Seafarer Mental Health Study

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About the authors:

Dr. Rafael Lefkowitz and Martin Slade of the Yale Occupational and Environmental Medicine Program have been conducting occupational medicine research on seafarers and mariners since 2012, including collecting/analyzing new data as well as analyzing existing data provided by industry stakeholders. They founded and co-direct the Yale University Maritime Research Center, which is committed to improving the evidence-base for seafarer injury and illness prevention, management guidelines, and health policy.

Table of Contents

Executive Summary

This report describes findings from the seafarer survey of injury, illness, and mental health risk factors in international seafarers, sponsored by the ITF/Seafarers' Trust. The goal of the study was to determine rates and factors associated with mental health conditions in seafarers, and identify opportunities for preventive interventions. The final study population included 1572 seafarers representing many regions of origin and vessel types. For the purposes of the study, seafarers with a PHQ-9 score of 10 or greater were considered seafarers with depression, and seafarers with a GAD-7 score of 10 or greater, seafarers with anxiety. Seafarers with suicidal ideation were defined those responding "several days," "more than half the days," or "nearly every day" to the question, "Over the past 2 weeks, how often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way?" The main findings are listed below, with recommendations narrated at the end of the full report.

Key findings included:

- 25% of seafarers completing a patient health questionnaire had scores suggesting depression (significantly higher than other working and general populations).

- 17% of seafarers completing a generalised anxiety disorder questionnaire were defined as seafarers with anxiety.

- 20% of seafarers surveyed had suicidal ideation, either several days (12.5%), more than half the days (5%) or nearly every day (2%) over the two weeks prior to taking the survey.

- Incorporating all demographic, occupational, and work environmental factors, final determinants of seafarer depression, anxiety, and suicidal ideation included work environmental factors (non-caring company culture, violence at work), job satisfaction, and self-rated health (the strongest predictor of anxiety and depression).

- The most significant factor associated with workplace violence was seafarer region of origin. Seafarers from the Philippines and Eastern Europe were most likely to report exposures to workplace violence.

- Depression, anxiety, and suicidal ideation were associated with increased likelihood of injury and illness while working on board the vessel.

- Seafarer depression, anxiety, and suicidal ideation were associated with increased likelihood of planning to leave work as a seafarer in the next 6 months.

- Periods in work/life cycle associated with high-risk of mental health issues included, most notably, during extension of a voyage.

While comparative data is limited, this analysis suggests that seafarers have higher rates of depression than other working populations, emphasizing the need for appropriate mental health policies and management strategies in this isolated, vulnerable, and globally essential workforce. The study also importantly identifies potential opportunities to reduce depression and anxiety risks in seafarers, which may also reduce risks of injury and illness, and improve retention. While limitations include that the data is self-reported data at one point in time, this study is a significant step towards understanding risk factors of seafarer mental health conditions.

Introduction

Background:

There is increasing recognition of the impact of mental health conditions on injury and illness risk in working populations. Despite the essential nature of their work, there is limited research on occupational exposures, injuries, illness, and mental health in international seafarers. This work represents a significant step in understanding psychosocial health risks in international seafarers.

In October 2016, the ITF/Seafarers' Trust convened a working group on social isolation, depression, and suicide, (SIDS) to understand the state of the knowledge-base and identify strategies to fill key gaps through research (1). While several potential psychological stressors in seafaring were described in the workshop, major gaps in the state of current seafarer mental health knowledge were also identified, including lack of data on rates of depression and suicide in contemporary crews. One result of this workshop was prioritizing research on seafarer SIDS, with a particular focus on understanding SIDS and related risk factors in current seafaring populations (2). Subsequently, the ITF/Seafarers' Trust issued a call for proposals to meet this research need. Concurrently, researchers at the Yale Occupational and Environmental Medicine Program had recently completed work in understanding risk factors for injury and illness in international seafarers (3-6), which included preliminary findings regarding mental health measures. This work demonstrated a potentially significant burden of depressive symptoms in seafarers, a significant prevalence of mental illness claims, and also identified the need for further research incorporating additional mental health items in a dedicated mental health survey. With this successful track record, and unique access to working seafarers through collaboration with Seamen's Church Institute in the Port of Newark (NJ, USA), the Yale group submitted a successful proposal to study demographic, occupational, and work-environmental factors related to SIDS in working international seafarers.

Methods, Data, and Analysis:

In this document, the Yale group reports conclusions of this Seafarer Mental Health survey project, incorporating demographic, occupational, and work-environmental questions, together with questions assessing injuries and illness events, and mental health outcomes (symptoms of depression and anxiety). Previously-validated mental health screening instruments contained in the final survey included the 9-Item Patient Health Questionnaire (PHQ-9) (7) and the 7-Item General Anxiety Disorder Questionnaire (GAD-7) (8). The psychosocial work environment was also assessed with targeted questions, including items from the Copenhagen Psychosocial Questionnaire (9, 10). The final distributed survey was the result of three months of ship visits, in which the survey was improved over several iterations based on feedback from approximately 100 working seafarers on multiple ship visits at the Port of Newark. The survey was then converted to an online electronic format. The electronic survey was promoted by the ITF/Seafarers' Trust and other seafarer networks including Sailors' Society, Seamen's Church Institute, and the North American Maritime Ministry Association.

The survey was actively promoted for a three-month period. When the survey promotion period concluded and results were downloaded on January 23, 2019, there were 1894 completed surveys. This analysis includes a review of the 1572 completed surveys for which respondents indicated they were working seafarers (defined as seafarers who had worked on a vessel within the past 2 years). This final report includes descriptive characteristics (seafarer characteristics and characteristics of the ship environment) as well as health and wellness data, with particular focus on aspects related to seafarer mental health and associated factors.

The data from the surveys were downloaded to Yale University computers and examined for completeness. Responses to each question were reviewed individually. Multiple choice questions were analyzed for the frequency distribution of responses. Of note, review of the surveys indicated that some participants did not answer every question. This is an anticipated event in conducting surveys and was accounted for prior to analyses including statistical modelling. The number of unanswered questions is presented as either "not answered," or "unknown" for each variable.

Categorical data is presented as frequency distributions in tables and/or figures in this report. Appropriate statistical tests were applied to determine which results were found to be statistically significant. Results are presented in narrative form and accompanying tables and figures. Each section concludes with a concise summary and discussion of implications and limitations. This final report concludes with recommendations regarding the mental health findings and potential interventions.

Of note, this report focuses on mental health conditions and associated risk factors self-reported by the seafarers participating in the survey. For the purposes of this report, seafarers with depression are defined as those surveyed seafarers with a PHQ-9 score of greater than or equal to 10, denoting significant current depressive symptoms (see Mental Health results, below). The survey also included a question regarding whether or not the seafarer had been previously diagnosed with depression. As per the study design, analyses of rates and associated risk factors for depression in the study are based on the seafarer's PHQ-9 score, not on a previous diagnosis of depression. Similarly, seafarers with anxiety were defined as seafarers with a GAD-7 score of 10 or above (indicating significant current anxiety symptoms), not if they reported a previous diagnosis of anxiety. Suicidal ideation was defined using the question "Over the past 2 weeks, how often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way?" with answer choices including "not at all," "several days," "more than half the days," or "nearly every day." Seafarers with suicidal ideation were defined those responding "several days," "more than half the days," or "nearly every day" to this question. Seafarers who responded "not at all" to this question were defined as seafarers without suicidal ideation.

Results and Discussion

Descriptive Statistics of Seafarer Study Population:

Discussion of the Seafarer Study Population:

The following is a discussion of findings regarding the overall seafarer population and vessel characteristics, occupational hazards and personal protective equipment use, baseline medical conditions, general health, and other characteristics.

Seafarer Demographic and Occupational Characteristics:

Seafarer demographic characteristics are displayed in Table 1/ The 1572 seafarer respondents analyzed were primarily male (1389, 88%), with a smaller number of female respondents (138, 9%), congruent with modern crewing norms. Only 45 seafarers (3%) did not answer the question regarding gender. Seafarers were approximately evenly distributed between age groups, with a minority of older seafarers (age 56 years and older constituting 13% of respondents). The distribution of regions of origin included many seafarers from the Philippines and Pacific region (621, 40%; of these, numbering 591, most of these seafarers were from the Philippines, followed by Western Europe (450, 29%), North America (142, 9%), Eastern Europe (132, 8%), and Asia (76, 5%; of these, numbering 52, most of these seafarers were from India).

Table 1: Seafarer Demographic Characteristics			
Parameter	Level	All Seafarers (n=1,572)	
		n	%
Age (years)	18–25	134	9
	26–35	431	27
	36–45	399	25
	46–55	290	18
	56+	201	13
	Unknown	117	7
Gender	Male	1389	88
	Female	138	9
	Unknown	45	3
Region of Origin	Philippines and Pacific	621	40
	Western Europe	415	27
	North America	142	9
	Eastern Europe	167	10
	Asia	76	5
	Other/Unknown	151	10

Regarding seafarers' individual occupational characteristics (Table 2), there were many participants from the deck (835, 53%) and engineering departments (412, 27%), and a smaller number of participants working in the galley (129, 8%) or other areas (96, 6%). Vessel captains (or masters; 171, 11%), and other officers (681, 43%) were well-represented, as were ratings (565, 35%). Many seafarers had worked for 10 years or less years at sea (571, 36%), with a substantial number working between 11 and 20 years at sea (465, 30%) and a smaller proportion of workers with 21-30 years of experience (227, 14%), or 31 years or more (186, 12%). The most frequently reported typical shift schedule was 4 hours on/8 hours off (374, 24%), followed by 8 on/ 8 off (243, 15%) and 12 on/ 12 off (215, 14%).

Table 2: Seafarer Occupational Characteristics			
Parameter	Level	All Seafarers (n=1,572)	
		n	%
Rank	Master/Captain	171	11
	Officer	681	43
	Rating	565	36
	Other/Unknown	155	10
Work site	Deck	835	53
	Engineering	421	27
	Galley	129	8
	Other/Unknown	187	12
Tenure (years)	0–5	266	17
	6–10	305	19
	11–15	181	12
	15–20	284	18
	21–30	227	14
	31+	186	12
	Unknown	123	8
Shift	4 hours on, 8 hours off	374	24
	8 hours on, 8 hours off	243	15
	12 on, 12 off	215	14
	6 hours on, 6 hours off	153	10
	8 on or 10 on	195	12
	Day work	58	4
	Other/Unknown	334	21

Summary and Implications:

The demographic distribution of participating seafarers by gender, with significantly more male than female seafarers, was reflective of the general seafarer population. Regarding regions of origin, the survey represented the Philippines/Pacific region and Western Europeans well, but under-represented seafarers from Asia. The distribution of ship departments was a close approximation of seafarers on a vessel, although the engine department was somewhat under-represented. It is worth noting that fewer galley workers (stewards) participated in the survey, but this may be expected based on usual crewing standards. Overall, the survey sample represents a diverse population of seafarers by age, gender, region of origin, and occupational characteristics.

Vessel Registry and Vessel Type:

In regards to the vessel registry (Table 3), 642 seafarers (41%) worked on vessels registered under a flag of convenience as declared by ITF's Fair Practices Committee. Many seafarers worked on tankers (296, 19%), passenger vessels (262, 17%), and bulk carriers (258, 16%).

Summary and Implications: As indicated above, the study defined flag of convenience vessels as per the ITF's fair practices committee (11). Vessels across the spectrum of registry and vessel types were represented in the study sample, allowing for greater generalizability.

