond the MLC requirements | 1 | 2 | 3 | 4 | 5 |
| 6. | Meet operational or commercial deadlines at the expense of safe operations | 1 | 2 | 3 | 4 | 5 |
| 7. | Maximise fleet availability at the expense of safe operations | 1 | 2 | 3 | 4 | 5 |
| 8. | Minimise time spent on shore leave | 1 | 2 | 3 | 4 | 5 |
| 9. | Take on additional job tasks and responsibilities beyond your core duties | 1 | 2 | 3 | 4 | 5 |
| 10. | Operate with less than optimum number of crew members | 1 | 2 | 3 | 4 | 5 |
| 11 | Continue operations in unsafe conditions (e.g. unsafe environmental conditions, heavily congested waters, bad visibility, etc.) | 1 | 2 | 3 | 4 | 5 |

## COMPANY PRIORITIES

| How much importance do you feel your company gives to each of the following aspects? | | Not at all important to my company | | | | | | | | | Extremely important to my company |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Minimising operational costs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2. | Ensuring on-time performance (operational availability) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. | Preventing damage to goods and/or cargo | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. | Preventing damage to the ship and equipment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5. | Ensuring the safety of the crew | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 6. | Ensuring the welfare of the crew | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

## SAFETY CULTURE: This section of the survey seeks to understand how safety is managed on this ship

There are nine questions below. Each question asks about a different aspect of safety. For each question we describe three ways of managing that aspect of safety. The descriptions are on a scale from 1 (worst) to 5 (best). The mid-point of the scale (3) represents the minimum standard that companies are expected to comply with under international regulations.

For each question circle the number that best describes how that aspect of safety is managed.

### 1. How is training managed on this ship?

| | | | | |
|---|---|---|---|---|
| Crew is not trained to use the correct procedures and operate equipment safely. | | Crew is given the minimum training that is needed to ensure they are certified to do their jobs and comply with international requirements. | | Training is comprehensive and covers both technical and non-technical aspects of safety (e.g. recognise unsafe situations, communicate with co-workers and work as a team). |
| ↓ | | ↓ | | ↓ |
| 1 | 2 | 3 | 4 | 5 |

### 2. How is communication managed on this ship?

| | | | | |
|---|---|---|---|---|
| There is no communication about safety. The information crew need to do their jobs safely is not available or accessible. | | The information the crew need to do their job safely is available, but it the crew's job to go find it if they need it. | | Crew are given all the information they need to do their jobs safely and discuss any concerns they have with their supervisors. |
| ↓ | | ↓ | | ↓ |
| 1 | 2 | 3 | 4 | 5 |

### 3. How are safety responsibilities managed on this ship?

| | | | | |
|---|---|---|---|---|
| Safety responsibilities have not been defined. Nobody takes responsibility for safety. | | The crew's safety responsibilities are to comply with safety requirements and to do as they are told. Ultimately, the safety of the ship is the master's responsibility. | | Everyone takes ownership for safety and safety is a shared responsibility. Crew all look out for each other, speak up and raise safety concerns. |
| ↓ | | ↓ | | ↓ |
| 1 | 2 | 3 | 4 | 5 |

**4. How is hazard/incident reporting managed on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Safety incidents are not reported. Investigations only take place after serious accidents, and focus on finding someone to blame. | | The company has a formal system for reporting incidents and accidents because it's a compliance requirement. Reports are not always acted on or taken seriously. | | Everyone takes reporting seriously. Hazards are reported before incidents occur and reports are acted on. The focus is on learning how to do things better. |

**5. How are planning and scheduling managed on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| The schedule is put above safety. Crew is forced to breach regulations regarding rest and duty hours to keep to schedule. | | There is pressure on the ship to keep to schedule but officers make sure regulations regarding rest and duty hours are not breached. | | The schedule is never put above safety. Crew is not put under pressure when delays occur and always gets adequate rest. |

**6. How are policies and procedures managed on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Safety policies and procedures are not documented, or are not enforced. | | Safety policies and procedures are documented and are enforced but they are not tailored to crew's work (e.g. too complex or hard to follow). | | There is a comprehensive set of safety policies and procedures. They are tailored to crew's work and are constantly updated and improved. |

