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Effects of an on-board psychosocial programme on stress, resilience, and job satisfaction amongst a sample of merchant seafarers

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ABSTRACT

Background: Seafarers are an occupational group amongst those at highest risk for stress, which may adversely affect their mental health. The primary aim of this study was to assess the effects of a psychosocial programme on perceived stress, resilience, and job satisfaction among a sample of merchant seafarers.

Materials and methods: Secondary data analysis was conducted using a work questionnaire administered by a large shipping company. The matched subjects technique and multivariate analysis of covariance were conducted using a theoretical model of the programme's effects on job satisfaction, resilience, and perceived stress.

Results: A significant interaction between programme participation and weeks on board indicated that the effects of weeks on board on perceived stress differed significantly for the intervention group and matched control group. Weeks on board had a significant effect for perceived stress for the control group (p = 0.02), but not for the intervention group (p = 0.857).

Conclusions: These findings indicate that participation in the programme moderated the effects of weeks on board on perceived stress, suggesting that the programme may have safeguarded participants against the effects of weeks on board on perceived stress. Importantly, however, a work environment that is experienced as supportive, inclusive and just is necessary as a cornerstone for individually-focused psychosocial interventions to be optimally applied.

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Key words: merchant seafarers, psychosocial intervention, duration on board, stress, resilience, job satisfaction, MANCOVA

INTRODUCTION

STRESS IN THE SEAFARING POPULATION

Maritime transport underpins trade and development, with over 80% of the volume and 70% of the value of global trade transported by sea [1]. In the shipping industry, in 2015, the global supply of seafarers was approximately 1,647,500 seafarers, and the global demand was approxi-mately 1,545,000 seafarers, with a world merchant fleet of approximately 68,723 ships [2]. The largest supply country of seafarers in 2015 was China, followed by the Philippines, Indonesia, Russian Federation, and Ukraine [2].

Occupational hazards experienced by seafarers com-prise restricted treatment for cardiovascular diseases, communicable diseases, restricted ability to provide med-

ical aid on board, and exposure to dangerous substances [3, 4]. Indeed, seafarers experience several substantial psychosocial and physical stressors, including fatigue and sleep deprivation, separation from family, loneliness, social isolation, multinational crew, high workload and long work hours, physical demands, lack of recreation [4–10], and potentially traumatic experiences such as serious injury, death of a colleague, piracy, and shipwrecks [11]. Seafarers' sleep may be adversely affected by continuous exposure to noise, vibration, and movement of the vessel and by the need to work in shifts to ensure the continuous running of the ship [5, 7].

As seafarers are on board for long durations, spending both work and recreation time in the same confined environment, several stressors may be chronic [12]. In addition, many stressors on board may occur simultaneously, creating physical and psychological strain [13]. For example, Jensen et al. [14] conducted a questionnaire study with a sample of 6,461 seafarers across 11 countries. They found that the majority of seafarers worked every day of the week and on average from 67 to 70 hours per week throughout durations of 2.5 to 8.5 months on board.

Significant changes throughout the past half-century have impacted on both the health and safety of seafarers [15]. These changes include the globalisation of the shipping industry; automatisation and mechanisation of work on vessels, with cargo transported in containers; reflagging of vessels, with multicultural seafarers working on vessels operating under flags of convenience; and unstable employment of seafarers on short-term contracts, who frequently originate from low-cost labour supply countries [15]. Further recent changes include faster turnaround schedules in ports, decreased manning, labour intensification, and social isolation, which have significantly altered the seafaring landscape [16–20]. Psychological pressure and social isolation are compounded by a lack of shore leave even when there is adequate time in ports, due to changes in port infrastructures and stricter international security [21, 22]. Furthermore, socialisation on merchant ships varies substantially depending on the vessel's workload and trade, and there is a lack of time or space for recreational activities on many ships [23].

Moreover, as suggested by Carter [24] (p. 62): "Perceived inequity can contribute to distress. Common concerns are: hours worked, length of tour, the link of senior posts to nationality, different pay rates for the same job, age discrimination in recruitment, access to health care during employment and between contracts".

According to the International Transport Workers' Federation (ITF) [25], discrimination according to nationality is prevalent in the shipping sector, with ship-owners cost-saving on seafarers from low- and middle-income countries as a strategy to increase the competitiveness of their companies. Carter [24] (p. 62) further proposes that "inequity may also be seen as a form of neo-colonialism with rich ship owning countries exploiting those with less economic strength". The concept of **sweat ships** signifies similar exploitation of employees [26, 27]. For example, a political spotlight has shone in recent years on labour exploitation and enslavement of maritime workers across numerous Southeast Asian countries; with such human rights violations compounded by factors such as human trafficking organisations, weak legislation, insufficient labour inspections and protections, inadequate access to healthcare, and corruption [28]. Urgent human rights issues are therefore evident in the maritime industry [29].

Accordingly, seafarers are an occupational group amongst those at the highest risk for stress [30], which may adversely affect their mental health [31]. Issues relating to psychological functioning, such as depression, anxiety, suicide, and alcohol or drug dependence, are recognised health problems in the maritime industry [32]. Indeed, minor mental health problems are the most common type of health problem on non-passenger ships [33]. Months or years spent away from home, loneliness, stress and fatigue, harassment or bullying, long work hours without adequate sleep, a lack of shore leave, short turnaround schedules in ports, and risk of piracy, may give rise to anxiety and depression, and for some seafarers, suicide [34]. Suicide comprised an estimated 1.4% of all deaths globally in 2016 [35]. However, suicide amongst seafarers may be considerably more common [36]. As reported by the United Kingdom Protection and Indemnity Club [37], 4.4% of all deaths on board were attributable to suicide from 2014–2015, which escalated to 15.3% for the year 2015–2016. Notably, mental health problems amongst seafarers can be under-reported as a result of social stigma and fear of one's employment being terminated [38]. A review of seafarers' depression and suicide reported that investigations of depression and suicide amongst seafarers indicate improvement, although numerous recent case series suggest that suicide remains problematic [39]. While the importance of seafarers' psychological well-being is being increasingly recognised, there is a call for a change in the culture of shipping to facilitate more openness and less stigma regarding mental health [40].