Table 3: Seafarer Vessel Characteristics			
Parameter	Level	All Seafarers (n=1,572)	
		n	%
Flag of Convenience	Yes	642	41
	No	719	46
	Unknown	211	13
Age (years)	Tanker	296	19
	Passenger	262	17
	Bulk carrier	258	16
	Dry cargo, Reefer, Ro-Ro, & Supply	230	15
	56+	189	12
	Unknown	337	21

Occupational Hazards and Personal Protective Equipment:

Analysis of reported workplace exposures demonstrated high exposures to noise, vibration, and heat, as well as working in tight spaces, with notable differences by work site. Overall, engineers had higher reported exposures than deck and galley seafarers in all categories of exposures (Figure 1). Seafarers used a variety of personal protective equipment (PPE) used to protect against exposures in work at sea (Figure 2).
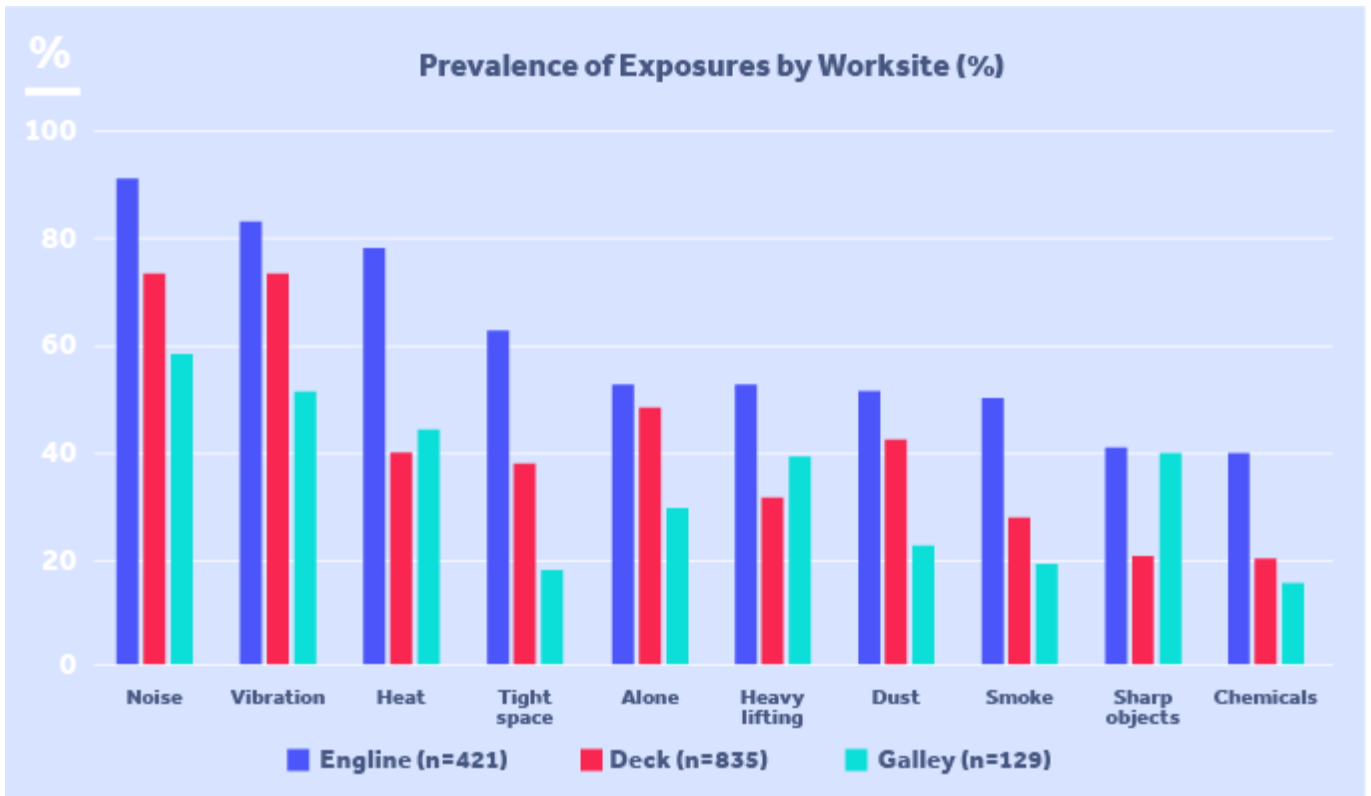
Figure 1. Prevalence (percent) of seafarer occupational exposures by work site. "Alone" signifies working alone, and "tight space" signifies working in tight spaces.
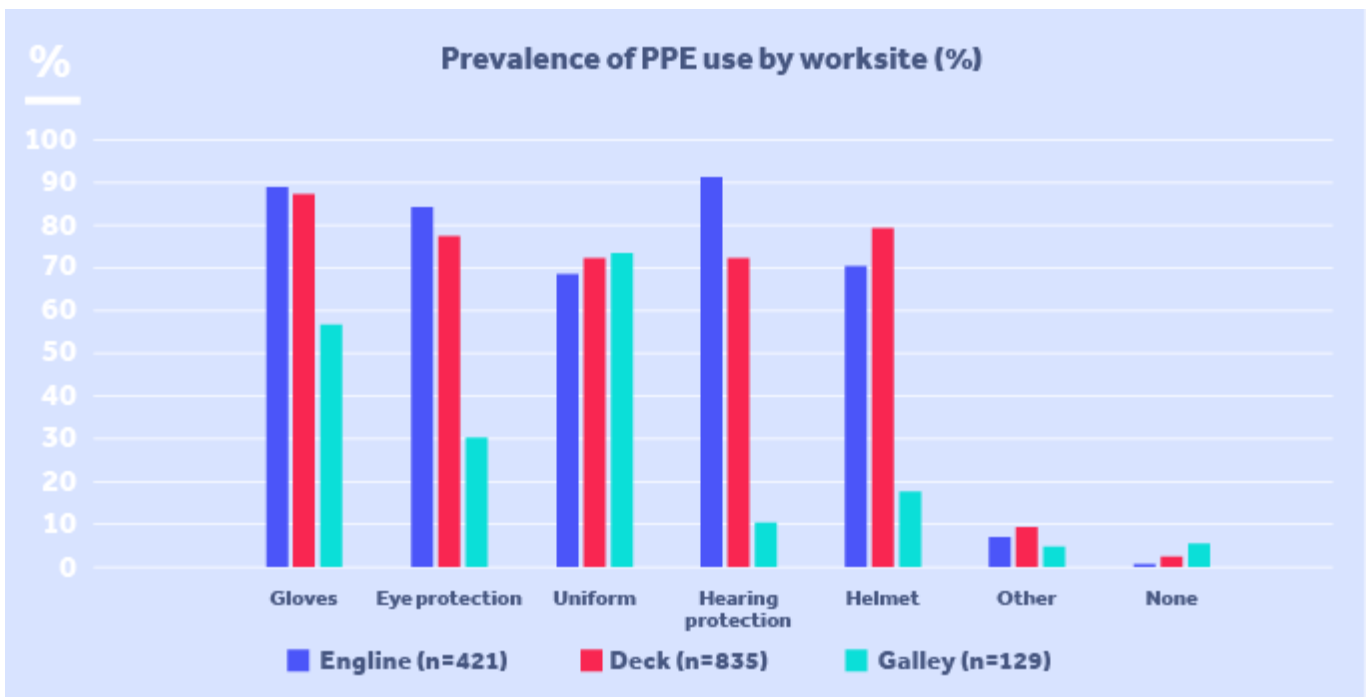

Figure 2. Reported personal protective equipment (PPE) utilized by seafarers, percent prevalence.

Summary and Implications:

Analysis of seafarer-reported exposures and PPE use also confirmed previously observed trends in other seafarer research studies recently conducted by the Yale investigators. These findings include higher exposures overall in the engine department, and particularly high exposures to noise, vibration, heat, and work in tight spaces. This study confirms the high prevalence of occupational exposures in the vessel environment.

General Health and Exercise:

Seafarers frequently ranked their own health as good, very good, or excellent (Figure 3). Seafarers with low PHQ-9 scores (not depressed) tended to report higher frequencies of exercise compared to seafarers with higher PHQ-9 scores (Figure 4).
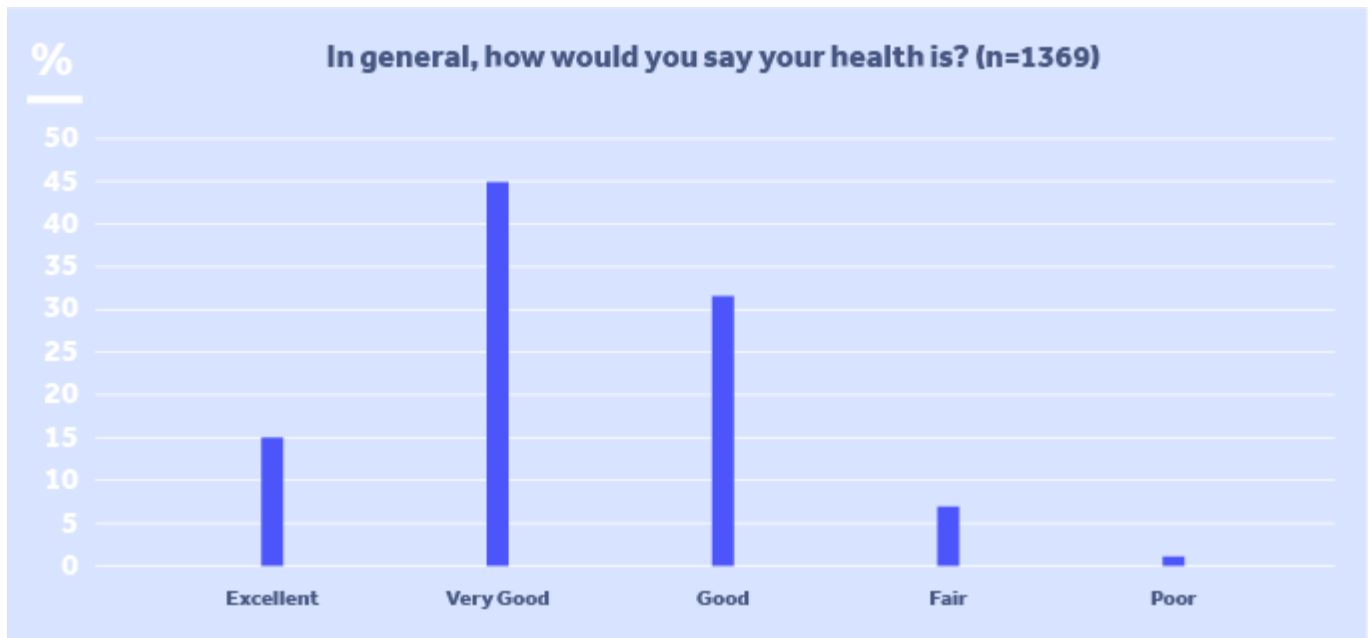