**7. What does the company value?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| The company does not care about meeting its legal obligations for health and safety. | | The company cares more about meeting its legal obligations than about crew's health and safety. | | The company genuinely cares for crew's health and safety. |

**8. What are the norms on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Most people on the ship think it's acceptable to break safety rules and procedures. | | Most people on the ship accept that it is necessary to follow the safety rules and procedures. | | Most people on the ship expect everyone to do more than just follow the rules: everyone needs to show initiative and help improve safety. |

**9. Why do people care about safety on this ship?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Most people on the ship don't care about safety because they think it's not worth the effort. | | Most people on the ship follow safety procedures because it's a requirement of their role. | | Most people on the ship want to make it as safe as possible, because they really believe safety is important. |

**WORK DEMANDS: In this section we will ask you a few questions about your work and the difficulties you encounter at work**

| | Thinking about your own job, how often do the following situations occur? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | I have to work very fast | 1 | 2 | 3 | 4 | 5 |
| 2. | I have too much work to do | 1 | 2 | 3 | 4 | 5 |
| 3. | I do not have enough work to do | 1 | 2 | 3 | 4 | 5 |
| 4. | I have to hurry to get things done | 1 | 2 | 3 | 4 | 5 |
| 5. | I struggle to remain alert and vigilant | 1 | 2 | 3 | 4 | 5 |
| 6. | I find it difficult to concentrate | 1 | 2 | 3 | 4 | 5 |
| 7. | I find the work boring and monotonous | 1 | 2 | 3 | 4 | 5 |
| 8. | Time passes slowly | 1 | 2 | 3 | 4 | 5 |

| | How often do the following conditions make it difficult to do your job? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Bad weather | 1 | 2 | 3 | 4 | 5 |
| 2. | Poor visibility | 1 | 2 | 3 | 4 | 5 |
| 3. | Loud noise | 1 | 2 | 3 | 4 | 5 |
| 4. | Small work spaces | 1 | 2 | 3 | 4 | 5 |
| 5. | Working at height | 1 | 2 | 3 | 4 | 5 |
| 6. | Working with hazardous equipment (e.g. machinery with exposed moving parts) | 1 | 2 | 3 | 4 | 5 |
| 7. | Working with hazardous materials (e.g. flammable material, explosives, chemicals, etc.) | 1 | 2 | 3 | 4 | 5 |
| 8. | Ship motion | 1 | 2 | 3 | 4 | 5 |
| 9. | Unclean or dirty working conditions | 1 | 2 | 3 | 4 | 5 |
| 10. | Maintenance problems (e.g. machinery and equipment breaking down) | 1 | 2 | 3 | 4 | 5 |
| 11. | Not having the right machinery or equipment | 1 | 2 | 3 | 4 | 5 |
| 12. | Poorly designed procedures or checklists | 1 | 2 | 3 | 4 | 5 |
| 13. | Not having the supplies and resources you need | 1 | 2 | 3 | 4 | 5 |
| 14. | Not having the right information | 1 | 2 | 3 | 4 | 5 |
| 15. | Changes to the schedule or manifest | 1 | 2 | 3 | 4 | 5 |
| 16. | Poor planning (e.g. journey or load planning) | 1 | 2 | 3 | 4 | 5 |
| 17. | Poor coordination (e.g. between ship and shore, or between different departments) | 1 | 2 | 3 | 4 | 5 |
| 18. | Disruptions or delays | 1 | 2 | 3 | 4 | 5 |

