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Fatigue in seafarers working in the offshore oil and gas re-supply industry: effects of safety climate, psychosocial work environment and shift arrangement

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ABSTRACT

This study examined the influence of safety climate and psychosocial work environment on the reported fatigue of seafarers working in the offshore oil and gas re-supply industry (n = 402). We found that seafarers who reported high psychological demands and perceived the organisational-level safety climate negatively, reported significantly more mental fatigue, physical fatigue, and lack of energy. In addition, seafarers who reported having high levels of job control reported being significantly less mentally fatigued. We also found some combined effects of safety climate and shift arrangement. Organisational-level safety climate did not influence the levels of physical fatigue in seafarers working on the night shift. On the contrary, seafarers working during the days reported to be more physically fatigued when they perceived the organisational-level climate to be negative compared with the positive. The opposite effect was found for group-level safety climate: seafarers working during the nights reported to be more physically fatigued when they perceived the group-level climate to be negative compared with the positive. The results from this study point to the importance of taking into consideration aspects of the psychosocial work environment and safety climate, and their potential impact on fatigue and safety in the maritime organisations.

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Key words: fatigue, offshore oil and gas, safety climate, psychosocial work environment

INTRODUCTION

In the general working population, occupational fatigue has been linked to poorer work performance [1], accidents and injuries [2, 3], as well as ill health, sick leave and disability [4, 6]. Seafaring is generally acknowledged as one of the most "physically demanding professions in one of the most dangerous work environments" [7]. Nonetheless, it has also been suggested that fatigue has been an under-researched issue in the maritime domain [8]. This is especially true compared to research into the road-transportation and air-transport industries. Road-transportation research have shown that driver fatigue may account for up to 20% of the road accidents and around 20–30% of all the fatal road crashes [9, 10].

While fatigue has no unifying definition, in this paper we adhere to the International Maritime Organisation's conceptualisation of fatigue as "a reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities" [11]. In this paper we want to investigate the effects of safety climate and the psychosocial work environment on the reported fatigue of seafarers working in the oil and gas re-supply industry. In what follows, we give a brief introduction to our proposed explanatory variables and how these might affect fatigue among the seafarers.

SAFETY CLIMATE AND PSYCHOSOCIAL WORK ENVIRONMENT

Organisational safety climate is often regarded as a more temporal phenomenon than safety culture; as a snapshot of organisational safety culture at that particular point in time [12]. While organisational *culture* can be considered to represent "patterns of shared basic assumptions that the

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group learned (...) that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel (...)" [13], safety *climate* generally refers to workers' perceptions of the way in which the organisation manages and prioritises safety [14, 15]. While the exact nature of safety climate and the factors thought to comprise it are still being debated, Zohar [15, 16] has emphasised workers' perceptions of the organisation's and management's relative priority of safety compared to other competing priorities as the key element in safety climate.

The notion that safety climate should affect seafarer fatigue comes from empirical evidence as well as from theoretical considerations. As to the empirical evidence, safety climate has emerged as a robust predictor of safety criteria across industries and countries [17], including fatigue-related behaviour and near-misses [10]. It is also reasonable to expect that the climate in which production costs, efficiency, and other competing priorities take precedence over safety (i.e. a poor safety climate) will leave the workers mentally and physically fatigued. We also suggest that the impact of poor safety standards will be more pronounced in the maritime organisations where workers spend their resting and off duty periods in the same physical environment as their working hours. Consequently, our first hypothesis is:

— H–1: Seafarers' perceptions of the top management's and closest supervisors' prioritisation of safety will be associated with reported levels of fatigue.

It is well documented that the adverse psychosocial work conditions represent a major hazard to the health of workers. Research have demonstrated that job control, job demands and other psychosocial characteristics are important in relation to a wide range of health criteria, including musculoskeletal complaints [18], sickness absence [19, 20], burnout [21, 22], and self-reported health and well-being [23]. Although several aspects of the work environment can be harmful, Karasek's [24] demand-control model has dominated the empirical research on job stress and health the last few decades [19]. In short, this model postulates that jobs characterised by high psychological demands and low control are particularly damaging for the workers' health. For instance, findings from the Maastricht Cohort Study showed that psychological demands at work increased the risk for fatigue among men, whereas job control served as a protective factor [25]. Based on this short discussion, our next hypothesis is:

— H–2: Psychological demands will be positively related to seafarers' reported fatigue, whereas job control will be negatively related to seafarers' reported fatigue.