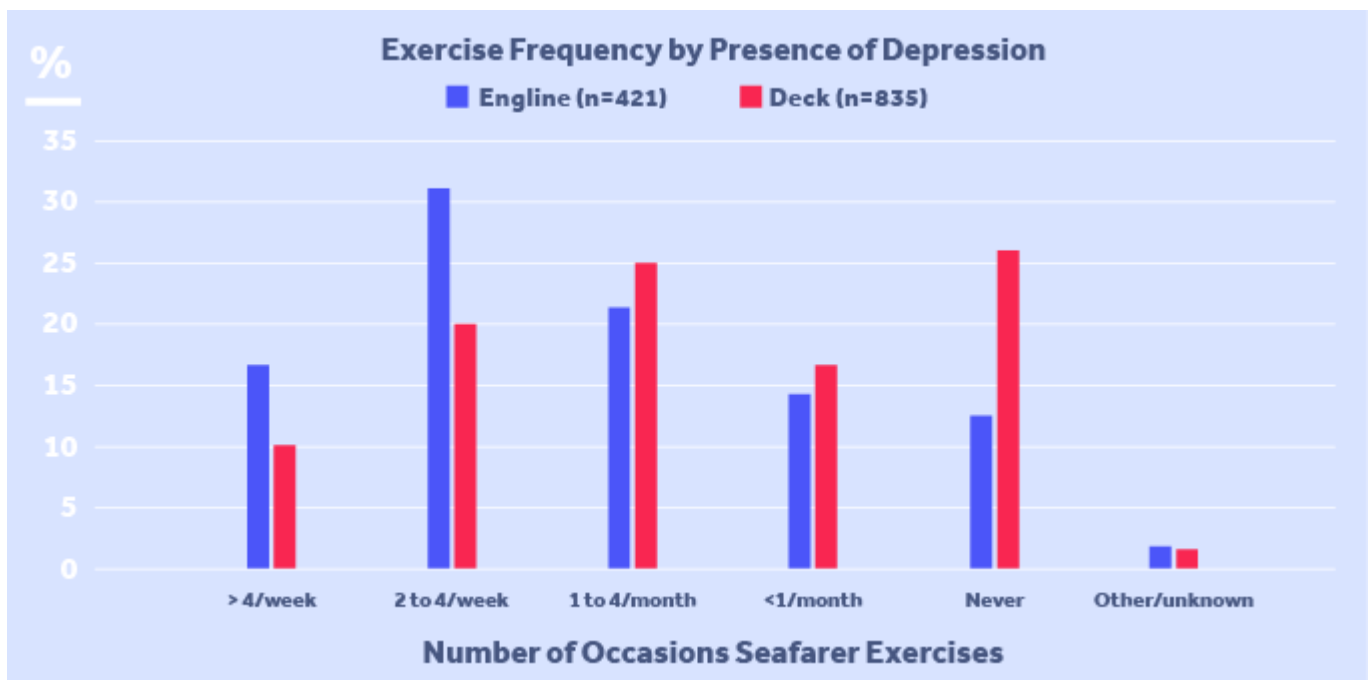**Figure 3.** Seafarers' self-rated health.

Figure 4. Exercise frequency among working seafarers, by PHQ-9 score. The category "other/unknown" includes non-quantitative responses and non-responses.

Summary and Implications:

Many seafarers had high rankings of self-rated health, a good correlate of actual health. Exercise frequency differed by responses to the depression screening measures. **Almost half (49%) of seafarers without depression exercised 2 or more times per week, while almost half (43%) of seafarers with depression exercised less than once a month.**

Reported Medical Conditions:

The seafarers were asked to select which medical conditions they have been diagnosed with previously (Figure 5). High cholesterol and high blood pressure were frequently reported (14% of seafarers for both conditions). Sleep disorders (7%), depression (6%) and anxiety (5%) were also frequently reported. As noted above, the survey analysis and discussion will focus on implications of screening positive for depression or anxiety using the PHQ-9 and GAD-7 screening tools.
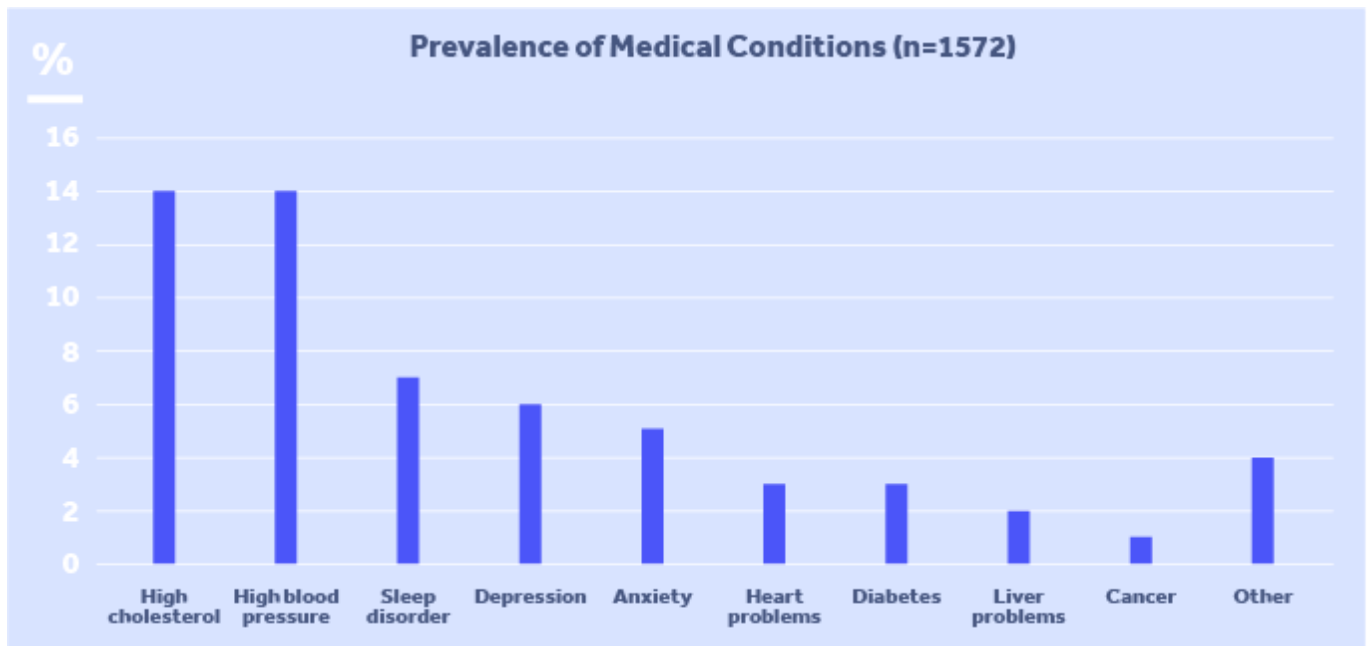

Figure 5. Prevalence of medical conditions as reported by seafarers. The category "other" includes headaches, skin conditions, gallbladder conditions, joint diseases, and other illnesses.

Summary and Implications:

The most prevalent conditions were high cholesterol and high blood pressure, which are common in the general population. Sleep disorders may be expected in this population due to their shift schedules, although specific sleep disorders were not reported. The reported rates of a pre-existing diagnosis of depression was comparable to general United States population rates (12), although reported anxiety rates were lower (13). The rate of hypertension appears low considering age-related norms in the comparable US population by age (14). This may be a true finding, in which case the seafarers are comparably of better health, either due to a work-related factor, other cultural factors (for example, diet and exercise), genetic factors, or other effect. It is also possible that this finding is due to a "healthy worker effect", in which workers with chronic conditions that cause significantly impairing symptoms drop out of the workforce. It is also possible that this finding could represent under-reporting.

Distribution of Mental Health Conditions:

The survey included previously-validated questionnaires to determine prevalence of depression and anxiety, and associated factors, in the seafarer study population. These questionnaire items assess the degree of depression or anxiety symptoms over the past 2 weeks. In the 9-Item Patient Health Questionnaire (PHQ-9), respondents are scored on a scale ranging from zero to 25. Higher scores indicate higher severity of depression, and a score of 10 or above correlates well with a clinical diagnosis of depression. Testing parameters of the PHQ-9 include a sensitivity and specificity of 88%, which means that 88% of people with depression would have a PHQ-9 score of 10 or above, and a PHQ-9 score of 10 or above would be present in only 12% of people without depression (15). The seafarer survey also included the 7-Item Generalized Anxiety Disorder Questionnaire (GAD-7). These questions assess for the presence of anxiety, with scores of 10 or above correlating well with generalized anxiety disorder. Testing parameters of the GAD-7 include a sensitivity of 89% and specificity of 82%, which means that 89% of people with generalized anxiety disorder would have a GAD-7 score of 10 or above, and a GAD-7 score of 10 or above would be present in 18% of people without generalized anxiety disorder (8). Therefore, it should be emphasized that these questionnaires may still miss some individuals with depression and anxiety and can in some cases incorrectly suggest the presence of depression or anxiety in healthy individuals. A further limitation of using questionnaires is that they were not validated in seafarer populations specifically, emphasizing the need for more detailed research on seafarer mental health including clinical diagnostic information.

In summary, these questionnaires were chosen recognizing their inherent limitations with the advantage of being able to use these questionnaires to effectively screen a large population of seafarers, using cut-off values to define depression and anxiety based on the specificity and sensitivities of the tests as above: seafarers with scores of 10 or higher on the PHQ-9 were defined to have depression, and seafarers with scores of 10 or higher on the GAD-7 were defined as seafarers with anxiety. Due to the limited use of PHQ-9 among seafarer populations, a second questionnaire, the five-question World Health Organization Well-Being Index (WHO-5) was also incorporated into the survey. Responses to the WHO-5 produced a similar prevalence of depression as the PHQ-9, and so the results are discussed in terms of the PHQ-9 scores.

Overall, the prevalence of depression and anxiety among the surveyed seafarers was 25% and 17%, respectively. Anxiety was detected in 17% of the seafarers, with 212 seafarers scoring 10 or above on the GAD-7; 1061 (83%) had mild or no anxiety (299 seafarers did not complete the anxiety screening questions). Of 1238 seafarers who answered all questions screening for depression and anxiety, 163 (13%) had both depression and anxiety, 148 (12%) had depression but not anxiety, 39 (3%) had anxiety but no depression, and 888 (72%) had neither depression nor anxiety (Figure 6). By depression category (Figure 7), 944 (75%) seafarers had mild or no depression, 200 (16%) moderate depression, 83 (7%) moderately-severe depression, 35 (3%) severe depression (310 seafarers did not respond to the depression screening questions).