Stress amongst seafarers has been identified as being associated with resilience. For example, Doyle et al. [41] found that self-reported higher levels of dispositional resilience was significantly associated with lower levels of perceived stress at sea in a sample of merchant seafarers. Similarly, in a related study to identify predictors of stress and job satisfaction in a sample of merchant seafarers using structural equation modelling, McVeigh et al. [42] reported that the study's theoretical model explained

23.8% of variance of perceived stress and the strongest predictive effect was for dispositional resilience. Beyond the seafaring population, research similarly indicates that resilience may protect against the adverse impact of stress [43–46].

RESILIENCE IN THE SEAFARING POPULATION

Resilience is defined by Luthans [47] (p. 702) as the "positive psychological capacity to rebound, to 'bounce back' from adversity, uncertainty, conflict, failure or even positive change, progress and increased responsibility". Resilience may therefore be more adequately conceptualised as adaptability rather than stability, as a process of 'bouncing back' from harm instead of immunity from harm [48]. An individual who is resilient is not therefore immune to experiencing challenges or distress, but rather has the ability to effectively adapt and 'bounce back' when confronted with adversity, trauma, tragedies, or substantial sources of stress [49].

One possible trajectory to resilience is personality hardiness, defined by Bartone [50] (p. S131) as "a characteristic sense that life is meaningful, that we choose our futures, and that change is interesting and valuable". Hardiness is conceptualised as incorporating three components: (1) **challenge**, signifying the belief that stressful changes are an opportunity to grow in knowledge and ability; (2) **commitment**, the view that no matter what difficulties are presented, it is important to stay involved with what is occurring instead of detaching and alienating oneself; and (3) **control**, the belief in turning stress from potential disasters into opportunities for growth [51]. The hardiness hypothesis posits that individuals with high levels of challenge, commitment, and control are more likely to remain healthy under stressful conditions than those with low levels of hardiness [52]. Hardiness is therefore a pattern of attitudes and skills that supports resilience and thriving under stress [53]. Indeed, the resiliency construct of hardiness has been empirically proven to be a significant resource for resistance to stress [54, 55].

While resilience may be dispositional and trait-like, there is evidence that it is also state-like and can be developed [53, 56, 57]. Resilience therefore comprises thoughts, behaviours and actions that can be learnt and strengthened [49]. In relation to hardiness, Bartone [50] (p. S137) suggests that "conceptually, hardiness is a personality dimension that develops early in life and is reasonably stable over time, although amenable to change and probably trainable under certain conditions". Hardiness is therefore both a trait and state, whereby individuals demonstrate consistency in their levels of hardiness across time and situations, but hardiness attitudes and behaviours may also be affected by different social and environmental factors [58].

Resilience has been explored in the maritime context. Turan et al. [59] argue that system resilience is needed for operational procedures on board to effectively deal with safety-critical operations and challenging environments, requiring resilience at the levels of the individual, team, multi-party team, and organisation. In one study, with a sample of 413 Filipino seafarers, Hystad and Bye [60] reported that personal values and hardiness explained a significant amount of variance in self-reported safety behaviour. The researchers recommended a focus on hardiness and personal values regarding the training of maritime workers and when planning interventions to support safety in maritime organisations [60]. Correspondingly, Carter [24] asserts that research needs to focus on the resilience, coping strategies and motivations of seafarers, and the organisation of work, with interventions aiming to modify these factors. It is proposed that psychological resilience training and education in the shipping industry could support safety and strengthen employee well-being [61]. As suggested by Leppin et al. [62], training programmes that strengthen resilience may increase health, well-being and quality of life.

JOB SATISFACTION IN THE SEAFARING POPULATION

Job satisfaction of merchant seafarers is associated with financial security, free time spent at home, the nature and dynamics of the work [63], as well as promotion, salary and benefits, the working environment, feeling of status, and satisfaction with management [64]. Job satisfaction [65–68] may be an imperative factor in maritime organisations [69]. For example, an association is empirically supported between job satisfaction and turnover intentions/retention of seafarers. For instance, Kim and Lee [70] found that a higher level of satisfaction in relation to working conditions and wages was associated with a lower level of turnover intention amongst a sample of Korean seafarers. Correspondingly, Nielsen et al. [71], with a sample of 541 seafarers from two Norwegian shipping companies, found a relatively strong negative association between intention to leave and job satisfaction. Caesar et al. [72] conducted a systematic review exploring retention issues for seafarers in global shipping and found that retention factors primarily pertained to satisfaction with job and employer, opportunities for career advancement, and good working conditions.

Empirical studies indicate that job satisfaction may also be an associate of safety in the maritime industry. For instance, in Nielsen et al.'s study [71] with a sample of 541 seafarers, job satisfaction was positively associated with individual intention and motivation to follow safety procedures, and negatively associated with management prioritising production over safety. Correspondingly, with a sample of 986 Norwegian offshore workers, Nielsen et
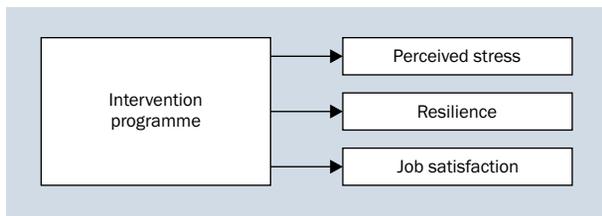
Figure 1. Theoretical model of the effects of the psychosocial programme on perceived stress, resilience, and job satisfaction amongst merchant seafarers

Table 1. Psychosocial programme modules

1. Introduction: What is resilience?
2. Take care of yourself
3. Make connections
4. Avoid seeing crises as insurmountable problems
5. Accept that change is a part of living
6. Move towards your goals
7. Take decisive actions
8. Look for opportunities for self-discovery
9. Being grateful can accomplish more
10. Nurture a positive view of yourself
11. Keep things in perspective
12. Maintain a hopeful outlook

al. [73] found that workers who perceived high levels of risk reported lower job satisfaction levels, while this effect decreased when workers perceived their safety climate as positive. Bergheim et al. [69] conducted a study on the relationship of psychological capital (efficacy, optimism, hope and resiliency) to perceptions of safety climate and job satisfaction with a sample of 594 maritime workers from Norwegian shipping companies. They found that for European participants, a high level of psychological capital resulted in higher job satisfaction, which resulted in positive perceptions of the safety climate; although this mediation through job satisfaction was not found for Filipino participants.