INTERACTIONS BETWEEN SAFETY CLIMATE, WORK ENVIRONMENT AND SHIFT ARRANGEMENT

Night work as a risk factor for fatigue and other health and performance indicators are well established and will not be discussed in detail here (for reviews, see [26, 27]). Rather, in this paper our interest lies in how working during nights or days may interact with safety climate and the psychosocial work environment. Smith et al. [28] have claimed that potential workplace stressors and occupational hazards are too often examined in isolation. This approach is likely to give an unrealistic picture of the workplace, since workers are often exposed to multiple hazards simultaneously, and, consequently, these authors call for more studies of the combined effects of occupational hazards. One way to study combined effects is to create statistical interaction-terms and then examine whether the effects of one occupational hazard varies as a function of another hazard (i.e. moderation).

In the current study we examined the joint effects of shift arrangement and safety climate, and shift arrangement and the psychosocial work environment. We expect that the effects of safety climate and the psychosocial work environment on fatigue will be more pronounced in seafarers working during the nights compared with those working during the days. Our last hypotheses are therefore:

— H–3a: The influence of safety climate will be stronger in seafarers working on the night shift compared with seafarers working on the day shift.

— H–3b: The influence of psychological job demands and job control will be stronger in seafarers working on the night shift compared with seafarers working on the day shift.

MATERIAL AND METHODS

PARTICIPANTS AND PROCEDURE

Data for the current study were collected from seafarers working in the offshore oil and gas shipping re-supply industry. Questionnaires were administered to 926 crew members aboard 22 vessels operating in the North Sea and Southeastern Asia. The questionnaires were mailed from the shipping company's onshore shipping and forwarding agent and returned in anonymous, sealed envelopes to the principal researcher. Altogether 402 questionnaires were returned, yielding a response rate of 43.4%. A detailed demographic description of the participants is presented in Table 1. Due to the low number of women working on board the vessels, the gender of participants was not recorded in order to protect the anonymity of women seafarers.

Norwegian crew members received surveys written in Norwegian, while the others were given their surveys in English. In the shipping company in question, all crew members are required to be fluent in English as a condition of employment.

MEASURES

Fatigue. The Swedish Occupational Fatigue Inventory (SOFI) [29] is a self-report instrument to measure work-re-

Table 1. Demographic characteristics of participants

Variable	Category	N (%)
Nationality	Norwegian	138 (34.3)
	Filipino	146 (36.3)
	European	98 (24.1)
	Asian/Australasian	15 (3.6)
Age	24 years and younger	49 (12.2)
	25–29 years	68 (16.9)
	30–39 years	130 (32.3)
	40–54 years	111 (27.6)
	55 years and older	39 (9.7)
Employment	Permanent	211 (52.5)
	Temporary	148 (36.8)
	Apprentice	17 (4.2)
Work area	Deck detail	178 (44.3)
	Machine detail	103 (25.6)
	Gallery detail	70 (17.4)
	Master	44 (10.9)
Length of current sailing period	Less than one week	61 (15.2)
	1–2 weeks	92 (22.9)
	3–4 weeks	110 (27.4)
	5–6 weeks	38 (9.5)
	More than 6 weeks	91 (22.6)
Shift arrangement	Night shift	94 (23.3)
	Day shift	177 (44.1)
	Other/unspecified	131 (32.5)

lated perceived fatigue and consists of 25 expressions equally distributed on 5 different dimensions: *Lack of energy* (e.g. "worn out"), *Physical exertion* (e.g. "out of breath"), *Physical discomfort* (e.g. "stiff joints"), *Lack of motivation* (e.g. "lack of concern"), and *Sleepiness* (e.g. "drowsy"). The physical exertion and discomfort dimensions can be combined into a physical component of fatigue, while sleepiness and lack of motivation can be combined into a mental component. Lack of energy has been suggested to represent a more general factor that reflects both the physical and mental aspects of fatigue [30]. In the present study a revised 20-item version of the SOFI was used [30]. The participants were asked to think about how tired they usually feel at the end of their shift, and then rate the 20 SOFI-expressions on a 7-grade response scale with anchors of *not at all* and *to a very high degree*. There are 4 expressions each for the 5 different fatigue dimensions.