Seafarers were asked to rank the various periods of their work/life cycle in terms of their mood. The time periods with the highest average rank of mood (better moods) included first day home and at the end of a voyage, with worst moods at the beginning of a voyage, last day home, and in times when the voyage is extended. This trend was true for both depressed and non-depressed seafarers, with depressed seafarers ranking their moods lower than non-depressed seafarers for all the periods of time assessed. (Figure 8).
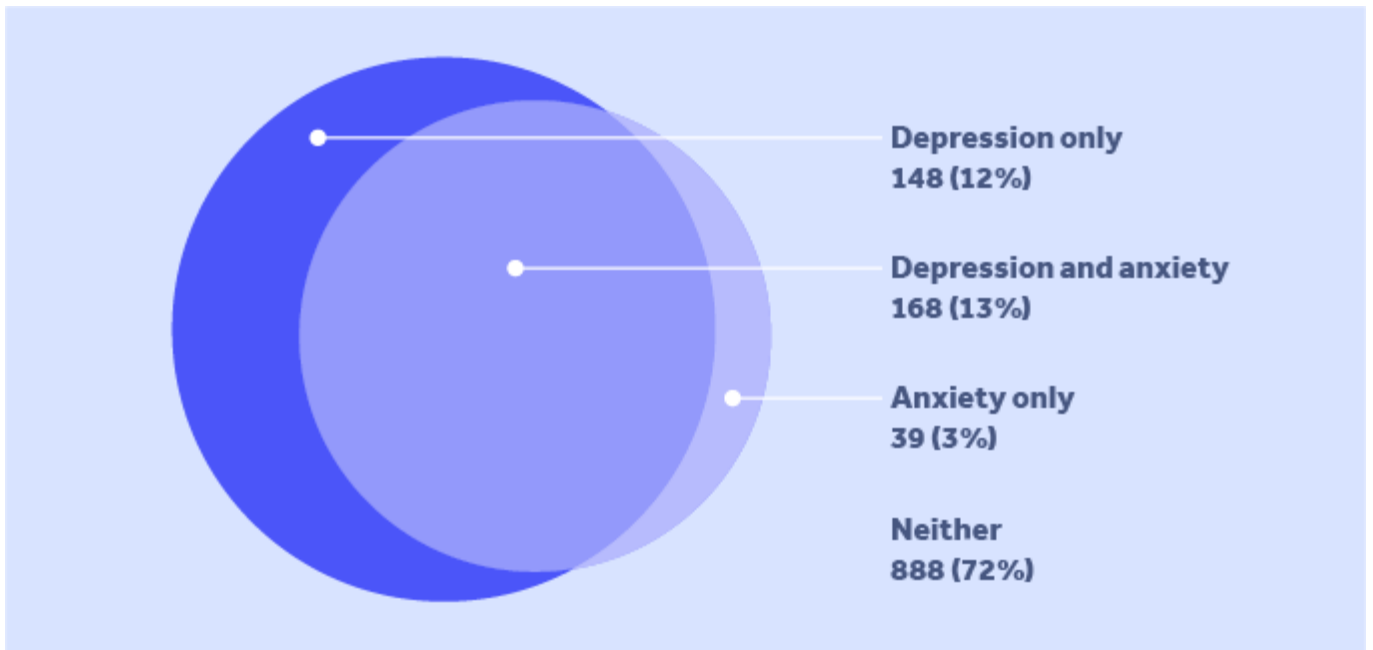
Figure 6. Distribution of depression and anxiety in the seafarer population studied, based on PHQ-9 and GAD-7 scores.
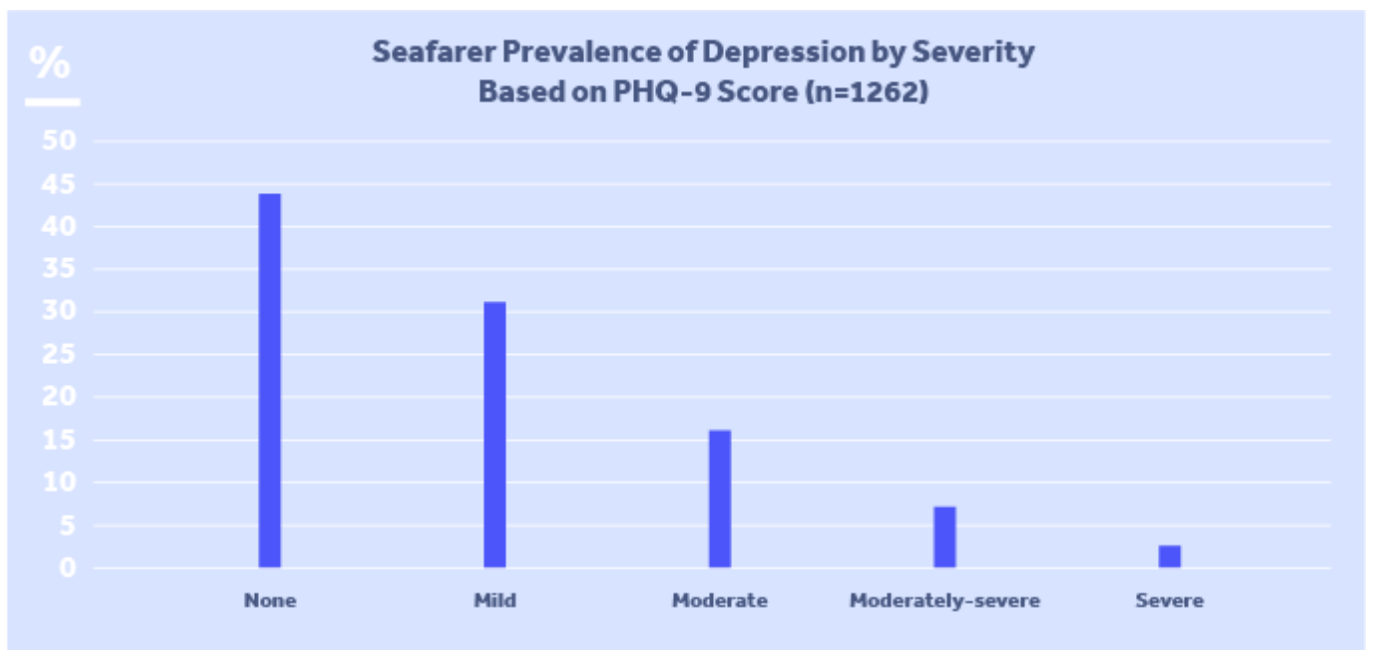

Figure 7. Distribution of depression severity based on PHQ-9 scores among surveyed seafarers.
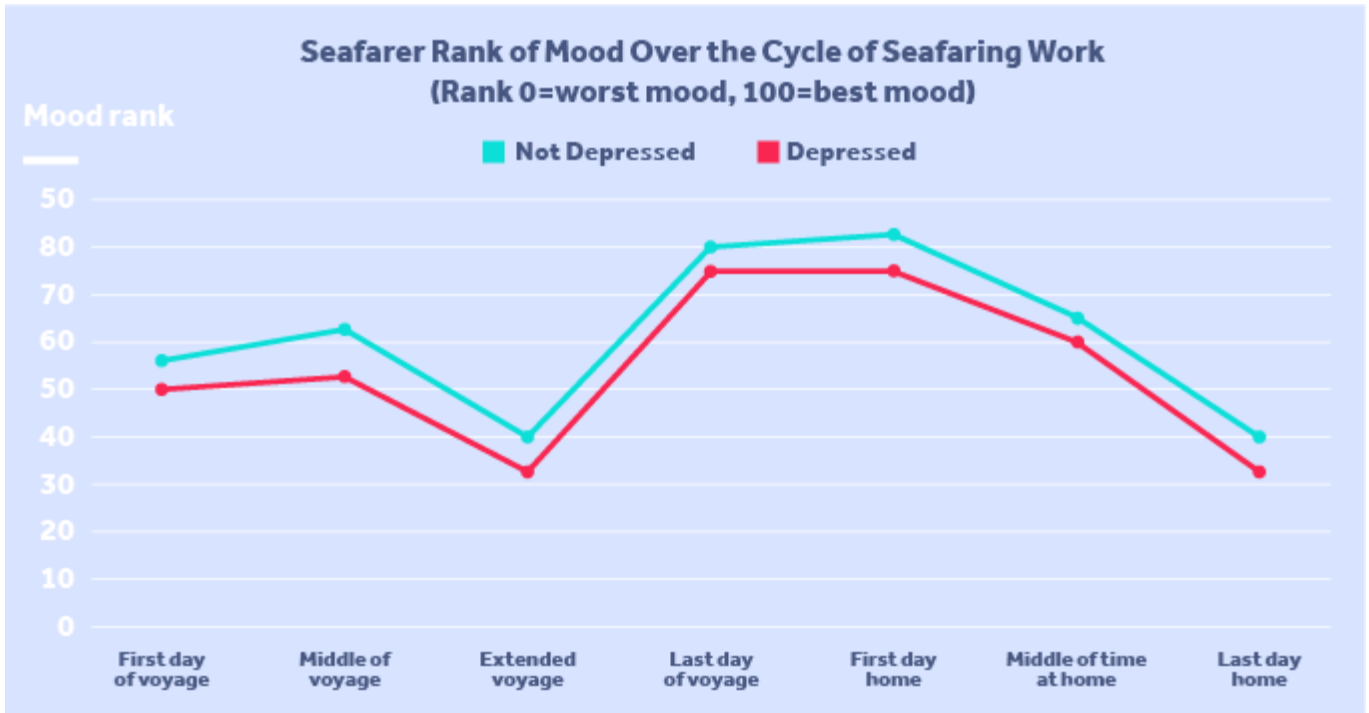
Figure 8. Mood as a function of the work-life cycle in seafaring. Best moods are reported at the end of a voyage or first day home, with worst moods at the beginning of a voyage, last day home, and in times when the voyage is extended. Being home is associated with improving mood, but this improvement is not sustained over time and worsens as the cycle turns towards return to work.

In order to explore possible factors effecting seafarer mood and mental health, participants were asked two additional questions: "What factors contribute to you feeling down or depressed?" and "Who do you ask for help when you feel down or depressed?" The seafarers were asked to rank factors contributing to depressed mood on a scale of zero to 100, with 100 being most contributory. As shown in Figure 9, **among depressed seafarers the factors ranked highest in attributing to feeling down and depressed included isolation from family, supervisor demands, trouble sleeping, and contract length.** Among seafarers who were not depressed, isolation from family, contract length, food quality and amount of food ranked the highest.
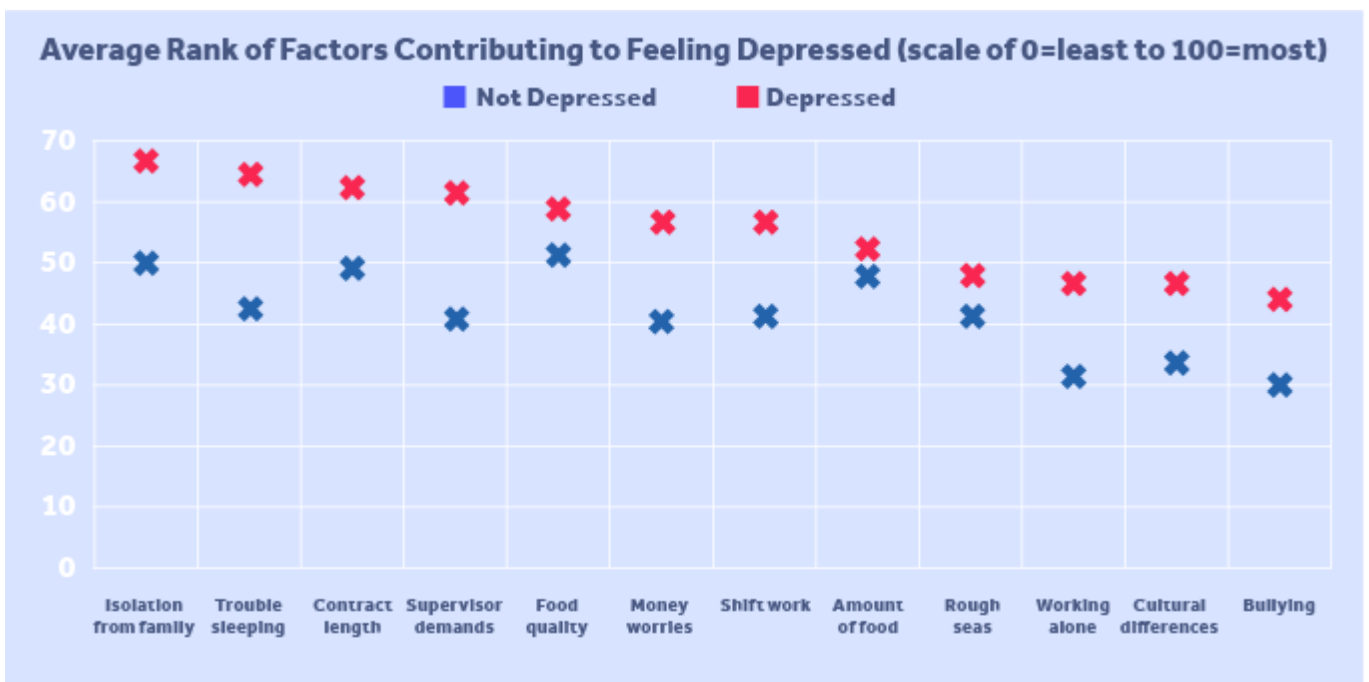

Figure 9. Factors that seafarers attributed to their mood, range of potential values of zero (least) to 100 (most attributable), by depressed status.

