

Occupational Stress in Seafaring

Ana Slišković

‘Voice’ of Croatian Seafarers Employed in the International Maritime Sector

A recent study conducted on a large sample of Croatian seafarers employed on cargo ships identified a range of themes, from the seafarer’s own qualitative reports, concerning their sources of job dissatisfaction (Slišković and Penezić 2015). Through answers to open questions, the study participants offered their own perspectives, experiences and insights with regard to the main sources of dissatisfaction they faced in their occupation. These themes and accompanying illustrative quotations (see Table 1) show some cultural and contextual specificities. A major concern was dissatisfaction with state laws governing seafarers’ rights and obligations, clearly having a number of practical implications for the State, the Croatian Ministry of Maritime Affairs, educational institutions, agencies and labour unions.

Most of the other sources of dissatisfaction found in this study (e.g. separation from home and family, living and working conditions on board, etc.) are quite well recognized as *occupational stressors in the maritime sector* (Allen et al. 2008; Carotenuto et al. 2012; Iversen 2012; MacLachlan et al. 2012; Oldenburg et al. 2010a). This supports previous findings of negative association between job satisfaction and occupational stress, obtained both in the general working population (Faragher et al. 2005) and in seafarers (Lang 2011). However, examples of typical answers given in Table 1 offer a deeper insight into what actually makes seafarers stressed, dissatisfied or unhappy in relation to their occupation. The source of dissatisfaction labelled *changes in the maritime sector* provides insight to a seafarer’s perspective on reasons for the increase of occupational stress in the maritime sector.

A. Slišković (✉)

Department of Psychology, University of Zadar, Obala kralja Petra Krešimira IV,
2, 23000 Zadar, Croatia
e-mail: aslavic@unizd.hr

Table 1 Sources of job dissatisfaction

Sources of job dissatisfaction (% of responses) ^a	Examples of responses
(1) Separation from home and family (20.9)	<p><i>"I miss being with the family, Internet helps, but does not solve the closeness with them"</i></p> <p><i>"... always missing family moments while children are growing up, which no one can replace"</i></p>
(2) Status of seafarers in the Republic of Croatia (22.8)	<p><i>"Well, generally most unhappy at the treatment of seafarers in our country, i.e. they require all sorts of things, and in return nothing ... First of all, paying taxes needs to be abolished immediately because the State does not give anything i.e. only demands, or if they want us to pay them they in turn should give something ..."</i></p> <p><i>"Neglect, from the State, of seafarers and their benefits. We can not be in the same group as others for retirement, since no one will find work in the profession to the age of 67"</i></p> <p><i>"The payment of health insurance in the Republic of Croatia during stays on board (at that time I already have health insurance through the company I work for, and my whole family)"</i></p>
(3) Status of Croatian seafarers in the international labour market (2.8)	<p><i>"Underpayment in comparison to other nations"</i></p> <p><i>"As a Croat it is hard to make progress in the offshore sector, for example. We can talk about what we want, but our passports are of no significance outside. Cheap labour will smash us"</i></p>
(4) Status of seafarers in the company and promotion opportunities (7.3)	<p><i>"Slave-holding treatment by the company of its people"</i></p> <p><i>"The fact that the work is not valued as it should be, people are being promoted by luck, because decisions about the progress of the people are made in the office of the company, not on board, where people know how one works, while the real evaluation of individual work is difficult to convey in paper reports to the people in the office"</i></p>
(5) Company and living and working conditions on board (35.8)	<p><i>"Non-respect of the contract, contract duration of 4 months on board converts to 5 months, sometimes even longer"</i></p> <p><i>"Daily work 12–14 h, after 3 months' stay I think we need a psychiatrist before coming home, because the only topic of my life is work"</i></p> <p><i>"Isolation. Today LNG ships are floating prisons"</i></p> <p><i>"The inability to use the Internet on board"</i></p> <p><i>"... in most companies food is criminally bad and poor quality, and even worse is the preparation. In addition to that, the menu is always adjusted for Asians, who are more prevalent on board, and the cook is Asian"</i></p>

(continued)

Table 1 (continued)

Sources of job dissatisfaction (% of responses) ^a	Examples of responses
(6) Interpersonal relationships on board (12.8)	<p><i>“Relationships that are sometimes negative and from which there is no escape”</i></p> <p><i>“Sometimes superiors are not correct towards the lower-ranking staff”</i></p>
(7) Changes in maritime sector (12.8)	<p><i>“The industry is moving in a direction that increases the number of tasks we perform, and which are not directly related to navigation. Autonomy of crew (especially officers) is decreasing, increasing administration...”</i></p> <p><i>“...capitalism that is relentless, and it is almost impossible to do the job by the book, i.e. to harmonize the rules imposed or required by the STCW, ISM and others”</i></p>

^aPercentages of responses are calculated as n of responses in each category divided by n of subjects (530), but the fact that some subjects cited two or more sources of job dissatisfaction must be taken into the account

Source Slišković and Penezić (2015)

Implementing Findings of Research in the Field of Occupational Stress in Seafaring

During the conducting of recent research focused on occupational stress in Croatian seafarers, I experienced many personal reactions not only of participants, but also of those who did not want to participate. The background of their reluctance to participate was largely based on the view that the research would not help in solving their real problems. Some of the negative characteristics of their working environment are seen by them as unchangeable because it is “just so in their particular company and/or in the maritime sector”. Company management is seen as primarily based on profit, while changes introduced by international regulatory bodies aimed at improvements in the maritime sector are often seen as “extra paperwork” and as “conflicting with real practices on board”. Through these adverse reactions came the claim that the scientist/psychologist employed on land cannot imagine the working stressors on board. Indeed, can we imagine the depth of loneliness and worry caused by the separation from home and family? Or the level of isolation of a seafarer whose stay on board, according to the contract, is 4 or 6 months, but who, due to irregularities of shift, does not know when he is going home? Add to this picture the intense work demands, safety and health risks, overtime hours—which are often not recorded—and poor interpersonal relationships, which occur in every work team, but from which you cannot distance yourself when you are on board. The above list of adverse characteristics (stressors) is by no means exhaustive.

This chapter gives a review of previous studies focused on occupational stress in seafarers, including a detailed overview of occupational stressors in seafaring. However, before focusing on the state of knowledge in the field, let us go back to

the main issue that I experienced from seafarers: “How can you help us?” Although the practical implications are commonly given at the end of a text, I believe that this question must be to the fore, and that addressing it requires collaborative work between the owners and managers of shipping companies, unions, and national and international regulatory bodies.