Safety climate. Zohar and Luria's [31] multi-level scale was used to measure safety climate in the present study. This scale measures both organisational-level (i.e. top management) and group-level (i.e. closest supervisor) safety climate with 16 items each, and respondent rate their agreement on a 5-point rating scale (1 = completely disagree; 5 = completely agree). The safety climate dimensions include indicators that reflect the top-management's and supervisors' commitment to safety and prioritisation of safety over competing goals such as production speed and costs. Example items are: "Top management in this company quickly corrects any safety hazard (even if it's costly)" (organisational-level) and "My direct supervisor refuses to ignore safety rules when work falls behind schedule" (group-level). Items within each dimension were reverse scored and aggregated into mean scores so that high scores equal more negative safety climate.

Psychosocial work environment. Psychological demands and job control were measured as the aspects of the psychosocial work environment. Psychological demands were measured with items that tapped the degree to which the work environment placed demands on the individual in terms of workload and time pressure. Job control was measured with questions that reflected the ability of the seafarers to make decisions about their work in terms of setting the work pace and influencing how the work is carried out. Respondents rated their agreement to 4 statements measuring psychological demands (e.g. "Do you have too much to do?") and 6 statements measuring job control (e.g. "Can you influence decisions that are important for your work?") on a 5-point rating scale (1 = very seldom or never; 5 = very often or always). These items were drawn from the General Nordic Questionnaire for psychological and social factors at work, a validated instrument that was developed to produce a comprehensive assessment of a wide range of work factors, including work demands and job control [32].

Demography and work characteristics. In addition to the variables so far mentioned, the survey also inquired about nationality, age, and several features of the seafarers' work arrangement. These included employment status (permanent, temporary, apprentice), work area (deck detail, machine detail, gallery detail, masters), length of current sailing period, and shift arrangement (see Table 1 for description).

STATISTICAL ANALYSES

Because the current data consist of seafarers nested within vessels, some of the assumptions intrinsic to ordinary least square regression may be violated, such as independent observations and uncorrelated residuals. To determine whether multi-level analyses were warranted, random-coefficient null models were performed in a preliminary check to assess the degree of non-independence in the physical fatigue, mental fatigue, and lack of energy variables.

To test our hypotheses, physical fatigue, mental fatigue, and lack of energy were next regressed on the demographic (age and nationality), the work-background (employment status, work area, duration of current work period, and shift

Table 2. Means (standard deviation – SD), Cronbach's alphas and inter-correlations between continuous study variables (n = 402)

Variable	Mean	SD	1	2	3	4	5	6	7
1. Physical fatigue	2.07	1.04	**0.88**						
2. Mental fatigue	2.26	1.14	0.70	**0.90**					
3. Lack of energy	2.31	1.30	0.81	0.78	**0.90**				
4. Organisational-level safety climate	1.98	0.66	0.09	0.28	0.23	**0.96**			
5. Group-level safety climate	1.96	0.68	0.13	0.20	0.19	0.62	**0.96**		
6. Psychological demands	2.51	0.74	0.36	0.25	0.41	0.08	0.14	**0.75**	
7. Job control	3.31	0.75	–0.13	–0.17	–0.17	–0.04	–0.07	–0.07	**0.82**

Internal consistency estimates (Cronbach's alpha) are reported in bold along the diagonal.
All correlations ≥ 0.14 are significant at $p < 0.01$.

arrangement), the safety climate, and the psychosocial work environment variables. To test the proposed interactions, cross-product terms between shift arrangement and the 2 climate variables, and between shift arrangement and the 2 work environment variables, were created. All variables were centred around their mean prior to computing the interaction terms in order to reduce problems of collinearity and to ease interpretation and plotting of the results [33].