In response to the question of who seafarers turn to for help when feeling down or depressed, seafarers responded with a variety of answers (Figure 10). Frequent responses included family, friend, and asking nobody for help; this was true for both depressed and non-depressed seafarers. Seafarers with depression were significantly more likely to report asking for help from doctors or therapists (20% and 16%, respectively), compared to non-depressed seafarers (6% and 5%, respectively).
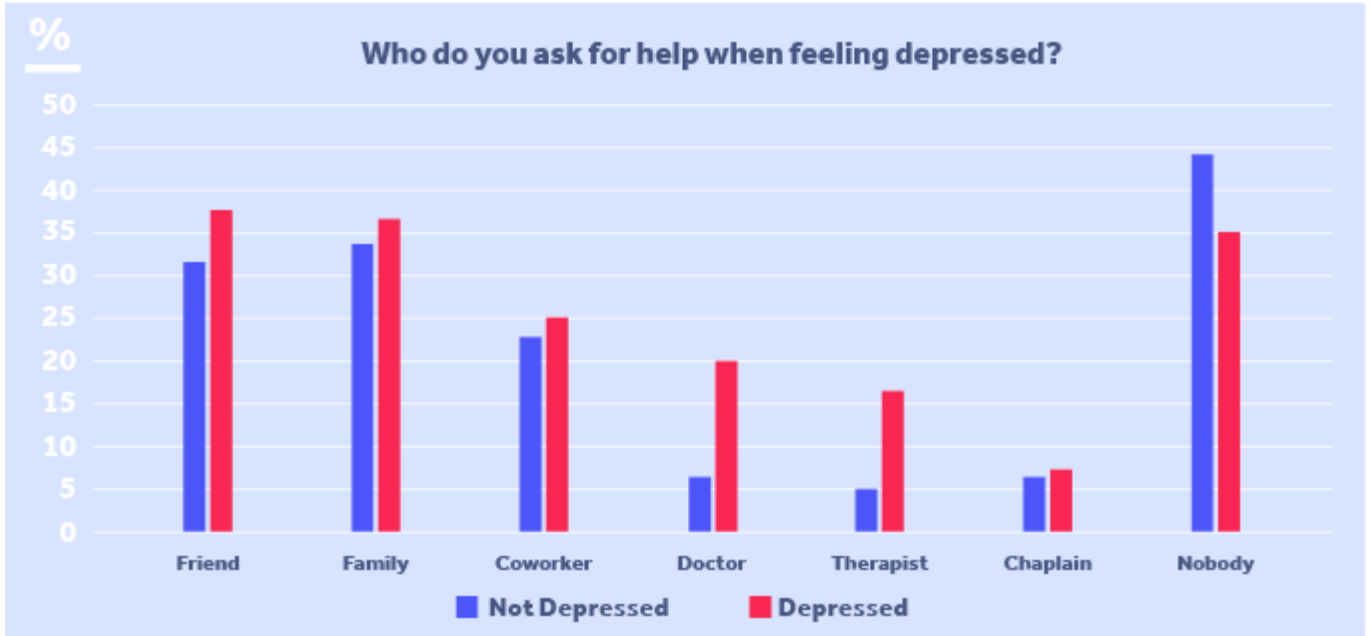

Figure 10. Distribution of who seafarers ask for help when feeling down or depressed, by depressed status. Respondents could select more than one choice, hence percentages add up to more than 100.

Seafarers were asked additional questions regarding the general workplace environment, or workplace culture. We asked: Can you set your own work pace? Can you influence decisions that are important for your work? Does your company take care of its workers? Compared to seafarers without depression, **seafarers with depression reported less control over their work** (less ability to set their own work pace or influence decisions) and **were less likely to report that their company takes care of its workers** (Figure 11). We also asked: Do you perform tasks for which you need more training? Have you been exposed to threats or violence at work during the last two years? **Seafarers with depression were more likely to report performing tasks for which they need more training, and exposure to threats or violence at work, compared to seafarers without depression** (Figure 12).
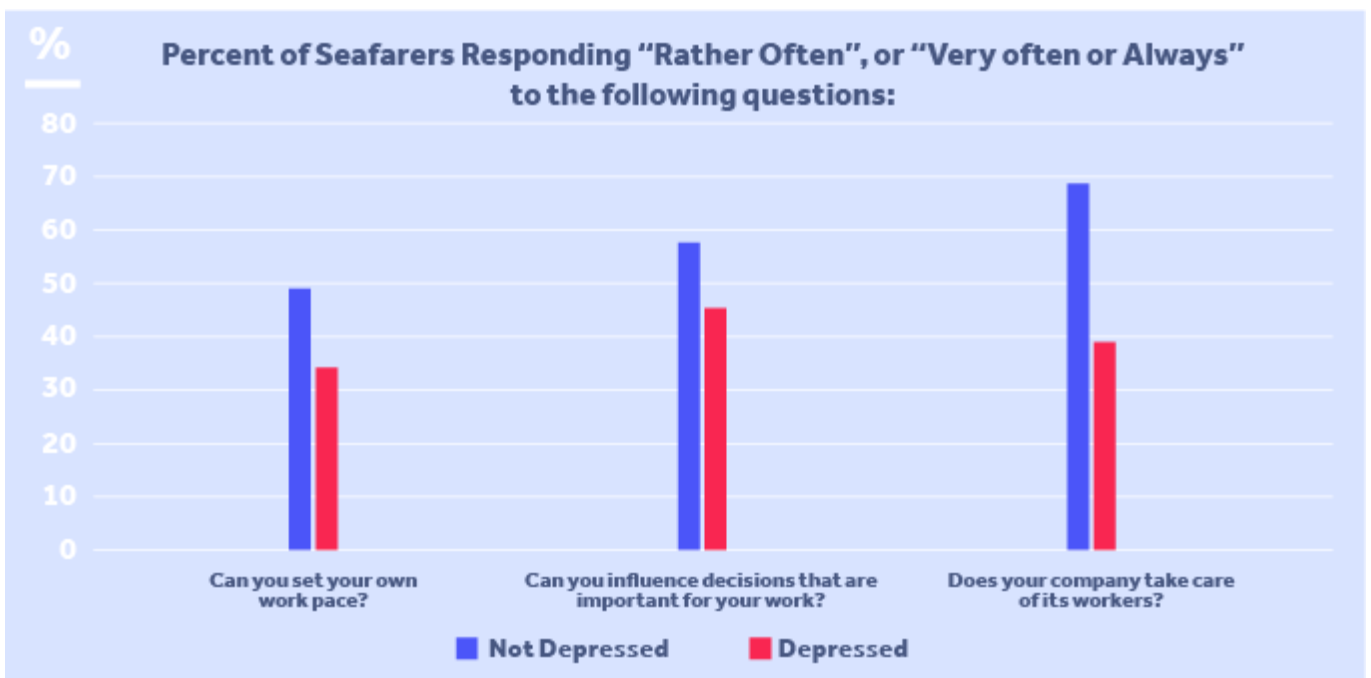

Figure 11. Seafarers with depression reported less control over their work and were less likely to report that their company takes care of its workers.
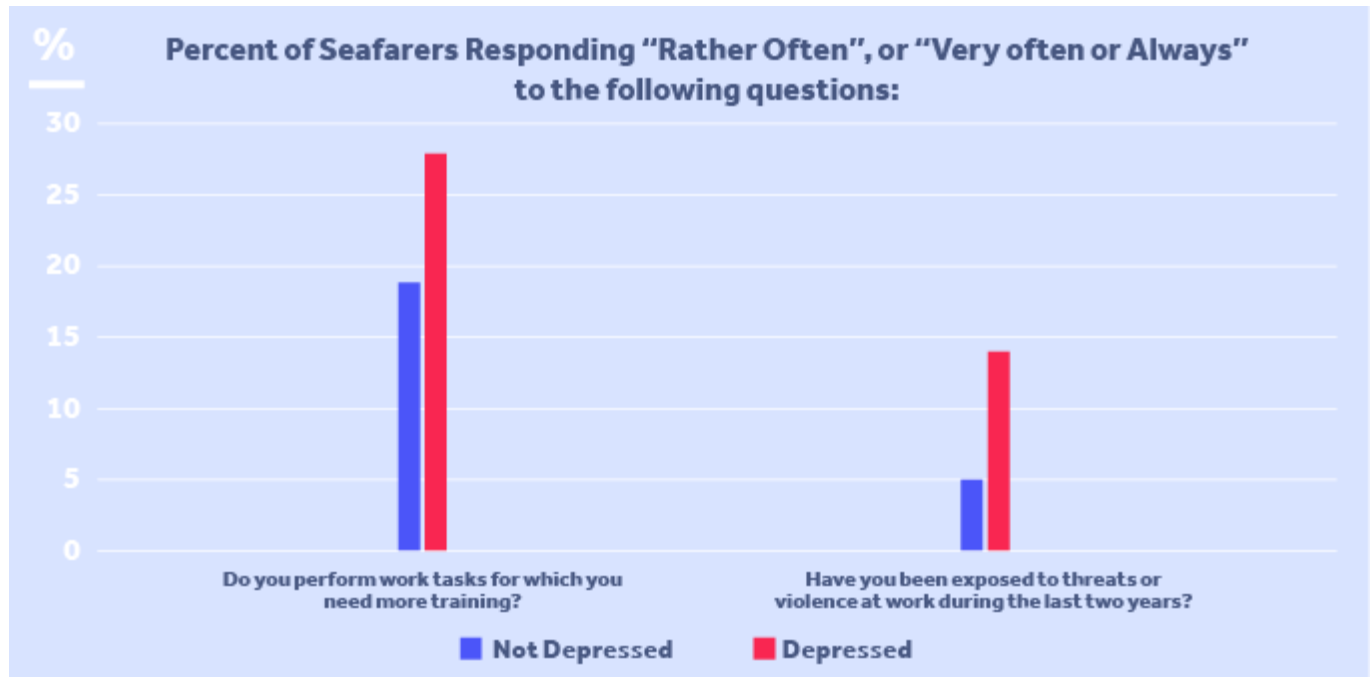
Figure 12. Seafarers with depression were **more likely** to report performing tasks for which they need more training, and exposure to threats or violence at work, compared to seafarers without depression.

In terms of responses to the specific PHQ-9 question regarding suicidal ideation, 20% of seafarers responded they were bothered by thoughts of suicide or self-harm, either several days (12.5%), more than half the days (5%), or nearly every day (2%) of the previous two weeks.

Summary and Implications: The results demonstrated here are notable for a high prevalence of depression and anxiety among seafarers, as measured by the PHQ-9 and GAD-7 in our study. Suicidal ideation was also notably prevalent. We are not aware of other published studies that have assessed this.

Seafarer Depression and Anxiety in Comparison with Other Populations:

It can be challenging to find comparative data because of the type of population (workers may be expected overall to have a lower prevalence of illness, including mental illness, than the general public, and working populations can be less accessible for research), and varying criteria for making a diagnosis of depression or anxiety in the literature (symptoms scale as used in PHQ-9 and GAD-7, compared to clinical diagnostic criteria by DSM-V or diagnostic codes such as ICD-10). In our study, seafarer depression rates were higher compared to a 6% rate in a German general population study by PHQ-9 (16). In comparison to other working populations, seafarers had higher prevalences of depression and anxiety compared to oil and gas workers in (using a cut-off of 10 for the PHQ-9 and GAD-7, as was used in our study, there was 5% prevalence of depression and 5% prevalence of anxiety among oil and gas workers) (17). Our observed depression prevalence was closer to a study of US airline pilots, which found a 13% prevalence of depression (18), although seafarer and airline pilot populations are notably different in terms of work stressors and exposures, as well as pre-employment screening. In terms of demographic factors, our study showed that women seafarers and younger seafarers (ages 18-35) had higher prevalences of depression, following trends in the US general population (12). Significant associations between mental health outcomes and occupational characteristics included: a higher proportion of suicidal ideation among officers and ratings compared to vessel masters/captains, higher frequencies of anxiety among deck and galley workers compared to engineers, and higher frequencies of depression among seafarers with shorter tenure (less years worked). Examined by type of vessel, container ships had the highest frequency of suicidal ideation, and bulk carriers and tankers had the lowest levels of anxiety and suicidal ideation. These factors were all included in advanced statistical modelling to determine which factors were independent predictors of seafarer depression, anxiety, and suicidal ideation (detailed below).