Importantly, job satisfaction amongst seafarers is also associated with resilience [69]. Beyond the seafaring population, job satisfaction has similarly been identified as being associated with resilience [74–78].

RESEARCH AIM

There is a call for more research investigating the psychosocial health and stress of seafarers [4, 9, 19, 24, 79, 80]. For example, Carter and Karlshoej [81] suggest that health promotion interventions for seafarers are limited in scope and their efficacy is uncertain. As suggested by Jagosh et al. [82] (p. 27), "the unique features of the work and lives of seafarers, in addition to the changes within the field in the past ten years, require a clear understanding of the psychosocial impact on seafarers and the kinds of interventions that can improve psychological resiliency".

Accordingly, the primary aim of this study was to assess the effects of a psychosocial programme on perceived stress, resilience, and job satisfaction among a sample of merchant seafarers. Based on a review of the literature above, Figure 1 schematically presents the study's simplified theoretical model of the effects of the psychosocial programme on stress, resilience, and job satisfaction in the sample of merchant seafarers.

We hypothesised that there would be differences between the intervention group and a matched control group on perceived stress, resilience, and job satisfaction. The programme was designed by the company to address

stress, resilience, and job satisfaction; and the relevance of these dependent variables is supported by a review of the literature.

MATERIALS AND METHODS
THE ON-BOARD PILOT PSYCHOSOCIAL PROGRAMME

The Shell Health psychosocial programme or 'resilience programme' is a resilience-training programme aiming to support the thriving of employees both on- and off-shore [83, 84]. The programme was developed by Shell Health professionals, based on the American Psychological Association's concept of resilience [49]. Launched onshore in 2009, the programme was subsequently adapted and launched as a pilot programme at sea between April and December 2014. The programme at sea was piloted with an intervention group of 21 vessels (half of the company's fleet). The programme is a voluntary intervention, based on positive psychology, cognitive behavioural therapy, neuro-linguistic programming, and research on leadership. The programme comprises 12 modules, which are 40–60 minutes in duration. Each of the modules focuses on a specific aspect in relation to resilience, outlined in Table 1.

Officers, who acted as lay facilitators of the modules, administered the programme to teams on board. A small number of officers were trained as facilitators throughout a one-hour training session at an annual officers' conference onshore. Officers, rather than non-officer ranks, were chosen to facilitate the programme as officers usually deliver routine training on board and were therefore considered to be more confident with delivering training. The choice of officers was limited to those attending the particular conference at the beginning of the study. The selection was not completely random as four events took place in the

United Kingdom, one in India and one in Croatia, so officers would likely have self-selected depending on their country of origin. However, participation was independent of the facilitator training, as officers would not have known prior to registration. Representation of each ship in the intervention group was a determining factor, and the organisation aimed to have a minimum of two trained officers for each ship. All officers of the intervention group ships who attended the conference participated in the facilitator training. Each ship's officer could determine how to share or lead the roll-out on the ship.

During this training session, a brief conceptual background was given, alongside a summary of the experience of the company with the programme. The introductory presentation first discussed resilience in terms of experiences in the military sector and disaster response, organisations that were embracing resilience, and the planned piloting of the programme. Participants were also given the opportunity to share their own views of resilience through structured group discussion. Guided group discussion took place over a 15-minute duration, guided by questions including 'What is your definition of resilience?', 'Why is resilience important nowadays?', and 'What well-known or personal examples of resilience do you recall?'.

Using a peer-to-peer training scheme, officers trained other officers on board so that the programme could continue when a trained facilitator disembarked or transferred between ships. Joint preparation and facilitation of the modules by more than one facilitator was encouraged. Although facilitators guided the activities and discussions, the modules were highly interactive and drew substantially on the experiences of participants.

Adopting the programme at sea presented challenges due to circumstances specific to life on board. An adequate number of facilitators needed to be trained as each vessel needed their own facilitator. However, the ships were in remote locations most of the time, restricting the availability of seafarers for training as facilitators. The working pattern required seafarers to be on board for numerous months, followed by a similar duration of shore leave, meaning that an adequate number of facilitators needed to be available on each ship to allow continuity of the programme. The staggered changeover of crew on each ship led to team members participating in a different number and combination of modules. Moreover, online information and additional programme materials to support facilitators were not routinely accessible on board.

To overcome some of these challenges, the programme was adapted and piloted with an intervention group of 21 ships. The modules themselves were not adapted for the programme at sea, but rather the delivery was adapted to take into account staggered crew and changes of facilita-tors. Materials for the modules and supporting information were tailored to the needs of the seafarers and prepared for offline use. Each ship in the pilot study was provided with all of the required programme materials.

Innovative examples of programme facilitation were shared by participants. For example, some seafarers created presentations for facilitating the programme, shared their personal experiences, and reframed the content of the modules into their own words, translating the programme into their cultural and occupational context. On one ship, everybody participated in the preparation and facilitation of the modules. This ship also chose to complete all of the modules on a single training day, instead of extending the implementation of the programme over months.