Occupational stress management strategies depend on perspectives or views on the stress issue, which are shaped and changed under political, cultural, social and economic influence. Generally, views on occupational stress may be divided into two broad categories. One of them is the understanding of stress at work as a “personal problem” of the employee, arising from his or her personal characteristics, while the second involves care on the part of the community, since the problems of employees result from the unfavourable characteristics of the work environment (Kenny and Cooper 2003). Therefore, stress management strategies can be targeted at the individual or at the working conditions (Michie 2007). Intervention strategies can be classified into three levels: primary, secondary and tertiary (Kendall et al. 2000; O’Driscoll and Cooper 2002). *Primary level* interventions relate to the reduction of stress in the workplace, and are typically developed following the evaluation of specific factors that induce stress in the work environment. Examples include reducing individual workloads or redesigning jobs to remove ambiguity and conflict. *Secondary level* interventions include helping individuals to cope with stress in the workplace, while *tertiary level* interventions are basically programmes of support and counselling for employees who experience the effects of occupational stress. Managers of work organizations under pressure from the public are becoming increasingly aware that they must do something, yet more often focus on the individual level than implementations of changes in organizational structure or redesigning of jobs. Programmes of support, and training in coping with stress, not only are perceived as cheaper and more convenient for implementation in relation to long-term restructuring or major organizational changes, but also divert responsibility for the excessive stress of employees from the work organizations’ managers.

Regarding intervention strategies for optimizing seafarers’ health and well-being, it has to be said that some countries, such as the UK and Australia, have valuable projects relating to the mental health of seafarers (Iversen 2012). However, their main activities (printed booklets and leaflets about methods of stress reduction, recognition of signs of depression, a 24/7 help hotline, etc.) are directed at the seafarers. As such, they can be regarded only as *tertiary* (dealing with stress outcomes) or in some cases *secondary* measures of intervention (help in coping with stressors). Still, since many seafarers are reluctant to seek medical and psychological help because of rigorous health requirements in the competitive job market (Iversen 2012), these measures which raise awareness and help in coping with stressors in seafarers are of great importance.

However, the main intervention strategies in reducing stress and diminishing the occupational health risk of seafaring among seafarers should focus on reducing the main occupational stressors and risks (*primary* measures). Experts in the field warn that preventive measures should be based on strong evidence, since many

suggestions for stress management in seafaring are based only on questionnaire surveys conducted ashore (Oldenburg et al. 2013b). Yet people who relate in any way to the maritime sector are aware, or should be aware, of the main stressors and hazards, such as, for example extremely long separation from home and family, or long working hours. Salyga and Juozulynas (2006) showed that psycho-emotional stress was already experienced after an average of 2.7 months from the beginning of the voyage. Still, the average stay on board for non-European crew members in a study conducted by Oldenburg et al. (2009) was 9.9 months per year. Furthermore, long working hours and related fatigue (Jensen et al. 2006; Smith et al. 2006) are also prevalent in the maritime sector. Knowledge from the broader area of occupational stress can also be a starting point for stress-preventive measures in seafarers. For example, data from a representative sample of the Canadian population aged 30–59 show that the number of hours spent working is a better predictor of stress and impaired health than is the type of activity (Beaujot and Anderson 2004). Finally, although the survey method has many shortcomings, in line with the transactional view of stress it is crucial, in the measurement of stress, to cover the appraisal of stressful factors in the work environment. Therefore, on the basis of the occupational stressors reviewed in this chapter, some of the main primary interventions in seafaring should include: *reduction in long separations from families* (i.e. shorter durations of stay on board), *minimizing fatigue* (through reduction of long working hours, increased number of crew and unbroken periods of rest and sleep), and *improvements in quality of life on board* (improvements in telecommunications, nutrition and recreational opportunities, as well as the promotion of social events on board). Although communication and family life among seafarers are today very favourable compared to former times (Hagmark 2003), free and unlimited internet access on board is still just an aspiration for many seafarers.

In addition to the above suggestions, it is extremely important for managers to listen to the voices of their employees and to take them into account in making decisions. There is a large volume of evidence, in the broader area of occupational stress, that intervention on this basis—in the direction of re-designing jobs (especially those which increase control and autonomy among employees), adopting participatory management styles, developing clear role descriptions, setting effective goals and giving feedback—can reduce stress and increase the well-being of employees (O’Driscoll and Cooper 2002). These approaches include the provision of certain financial resources, as well as involvement and effort from the management, but in the long term bring benefits to the employees and the work organization (Giga et al. 2003; O’Driscoll and Cooper 2002). On the other hand, evidence of the efficacy of secondary and tertiary interventions is inconsistent and very limited (McKenna 2000; O’Driscoll and Cooper 2002). The managements of shipping organizations, as well as national and international regulatory bodies in the maritime sector, have responsibility for development activities that enhance, rather than impair, the physical and mental health of employees. A common approach in dealing with stress may result in a work environment that is productive for the shipping organizations and healthier for seafarers. Furthermore, intervention strategies should be focused not solely on the prevention of physical or

psychological risk, but on practices which yield healthy organizations (Jaimez and Bretones 2011). A “healthy organization” is defined as one whose culture, management, working climate and other business practices create an environment that promotes the complete physical, mental and social well-being, effectiveness and performance of its employees (Wilson et al. 2004). According to Jaimez and Bretones (2011), there is no single solution for all types of organization, but the participation and involvement of employees is proposed as a fundamental element for creating a healthy organization. Therefore, all workers should be actively involved in the development and optimization of organizational practices which promote a healthy workplace—which, in the case of shipping companies, includes seafarers on board.

Occupational Stress in Seafaring from the Transactional Perspective

Seafaring is a demanding, high-risk and stressful occupation which cannot be compared with jobs ashore. There are a large number of stressors, risks and challenges that seafarers face, which can lead to consequences for their physical and psychological health (Allen et al. 2008; Carotenuto et al. 2012; Iversen 2012; MacLachlan et al. 2012; Oldenburg et al. 2010a). MacLachlan et al. (2012, 2013) noted that the health of seafarers has been dramatically influenced by factors such as globalization of the shipping industry, increased automation and mechanization of work on ships, improvements in navigation techniques, reduction in crew numbers, increased uncertainty and short-term contracting of seafarers in commercial fleets, multicultural crewing and ships operated under flags of convenience.

In accordance with the transactional perspective on occupational stress, in this chapter the main stressors in the field will be determined, as well as their potential effects on the health and well-being of seafarers. In addition to effects at the individual level, effects at the organizational level will also be discussed. Finally, important individual and organizational characteristics which can moderate or mediate links between occupational stressors and stress outcomes will be reviewed, some of which have been relatively neglected in the research field. However, it is important to first define the concept of occupational stress within the theoretical framework in use.

Definition of Occupational Stress

Occupational stress is a term which is often used in the scientific literature and in daily life. However, there is no general agreement on its definition, which is the

result of various research approaches to *stress* in general, and also too broad a use of the term *stress* (Hart and Cooper 2001).