| | How often do work difficulties cause the following to occur? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | You don't have the information you need | 1 | 2 | 3 | 4 | 5 |
| 2. | You find it difficult to see or hear things properly | 1 | 2 | 3 | 4 | 5 |
| 3. | You miss or overlook information | 1 | 2 | 3 | 4 | 5 |
| 4. | You are given the wrong information | 1 | 2 | 3 | 4 | 5 |
| 5. | You don't know what is happening around you | 1 | 2 | 3 | 4 | 5 |
| 6. | You have trouble understanding things | 1 | 2 | 3 | 4 | 5 |
| 7. | You feel confused | 1 | 2 | 3 | 4 | 5 |
| 8. | You feel unsure if you've missed something | 1 | 2 | 3 | 4 | 5 |
| 9. | You don't know what to do next | 1 | 2 | 3 | 4 | 5 |
| 10. | You are surprised by how events unfold | 1 | 2 | 3 | 4 | 5 |
| 11. | You feel unprepared | 1 | 2 | 3 | 4 | 5 |
| 12. | You are not able to spot problems before they occur | 1 | 2 | 3 | 4 | 5 |

## LEVEL OF AUTHORITY YOU HAVE AT WORK

| | At work, to what extent... | To a very small extent | | | | To a very large extent |
|---|---|---|---|---|---|---|
| 1. | I am able to use personal initiative or judgement in carrying out my work | 1 | 2 | 3 | 4 | 5 |
| 2. | I am able to make a lot of decisions on my own in my work | 1 | 2 | 3 | 4 | 5 |
| 3. | I am given the authority to make my own decisions | 1 | 2 | 3 | 4 | 5 |
| 4. | I am given tasks that are difficult to achieve | 1 | 2 | 3 | 4 | 5 |
| 5. | I have to do things that are likely to be accepted by one person and not accepted by others | 1 | 2 | 3 | 4 | 5 |
| 6. | It is very difficult to meet the expectations of my supervisor | 1 | 2 | 3 | 4 | 5 |

## MY TEAM: The following questions will explore how you feel about the team your work with

| | How much do you agree with the following statements? | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I can rely upon my immediate supervisor when things get tough at work | 1 | 2 | 3 | 4 | 5 |
| 2. | If necessary, I can ask my immediate supervisor for help | 1 | 2 | 3 | 4 | 5 |
| 3. | I can rely upon my co-workers when things get tough at work | 1 | 2 | 3 | 4 | 5 |
| 4. | If necessary, I can ask my co-workers for help | 1 | 2 | 3 | 4 | 5 |
| 5. | I trust my immediate supervisor to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |
| 6. | My immediate supervisor trusts me to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |
| 7. | I trust crew members on this ship to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |
| 8. | Crew on this ship trust me to look after our safety and welfare | 1 | 2 | 3 | 4 | 5 |

## MY SUPERVISOR: The following questions will explore how your immediate supervisor promotes safety

| | Please state how much you agree with each of the following statements:<br>In this company, my immediate supervisor... | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | Explains the consequences of unsafe behavior | 1 | 2 | 3 | 4 | 5 |
| 2. | Rewards safe behaviour | 1 | 2 | 3 | 4 | 5 |
| 3. | Communicates safety expectations clearly to crew members | 1 | 2 | 3 | 4 | 5 |
| 4. | Provides advice if people make mistakes | 1 | 2 | 3 | 4 | 5 |
| 5. | Sincerely encourages crew members to speak about safety concerns | 1 | 2 | 3 | 4 | 5 |
| 6. | Places a high personal value on the crew's safety | 1 | 2 | 3 | 4 | 5 |
| 7. | Inspires crew members to support safety at work | 1 | 2 | 3 | 4 | 5 |
| 8. | Presents a positive image of safety for the crew | 1 | 2 | 3 | 4 | 5 |
| 9. | Encourages new ways of thinking about safety | 1 | 2 | 3 | 4 | 5 |
| 10. | Asks us to learn from our errors and mistakes | 1 | 2 | 3 | 4 | 5 |
| 11. | Acts quickly to correct safety problems | 1 | 2 | 3 | 4 | 5 |
| 12. | Changes plans or schedules when safety problems happen | 1 | 2 | 3 | 4 | 5 |
| 13. | Is alert for unsafe behaviour in the crew | 1 | 2 | 3 | 4 | 5 |
| 14. | Monitors crew to detect unsafe actions | 1 | 2 | 3 | 4 | 5 |
| 15. | Ensures the crew follow safety procedures at all times | 1 | 2 | 3 | 4 | 5 |
| 16. | Never ignores safety rules, not even when work falls behind schedule | 1 | 2 | 3 | 4 | 5 |