PARTICIPANTS AND PROCEDURES

Secondary data analysis was conducted, using work questionnaires administered at two time points to seafarers within the shipping organisation. The organisation did not select or exclude any individual or vessel when administering the questionnaires. Fleet information messages were sent by the organisation to ship captains, requesting them to inform seafarers on board of the questionnaires and upload them onto the vessels' web-based servers. Respondents completed the anonymous online-based questionnaires, on a voluntary basis, while at sea. Data were not available in relation to the number of seafarers on each ship who were informed of the study and asked to complete the work questionnaire. Therefore, it was not possible to specify a response rate.

Time 0 (T0) baseline questionnaires were completed between January and July 2014 across 51 of a possible 53 tanker vessels (n = 575). After implementation of the pilot resilience programme, a follow-up questionnaire (T1) was then completed between November 2014 and March 2015 across 41 of a possible 52 vessels (n = 329). Of the total sample of questionnaire respondents at T1, 61 respondents reported participating in the programme.

Participants were merchant seafarers, both officers and ratings/crew, working in the company's fleet on liquefied natural gas carriers, product oil tankers and crude oil tankers, operating globally. The categorisation of departments on merchant ships can be primarily classified as: (1) deck department, responsible for managing the navigation of the ship and handling cargo operations and berthing instruments on the ship deck; (2) engine department, tasked with the operation and maintenance of the machinery of the ship; and (3) catering department, responsible for meal preparation and general housekeeping on board [85]. Merchant seafarers are categorised as officers and ratings, and these groups are further divided by rank, ranging from captain to third officer, chief engineer to fourth engineer,

and bosun to ordinary seaman [23]. Demographic characteristics of questionnaire respondents at T0 and T1 are reported elsewhere [42].

Ethical approval for this study was granted by the School of Psychology Ethics Committee, Trinity College Dublin, Ireland. Data collection was conducted using Survey Monkey, which is a third-party online survey software and not linked to any systems of the shipping organisation from which the study sample originated. Due to requirements within the company to protect the confidentiality and anonymity of respondents, questionnaire data were not collected on respondents' names, email addresses or phone numbers. Moreover, demographic data were collected on age ranges rather than specific ages. Respondents were also asked to provide their race/ethnicity rather than nationality for the purpose of making respondents less identifiable. Such procedures safeguarded the anonymity of respondents. Consent of participants was implicitly provided by virtue of questionnaire completion. Both the baseline and follow-up questionnaire outlined that information would be treated confidentially, that respondents' identification could not be known, that participation was on a voluntary basis, and the freedom to withdraw from the study at any time without providing a reason. Employees of the shipping company participated in the planning and co-ordination of the study and in jointly reviewing with the primary researcher the study design, analyses, findings and interpretations. Although the company collected the questionnaire data, the primary researcher independently conducted secondary analyses of the questionnaire data, independently interpreted and discussed the findings, and independently wrote the original draft of this manuscript and chose to publish.

STUDY MATERIALS

Both the T0 and T1 work questionnaires comprised demographic items; items from the organisation's Employees Survey; the Dispositional Resilience Scale-15; and the Perceived Stress Scale-4, which are each described in more detail below. The T0 questionnaire contained 48 items. The T1 questionnaire comprised 64 items, which included additional items on resilience and the programme. As English has been the lingua franca of the maritime industry for approximately the last century [86], questionnaires were administered in English.

Employees Survey. The company's Employees Survey is an annual and anonymous employee survey of work experiences and attitudes. Sixteen items from the Employees Survey were completed at T0, and seventeen items were completed at T1. Previous exploratory factor analysis with a subsample of respondents at T0 [41] indicated that five items reflected the dimension of 'job satisfaction'.

All items of the Job Satisfaction Scale (JS Scale) were measured on a five-point Likert scale, including scales ranging from 'very satisfied' to 'very dissatisfied', and 'strongly agree' to 'strongly disagree'. Total scores for job satisfaction were calculated by averaging scores ranging from 1 to 5. Higher scores reflect higher levels of job satisfaction. The five items comprised in the JS Scale were: 'Considering everything, how satisfied are you with your job?', 'I am proud to work for Shell', 'I would recommend Shell as a good employer', 'The level of work pressure I experience is acceptable', and 'I am able to balance my work and my personal life'. The reliability estimates for the JS Scale were satisfactory: Cronbach's alpha = 0.79 at T0 and 0.80 at T1. Confirmatory factor analysis of the JS Scale is reported elsewhere [42].

Dispositional Resilience Scale-15. The Dispositional Resilience Scale-15 (DRS-15) was used to measure hardiness [50, 54, 87]. The decision to use the DRS-15 was based on its established validity, acceptable internal consistency, and acceptable test-retest reliability, as well as its brevity [87, 88]. While the DRS-15 is a measure of hardiness, the scale was used by the organisation as it was considered that hardiness and resilience were closely associated. The DRS-15 uses both positively and negatively keyed items and comprises three facets of hardiness: commitment, control and challenge [50], each measured by five items scored on a four-point scale ranging from 'not at all true' to 'completely true'. Example items are: 'Most of my life gets spent doing things that are meaningful' (commitment), 'By working hard, you can nearly always achieve your goals' (control), and 'Changes in routine are interesting to me' (challenge) [89, 90]. When the six negatively keyed items are reversed, a total score for resilience can be calculated by summing scores for all items [91]. For the present study, as several respondents were missing scores for particular items of the DRS-15, a total score for each respondent was calculated by averaging rather than summing scores.

Bartone [88] reports internal consistency for the total scale (alpha = 0.83) and three subscales of commitment, control and challenge (alpha ranging from 0.70 to 0.77), which equal or exceed the acceptable alpha threshold of 0.70 [92]. In another study conducted by Bartone [87], the 3-week test-retest reliability coefficient for the DRS-15 was 0.78, exceeding the recommended threshold of above 0.70 [93]. However, the test-retest coefficients for the three subscales were 0.75 for Commitment, 0.58 for Control, and 0.81 for Challenge, indicating a test-retest coefficient for Control that was below the recommended threshold [87]. While Doyle et al. [41] reported the internal consistency for the total DRS-15 score as 0.72, the internal consistency was 0.65 for Commitment, 0.57 for Control, and 0.57 for Challenge, which were below the acceptable alpha value of 0.70. Total resilience scores were therefore used in the

present study. The internal consistency for the DRS-15 was 0.70 at T0 and 0.73 at T1.