Seafarers with depression commonly attributed their low mood to isolation from family, supervisor demands, trouble sleeping, and contract length. Seafarers without depression also cited isolation from family and contract length but did not identify supervisor demands or trouble sleeping as relevant factors. Seafarer responses also indicated high-risk time periods in the work/life cycle of seafaring. Overall, these findings confirmed the impact of isolation from family, as best moods correlated with returning home, and worst moods correlated with returning to work (lowest moods were reported with voyage extension). Reducing seafarer isolation from family is inherently challenging (although internet connection may be helpful), while other work factors may be minimized with appropriate work-environmental interventions in collaboration with employers.

Seafarers with depression often asked nobody for help (35%), and otherwise mostly spoke to friends (38%) or family (36%). A minority of seafarers with depression asked professionals for help (doctors or therapists). As seafarers spend a significant amount of time away from family and friends, as well as doctors and therapists, it is notable that 25% of depressed seafarers asked their co-workers for help as well. It is possible that encouraging seafarer mental health concern and reducing stigmatization of mental illness can raise this percentage, enabling more depressed seafarers to seek help from their co-workers over long voyages. This may be particularly important to reducing suicide risks, noting that 20% of seafarers reported thoughts of suicide or self-harm during the two weeks prior to taking the survey as noted above. While frequency of internet and email access was not associated with statistically significant differences in the depression or anxiety distribution, more frequent email and internet was associated with decreased likelihood of suicidal ideation.

Determinants of Seafarer Mental Health Conditions:

The major goal of the research was to assess for determinants of depression, anxiety, and suicidal ideation among working seafarers. We used statistical modelling to discover baseline medical, demographic, occupational, and vessel environment- related determinants. Baseline medical conditions included: a history of high cholesterol, hypertension, sleep disorder, diabetes, liver disease, and cancer. Demographic variables included: age, gender, and region of origin. Occupational variables included: rank, work site, shift, and tenure. Vessel environment variables included: registry type, vessel type, work-environment and cultural questions (including performing tasks for which more training is needed, ability to set your own work pace, influence over work decisions, company cares about its workers, and exposures to violence or threats of violence at work). Work environmental questions were re-categorized as binary variables, with seafarers responding "rather often" or "very often or always" categorized as yes, and those responding "very seldom or never," "rather seldom," and "sometimes" categorized as no. Additional factors included: email and internet access frequency, location of internet access, job satisfaction, self-rated health, and frequency of exercise. It is necessary to use statistical modelling incorporating all of these variables together in order to understand which variables are the true determinants of the mental health outcomes. This approach enables identification of potential preventative strategies through reduction of modifiable associated risk factors.

A backward elimination strategy for variable reduction was utilized in the statistical procedure. This methodology removes one variable at a time (the least significant) in an iterative process, producing a final model which includes only the statistically significant determinants of the outcome (depression, anxiety, or suicidal ideation). This means that the final determinants are the factors associated with the outcome of interest, and that the other variables are not risk factors (or protective factors) for the outcome. Results of the statistical modelling for the mental health outcomes are as follows:

Positive correlations for depression, anxiety, and suicidal ideation in seafarers:

- Lack of adequate training
- Uncaring work environment
- Exposure to violence or threats of violence
- Co-existing medical conditions (including cardiac disease and sleep disorders).
- Low job satisfaction
- Ill health (self-rated)

Opportunities for Mental Health Risk Reduction:

Upon examining these models for consistent themes, it is apparent that workplace environment factors, lack of adequate training and lack of control over work, job satisfaction, and overall self-rated health were all significant risk factors related to all aspects of seafarer mental health. Medical conditions, including sleep disorders and cardiac conditions, were also associated with mental health outcomes. It is important to note that these are all modifiable risk factors, considering workplace culture and individual health can be improved. Therefore, although a causal relationship between the risk factors and mental health outcomes cannot be determined with certainty from this cross-sectional study, it would be logical and appropriate to attempt reduction in seafarer depression, anxiety, and suicidal ideation by optimizing the work environment and individual job satisfaction. This will be further elaborated in the final section of conclusions and recommendations.

Distribution of Injury and Illness:

Before discussing the impact of seafarer mental health conditions on injury and illness, it is necessary to present the overall distribution of injuries, illness, and their severity in the seafarer population. As shown in Figures 13 and 14, seafarers reported suffering from illness at sea (31%) compared to having an injury at sea (12%) in the past one year. Seafarer injuries were most often treated with first aid, while illnesses more often needed medications (Figure 15). 21% of injuries required hospitalization and 13% resulted in work restrictions. Illnesses were most frequently treated with medications (45%) and more rarely resulted in hospitalization (11%) or work restriction (8%). Evacuations were infrequent among both injuries (4%) and illnesses (3%).
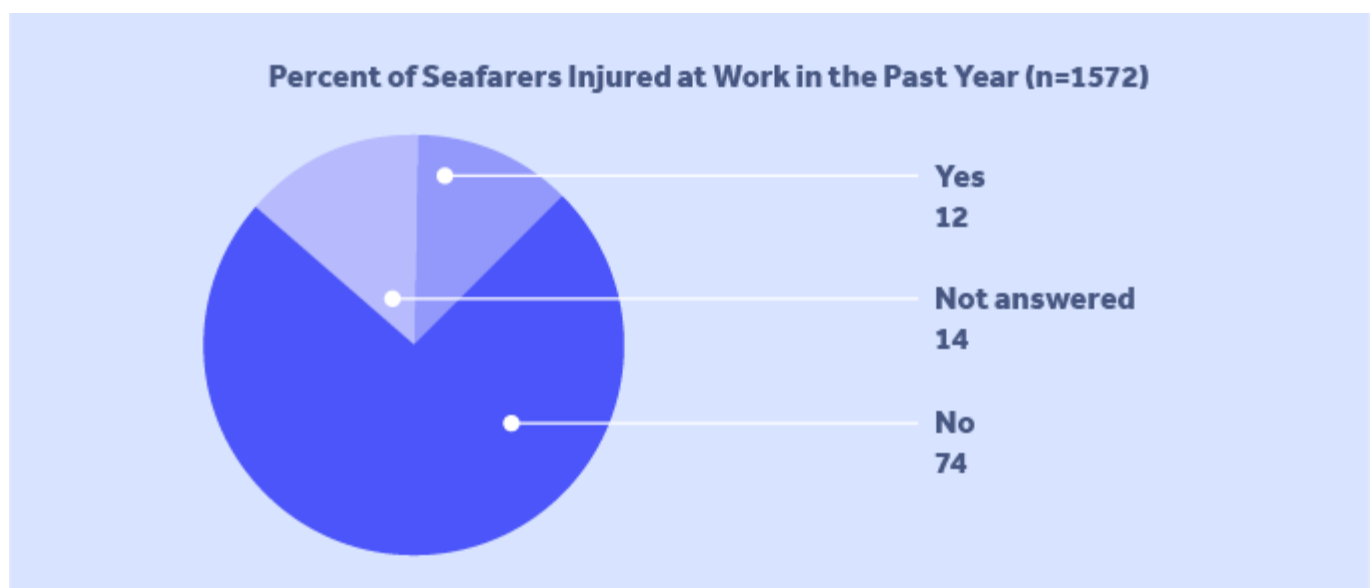

Percent of Seafarers Injured at Work in the Past Year (n=1572)

Yes
12

Not answered
14

No
74

Figure 13. Percentage of seafarers reporting an injury while working on board during the past year.
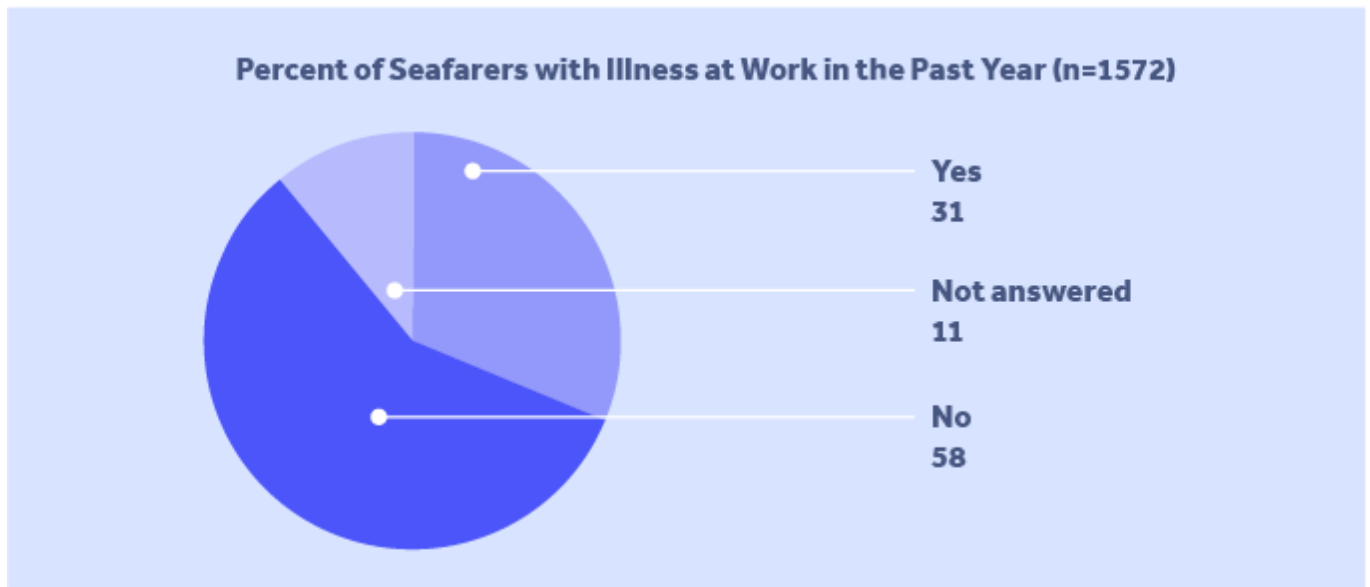
Figure 14. Percentage of seafarers reporting an illness in the course of work over the past year.
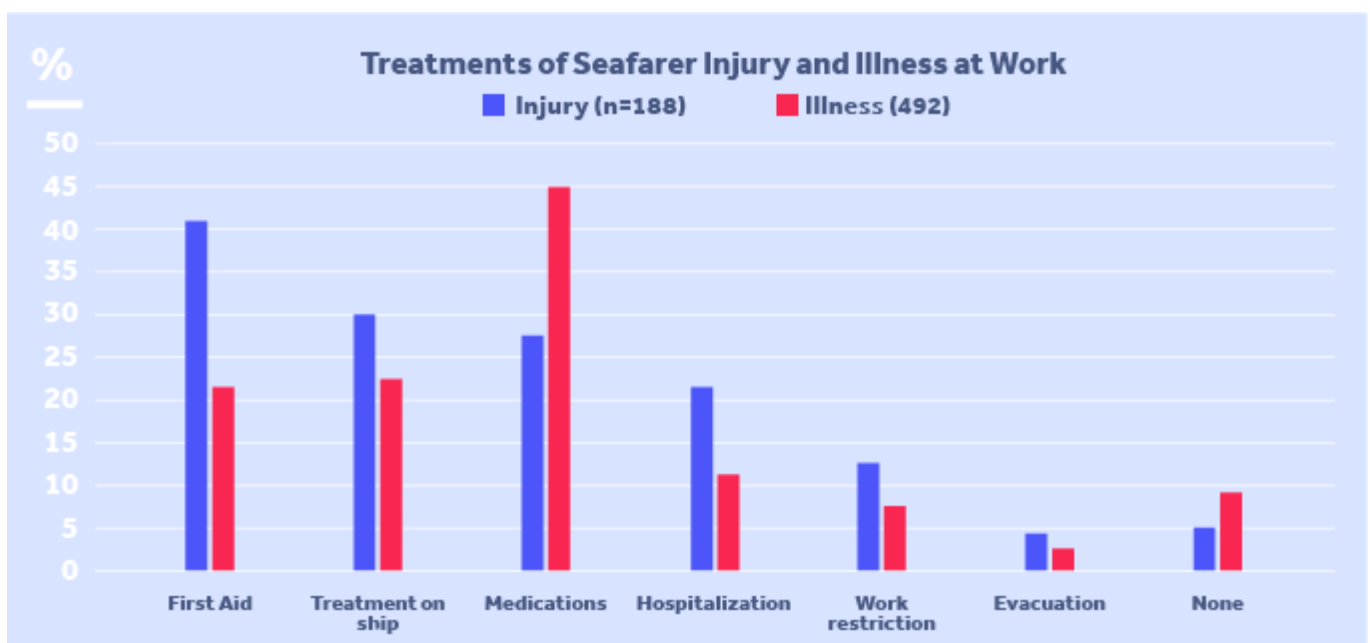

Figure 15. Treatments rendered for seafarer injuries and illness at work, an indication of the severity of the medical event.