**MY WELLBEING:** In this section we will ask you some questions regarding your general well being, health and sleep quality

| | Over the past MONTH, how often you have felt the following: | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Happy | 1 | 2 | 3 | 4 | 5 |
| 2. | Interested in life | 1 | 2 | 3 | 4 | 5 |
| 3. | Satisfied with life | 1 | 2 | 3 | 4 | 5 |
| 4. | Useful to your community/ society | 1 | 2 | 3 | 4 | 5 |
| 5. | That you are part of a community (group/ neighbourhood) | 1 | 2 | 3 | 4 | 5 |
| 6. | That the world is becoming a better place for all people | 1 | 2 | 3 | 4 | 5 |
| 7. | That people are basically good | 1 | 2 | 3 | 4 | 5 |
| 8. | That the way the world works makes sense to you | 1 | 2 | 3 | 4 | 5 |
| 9. | That you felt good about yourself | 1 | 2 | 3 | 4 | 5 |
| 10. | That you were dealing with your responsibilities or problems well | 1 | 2 | 3 | 4 | 5 |
| 11. | That you had good relationships with other people | 1 | 2 | 3 | 4 | 5 |
| 12. | That you were interested in learning new things and improving yourself | 1 | 2 | 3 | 4 | 5 |
| 13. | Confident to think or communicate your own ideas and opinions | 1 | 2 | 3 | 4 | 5 |
| 14. | That you live a good and meaningful life | 1 | 2 | 3 | 4 | 5 |

| | Over the past MONTH, how often have you experienced the following? | Never | | | | Always |
|---|---|---|---|---|---|---|
| 1. | Lonely | 1 | 2 | 3 | 4 | 5 |
| 2. | Depressed or hopeless | 1 | 2 | 3 | 4 | 5 |
| 3. | Upset or sad | 1 | 2 | 3 | 4 | 5 |
| 4. | Always worrying about something | 1 | 2 | 3 | 4 | 5 |

| | When working at sea.... | Strongly disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I often fear waking up to another day onboard | 1 | 2 | 3 | 4 | 5 |
| 2. | I often wonder how long I can keep working at sea | 1 | 2 | 3 | 4 | 5 |
| 3. | I feel I don't get to do anything else in my life besides work | 1 | 2 | 3 | 4 | 5 |
| 4. | My job at sea takes all my energy from me | 1 | 2 | 3 | 4 | 5 |
| 5. | I usually have lots of energy to talk to my colleagues or to my family back home | 1 | 2 | 3 | 4 | 5 |
| 6. | I have energy for my hobbies/relaxing activities in my spare time (while at sea) | 1 | 2 | 3 | 4 | 5 |
| 7. | I have plenty of reserve energy when I need it | 1 | 2 | 3 | 4 | 5 |
| 8. | I don't get enough time between shifts to recovery my energy fully | 1 | 2 | 3 | 4 | 5 |
| 9. | I can't recover my energy completely between shifts | 1 | 2 | 3 | 4 | 5 |
| 10. | I am fully rested at the start of each work shift | 1 | 2 | 3 | 4 | 5 |
| 11. | I feel stressed about not being able to adequately support my family | 1 | 2 | 3 | 4 | 5 |
| 12. | It worries me that something might happen with my family while I am at sea | 1 | 2 | 3 | 4 | 5 |
| 13. | I am stressed by the long separation from my family | 1 | 2 | 3 | 4 | 5 |
| 14. | I am not really sure how long I'll have a job with this company | 1 | 2 | 3 | 4 | 5 |

| | When I am on board the vessel I often..... | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | Have difficulties falling asleep | 1 | 2 | 3 | 4 | 5 |
| 2. | Have difficulties in staying asleep | 1 | 2 | 3 | 4 | 5 |
| 3. | Have difficulties staying awake (during work) | 1 | 2 | 3 | 4 | 5 |
| 4. | Have restless or disturbed sleep | 1 | 2 | 3 | 4 | 5 |