Perceived Stress Scale-4. The Perceived Stress Scale-4 (PSS-4) was used to measure perceived stress. The PSS-4 is a four-item version of the Perceived Stress Scale developed by Cohen et al. [94], which measures an individual's assessment of stressful situations in the last month. The decision to use the PSS-4 was based on its validity, acceptable internal consistency, and brevity [94–96]. The PSS-4 comprises two positively stated and two negatively stated items, with a response set ranging from 0 (never) to 4 (very often) [97]. An example item is: 'In the last month, how often have you felt that you were unable to control the important things in your life?'. Positively stated items are reverse coded prior to summing the items, and higher scores indicate higher perceived stress [97]. For the present study, as several respondents were missing scores for particular items of the PSS-4, total scores were calculated using average instead of summed scores.

Cohen et al. [94] reported the internal consistency for the PSS-4 as 0.72, exceeding the acceptable alpha threshold of 0.70 [92]. In the same study, Cohen et al. [94] reported the test-retest reliability over a 2-month interval as 0.55, below the recommended threshold of above 0.70 [93]. In another study comprising a probability sample of the United States (n = 2,387), Cohen and Williamson [95] reported the internal reliability for the PSS-4 (alpha = 0.60) as less than that of the 10-item version (alpha = 0.78) and 14-item version (alpha = 0.75). While the PSS-4 indicates a moderate loss in internal reliability relative to the 14-item scale, the brevity of this scale is advantageous when time for assessment is limited [96]. For the present study, the internal consistency for the PSS-4 was 0.55 at both T0 and T1.

DATA ANALYSIS

Of the 575 questionnaires returned at T0, 55 respondents provided only demographic information and were therefore excluded from analyses. Moreover, 4 respondents who reported their job description as office-based and 4 extreme outliers were excluded from analyses, resulting in a total of 512 respondents at T0. Of the 329 questionnaires returned at T1, 50 respondents provided only demographic information and were consequently excluded from analyses. Furthermore, 3 extreme outliers were removed, resulting in a total of 276 respondents at T1.

Matched subjects procedure. The T0 and T1 samples could not be matched due to several reasons. The company's data privacy rules would have required a cumbersome process if any identifiable information was collected (such as using a unique identifier code); any traceable information may have reduced participation; and the same seafarers may not have been 'on tour' on the ships at both T0 and T1.

A comparative analysis could therefore not be conducted of respondents' scores at T0 and T1. Accordingly, this study evaluated the intervention by a comparison of dependent variables at T1 only, using the intervention group and a matched control group.

The matched subjects technique comprises the matching of each individual in one sample to an individual in a second sample, so that the two individuals correspond with regards to specific variables that the researcher aims to control [98]. When selecting variables on which to match, a high correlation between the variables used for matching and the dependent variables is recommended [99, 100]. By matching on variables that are expected to strongly affect the dependent variable(s), these potential sources of confounding can be removed [101]. Accordingly, to reduce potential confounding bias caused by differences between participants in the intervention and control groups, these groups were matched according to characteristics likely to influence the dependent variables.

To select variables on which to match, a MANCOVA was conducted using T0 data, with perceived stress, resilience, and job satisfaction as dependent variables. MANCOVA comprises an analysis of the effects of one or more independent variables on more than one dependent variable, while controlling for the effect of one or more covariates on dependent variables [102, 103]. MANCOVA is comparable to multivariate analysis of variance (MANOVA) with the exception of the addition of covariates, which act as control variables to decrease the error in the model and produce the best fit [104, 105].

Analysis was conducted using IBM SPSS Statistics 23. Preliminary MANCOVA was conducted to test the assumption of homogeneity of regression slopes, by testing for interactions between the factors (independent variables) and covariate (weeks on board) [104]. Categorical predictors were entered as fixed factors, and continuous predictors were entered as covariates [106]. Categorical predictors comprised age, race/ethnicity, job, seafaring experience, and vessel location; while weeks on board was entered as a continuous predictor. Factors or covariates with significant effects on dependent variables in this analysis were considered potential confounders in the evaluation of the intervention effect, and hence were subsequently used to manually match participants of the programme (n = 61) with non-participants of the programme (n = 61) at T1. Table 2 presents demographic characteristics of programme participants and the matched control group.

Differences between the Intervention Group and Control Group. A second MANCOVA was then conducted using T1 data to assess differences between the intervention group (n = 61) and matched control group (n = 61) on the dependent variables of perceived stress, resilience, and job

Table 2. Demographic characteristics of programme participants and matched control group

Variables	Participants n (valid %)	Matched n (valid %)
Gender		
Male	61 (100)	61 (100)
Female	0 (0)	0 (0)
Ethnicity		
South Asian	22 (36.1)	22 (36.1)
East Asian	21 (34.4)	21 (34.4)
Other	8 (13.1)	8 (13.1)
Latino/Hispanic		
Middle Eastern		
Mixed		
African	5 (8.2)	5 (8.2)
Caucasian	5 (8.2)	5 (8.2)
Job		
Officer, Engineer	31 (50.8)	35 (57.4)
Rating, Crew	19 (31.1)	19 (31.1)
Catering	11 (18.0)	7 (11.5)
Age [years]		
18–29	9 (14.8)	11 (18.0)
30–39	28 (45.9)	23 (37.7)
40–64	24 (39.3)	27 (44.3)
65+	0 (0)	0 (0)
Seafaring experience [years]		
0–1	11 (18.0)	8 (13.1)
1–5		
5–10	14 (23.0)	16 (26.2)
10–20	26 (42.6)	27 (44.3)
> 20	10 (16.4)	10 (16.4)
Weeks since last shore leave		
0	0 (0)	0 (0)
1–5	32 (52.5)	31 (50.8)
6–10	13 (21.3)	21 (34.4)
11–15	9 (14.8)	3 (4.9)
16–20	3 (4.9)	5 (8.2)
21–25	3 (4.9)	1 (1.6)
26 or more	1 (1.6)	0 (0)
Current location		
On passage	50 (82.0)	53 (86.9)
Approaching port	11 (18.0)	8 (13.1)
Loading/discharging		