In scientific literature, *stress* has usually been understood in three ways: (1) stress as an external stimulus or the force exerted on the individual, i.e. *stimulus model* (2) stress as the individual psychological or physical response to an external force, i.e. *response model*, and (3) stress as the interaction of stimulus and response, i.e. *interactional* or *cognitive model* (Arnold et al. 2005; Sulsky and Smith 2005). Today, however, most researchers use the term *stressor* to identify external stimuli or events, and the terms *strain* or *distress* for the response or reaction of the individual. Thus, the term *stress* covers the general interactional process of linking stressors, coping with the stressors and the effects of stress, rather than specific elements. The key factor which determines whether the stress occurs is a personal appraisal of the situation and assessment of the risk level, unlike physical and environmental stressors, where, for example, exposure to toxic substances does not necessarily lead to appraisal, but often leads to physical reactions: “For psychosocial stressors, stress is indeed in the eye of the beholder” (Sulsky and Smith 2005, p. 12).

A great contribution to the field of stress was made by Lazarus and Folkman (1984, 1987; Lazarus 1990). They defined stress as a relationship between the individual and the environment arising from the former’s estimation that the requirements of the latter exceed his capabilities to meet them. If such requirements persist over time, this can lead to chronic adverse effects. However, stress reaction is preceded by an appraisal of the stressfulness of the situation. The primary appraisal of stress depends on personal and situational factors, and it is followed by a secondary cognitive appraisal which implies the evaluation of different strategies of coping with the stressor. Lazarus and Folkman gradually formed a *transactional model* of stress and, with its formulation, theoretically moved away from the classical interactional models of stress, which assumed an additive and linear relation between environmental and individual factors in determining outcomes of stress, or a one-way causality. Under the interactional approach, stress has been studied as a static structure with fixedly divided independent and dependent variables, which does not allow reciprocal causation—for example, that the level of stress responses of an individual affects the perception of stressors. In contrast, Lazarus’ transactional standpoint implies a circular nature and a feedback system. It introduces the concept of reappraisal based on new information, either from the environment or personal reaction. Because the model assumes constant change in the individual and the environment, cognitive appraisal is continuously renewing and changing (Hart and Cooper 2001). These benefits of the transactional model compared to previous models are also shortcomings from the methodological point of view, because it is difficult to determine when the stress process begins and when it ends, which creates difficulties in stress research (Lazarus 1990).

As there is no single definition of stress in general, there is no single definition of occupational stress. This ambiguity in the definition and operationalization of professional stress is one of the most important methodological problems in its research (Schonfeld et al. 1995). Kenny and McIntyre (2005) classified

contemporary approaches and models of occupational stress into five categories: (1) intrapersonal approach; (2) interpersonal approach; (3) organizational and transactional occupational stress theories; (4) cybernetics and systems theory; and (5) occupational stress in the framework of the analysis of the work process.

The most comprehensive transactional perspective on occupational stress is given in the model of Cooper et al. (1988, 2001; Cooper and Baglioni 1988; O'Driscoll and Cooper 2002; Williams and Cooper 1998), as well as in that of Cox and co-workers (Cox and Mackay 1981; Cox 1987; Cox and Griffiths 1995). Considering the great influence of the transactional approach to stress in the broader area of stress, it will serve here as a broader theoretical frame to illustrate the main elements of stress in seafarers. In establishing the transactional model of occupational stress, Cooper et al. (1988) argued that the dominant models in that time period (Karasek's *demand-control model* and *person-environment fit theories*) were limited and should be incorporated into the broader multidimensional transactional model of Lazarus. In spite of differences between the different models (e.g. Cooper's vs. Cox's model), a general transactional perspective on occupational stress is focused on three elements: the sources of stress, the consequences for the individual and the organization, and individual differences in personality and behaviour. Stress transactions are the product of the individual and the environment: the individual affects the environment and at the same time responds to demands of the environment. The central place in the model is taken by appraisal or assessment, so the object of measurement of occupational stress is not work requirement or pressure, but the perception of pressure. Therefore, in examining occupational stress and stressors it is appropriate to use questionnaires. The process of stress depends on the perception of the situation or the assessment of the stressfulness of situations. Stress reaction occurs when an individual determines that the intensity of the stressors overcomes his ability to cope. Therefore, the following sections will relate to (1) sources of stress in seafarers; (2) stress reactions, i.e. effects of stress at the individual and organizational levels; and (3) individual characteristics which influence the perception of stressfulness, stress reactions and consequences.

Sources of Stress in Seafarers

Table 2 shows the different sources of stress (i.e. stressors) faced by seafarers, some of which are occupation related, while the others (work related) are typical sources of work stressors recognized in different occupations, but also found in seafarers.

One of the most frequently cited psychosocial sources of stress (i.e. stressors) in seafaring is *long-term separation* from home and family (Carotenuto et al. 2012; Iversen 2012). Although this stressor is especially evident in the cases of longer contract duration and in younger seafarers with children (Oldenburg et al. 2009, 2010a), the fact is that all seafarers are, by the nature of their work, separated from their homes. Even under the most favourable employment conditions, seafarers

Table 2 Sources of stress in seafaring

Occupation-related stressors in seafaring	Work-related stressors in seafaring
<p>Long-term separation from home and family Deprivation of physical and psycho-social needs on board: sleep deprivation, limited influence on quality and quantity of food, limited opportunities for recreation, disturbed sexual life, social isolation “Living two separate lives” Environmental stressors on board: poor weather, ship motion, noise, vibration, heat Multinational crews Exploitation and abuse “Criminalization of seafarers”</p>	<p>Demands of the job: high workload, long working hours, shift work Low level of control over work Interpersonal relationships with supervisors, colleagues, and subordinates Level of support received from management and colleagues Role in the organization and role conflict Introduction of changes and change management Job insecurity</p>

spend at least 6 months a year at sea (Alderton et al. 2004). Stress levels caused by separation from home increase significantly when family members are unwell or when contact with the family is difficult (Carotenuto et al. 2012). Being physically away from home and family can bring anxiety relating to the illness of loved ones, sexual fidelity of the partner, problematic behaviour of children, the family’s general well-being and practical household matters (Alderton et al. 2004). Therefore, cyberspace communication with the partner is of great importance for peer social support and strengthening of relationships in seafaring (Tang 2012).

Alongside loneliness caused by separation from family, partner or wife and children, seafarers also report *social isolation*, caused by their characteristic way of life on board, now additionally aggravated by reduction in crew numbers, short ship-turnaround times and lack of shore leave (Iversen 2012; MacLachlan et al. 2012). Besides short ship-turnaround times, the reasons for low levels of shore leave are: working, a need for rest, difficulties in simply getting to the dockyard gate from the berthing area, lack of visa or security regulation in the country, and depression (Iversen 2012). Social isolation in seafarers is a major cause of psychological problems, such as depression, and in particular situations, and in vulnerable individuals, this can lead to suicide (Carotenuto et al. 2012; Iversen 2012).