All fatigue variables were logarithmically transformed prior to performing the analyses to correct for the fact that they were positively skewed. Missing data were replaced by the use of the Hot Deck imputation procedure [34]. Hot Deck imputation involves replacing a missing value with the value of a randomly selected record in the dataset that matches the missing value record on other variables. All analyses were conducted using SPSS 20.

RESULTS

DESCRIPTIVE STATISTICS AND PRELIMINARY ANALYSES

Table 1 presents demographic and background information for the seafarers participating in the current study, while Table 2 presents means, standard deviations, inter-correlations, and internal consistency estimates for all the continuous variables employed in the current study.

The preliminary check for non-independence in the fatigue variables revealed an intra-class correlation coefficient (ICC) of 0.03 for physical fatigue, an ICC of 0.04 for mental fatigue, and an ICC of 0.01 for lack of energy. Thus, approximately between 1–4% of the variance in fatigue can be attributed to between-ship differences, not enough to warrant multi-level analysis by conventional standards [35].

REGRESSION ANALYSES

In the regressions, the demographic and work-background variables were entered as the first step in a multiple hierarchical analysis. Because of the low number of seafarers employed as apprentices (see Table 1), "temporary" and "apprentice" were collapsed into a single employment-status category. For similar reasons seafarers of European, Asian and Australasian origin were collapsed into an "other" dummy category and compared with the Norwegian reference group.

Results from the regressions showed that only employment status and shift arrangement made a significant contribution to explaining variance in the fatigue variables at Step 1. Compared with seafarers with permanent employment, those in the temporary/apprentice category reported significantly more physical fatigue ($B = 0.09$, $p < 0.01$), mental fatigue ($B = 0.07$, $p < 0.05$), and lack of energy ($B = 0.07$, $p < 0.05$). Compared to day shift, those working on the night shift reported significantly more mental fatigue ($B = 0.08$, $p < 0.05$) and lack of energy ($B = 0.07$, $p < 0.05$). The coefficient for physical fatigue did not reach conventional levels of statistical significance ($B = 0.05$, $p = 0.09$).

The safety climate variables were entered in Step 2 and revealed a significant contribution of organisational-level climate for all fatigue outcomes. More negative levels of organisational-level safety climate were associated with more reported physical fatigue ($B = 0.06$, $p < 0.05$), mental fatigue ($B = 11$, $p < 0.001$), and lack of energy ($B = 0.09$, $p < 0.01$). In addition, some effects of nationality and age reached statistical significance, with Filipinos reporting more physical fatigue compared with Norwegians ($B = 0.11$, $p < 0.05$), and the youngest age group reporting more mental fatigue compared with the reference group (30–39 years; $B = 0.10$, $p < 0.05$).

In Step 3, the psychosocial work environment variables were entered and psychological demands significantly explained variance in all 3 fatigue variables, whereas perceptions of job control explained variance in mental fatigue only (see Table 3). As can be seen in Table 3, the final model estimates showed that in addition to demands, employment status and shift arrangement both significantly explained

Table 3. Final coefficients from regression analyses predicting fatigue

	Physical fatigue		Mental fatigue		Lack of energy	
Variable	**B (SE)**	**β**	**B (SE)**	**β**	**B (SE)**	**β**
Age[a]						
24 years and younger	NS	NS	0.13*** (0.04)	0.19	NS	NS
25–29 years	NS	NS	0.06# (0.03)	0.11	NS	NS
Nationality[b]						
Filipino	0.09* (0.04)	0.22	NS	NS	NS	NS
Employment[c]	0.10*** (0.03)	0.24	0.08** (0.03)	0.18	0.08* (0.03)	0.17
Shift[d]	0.06* (0.03)	0.13	0.09** (0.03)	0.20	0.08** (0.03)	0.16
Safety climate						
Organisational	0.04& (0.02)	15	0.09*** (0.03)	0.28	0.07** (0.03)	0.20
Work environment						
Psychological demands	0.10*** (0.02)	0.35	0.09*** (0.02)	0.29	0.14*** (0.02)	0.43
Job control	NS	NS	–0.04* (0.02)	–0.12	–0.03# (0.02)	–0.11
R^2	0.29***		0.27***		0.31***	
Adjusted R^2	0.23***		0.21***		0.25***	