Note: The variables of ethnicity and job (emboldened) were used to match programme participants with non-participants. The ethnicity group of 'Other Combined' (Latino/Hispanic, Middle Eastern, and Mixed) was combined with the ethnicity group of 'Other' as the former had fewer than 10 cases. The seafaring experience group of '0–1 year' was combined with the group of '1–5 years' as the former had less than 10 cases. Similarly, the location group of 'Loading/ /Discharging' was combined with the location group of 'Approaching port' as the former had fewer than 10 cases.

satisfaction, while controlling for age, race/ethnicity, job, seafaring experience, location, and weeks on board. While this final MANCOVA for assessing the programme effects was conducted using T1 data, the initial MANCOVA for selecting matching variables was conducted using T0 data to avoid biasing the main analysis. This approach, comprising matching subjects and MANCOVA, was developed in consultation with two statisticians in two different universities, who independently agreed on this method for assessing the effects of the programme.

MANOVA is robust to violations of multivariate normality when the sample size is sufficiently large, namely, an overall sample size of 40 with 10 participants or more per group of the independent variable [107, 108]. Therefore, tests of normality were not relevant.

Dose-response relationships. An analysis was also conducted of dose-response relationships to assess a potential effect on the dependent variables of participating in a different number of programme modules. Programme participants were categorised into three groups of approximately equal size: 1–5 modules (n = 16), 6–11 modules (n = 23), and 12 modules (n = 22). MANCOVA was conducted to measure differences between these three groups for the dependent variables of perceived stress, resilience, and job satisfaction, while controlling for age, race/ethnicity, job, seafaring experience, location, and weeks on board. Categorical predictors comprised the three participant groups (categorised according to number of participated modules), age, race/ethnicity, job, seafaring experience, and vessel location; while the continuous predictor was weeks on board.

RESULTS
MATCHED SUBJECTS PROCEDURE

Descriptive statistics of variables at T0 and T1 are presented elsewhere [42]. For the preliminary MANCOVA conducted to test the assumption of homogeneity of regression slopes, a custom model was specified comprising all 2-way interactions between each factor and weeks on board, and main effects. Box's test of equality of covariance matrices indicated validity of the assumption of homogeneity of variance-covariance matrices. Levene's test of equality of error variances indicated equal variances between groups for each of the dependent variables. The interaction between weeks on board and location was significant, Wilks'^ = 0.963, $F(6, 882) = 2.77$, p = 0.011, multivariate $\eta^2 = 0.019$. This significant interaction term was therefore included in the final MANCOVA for selecting matching variables.

Final MANCOVA was conducted to select variables on which to match, with perceived stress, resilience, and job satisfaction as dependent variables. A custom model was specified comprising the weeks on board X location in-

teraction, and main effects. MANCOVA results indicated significant differences among categories of race/ethnicity on the dependent variables overall, Wilks'^ = 0.904, $F(15, 1253.695) = 3.108$, p < 0.001, multivariate $\eta^2 = 0.033$. Significant differences were also found among job categories on the dependent variables overall, Wilks'^ = 0.937, $F(6, 908) = 4.98$, p < 0.001, multivariate $\eta^2 = 0.032$. A significant interaction was found for weeks on board and location, Wilks'^ = 0.970, $F(6, 908) = 2.33$, p = 0.031, multivariate $\eta^2 = 0.015$.

As significant differences were found among race/ethnicity categories and among job categories on the dependent variables overall, the variables of race/ethnicity and job category were used to match control and intervention groups. Although a significant interaction between weeks on board and location was found, the variables of weeks on board and location were not used as matching variables, as the use of more than two variables was impractical. At any rate, the variables of weeks on board and location were subsequently controlled for in the MANCOVA conducted with T1 data to assess the effects of the programme.

Using T1 data, participants of the programme (n = 61) were matched with non-participants of the programme (n = 61) in relation to the variables of race/ethnicity and job category. As a match on both race/ethnicity and job category could not be identified for four programme participants, these participants were matched only on race/ethnicity.

DIFFERENCES BETWEEN THE INTERVENTION GROUP AND CONTROL GROUP

The data set comprising the intervention group and matched control group at T1 (n = 122) was again screened prior to conducting MANCOVA to measure differences between the intervention group and matched control group. Two intervention group participants had missing data on predictor variables, and these missing values were therefore replaced with the most common value for the respective variable, i.e. a missing value for location was replaced with 'on passage', and a missing value for job category was replaced with 'officer, engineer'. The ethnicity group of 'Other Combined' (Latino/Hispanic, Middle Eastern, and Mixed) was combined with the ethnicity group of 'Other' as the former had fewer than 10 cases. The seafaring experience group of '0–1 year' was combined with the group of '1–5 years' as the former had less than 10 cases. Similarly, the location group of 'Loading/Discharging' was combined with the location group of 'Approaching Port' as the former had fewer than 10 cases.

Categorical predictors comprised the intervention group/matched control group, age, seafaring experience, and location; while the continuous predictor was weeks on board. Race/ethnicity and job category were not included

as these variables were previously controlled for through the matched subjects procedure.