Work-related stressors of seafaring include typical sources of work stress which are recognized in many occupational stress models, such as: the *demands of the job* (high workload and long working hours); the *level of control* seafarers have over their work; the *support* received from management and colleagues; *relationships at work*; the *seafarers’ role* in the organization; *change and change management*; and *job security* (especially for non-rated seafarers who are employed on contract) (Iversen 2012). These stressors lead to typical symptoms of stress, such as insomnia, loss of concentration, anxiety, frustration, anger, headaches, heart disease and less productivity in general, but they can also lead to burnout and chronic responsibility syndrome. Chronic responsibility syndrome is defined as a kind of burnout where people become mentally and physically exhausted from high

workload caused by the individual's perception that no one but them can do the work (Iversen 2012). Regarding *working hours*, the results of an international study which included 6461 seafarers from 11 countries showed that most seafarers worked every day of the week, for 67–70 h a week on average, during periods of 2.5–8.5 months at sea (Jensen et al. 2006). In addition, comparison of seafarers with non-seafarers of matched ages shows a significant difference in the *level of control* between them (Lodde et al. 2008). That is, assessments of Karasek's decision-latitude dimension were at much lower levels for seafarers than for non-seafarers. The results also showed that 17 % of seafarers (compared to 0 % of non-seafarers) were ranked in the category of heavy strain/low decision latitude, which is regarded by Karasek as a high risk of stress, and that 33 % of seafarers reached a score which indicated psychic stress according to Langner's Total Health Test. One of the work-related stressors which was highly elevated was *role conflict* (Rydstedt and Lundh 2010). Role conflict appears where conflicting requirements by other actors and interested parties in the shipping operation are directed towards the individual seafarer. It is particularly characteristic of mid-level managers "who are supposed [to] live up to their professional standards in shipping and at the same [time] operate the ship with reduced crew numbers and high speed, so as to satisfy the requirements for profitability" (Rydstedt and Lundh 2010, p. 174). The authors assumed that the rapid technological and organizational change and increased pressure for economic profitability that characterize the shipping industry have aggravated this source of stress. In the context of working stressors on board, one of the major issues is fatigue.

Fatigue in seafarers is regarded as a consequence of work stress, high job demands, insufficient crew members, long working hours, watch systems which do not allow enough rest periods (2-watch system and rotating watch system), disturbed circadian rhythms imposed by shift schedules and quick travel across multiple time zones, sleep deprivation and compromised safety standards (Allen et al. 2008; Arulanandam and Chan Chung Tsing 2009; Carotenuto et al. 2012; Hystad et al. 2013; Oldenburg et al. 2010a, 2013b; Wadsworth et al. 2006, 2008). Many maritime studies have focused on fatigue, since it is considered the most important risk factor for maritime accidents, with severe life-threatening environmental and economic consequences, as well as for the impairment of seafarers' health and well-being. Unfortunately, fatigue is more prevalent in the seafaring world than scientists are currently able or prepared to measure (Allen et al. 2008). Authors in this field warn of a concerning number of under-recorded working hours in seafarers (Smith et al. 2006). Disturbance of circadian rhythms imposed by *shift work*, especially night work, is recognized as an important factor in the development of sleep disturbance, as well as serious illnesses, such as gastrointestinal and cardiovascular diseases (Slišković 2010). Results of studies in seafarers confirm a strong independent association between longer term fatigue and physical and mental health outcome measures (Smith et al. 2006; Wadsworth et al. 2006, 2008). Data also show that measuring seafarers' fatigue on waking may be a more sensitive measure of emerging cumulative fatigue, which could relate to occupational

performance, accident risk, and perhaps longer-term well-being (Wadsworth et al. 2006).

In addition to psychosocial stressors related to the seafarers' characteristic way of life (separation from home and families, isolation and loneliness) and specific work stressors and related fatigue, seafarers are continuously exposed to *environmental stressors on board*. These include *poor weather, ship motion, noise and vibration*, and they can significantly impact the recreational value of leisure and sleeping times (Oldenburg et al. 2010a). An additional environmental stressor for engine personnel is the *heat* in the workplace (Oldenburg et al. 2009; Rengamani and Murugan 2012). Life on board brings with it additional stressors, primarily those related to the *deprivation* of physical and psycho-social needs. During the stay on board, seafarers have *limited influence on quality and quantity of food* (Oldenburg et al. 2013a), and their nutrition issue is even more pronounced in multi-ethnic crews with different dietary habits. Recent studies showed poor food hygiene knowledge of cooking and catering staff on board (Grappasonni et al. 2013), and numerous barriers to promotion of healthy diet at sea (Hjarnoe and Leppin 2014). *Limited opportunities for recreation* are regarded as an important source of stress, since the often-observed lack of leisure-time facilities (e.g. fitness rooms or social events) impairs seafarers' physical, psychological and social well-being (Carotenuto et al. 2012; Oldenburg et al. 2010a). *Disturbed sexual life* on board is also associated with the occurrence of psycho-emotional stress in seafarers (Oldenburg et al. 2010a).

Interpersonal relationships with supervisors, colleagues, and subordinates are generally recognized as one of the major occupational stressors (Cartwright and Cooper 1996). Considering the frequent changes in working teams on board and working in the multinational and multicultural environment of the seafaring sector, interpersonal relationships may pose a specific challenge for seafarers. Regarding familiarity of working teams, Espevik and Olsen (2013) showed that unfamiliar teams use less efficient coordination strategies, which reduce efficiency and increase levels of stress in novel and critical work situations. *Multinational crews* are recognized as a specific stressor, too (Oldenburg et al. 2010a). Since crews consist not only of many different nationalities, but also of different religious and cultural backgrounds, different needs, values and expectations may lead to communication problems, conflicts, abuse, racism and isolation (Carotenuto et al. 2012; Oldenburg et al. 2010a; Iversen 2012). Adequate English language skills among crew members are prerequisite not only for work, but also for socialization on board (Sampson and Zhao 2003). Furthermore, ship owners' preferences for particular groups on the basis of skills, nationality and cost may lead to discrimination, which takes varying forms, but the most widespread is in terms of wage differentials between different nationalities (McLaughlin 2012). This could also be reflected in the crew on board in terms of poor relations between nationals and non-nationals working on vessels flying certain flags. Oldenburg et al. (2009) note that the social gradient in their study, where only 6.4 % of non-Europeans performed superior duties, likely also constitutes a source of stress on ships.

Some seafarers report *exploitation and abuse* (Iversen 2012). This is most evident in those seafarers who work in a substandard sector of merchant shipping (ships defective in structure and equipment, and those with low wages and poor working conditions). Hayashi (2001) warned that the entire maritime industry suffers from practices which disregard generally accepted standards. With regard to the evident decline in the numbers of seafarers coming from developed countries, coupled with shipping companies' desire to reduce labour unit costs (McLaughlin 2012), exploitation of the cheap workforces of the Far East and Eastern Europe is becoming a significant issue for seafarers' health and well-being.