B — unstandardised regression coefficient; β — standardised regression coefficient; SE — standard error; NS — non significant
***p < 0.001; **p < 0.01; *p < 0.05; &p = 0.05; #p < 0.10
[a]The age group 30–39 years serves as the reference group for the dummy-coded age variable; [b]Norwegians serve as the reference group for the dummy coded nationality variable; [c]Employment is coded 0 = permanent position and 1 = temporary/apprentice; [d]Shift is coded 0 = day shift and 1 = night shift

variance in all fatigue variables. Organisational-level climate explained variance in mental fatigue and lack of energy, while the coefficient fell just outside conventional levels of statistical significance (p = 0.052) in the regression with physical fatigue as criterion. The effects of nationality on physical fatigue and age on mental fatigue were still significant in the final model.

INTERACTIONS BETWEEN SHIFT AND CLIMATE AND SHIFT AND WORK ENVIRONMENT

When the product terms were entered in the final step, statistically significant interactions between shift and organisational-level safety climate (B = –0.10, p < 0.05) and shift and group-level safety climate (B = 0.11, p < 0.05) were found. To interpret these interactions, we plotted the predicted values of fatigue for seafarers working during the day shifts and the night shift at low (–1 SD) and high (+1 SD) values of organisational- and group-level safety climate. As can be seen from Figure 1, the negative effect of organisational-level climate on physical fatigue was reserved for seafarers working on the day shift. While seafarers working on the night shift reported essentially similar levels of physical fatigue at different levels of safety climate, seafarers on the day shift reported more fatigue when the safety climate was negative than when it was positive. Quite the opposite effect was found for group-level safety climate. When the group-level climate was perceived positively, working during the day or night shift did not affect reported fatigue. However,

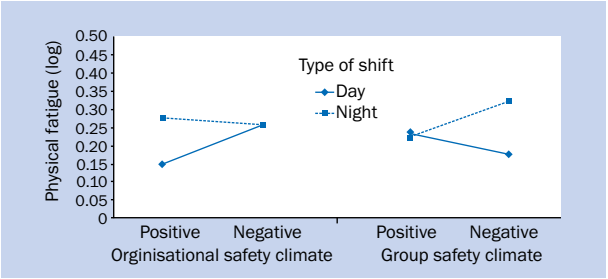

Figure 1. The joint effect of shift arrangement (days vs. nights) and safety climate on reported physical fatigue. "Positive" and "negative" indicate a climate score of one standard deviation below and 1 standard deviation above the mean, respectively. The Y-axis show the logarithmically transformed fatigue variable

seafarers working during the nights reported more fatigue when the group-level climate was perceived as negative compared with seafarers working during the days.

DISCUSSION

This study sought to examine the effects of safety climate, psychological demands, and job control on the fatigue of seafarers working in the oil and gas re-supply industry. In the hypotheses H–1 and H–2 we suggested that safety climate (organisational- and group-level), psychological demands, and job control all would influence the reported fatigue of seafarers. The results yield some support for both the hypo-

theses. In support of H–2, psychological demands were positively related to all fatigue criteria, whereas job control only explained variance in the mental fatigue criteria. Similarly, the results for safety climate are in partial support of our H–1; organisational-level safety climate explained variance in mental fatigue and lack of energy, whereas group-level climate did not have any direct effect on any of the fatigue variables. In sum, the results are in partial support of our hypotheses H–1 and H–2.