**SAFETY: In this section we will ask you some questions regarding the safety behaviours of YOUR SUBORDINATES**

**Please state how much you agree with each statement.**
**When MY SUBORDINATES are doing a task which requires a work procedure...**

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | They focus on completing the procedure and task properly | 1 | 2 | 3 | 4 | 5 |
| 2. | They try their best to apply the procedure correctly to the task | 1 | 2 | 3 | 4 | 5 |
| 3. | They concentrate on following the procedure correctly | 1 | 2 | 3 | 4 | 5 |
| 4. | They do what the procedure says without thinking too much about it | 1 | 2 | 3 | 4 | 5 |
| 5. | They put in the minimum effort needed to complete the procedure | 1 | 2 | 3 | 4 | 5 |
| 6. | They just follow the rules without worrying too much about the task | 1 | 2 | 3 | 4 | 5 |
| 7. | They don't think about what is required and just get the job done | 1 | 2 | 3 | 4 | 5 |
| 8. | They ignore the procedure and do the task as they always do | 1 | 2 | 3 | 4 | 5 |
| 9. | They skip parts of the procedure to save time | 1 | 2 | 3 | 4 | 5 |

**When MY SUBORDINATES believe a procedure is not appropriate...**

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | They think about the risks/hazards and assess whether the standard procedure will work | 1 | 2 | 3 | 4 | 5 |
| 2. | They use their experience and knowledge to come up with a solution to do the task safely | 1 | 2 | 3 | 4 | 5 |
| 3. | They discuss these issues with me | 1 | 2 | 3 | 4 | 5 |

**How much do you agree with the following statements about YOUR SUBORDINATES?**

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | They make suggestions to improve the safety of ship | 1 | 2 | 3 | 4 | 5 |
| 2. | They always try to improve safety procedures on this ship | 1 | 2 | 3 | 4 | 5 |
| 3. | They try to change the way the job is done to make it safer | 1 | 2 | 3 | 4 | 5 |
| 4. | They use all the necessary safety equipment to do their job | 1 | 2 | 3 | 4 | 5 |
| 5. | They use the correct safety procedures for carrying out their job | 1 | 2 | 3 | 4 | 5 |
| 6. | They carry out their work in a safe manner | 1 | 2 | 3 | 4 | 5 |
| 7. | They promote the safety programs on board the ship | 1 | 2 | 3 | 4 | 5 |
| 8. | They put in extra effort to improve the safety of the workplace | 1 | 2 | 3 | 4 | 5 |
| 9. | They voluntarily carry out tasks or activities that help to improve workplace safety | 1 | 2 | 3 | 4 | 5 |
| 10. | They are proud of the safety program on this ship | 1 | 2 | 3 | 4 | 5 |
| 11. | They are very interested in the safety program on this ship | 1 | 2 | 3 | 4 | 5 |
| 12. | They focus on how to do their jobs in the safest possible way | 1 | 2 | 3 | 4 | 5 |
| 13. | They pay a lot of attention to the rules and procedures necessary to do their work | 1 | 2 | 3 | 4 | 5 |
| 14. | They concentrate on the safety aspects of their work | 1 | 2 | 3 | 4 | 5 |

**INCIDENTS AND ACCIDENTS: The following questions ask about incidents and accidents on board this ship**

**In the past 6 months, how many times have the following happened to you at work?**

| | | Number of times | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. | I have been involved in an incident in which I narrowly escaped being injured | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |
| 2. | I have observed/witnessed an incident in which someone else narrowly escaped being inured | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |
| 3. | I have observed/witnessed an incident that had the potential to harm the ship or the environment | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |
| 4. | I have been injured at work | 0 | 1 | 2 | 3 | 4 | 5 | 6 or more |

Lastly, please note down the date you filled in this survey to help us keep track of the timing of the data collection: ____/ ____/ _____

THANK YOU VERY MUCH FOR YOUR SUPPORT!