Seafarers also report one special source of stress, known as *criminalization of seafarers*. It is a term used to describe the treatment of maritime incidents (for example, oil pollution incidents; maritime accidents beyond their control; maritime accidents where there has been some negligence, regardless of the fact that such negligence is not considered criminal in the maritime industry) as 'true crimes'. It is also used as a blanket term to describe the denial of procedural and human rights in the investigation and prosecution of those incidents (Iversen 2012).

In addition to the above stressors, the specificity shared by all seafarers is the fact that they are *living two separate lives* (Hafez 1999). The first life is the onboard ship life away from home with all specificities. The second life is the home life, where the seafarer is supposed to enjoy family life and generally relax before returning to sea. However, seafarers at home may also be exposed to different types of stress concerning their family issues. Adaptation by the seafarer and his family to differences related to the two ways of life may also be stressful. Stressfulness of their period at home may also especially be the case if they are not protected and covered by a social security system (Hafez 1999; Slišković and Penezić 2015).

Besides the stressors, it should be noted that seafaring still has many risks (Grappasonni et al. 2012; Iversen 2012; Rodríguez et al. 2011; Oldenburg et al. 2010a, b). Seafaring risks include (1) *accidents* due to harmful conditions at sea and to non-observance of safety rules; (2) *piracy*, whose incidence has been rising since the mid 1990s; (3) risk of *communicable diseases*, including those related to on-board hygiene; (4) *the limited ability to provide medical aid on board*, which is most pronounced in cases of heart failure; and (5) *exposure to hazardous substances and UV light*, which may be related to the risk of *occupational cancer*.

Effects of Stress in Seafaring at the Individual and Organizational Levels

Occupational stressors have been implicated as risk factors for many physical, psychological and behavioural problems in workers, including increased risk of heart disease, gastrointestinal problems, musculoskeletal disorders, sleep problems, headache, anxiety, depression, burnout, fatigue, accidents, substance misuse, dysfunctional behaviour, suicide, homicide, work-family conflict, and many other

problems (Arnold et al. 2005; Cox and Griffiths 1995; Leka et al. 2005; Theorell and Karasek 1996). At the individual level, stressors lead to a state of being unable to perform one's duties with the usual diligence, accuracy and efficiency. The outcomes described at the individual level can also have serious consequences for employers, potentially leading to decreased performance and productivity, high turnover and absenteeism, increased unsafe working practice and accident rates, and low morale (Arnold et al. 2005; Leka et al. 2005). The financial costs of stressful work are due to a combination of two reasons: reduced productivity and increased levels of health problems associated with stress. According to Arnold et al. (2005), the UK is losing 10 % of its annual national income due to stress generated at work. The causes of these losses are manifold. In the first place are the organizational and medical costs of sick leave, since stress at work is generally the most significant cause of absenteeism. In addition, job turnover increases the costs of job training, job advertising and selection, reduces overall efficiency and disturbs other workers. Finally, the complaints of workers due to stress-related illness, and the implementation of stress management programmes in organizations, which are becoming a necessity nowadays, also contribute significantly to the aforementioned losses.

Regarding the effects of stress in seafaring at the organizational level, the main contributions are made by a Cardiff study (Smith et al. 2006) and maritime field studies (Oldenburg et al. 2013b), which showed links between working hours in reduced crewing, fatigue and performance. These results indicated that the policy of reduced crewing in the shipping industry is associated with an increase in stress and a decrease in health and safety. However, most of the research in this field focuses on outcomes at the individual level, i.e. the health and well-being of seafarers. Yet results obtained from general working populations show an association between average well-being at the organizational level and organizational performance (Daniels and Harris 2000). Furthermore, workers' attitudes, such as job satisfaction, are associated with their health and level of occupational stress (Faragher et al. 2005), and also with job performance, turnover and withdrawal behaviour (Saari and Judge 2004). Therefore, outcomes of stress at the individual and organizational levels are presumably inevitably intertwined also in the maritime sector.

Since intensive stress could be a trigger for impaired health in seafarers, further sections present the results of research relating to the mortality, health and well-being of seafarers. Potential clues about links between stressors in seafaring and health may be found in studies using biochemical parameters. For example, Lu et al. (2010) analysed blood chemistry measures in 170 Chinese seafarers before and after a 3-month voyage, and identified nine measures (monoamine oxidases, creatine kinase, lactate dehydrogenase, albumin, fructosamine, inorganic ions: calcium, phosphate, kalium and natrium) which were affected during the sailing. The authors argue that great temperature changes, poor diet structure, lack of exercise, abnormal electromagnetic radiation and stress may cause subtle changes in physiological and psychological functions in seafarers' bodies.

Mortality in Seafarers

The results of a study which involved 24,132 Danish seafarers (Hansen and Pedersen 1996) have shown that merchant seafarers have a higher mortality than the general population. (The standardized mortality ratio was 1.43 from all causes and 3.05 from accidents.) Despite a very high risk of fatal accidents in the workplace, these accidents could only explain a proportion of the observed excess mortality, while accidents ashore and diseases related to lifestyle factors made a major contribution to the observed excess mortality. The results of mortality studies in seafarers can generally be divided into three categories: (1) accident-related mortality, (2) disease- and lifestyle-related mortality, and (3) suicide mortality.

Further research on Danish seafarers (Hansen et al. 2002) focused on *occupational accidents* aboard merchant ships in international trade (time period 1993–1997). Among a total number of 1993 accidents, 209 accidents resulted in permanent disability of 5 % or more, and 27 were fatal. An analysis of traumatic work-related mortality among seafarers employed in British merchant shipping from 1976 to 2002, which was based on official mortality files, with a very large sample, has shown that the mortality rate for the 530 fatal accidents that occurred in the workplace in the observed time period was 27.8 times as high as in the general workforce in Great Britain during the same time period (Roberts and Marlow 2005). To be precise, of 835 traumatic work-related deaths, 564 were caused by accidents, 55 by suicide, 17 by homicide, and 14 by drug or alcohol poisoning. The circumstances in which the other 185 deaths occurred, including 178 seafarers who disappeared at sea or were found drowned, were undetermined. The authors conclude that, despite improvements in health and safety that have led to substantial reductions in fatal accident rates in UK merchant shipping throughout most of the last 90 years, seafaring has remained a hazardous occupation (Roberts and Marlow 2005). Actually, the data show that the relative risk of an accident in UK shipping, compared with the general British workforce, was similar in 2001 to that in 1961 (Roberts 2008). Since shipping accidents remain a major concern in the modern shipping industry, contemporary studies deal with analysis of causes of different classes of accidents and collisions (Chauvin et al. 2013), prediction of mortality count based on influencing factors, such as type and place of accident, weather and darkness conditions (Weng and Yang 2015), and differences between nationalities in the rate of accidents, such as those which were found in the Danish merchant fleet (Ádám et al. 2014). Although differences decreased over the investigated period (2010–2012), the higher accident rate of Western European than that of Eastern European, South East Asian and Indian seamen, according to the authors, may be related to national differences in reporting practice, safety behaviour and fitness to work. Further exploration of the underlying causes of nationality differences in occupational safety culture is recommended (Ádám et al. 2014).