The results from this study provide further support for safety climate as an important and robust predictor of safety-related criteria. It is interesting to note that it was the perceptions of how the top-management onshore (i.e. organisational-level) prioritises and commits to safety that influenced fatigue, and not perceptions of the more local group-level climate at the ship. This result suggests that organisations and the management onshore should be cognisant of the impact that procedures, practices and policies can have on seafarers' fatigue and health in general. Our findings also emphasise the importance of striking the right balance between the corporate management prioritising the customer needs and economic gain versus local priorities of safe operations on the re-supply vessels. In terms of practical utility, organisations should take this inherent conflict between competing priorities into account in future safety planning and policy implementation. An important part of an organisational climate is the perception of employees regarding what kinds of behaviours that get rewarded and supported with regard to a specific strategic focus, and in this case the specific focus is safety [36]. Besides procedures and policies designed to enhance the safety, organisations should therefore also send a clear message to their employees that safety and safe behaviours are valued and rewarded, for example by considering a person's safety behaviour when promoting people and ensuring that experienced captains and personnel with seafaring experience are a part of the shore-based management team.

For physical fatigue, however, the detrimental impact of a negative organisational-level safety climate seemed to be reserved for seafarers working during the days. In support of our H–3a, a statistically significant interaction between shift arrangement and safety climate was found. Seafarers working during the days reported being more physically fatigued when the organisational-level climate was perceived as negative than when the climate was perceived as positive. A possible explanation could be that a substandard safety climate entails that more of the necessary maintenance and repairs will be carried out whilst at sea by crew members as an addition to their regular duties, rather than going to shore or having extra personnel brought on board. This is work that is most likely performed during the day and should therefore affect the part of the crew working on the day shifts.

As can be seen in Figure 1, regression slope for seafarers working during the nights was not affected by organisational-level safety climate. Group-level safety climate, on the contrary, did seem to affect seafarers working during the nights. The slope here showed that seafarers working during the nights reported being more physically fatigued when they perceived the group-level climate negatively compared with positively. We have no ready explanation for why group-level and not organisational-level climate influenced reported fatigue among crew members working during the nights, but speculate that the personal responsibilities associated with safe navigation will be seen as greater at night time if safety climate on board is perceived as substandard and an emergency situation should occur.

Our results also support previous research indicating that the adverse psychosocial work conditions can have a damaging impact. The finding that psychological demands were a consistent predictor across all 3 fatigue dimensions, whereas job control was significantly associated with mental fatigue only, is not unlike previous research that sometimes found effects for demands, sometimes for control, and sometimes for both [e.g. 19, 23]. It should be noted, however, that we did not test the usual strain hypothesis of the demand-control model, in which job control acts as a buffer for psychological demands and the combination of high demands – low control is expected to be particularly harmful to the health of the employees.

We also included several demographic and background variables in the regressions, albeit without any particular hypotheses regarding their effects on fatigue. The results showed that employment status significantly predicted fatigue across all 3 dimensions. Compared with seafarers with permanent employment, those employed on a temporary basis, or those employed as apprentices, reported significantly more physical and mental fatigue, as well as lower levels of energy. One explanation for this could be that the seafarers working on a temporary contract or as an apprentice are less experienced than seafarers on a permanent contract, and thus are more affected by the physically and mentally demanding working conditions at sea. A second explanation could be that seafarers on a temporary contract actually work harder and/or for longer hours, either to "prove their worth" in order to gain a permanent position, to increase the likelihood for re-hire, or for purely organisational/structural reasons (e.g. the worst jobs are given to the temporary employees). Finally, working on a temporary contract is likely to lead to feelings of job insecurity, which is itself known to be a major stressor [37]. Our results also showed some effects of age, with the youngest group (24 years and younger) reporting significantly more mental fatigue than the reference group (30–39 years). Again, a plausible explanation is that the less experienced seafarers are more mentally taxed by the demanding working conditions at sea.

Finally, compared with Norwegian seafarers, Filipinos reported significantly more physical fatigue. From what we know about the life of the Filipino seafarer this comes as no great surprise. For example, the reasons for working at sea are often different for Filipinos than for Norwegians. As Lamvik [38] has noted, one of the core features of Filipino maritime labour migration is Filipinos willingness to "endure hardship (*pagisiskap* in Tagalog) or make sacrifices for the sake of the family" (italics in original). For the Filipino seafarer, therefore, hard labour in order to be able to support the extended family back home is of utmost importance. Coupled with the fact that Filipinos are typically employed via a manning agency for a limited time period and will have to apply for re-hire [39], this may lead them to work harder and for longer hours, resulting in physical exhaustion.