The distribution of injuries and illnesses differed according to the presence or absence of mental illness conditions (Figures 16 & 17). **Seafarers who screened positive for depression or anxiety were more likely to report injuries or illnesses in the previous year;** among seafarers screening positive for depression, 22% were injured and 50% were sick in the past year, compared to seafarers who did not screen positive for depression (10% and 28% for injured or ill, respectively). Among seafarers screening positive for anxiety, 24% were injured and 56% were sick in the past year, compared to seafarers who did not screen positive for depression (11% and 29% for injured or ill, respectively). 21% of seafarers with suicidal ideation reported an injury while working as a seafarer in the past year, compared to 12% of seafarers without suicidal ideation. Similarly, 42% of seafarers with suicidal ideation reported an illness, compared to 32% without suicidal ideation.

Summary and Implications:

Illnesses were more frequently reported than illnesses in this seafarer population, which is consistent with previous research by the investigators (3, 4). Both injuries and illnesses were significant causes of work restriction, although many were managed with first-aid or medications. Important associations between mental health conditions and injury and illness at sea were observed, which were further explored in statistical modelling as described in the following section.
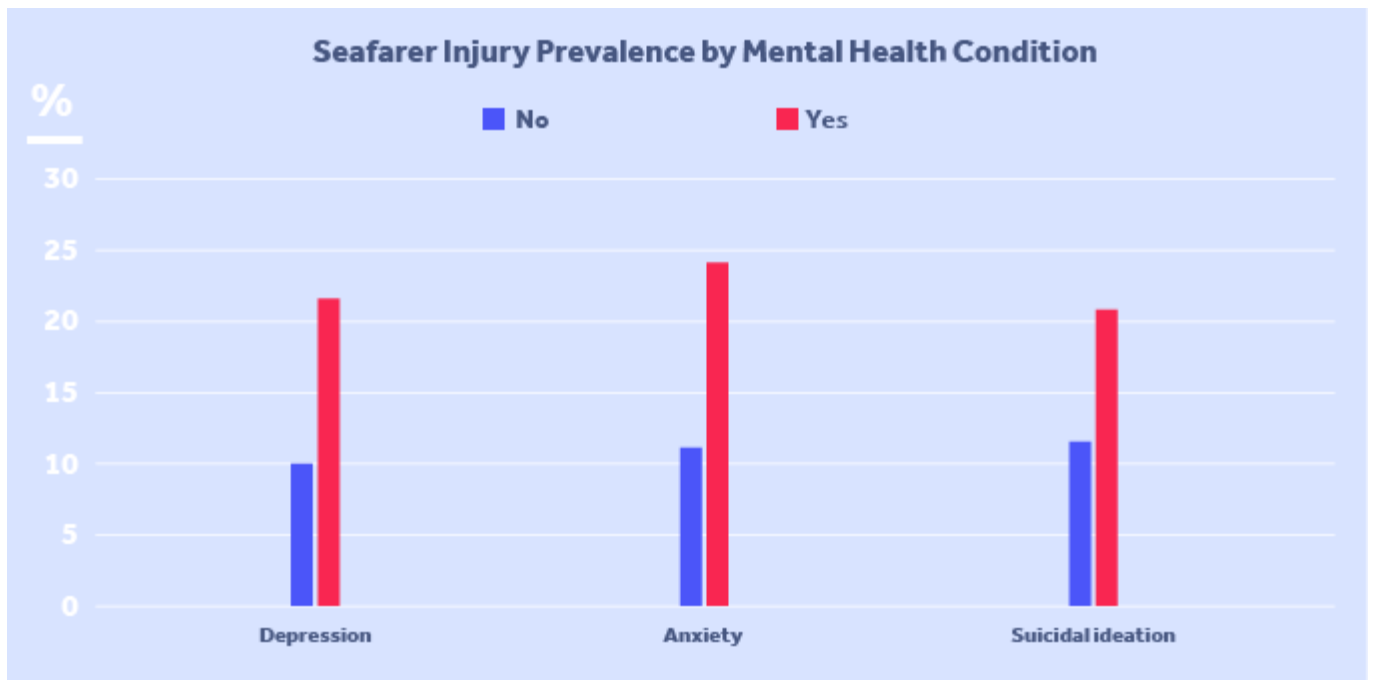

Figure 16. Prevalence of seafarer injury in the past year by depression, anxiety, or suicidal ideation status.
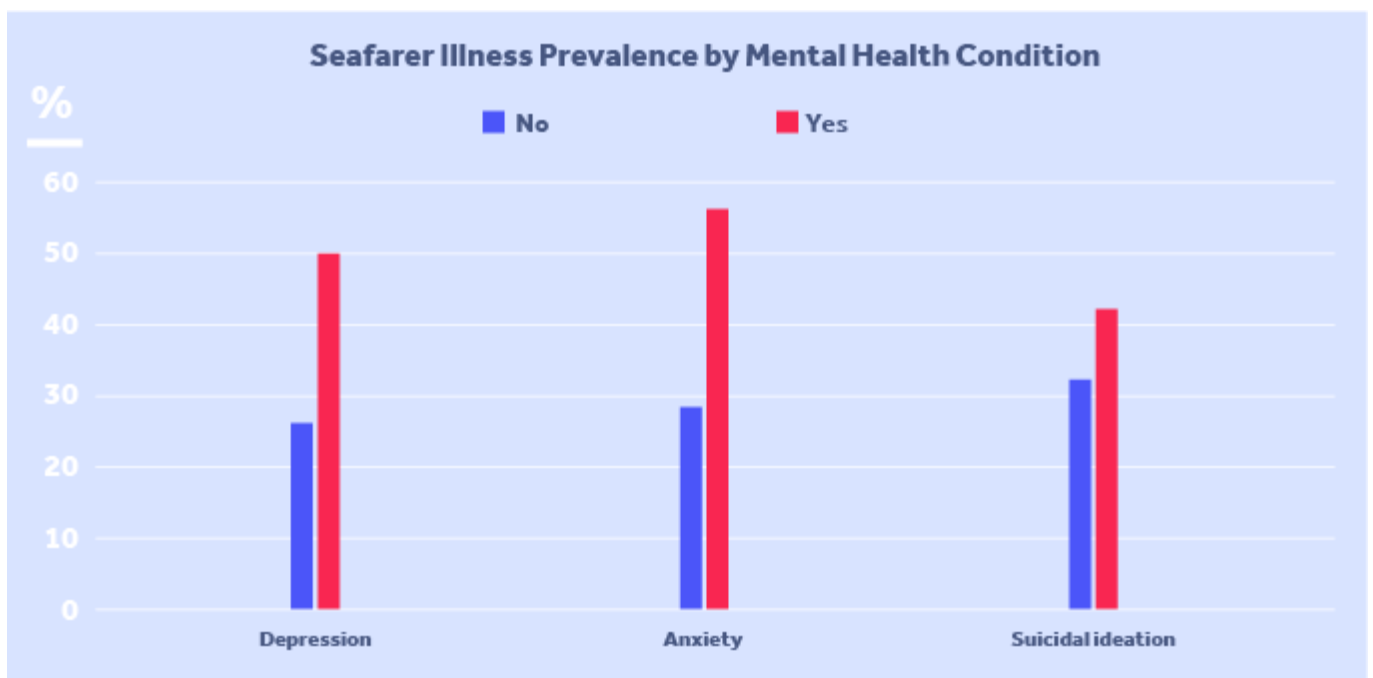

Figure 17. Prevalence of seafarer illness in the past year by depression, anxiety, or suicidal ideation status.

Mental Health Conditions as Determinants of Injuries or Illness:

Another major goal of this research was to understand how mental health conditions impact seafarers' risk for injuries and illness at sea. To this end, we modelled risk for injury and illness in the past year (as reported by the seafarers) incorporating depression, anxiety, and suicidal ideation in the statistical models together with all the other variables used in the mental health modelling (excluding the factors that were already determined to be determinants for the individual mental health outcomes). Results of this modelling found that depression, anxiety, and suicidal ideation were all associated risk factors for seafarer injury. Depression and anxiety were associated with illness, but suicidal ideation was not found to be related to illness. The results of this statistical modelling are summarized as follows:

Correlations with injury in seafarers included:

- Depression, anxiety, and suicidal ideation (each confers higher likelihood of injury)
- Rank (ratings with higher injury likelihood compared to captains/masters)
- Ability to influence decisions about work (lower injury likelihood if greater ability to influence decisions).

Correlations with illness in seafarers included:
- Depression and anxiety (each confers higher likelihood of illness)
- Gender (female with higher likelihood of illness compared to male seafarers)
- Vessel type (seafarers on container vessels with lower likelihood of illness)
- Ability to influence decisions about work (lower illness likelihood if greater ability to influence decisions).
- Company cares about its workers (lower illness likelihood with higher rank of company caring).

The overall theme of the injury models is that mental health outcomes depression, anxiety, and suicidal ideation were significant determinants of injury. Seafarer rank and ability to influence work decisions also emerged as factors related to injury. As for seafarer illness, the presence of depression and anxiety each were determined to be associated with illness. However, suicidal ideation was not. Other significant factors associated with seafarer illness included seafarer gender, vessel type, and workplace culture. **Efforts to reduce depression and other mental health risks may have significant positive financial implications for employers** as well; studies have demonstrated that working while depressed is associated with injury (as demonstrated in this study) as well as other significant costs (19-21).

Mental Health Conditions as Determinants of Seafarer Retention:

We additionally explored the impact of mental health conditions on seafarer retention. We asked the following question: "Do you plan to leave your job as a seafarer within the next six months?" The answer choices were yes, no, and maybe. To model risk of leaving the job in the next six months, these responses were converted to binary categories, with yes and maybe combining to form a new yes category, and no in the no category. Using logistic regression modelling in the same procedure employed to determine injury and illness risk factors, and our findings are presented as follows:

Correlations with seafarer retention included:

- Seafarers with depression, anxiety, or suicidal ideation had lower likelihood to stay in seafaring.

- Seafarers from North America had lower likelihood to stay in seafaring.

- Seafarers with background medical conditions including cardiac conditions or high cholesterol had lower likelihood of retention.

- Younger-aged seafarers had higher likelihood to stay in seafaring.

- Greater ability influence decisions at work associated with higher likelihood of staying in seafaring.

- Internet access at sea was associated with a higher likelihood to stay in seafaring.

Overall, mental health conditions, including **depression, anxiety, and suicidal ideation, together with region of origin and baseline medical conditions,** were found to have a significant association with **seafarers intending to leave work** as a seafarer within the next 6 months. **Younger age, ability to influence work decisions, and internet access were protective factors.**

Conclusions and Recommendations

Key findings 1: Prevalence of depression, anxiety and suicidal ideation

Prevalence of depression in the seafarers, as measured by the PHQ-9, was found to be significantly higher than that observed in other populations using the same survey questions: 25% as compared with 6% in a German general population and 5% prevalence among oil and gas workers.