Studies focusing on *morbidity and mortality* in seafarers are often confounded by the “healthy worker effect,” i.e. better or equal health status of seafarers compared to the general population. This effect is commonly obtained in cross-sectional studies and may be explained by self-selection and adaptation. Seafarers who

cannot adapt to the work on board, as well as those who are suffering from the effects of occupational stressors, leave the occupation. This effect is also known as the “survival effect,” meaning that individuals capable of coping with work demands tend to remain in the workforce (Bridger et al. 2010). For example, mortality data on seafarers employed in British merchant shipping from 1939 to 2002 (Roberts 2005) show sharp reductions regarding mortality from gastrointestinal diseases and from alcoholism. These results contrast with increases among the general British population, and are largely due to the “flagging-out” of most British deep-sea ships, and consequent reductions in long voyages, as well as reductions in alcohol consumption among seafarers at work. Lower work-related mortality from cardiovascular diseases (CVD) and ischemic heart disease (IHD) among seafarers employed in British shipping than in the corresponding general population is also explained by a healthy worker effect among the seafarers (Roberts and Jaremin 2010). At the same time, mortality risk from CVD among British seafarers ashore in Britain increased, which is at least partially caused by seafarers’ being discharged ashore from active service because of sickness or disability, including CVD morbidity. Results from the same study showed an increase in mortality risk from CVD among the crews of North Sea offshore ships, which may reflect particular work-related hazards in this sector. It can be concluded that cross-sectional research may underestimate health problems in seafarers, so longitudinal studies are strongly recommended. However, since an increase in morbidity and mortality occur in the function of ageing, a seafarers group followed through their work and life span (including the period after any abandonment of the occupation) should be accompanied by a control group of workers with matching characteristics.

The data on *suicides* prove that the mental health of seafarers in many cases continues to be very poor and often fatal (Iversen 2012). While the figure for suicide among total deaths in the general population ranges from 1.2 to 2 %, suicides by seafarers are much more common. Seafarers’ international death statistics based on 20 reports published in the years from 1960 to 2009 show that, of a total of 17,026 seafarer deaths, 1011 (i.e. 5.9 %) were by suicide (Iversen 2012). Analysis of suicides among seafarers in UK merchant shipping (Roberts et al. 2009) show that the suicide rate among seafarers was substantially higher than the overall suicide rate in the general British population from 1919 to the 1970s, but, following reductions in suicide mortality among seafarers, it has become more comparable since. These drops are explained by reductions over time in long intercontinental voyages and changes in seafarers’ lifestyles over time. The results of this study additionally show that suicide rates among seafarers in UK merchant shipping were higher for ranks below officers and for older seafarers, and higher for Asian seafarers than for British seafarers (Roberts et al. 2009). The data also indicate that suicide rates among seafarers in UK merchant shipping were typically lower than those in Asian and Scandinavian merchant fleets. The results of a mortality study among Polish seafarers and deep-sea fishermen have shown that the incidence of suicides among the observed sample during work at sea was significantly higher than suicides among the age-comparable male population of the country

(Szymanska et al. 2006). The risk is greatest for seafarers aged 30–39 years, with a period of service from 10 to 24 years, working as ratings, with known or concealed alcohol addiction and/or family problems or insufficient identification with the group.

Physical Health and Psychological Well-Being of Seafarers

According to a review of papers published in the journal *International Maritime Health* from 2000 to 2010 (MacLachlan et al. 2012), among *physical health problems* in seafarers, most papers focused on cardiovascular disease, heart attack, diabetes, and lifestyle factors which contribute to these diseases.

Although acute cardiovascular diseases are the main cause of death in industrialized countries (both at sea and on land), the results of the study show that, after taking into consideration the healthy worker effect of seafarers, cardiac risk factors are shown to occur slightly more frequently in seafarers than in the general population (Oldenburg et al. 2010b). Results of research on cardiovascular and coronary diseases in seafarers on vessels under the German flag show that, in spite of the seafarers' regular medical surveillance examination, their CHD risk was similar to that of a reference population working ashore (Oldenburg et al. 2007, 2010c).

Since seafarers may be exposed to engine exhaust, various oil products and many carcinogenic chemicals, some studies have focussed on cancer risk. The results of a study which aimed to investigate the possible work-related reasons for the increased incidence of many cancers among seafarers who worked on Finnish ships for any time during the period 1960–80 (Saarni et al. 2002) show that occupational exposure of deck crews on tankers adds to their risk of renal cancer, leukaemia and possibly lymphoma. On the other hand, engine crews have an asbestos-related risk of mesothelioma, and engine-room conditions also seem to increase the risk of lung cancer. The results of research conducted on all Danish seafarers during 1986–1999 who were followed up for cancer until the end of 2002 have shown that Danish seafarers, especially men, face an increased overall cancer risk—in particular, risk of lung cancer and other tobacco-associated cancers (Kaerlev et al. 2005).

Regarding the slightly elevated risk of cardiovascular disease in seafarers, Oldenburg (2014) allocated three potentially influential risk factors: the ship's specific stress situation (originating from specific occupational psychosocial stressors), malnutrition (unbalanced, high-fat diet) and the lack of exercise on board. Data generally show that lifestyle factors explain a large proportion of mortality and disease in seafarers. Comparison of sea captains and marine chief engineers with a group of shore-based employed men (matched with the seafarers for age, ethnic origin and level of education) has shown that certain behavioural risk factors were more dominant among the seafarers than among the control group (Carel et al. 1990). These include smoking level, alcohol consumption and lack of leisure-time

physical activity. Analysis of national data for England and Wales indicates that seafarers are among the groups of occupations with the highest mortality from alcohol-related diseases and injuries (Coggon et al. 2010). The results of a stratified survey of French seafarers (Fort et al. 2009) confirmed that alcohol and nicotine consumption is a major public health issue in seafarers. Approximately 44 % of their sample was current smokers, and more than 11 % drank alcohol every day. A review study (Pougnet et al. 2014) which focused on consumption of addictive substances showed a higher prevalence of tobacco and alcohol consumption in seafarers than the general population. According to this review, which was based on international publications, 63.1 % of seafarers smoked, while 14.5 % were hazardous drinkers (according to the World Health Organization (WHO) definition). Besides smoking and alcohol consumption, one of the factors in lifestyle-related diseases that dominate among seafarers is obesity. Overweight was found, to a statistically significant extent, to be represented more highly in seafarers than a reference group ashore (Hoeyer and Hansen 2005), and this can influence seafarers' health and shipboard safety. Data also show that the best predictor of work ability in seafarers was the interaction between body mass index and age, where the adverse effect of high body mass index was greater in older seafarers (Bridger and Bennett 2011). Study results show that obesity among seafarers is favoured by compulsive eating disorder, night eating disorder and emotional eating disorder, and that eating is most frequently a reaction to stress or boredom (Jeżewska et al. 2009).