For the preliminary MANCOVA conducted to test the assumption of homogeneity of regression slopes, a custom model was specified comprising all 2-way interactions between each factor and weeks on board, and main effects. Box's test of equality of covariance matrices indicated validity of the assumption of homogeneity of variance-covariance matrices. Levene's test of equality of error variances indicated equal variances between groups for each of the dependent variables. The interaction between weeks on board and intervention group/matched control group was significant, Wilks'^ = 0.885, $F(3, 104) = 4.52$, p = 0.005, multivariate $\eta^2 = 0.115$. Furthermore, the interaction between weeks on board and seafaring experience was significant, Wilks'^ = 0.823, $F(9, 253.259) = 2.35$, p = 0.015, multivariate $\eta^2 = 0.063$. These significant interaction terms were therefore included in the final MANCOVA.

Final MANCOVA was conducted to measure differences between the intervention group and matched control group for the dependent variables of perceived stress, resilience, and job satisfaction. A custom model was specified comprising the weeks on board X intervention group/matched control group interaction, the weeks on board X seafaring experience interaction, all 2-way interactions between matched groups and each predictor, and main effects.

MANCOVA results indicated a significant difference between the intervention group and matched control group on the dependent variables overall, Wilks'^ = 0.923, $F(3, 101) = 2.79$, p = 0.044, multivariate $\eta^2 = 0.077$. The covariate weeks on board also significantly influenced the dependent variables overall, Wilks'^ = 0.853, $F(3, 101) = 5.82$, p = 0.001, multivariate $\eta^2 = 0.147$. A significant interaction was found for weeks on board and intervention group/matched control group, Wilks'^ = 0.912, $F(3, 101) = 3.23$, p = 0.025, multivariate $\eta^2 = 0.088$. Moreover, a significant interaction was found for weeks on board and seafaring experience, Wilks'^ = 0.795, $F(9, 245.958) = 2.69$, p = 0.005, multivariate $\eta^2 = 0.073$.

Univariate ANOVA results indicated a significant difference between the intervention group and matched control group for perceived stress, $F(1, 103) = 7.44$, p = 0.008, partial $\eta^2 = 0.067$; but not for job satisfaction, $F(1, 103) = 0.55$, p = 0.46, partial $\eta^2 = 0.005$; or for resilience, $F(1, 103) = 0.27$, p = 0.603, partial $\eta^2 = 0.003$. Furthermore, differences for weeks on board were significant for perceived stress, $F(1, 103) = 15.46$, p < 0.001, partial $\eta^2 = 0.131$; but not for job satisfaction, $F(1, 103) = 0.29$, p = 0.59, partial $\eta^2 = 0.003$; or for resilience, $F(1, 103) = 1.42$, p = 0.23, partial $\eta^2 = 0.014$.

A significant effect was found for the intervention group/matched control group X weeks on board interaction on perceived stress, $F(1, 103) = 4.90$, p = 0.029,

partial $\eta^2 = 0.045$. A significant effect was also found for the seafaring experience X weeks on board interaction on perceived stress, $F(3, 103) = 3.95$, $p = 0.01$, partial $\eta^2 = 0.103$, and on job satisfaction, $F(3, 103) = 3.80$, $p = 0.012$, partial $\eta^2 = 0.100$. Weeks on board had a significant effect for perceived stress for the control group ($p = 0.02$); but not for the intervention group ($p = 0.857$).

DOSE-RESPONSE RELATIONSHIPS

For the preliminary MANCOVA conducted to test the assumption of homogeneity of regression slopes, a custom model was specified comprising all 2-way interactions between each factor and weeks on board, and main effects. Box's test of equality of covariance matrices could not be computed as there were fewer than two nonsingular cell covariance matrices. Levene's test of equality of error variances indicated equal variances between groups for each of the dependent variables. Pillai's Trace is used, rather than Wilks' Lambda, when homogeneity of variance-covariance (Box's test) is in question [104]. Factor-covariate interactions were not significant.

Final MANCOVA was conducted to assess dose-response relationships. A custom model was specified comprising all 2-way interactions between the three participant groups (categorised according to number of participated modules) and each predictor, and main effects. MANCOVA results indicated no significant difference between the three groups on the dependent variables overall, Pillai's Trace = 0.211, $F(6, 38) = 0.747$, $p = 0.616$, multivariate $\eta^2 = 0.105$, and no significant interactions between participant groups and each predictor. Accordingly, no significant dose-response relationships were identified.

DISCUSSION

The primary aim of this study was to assess the effects of a psychosocial programme on perceived stress, resilience, and job satisfaction among a sample of merchant seafarers. The discussion presented below examines some of the issues emerging from the findings in relation to a review of the literature.

EFFECTS OF THE PILOT PSYCHOSOCIAL PROGRAMME

We hypothesised that there would be differences between the intervention group and a matched control group on perceived stress, resilience, and job satisfaction. Findings indicated a significant difference between the intervention group and matched control group for perceived stress, although a significant difference was not found between these groups for job satisfaction or resilience. A significant effect was found for the intervention group/matched control group X weeks on board interaction on perceived stress. The

significant interaction between participation in the programme and weeks on board indicated that the effect of weeks on board on perceived stress differed significantly for the intervention group and matched control group. Weeks on board had a significant effect for perceived stress for the control group ($p = 0.02$); but not for the intervention group ($p = 0.857$). These results suggest that participation in the programme moderated the effect of weeks on board on perceived stress.

Accordingly, the analyses suggested that the programme may have safeguarded participants against the effects of weeks on board on perceived stress. While only a limited evidence base exists on the success of health promotion interventions for seafarers [81], this study's findings suggest beneficial effects of an on-board pilot psychosocial programme on the psychosocial well-being of a sample of merchant seafarers. This finding lends support to the contention that psychological resilience training in the shipping industry could support employee well-being [61]. Research may therefore need to focus on the resilience and coping strategies of seafarers, with interventions aiming to modify these factors [24]. This study has aimed to address a critical gap in research investigating the psychosocial health and stress of seafarers [4, 9, 19, 24, 79, 80]. Such research is crucial to examine interventions that can increase psychological resilience amongst seafarers [82].