LIMITATIONS OF THE STUDY

As with any cross-sectional research, the design of our study limits our ability to make firm conclusions regarding causality. It should also be noted that our study suffers from the usual limitations inherent to self-report research, such as common method variance, memory biases and social desirability. Further, the representativeness of our sample should also be considered. Although a response rate of 43.4% is not unusual and certainly within the boundaries of what is typically achieved in organisational research [40], caution is nevertheless advised when attempting to generalise our results to seafarers from other populations. It should be noted, however, that this is a difficult population to reach as the vessels are often travelling in remote waters, and are often at sea for several weeks at length.

CONCLUSIONS

Seafaring is a demanding and potentially dangerous profession. This study presents support for the notion that both individual and organisational factors can affect safety performance. Specifically, the results from this study point to the importance of taking into consideration psychological demands and their potential impact on fatigue and safety in the maritime organisations. This study also provides empirical evidence to suggest that company policy and decisions are being perceived and interpreted by the crew and may influence the vigilance of crew members when working at sea. In order to enhance the maritime safety, it is important to continue study how individual and organisational factors may contribute to maritime incidents, both individually and in combination with other risk factors.

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REFERENCES

1. Beurskens AJHM, Bultmann U, Kant IJ, Vercoulen JHMM, Bleijenberg G, Swaen GMH. Fatigue among working people: validity of a questionnaire measure. Occupational and Environmental Med 2000; 57: 353–357.
2. Harrison J, Mandryk J, Frommer M. Work-related road fatalities in Australia, 1982-1984. Accident Analysis Prev 1993; 25: 443–451.
3. Rasleara TG, Gertlerb J, DiFioreb A. Work schedules, sleep, fatigue, and accidents in the US railroad industry. Fatigue: Biomedicine, Health & Behavior 2013; 1: 99–115.
4. Janssen N, Kant IJ, Swaen GMH, Janssen PPM, Schroer KAP. Fatigue as a predictor of sickness absence: results from the Maastricht cohort study on fatigue at work. Occupational and Environmental Med 2003; 60 (suppl. 1): i71–i76.
5. van Amelsvoort LGPM, Kant IJ, Beurskens AJHM, Schroer CAP, Swaen GMW. Fatigue as a predictor of work disability. Occupational Environmental Med 2002; 59:712–713.
6. Andrea H, Kant IJ, Beurskens AJHM, Metsemakers JFM, van Schayck CP. Associations between fatigue attributions and fatigue, health, and psychosocial work characteristics: a study among employees visiting a physician with fatigue. Occupational Environmental Med 2003; 60 (suppl. 1): i99–i104.
7. IMHA. International Maritime Health Association. Newsletter. January 2012: 14.
8. Allen P, Wadsworth E, Smith A. Seafarers' fatigue: a review of the recent literature. Int Marit Health 2008; 59: 81–91.
9. Smith A, Allen P, Wadsworth E. Seafarer fatigue: the Cardiff Research Programme. Wales, UK: Centre for Occupational and Health Psychology, Cardiff University 2006: 87.
10. Strahan C, Watson B, Lennonb A. Can organizational safety climate and occupational stress predict work-related driver fatigue? Transportation Res Part F 2008; 11: 418–426.
11. IMO. Guidelines on fatigue: International Maritime Organization 2002.
12. Mearns K, Whitaker SM, Flin R. Safety climate, safety management practice and safety performance in offshore environments. Safety Science 2003; 41: 641–680.
13. Schein EH. Organizational culture and leadership. 2nd Ed. Jossey -Bass, San Francisco, CA1992.
14. Cooper MD. Towards a model of safety culture. Safety Science 2000; 36: 111–136.
15. Zohar D. Thirty years of safety climate research: reflections and future directions. Accident Analysis Prevention 2010; 42: 1517–1522.
16. Zohar D. Safety climate: conceptual and measurement issues. In: Quick JC, Tetrick LE (eds.). Handbook of Occupational Health Psychology. American Psychological Association Washington, DC 2003: 123–142.
17. Christian MS, Bradley JC, Wallace JC, Burke MJ. Workplace safety: a meta-analysis of the roles of person and situation factors. J Applied Psychology 2009; 94: 1103–1127.
18. Bongers PM, Kremer AM, Laak J. Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow, or hand/ /wrist? A review of the epidemiological literature. Am J Industrial Med 2002; 41: 242–315.
19. de Lange AH, Taris TW, Kompier MAJ, Houtman ILD, Bongers PM. "The very best of the millennium": longitudinal research and the demand-control-(support) model. J Occupational Health Psychology 2003; 8: 282–305.
20. Hystad SW, Eid J, Brevik JI. Effects of psychological hardiness, job demands, and job control on sickness absence: a prospective study. J Occupational Health Psychology 2011; 16: 265–278.