The above-mentioned review (MacLachlan et al. 2012) showed that the category *psychological functioning and health* had a relatively small, but increasing, number of papers. Papers relating to stress, fatigue, alertness levels and psychological issues such as depression and general psychological well-being featured most prominently in this category. It can be said that the area of psychological well-being and mental health has been relatively neglected in previous studies in comparison to studies which focused on physical health. For example, in a paper titled 'Mapping the knowledge base for maritime health', psychological aspects of health are also relatively unattended to (Carter 2011). Respecting the definition of health given by the WHO (1948), where health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", scientists and practitioners in the maritime health area need to place greater emphasis on psychological and mental aspects of health, especially regarding the numerous mental and psychosocial stressors that seafarers face.

Therefore, studies that have focused on psychological well-being (e.g. Carotenuto et al. 2013), psychological quality of life (e.g. Juozulynas et al. 2007) and burn-out syndrome (e.g. Oldenburg et al. 2012) are encouraged, especially those which aim to determine the role of working conditions in the well-being of seafarers. For example, Oldenburg et al. (2012) showed that emotional exhaustion in seafarers is associated with a subjective perception of insufficient sleep on board, lack of care provided by their superiors and/or the shipping company, with high responsibility for work organization (for senior members of crew) and with social problems due to the long periods of separation from their families.

Since job satisfaction and intent to leave are considered reliable indicators of work-related well-being, one survey study focused on these variables (Nielsen et al. 2013). The results of this study, conducted on 817 seafarers working on vessels belonging to two large Norwegian shipping companies, show that job satisfaction and intent to leave among seafarers are related to physical and psychosocial factors in the working environment, and especially safety perceptions, job demands and team cohesion. The results of a study on Danish seafarers (Haka et al. 2011) confirmed that the main motivating and demotivating factors are related to psychosocial factors rather than organizational or structural factors. The work motivators which were identified in this study include duration of home leave, level of responsibility and level of challenge, while the main demotivating factors that were identified were being away from home, the shipping company's HRM, and regulatory requirements. However, it would be interesting to conduct similar studies on other national and cultural groups. The results of a pilot study of Croatian seafarers (Penezić et al. 2013) have shown that job satisfaction is a significant positive predictor of their life satisfaction. On the other hand, the results also showed that significant negative correlates of seafarers' life satisfaction include depression, stress and social loneliness, loneliness in love and loneliness in the family.

Individual Differences in Experience of Occupational Stressors, Health and Well-Being Among Seafarers

Regarding the various socio-demographic and working characteristics (age, cultural background and nationality, length of service, level of education, rank and type of job on board, type of employment contract and duration of onboard stay, type and size of vessel, marital status, having children, etc.), the seafaring population cannot be regarded as a whole. The results of an international study of seafarers (Jensen et al. 2006) showed that self-rated health generally declined significantly with age, and it varied by country. Obvious explanations of national differences can be found in the fact that seafarers from South-East Asian countries spent longer periods at sea, and had lower numbers of officers and older seafarers than are found among seafarers from western countries. According with that fact is the result of a study conducted by Borovnik (2011), who warned of particular health risks for seafarers from developing Pacific countries because of their long contracts on board. Oldenburg et al. (2009) noted that non-European crew members on German-flagged ships stay twice as long as Europeans: 9.9 versus 4.9 months, and sometimes exceeding 12 months.

The ageing of the workforce is particularly important within the whole of the transportation industry (Popkin et al. 2008). Regarding seafarers, the results of a study conducted by Rydstedt and Lundh (2012) suggest that rapid technological and organizational development in the shipping industry may be associated with increased mental strain for older engine-room officers. Data from a study of Lithuanian seafarers (Juozulynas et al. 2007) have confirmed age differences in the physical and psychological health-related quality of life (QOL). These results show

that physical QOL is best among the youngest seafarers (20–24 years old), while psychological QOL is best among seafarers aged 20–24 and 25–34 years.

Length of service is also an important variable. Although seafarers' health declines with age (Jensen et al. 2006), the experience which is obtained with years of service could minimize the effects of work-related stressors. The results obtained by Jeżewska et al. (2006) showed that students, during their training period on merchant ships, perceive the job as highly stressful compared to the group of merchant marine officers.

The results of the abovementioned study of Lithuanian seafarers (Juozulynas et al. 2007) also show differences by profession, where health-related QOL is best among commanding group members. The physical dimension of QOL is worst among engineer ship service members, while psychological QOL is worst among ship auxiliary service seafarers. A study done by Carotenuto et al. (2013) also showed differences in some aspects of psychological well-being between seafarers of different categories. The results obtained (higher levels of anxiety and self-control among deck and engine officers than among the crew) supported the view that management responsibilities are related to higher levels of stress. A study on a sample of Danish seafarers has shown differences in the motivational profiles of officers and non-officers (Haka et al. 2011). All these results show the importance of considering the rank and job tasks on board, since they involve coping with different stressors. While non-officers stay on board for considerably longer periods than officers (8.3 months vs. 4.8 months), officers complain more frequently of time pressure and report a far higher number of working hours than non-officers (Oldenburg et al. 2009). The results of the study conducted by Oldenburg et al. (2009) also showed that low qualification of subordinate crew represents a stressor on board for superiors, and that deck and catering staff had higher stress levels due to long working days and time pressure or hectic activities, compared to engine-room personnel.

Furthermore, working conditions, occupational stressors and stress levels depend upon type of ship (cargo vs. passenger ship), type of cargo (e.g. container, tanker, etc.), size of vessel, and port frequency or average time period of voyage (short vs. long voyages) and ship route, although systematic investigation of these factors has as yet scarcely been performed (Oldenburg et al. 2009).

Regarding family situation, Oldenburg et al. (2009) noted that separation from home and family particularly affects younger seafarers with children. Peplińska et al. (2013, 2014) showed that marital satisfaction has a significant mediating role in the association between perceived stress and anxiety reactions, as well as between stress and sense of purpose of life. Marital satisfaction in seafarers thus increases their ability to cope with stressful situations at sea, reducing the likelihood of anxiety reaction, and providing a sense of purpose in life. On the other hand, low levels of marital satisfaction may intensify the poignancy of stress, increase the probability of experiencing fear and anxiety and thus negatively influence a general sense of purpose in life.