Prevalence of anxiety (17%) and suicidal ideation (20%) was also notably high.

Seafarer organizations and the maritime industry should aim to reduce mental health conditions and their consequences. As resources for mental health services at sea are generally limited, incorporating strategies for mental health interventions in resource-poor environments will be useful. Specific attention may be focused on higher-risk seafarers, in higher-risk environments, as well as higher-risk periods in the seafarer work/life cycle, including the first days of a voyage, last days at home, and during periods of contract extension.

Significant modifiable risk factors include:

- Lack of adequate training
- Lack of control and influence
- Uncaring work environment
- Exposure to violence or threats of violence
- Lack of job satisfaction

Interestingly, significant environmental factors related much more to organizational culture than the characteristics of specific vessels or jobs. It is of great importance for seafarers to be properly trained for the tasks they are required to perform, to have a sense of personal control over their environment and work in a supportive environment where seafarers' views can influence decisions. The above list of indicators would suggest that working in a company with well-structured training and on-board procedures (including those to combat workplace violence, including bullying, harassment, or other forms of violence/aggression), and a culture that recognizes the value of its workforce makes a big difference to likely mental health outcomes.

Recommendations:

Maritime Training Institutes should address seafarers' mental health issues and train for resilience. Companies should consider mechanisms to increase support for cadets and new recruits such as mentoring schemes, employee assistance programs, and promotion of awareness around mental health in the workplace. Companies should ensure that they have appropriate training programs meeting the needs of the seafarers, with training regulations updated and enforced as needed. There should be clear and effective complaints procedures and measures against bullying, harassment and workplace violence. Efforts to reduce workplace violence, as reported highest among seafarers from the Philippines, Eastern Europe, and Asia (including India), should be tailored to these vulnerable groups.

In line with other studies, this research confirms a correlation between depression and the pre-existence of poor health.

Seafarer self-rated health was overall the strongest predictor of depression and anxiety. Self-rated health is a good indicator for actual health, for several possible reasons: self-rated health may capture the full array of illnesses a person has, possibly incorporates yet-undiagnosed symptoms of disease, may reflect the severity of current illnesses, or other reasons (22).

Recommendations:

Seafarers should be encouraged to take frequent, regular exercise. Measures should be taken to ensure that seafarers have adequate, uninterrupted sleep for the avoidance of fatigue and associated depression. Improving overall seafarer health through better access to healthcare (including more optimized medical treatment procedures on board, and access to physicians via telemedicine) may also lead to improvements in mental health.

Exposures to violence or threats of violence at the workplace had the strongest association with all three mental health outcomes. As workplace violence reduction interventions may be key to improving mental health at sea, additional statistical modelling was performed to assess demographic and occupational factors associated with workplace violence exposures. Using the same modelling procedure as in all other models, and including all demographic (age, gender, region of origin) and occupational/ vessel factors (rank, work site, tenure, shift, registry type, and vessel type), we determined that of all the variables tested, **region of origin** was significantly associated with exposure to workplace violence or threats of violence.

The results of this model indicated that **seafarers from the Philippines / Pacific region and Eastern Europe were four times as likely to report exposures to workplace violence** compared to seafarers from Western Europe. The distribution of workplace violence exposures by region of origin demonstrated the highest rates of reported exposures to violence among seafarers from Philippines/ Pacific (11%), Eastern Europe (9%), and Asia/India (9%). Efforts to reduce workplace violence should focus on these most vulnerable populations of seafarers.

There has been some research on workplace violence interventions, generally focused on the retail and healthcare industries (23). Certain lessons would carry over well into the shipping industry, including:

• Defining and measuring violence in the seafaring workplace.

• Involvement of key stakeholders to identify sources and strategies to reduce workplace violence.

• Support for research in intervention evaluation, with dissemination of results to governing bodies, registries, unions, and shipping companies.

Increased job satisfaction (an independently associated risk factor for seafarer mental health conditions) may also result from interventions to reduce violence in the seafaring workplace. Similarly, creating a caring workplace environment may lead to improvements in job satisfaction as well as reduction in mental health conditions.

Key findings 2: Impact of mental health conditions on injury and illness (measured over the previous year)

Seafarers completing the questionnaire were asked to report on injuries and illnesses occurring over the previous year.

- Seafarers with **depression** had more than twice the likelihood of a work **injury**
- Seafarers with **anxiety** had twice the likelihood of a work **injury**
- Seafarers with **suicidal ideation** had increased likelihood of a work **injury** but to a lesser degree than those with depression and or anxiety
- Seafarers with **depression** had twice the likelihood of an **illness** at work
- Seafarers with **anxiety** had more than twice the likelihood of an **illness** at work
- **Suicidal ideation** was not independently associated with increased likelihood of **illness**

Additional workplace environment factors were associated with injury and illness at sea, including the ability to influence decisions (independent of seafarer rank) having a protective effect against injury and illness. Increased risk for injury in workers with low job control has been observed in other working populations including a large aluminum manufacturing cohort (24). Our findings suggest that, in addition to reducing incidence of mental health conditions (which may in turn be improved by other work-environment interventions), efforts to improve seafarer influence over decisions, and other factors leading to low job control, may also lead to reduced injury and illness risk as well as greater retention of seafarers in the job market.

There is a clear correlation between mental health conditions and prevalence of work related injury and illness. Employers and P&I clubs who have an interest in reducing the likelihood of health claims and companies would have an economic interest in avoiding the potential additional costs of replacement crew, delayed schedules and medical treatment. Therefore, it appears the moral and economic imperatives are aligned to prioritize strategies to mitigate the risks of poor mental health outcomes.

Recommendations:

Employers should work together with P&I clubs, unions, and other interested parties to prioritize strategies to mitigate the risks of poor mental health outcomes in seafarers.

A multifaceted approach to seafarer health:

Additional risk factors associated with mental health conditions, injury, illness, and seafarer retention included pre-existing medical conditions: cardiac disease, sleep disorder, high cholesterol, and cancer histories all featured in various models. These findings as a whole suggest that a multifaceted approach to seafarer health, incorporating efforts to improve general health in addition to work-environmental factors, could lead to improvements in mental health, increase retention, and reduced risk for injuries and illness at work. Improvements from a general health perspective may include increased access to primary care while working on vessels through telemedicine, primary medical care in seafarer communities, and dedicated exercise time and space on the vessel. Reduction in stigmatization of non-mental health conditions, in addition to mental health conditions, can also establish a work environment in which seafarers are more comfortable appropriately treating their background medical conditions.

Recommendations:

Mental health is integral to wider health issues and is impacted by a multitude of environmental factors. Poor mental health has a dramatic impact on injuries and illness which in turn have an impact on broader human and operational issues. Therefore, the maritime industry should strive to de-stigmatize mental health matters and foster an inclusive, supportive environment in the maritime work place.

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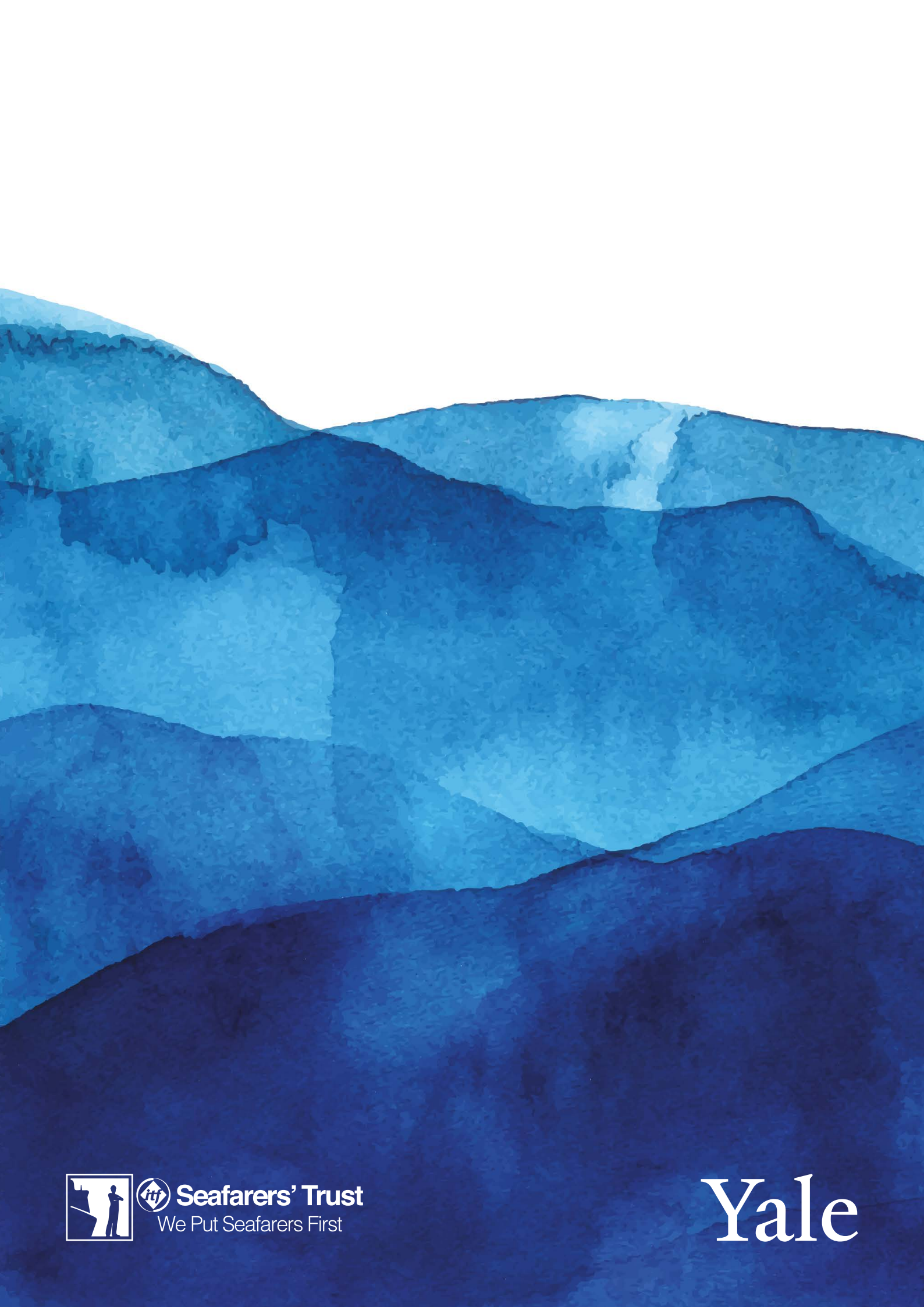
Annex

1.   The PHQ-9:

Over the last two weeks, how often have you been bothered by any of the following problems?				
Parameter	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things				
Feeling down, depressed, or hopeless				
Trouble falling or staying asleep, or sleeping too much				
Feeling tired or having little energy				
Poor appetite or overeating				
Feeling bad about yourself - or that you are a failure or have let yourself or your family down				
Trouble concentrating on things, such as reading the newspaper or watching television				
Moving or speaking so slowly that other people could have noticed Or the opposite- being so fidgety or restless that you have been moving around a lot more than usual				
Thoughts that you would be better off dead, or of hurting yourself in some way				

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2.   The GAD-7:

Over the last two weeks, how often have you been bothered by any of the following problems?				
Parameter	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious, or on edge				
Not being able to stop or control worrying				
Worrying too much about different things				
Trouble relaxing				
Being so restless that it's hard to sit still				
Becoming easily annoyed or irritable				
Feeling afraid as if something awful might happen				

Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Archives of internal medicine. 2006 May 22;166(10):1092-7.

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