21. Martinussen M, Richardsen AM, Burke RJ. Job demands, job resources, and burnout among police officers. J Criminal Justice 2007; 35: 239–249.
22. Oldenburg M, Jensen H-J, Wegner R. Burnout syndrome in seafarers in the merchant marine service. International Arch Occupational Environmental Health 2013; 86: 407–416.
23. van der Doef M, Maes S. The job-control-(-support) model and psychological well-being: A review of 20 years of empirical research. Work Stress 1999; 13: 87–114.
24. Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. Administrative Science Quarterly 1979; 24: 285–308.
25. Bultmann U, Kant IJ, van den Brandt PA, Kasl SV. Psychosocial work characteristics as risk factors for the onset of fatigue and psychological distress: prospective results from the Maastricht Cohort Study. Psychological Med 2002; 32: 333–345.
26. Smith AP. Time of day and performance. In: Jones DM, Smith AP (eds.). Handbook of Human Performance. 3: State and Trait. Academic Press Limited, London 1992: 217–236.
27. Knutsson A. Health disorders of shift workers. Occupational Med 2003; 53: 103–108.
28. Smith AP, McNamara RL, Wellens BT. Combined effects of occupational health hazards. HSE boks, Sudbury, UK 2004.
29. Åhsberg E, Gamberale F, Kjellberg A. Perceived quality of fatigue during different occupational tasks. Development of a questionnaire. Inter J Industrial Ergonomics 1997; 20: 121–135.
30. Åhsberg E. Dimensions of fatigue in different working populations. Scand J Psychology 2000; 41: 231–241.
31. Zohar D, Luria G. A multilevel model of safety climate: cross-level relationships between organization and group-level climates. J Applied Psychology 2005; 90: 616–628.
32. Dallner M, Elo A-L, Gamberale F et al. Validation of the General Nordic Questionnaire (QPSNordic) for psychological and social factors at work. Nordic Council of Ministers 2000.
33. Cohen J, Cohen P, West SG, Aiken LS. Applied multiple regression/ /correlational analysis for the behavioral sciences. 3rd Ed. Lawrence Erlbaum, Mahwah, NJ 2003.
34. Myers TA. Goodbye listwise deletion: presenting hotdeck imputation as an easy and effective tool for handling missing data. Communication Methods Measures 2011; 5: 297–310.
35. Biemann T, Cole MS, Voelpel S. Within-group agreement: on the use (and misuse) of rWG and rWG(J) in leadership research and some best practice guidelines. Leadership Quarterly 2011; 23: 66–80.
36. Schneider B. The climate for service: an application of the climate construct. In: Schneider B, editor. Organizational climate and culture. Jossey-Bass, San Francisco, CA 1990: 383–412.
37. De Witte H. Job insecurity and psychological well-being. Review of the literature and exploration of some unresolved issues. Eur J Work Organizational Psychology 1999; 8: 155-177.
38. Lamvik GM. The Filipino seafarer: a life between sacrifice and shopping. Anthropology Action 2012; 19: 22–31.
39. Hansen H, Laursen LH, Frydberg M, Kristensen S. Major differences in rates of occupational accidents between different nationalities of seafarers. Inter Marit Health 2008; 59: 7–18.
40. Baruch Y, Holtom BC. Survey response rate levels and trends in organizational research. Human Relations 2008; 61: 1139–1160.