Suggestions for Further Studies

Further Research Questions

Considering the lack of systematic comprehensive investigation of the complex and multivariate process of occupational stress in seafaring, the main suggestion is implementation of an ecologically valid and theoretically rich transactional perspective into the research field. Although individual differences and subjective appraisal are seen by occupational stress authors as integral to the entire stress process, a great amount of empirical research is still based on models that focus solely on environmental stressors, neglecting individual differences (Mark and Smith 2008). Within transactional models of occupational stress an important role is given to the variables which may moderate or mediate links between sources of stress and outcomes, i.e. moderator and mediator variables. The moderator variable is a stable variable (such as gender) which affects the direction and/or strength of the relation between an independent variable (e.g. stressor) and a dependent variable (e.g. stress outcome), while the mediator variable (such as personal coping skills) is itself changing under the influence of an independent variable and in turn influences the dependent variable (Baron and Kenny 1986). A great number of individual and organizational characteristics may have a moderator or mediator role in the relationship of stressors and stress outcomes in seafaring. As noted in the previous section, while earlier studies showed the significant role of some of the socio-demographic and work-related characteristics, many important characteristics have not gained as much attention (e.g. type of cargo or ship route).

Regarding individual characteristics, along with socio-demographic and work-related characteristics, further studies in the field therefore should include personality traits, whose moderator or mediator role is shown in the broader area of occupational stress. These include anxiety as a trait, neuroticism, negative affectivity, extraversion, conscientiousness, self-esteem, work locus of control, personal hardiness, and some aspects of type-A behaviour, such as hostility, etc. (Arnold et al. 2005; Grant and Langan-Fox 2006; Hart and Cooper 2001; Kobasa 1979; Ng et al. 2006; O'Driscoll and Cooper 2002; Semmer 2003; Sulsky and Smith 2005). For example, internal locus of control in the work setting is positively related to general well-being, including psychological well-being, physical health, and job satisfaction, and also to intrinsic motivational orientation and proactive behavioural orientation of workers (Ng et al. 2006).

Further research should also incorporate coping with stress, since coping strategy may be more important for outcomes at both individual and organizational levels than frequency and intensity of stressful events (Lazarus and Folkman 1984). Therefore, further studies may investigate the use of different coping strategies (problem-focused vs. emotion-focused strategies) in dealing with different occupational stressors in seafaring. This line of research could differentiate adaptive and maladaptive coping techniques in seafarers and provide practical implications for interventions.

With regard to the important direct and/or moderator role of social support in dealing with occupational stress (Karasek and Theorell 1990; O'Driscoll and Cooper 2002), social support also deserves special attention in further studies of stress in seafarers. Thereby, different sources of social support (support from superiors, work colleagues and family), as well as different types of support (emotional vs. instrumental, actual vs. perceived) should be taken into account. Considering the relationship between social support from the supervisor and strain (Batista-Taran and Reio 2011), a special focus should be given to the identification of supportive and unsupportive behaviours of supervisors which can lead to or decrease occupational stress in seafaring.

Further, many work and organizational characteristics may moderate links between occupational stressors and strain. One of the most important is level of control in the work (Jones and Fletcher 2003; Karasek and Theorell 1990; O'Driscoll and Cooper 2002). However, links between stressors and strain depend on operationalization of control. Parkes (1989) identified three approaches to control in the working context: (1) objective characteristic of the working situation, (2) perceived control over the work, and (3) individual work locus of control. However, considering the importance of work control in both the appraisal of occupational stressors and the experience of stress reactions and long-term consequences, and the different levels of objective control present in crew members on board, it would be valuable to include work-control measurements in further studies. Since leadership behaviour and organizational culture may be related to health behaviours and practices, as well as to health problems and accidents on board (Shea 2005), organizational culture in the maritime sector should also be examined further.

Studies in the field have shown contextual and cultural implications for seafarers' health (Jensen et al. 2006; MacLachlan et al. 2012). Considering wage discrimination by nationality (McLaughlin 2012), which has implications for work motivation and mental health (MacLachlan et al. 2013), further research in the field may also include the concept of organizational justice (Greenberg 1987). Organizational justice refers to how an employee judges the behaviour of the organization and the employee's resulting attitude and behaviour. Moreover, regarding the fact that values in the workplace are influenced by culture (Hofstede 1980), some of the cultural dimensions, such as power-distance index, uncertainty avoidance, and individualism versus collectivism, appear to have relevance for the field (MacLachlan et al. 2013).

Finally, more research focusing on the families of seafarers is recommended. In spite of the fact that separation from partner and family is still one of the most important stressors for seafarers, a relatively small number of studies have focused on the effects of separation on seafarers' spouses and families (e.g. Parkes et al. 2005; Ulven et al. 2007), which is especially important in cases of longer contract duration (Thomas et al. 2003).

Methodological Considerations

Although a great number of individual and organizational variables are recommended for inclusion, design of further studies requires serious theoretical and methodological considerations. First of all, it is important to find a good balance between simplicity of models based only on objective working conditions, and complexity of models based on a transactional view of stress as a process, as it includes a great number of variables and stages, which may be hard to support empirically (Mark and Smith 2008).

Further research in this area should also seriously consider basic limitations relating to the studies of occupational stress (Sulsky and Smith 2005). In the first place, strain measures, regardless of whether they are subjective in their nature (self-reports) or objective (physiological, biochemical and behavioural), should have acceptable reliability and validity. One of the controversial issues in this area is the choice between subjective and objective strain measures. Since many studies are based on self-report conducted on land, some authors strongly recommend objective measurements, such as monitoring basic physiological parameters, to be conducted on board (Leszczynska et al. 2007; Oldenburg et al. 2013b). However, most of the maritime field studies have focused on working hours, watch systems and fatigue as univariate parameters (Oldenburg et al. 2013b). In spite of the fact that only by experimentally designed studies may causal relations between stressor and strain be tested, this approach neglects multivariate stressors present on board and numerous individual and organizational characteristics which may affect links between stressor and strain.

Taking a transactional approach, the recommendation is to use a mixture of multiple objective and subjective measures, along with careful control of the numerous confounding variables which may affect not only subjective, but also so-called objective, strain measurements. With this mixed approach, the *common method variance* characteristic of self-report studies (inflated relationships between sources and outcomes of stress) will be reduced. Studies that rely on self-report should also control negative affectivity, since some authors find that it can be a methodological nuisance in the relations between stressors and strains. Since occupational stress is a dynamic, multifaceted process, measurement of stressors and strains at one single time point do not have the capacity to capture this process. Therefore, longitudinal research is needed to examine dynamic changes in the occupational stress of seafarers over time. Such an approach, although time-consuming, would give new insight into some critical aspects of the occupation, including choice of the occupation, adaptation period, and reasons for leaving the occupation. Finally, in broadening the research field by focussing on some less-explored issues (e.g. coping with stress in seafarers, seafarers' families, cultural and contextual considerations in motivational profiles of seafarers, etc.) a qualitative approach (e.g. interviews, focus groups) is also necessary.

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