This study found that the programme impacted on participants' levels of perceived stress, but not on their levels of hardiness. The programme may have impacted on other factors not measured by the study; this is very likely considering the programme's basis in several fields including positive psychology, cognitive behavioural therapy, neuro-linguistic programming, and research on leadership. Indeed, the programme may have strengthened participants' resilience, but other aspects or types of resilience beyond hardiness. The measurement of resilience with a single self-report scale is questionable, as resilience is multi-dimensional and needs to be measured while considering several different factors. While the DRS-15 is a measure of hardiness, the scale was used by the organisation as it was considered that hardiness and resilience were closely associated. While there is some conflation between hardiness and resilience as concepts, these concepts were used synonymously within Shell. This reflects the importance of conceptual distinctions and of psychometric measures that address distinct theoretical constructs. The challenges of this study, however, also illustrate the practicalities of designing, rolling out, and administering an intervention in an organisational context in a timely manner, the inherent difficulties of implementing interventions outside of a controlled experimental setting, and of conducting real-world "messy research" (p. 227) [109].

This study provides a quantitative analysis of the effects of the programme. A related qualitative study of this programme [110] found that participants reported positive perceptions of the programme, but also communicated criticisms, many of which were underpinned by the need to adapt the programme to the unique context on board. Specifically, a number of participants reported that the personal nature of the programme was an uncomfortable experience on board; a lack of time for the programme; and the need for trained facilitators. Moreover, the need to tailor the programme was highlighted with regards to addressing its concurrent delivery across different nationalities and ranks, the importance of simpler English, and of shipping-specific examples. Notably, change of crew on board was also reported as a barrier to programme continuity and to assessing the impact of the programme. Notably, many of these concerns raised by these programme participants may be addressed through the use of computer-based psychosocial interventions on board, which could be completed in the individual's own time, privacy, and even language. Online or computer-based psychosocial interventions and training lend themselves to the isolated and dispersed context of seafaring [110]. Numerous Internet-based interventions have been tested for common psychological disorders, and research indicates that they frequently lead to similar outcomes as face-to-face psychotherapy, alongside being cost-effective [111].

LIMITATIONS OF THE STUDY

Matched subjects procedure. It is a limitation of this study that pre-treatment (T0) and post-treatment (T1) questionnaires were not matched and that the sample of participants at T0 was not the same sample at T1. We can therefore suggest that differences in perceived stress between the intervention and matched control groups may be explained by the intervention itself. However, we are unable to assert with certainty that differences are a result of the intervention, due to potential confounding factors.

Extrapolation of findings. This research has focused on a single company engaged in bulk hydrocarbon transport. The distances travelled in such ships, the routines over long passages, the multinational nature of the company, along with its high public profile, all constitute a specific combination of attributes that create a work and social environment not necessarily shared by other shipping companies or cohorts of seafarers. It is important to caution against extrapolation from one study across an industry that has a great variety of employers, flags, States, ship types, types of contracts, and different recruitment and remuneration practices. Elsewhere we have argued for the importance of considering context in developing relevant policy initiatives [112], and this certainly also applies in the maritime sector.

Response rate. Data were not available in relation to the number of seafarers on each ship who were informed of the study and asked to complete the work questionnaire. Therefore, it was not possible to specify a response rate. Without this information, it is possible that a sampling bias may have been present. For example, those who responded to the questionnaire may have been particularly resilient.

Work questionnaire. The item in the questionnaire assessing seafaring experience contained overlapping response categories, i.e. 0–1 year, 1–5 years, 5–10 years, 10–20 years, and > 20 years. Accordingly, for example, respondents with 1 year of experience may have responded as having '0–1 year' or '1–5 years' of experience. These overlapping response categories were therefore not mutually exclusive [113, 114].

Perceived Stress Scale-4. The internal reliability for the PSS-4 was 0.55 at both T0 and T1, below the acceptable alpha threshold of 0.70 cited in the literature [92]. The internal reliability for the PSS-4 was marginally lower than that reported by Cohen and Williamson [95] with a probability sample of the United States (n = 2,387), whereby the internal reliability for the PSS-4 (alpha = 0.60) was reported as less than that of the 10-item version (alpha = 0.78) and 14-item version (alpha = 0.75). This may be due to fewer items in the PSS-4 than the PSS-10 or PSS-14, as Cronbach's α may increase relative to the number of items in a scale [92, 115]. While the decision to use the PSS-4 for the present study was based on its brevity, validity, and acceptable internal consistency as reported in the literature [94–96], one of the limitations of this study was the less than satisfactory internal reliability of the PSS-4.

CONCLUSIONS

The findings of this study suggest that the on-board psychosocial programme may have provided a psychological buffer against the impact of duration on board on perceived stress. Importantly, however, a work environment that is experienced as supportive, inclusive and just is necessary as a cornerstone for individually-focused psychosocial interventions to be optimally applied [116]. As MacLachlan [26] suggests, "no matter what sort of clever individual psychological interventions maritime psychologists can develop, implementing these in a fundamentally unfair and exploitative working environment can be counterproductive, individualising a systems problem" (p. 7). Although depression, suicide, and other forms of psychological distress may be experienced at the individual level, their origins are manifold and cannot be effectively addressed by focusing only at the level of individual functioning. Rather, factors that affect well-being and performance in the maritime industry are embedded at different levels of work, including the team, organisation, and industry [32].

The maritime industry at large prioritises 'rationalisation' of work practices and 'optimisation' of budgets, which may result in the infringement of rights and working standards for seafarers [117]. To be competitive in the industry, maritime companies may be compelled to rationalise in ways that compromise the well-being, dignity, performance, and safety of seafarers; therefore, incentives and strategies at the industry level are also needed to support seafarers' well-being [117]. At a period of excessive cost-saving in the maritime sector, occurring alongside psychosocial problems amongst seafarers, now is the time for the well-being of seafarers to be prioritised and incentivised by maritime companies and the maritime sector at large.

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