

Merchant seafaring: a changing and hazardous occupation

Marcus Oldenburg, Hans-Joachim Jensen

Department of Maritime Medicine, Hamburg Port Health Centre, Institute for Occupational and Maritime Medicine (ZfAM), University of Hamburg, Hamburg State Department for Health and Consumer Protection, Germany

Correspondence to

Dr Marcus Oldenburg, Department of Maritime Medicine, Hamburg Port Health Centre, Institute for Occupational and Maritime Medicine (ZfAM), Hamburg State Department for Health and Consumer Protection University of Hamburg, Germany, Seewartenstrasse 10 D-20459 Hamburg, Germany; marcus.oldenburg@bgv.hamburg.de

Accepted 8 May 2012
Published Online First
19 June 2012

Currently, the world's merchant fleet encompasses more than 50 000 vessels.¹ Approximately 90% of the goods traded worldwide are transported by sea; international transport is the basis for the global division of labour. The goods are transported on container ships, bulk carriers and oil tankers, chemical tankers, reefer ships, general cargo ships and other specialised ships (eg, vessels for the transport of cars, livestock carriers and off-shore supply vessels). This manuscript focuses mainly on merchant seafaring, particularly on the situation on board container ships, the most important ship type in the merchant maritime industry. In recent years, seafaring has undergone economic and technological change.² This change has been characterised by:

- ▶ The introduction and current dominance of container vessels and their integration into worldwide transport chains.
- ▶ The quick turnaround time of vessels with short stays in port due to high costs. Furthermore, the loading/unloading process in ports has been distinctly improved. Thus, the duration of stays in port has been shortened in the past 30 years (from 2 or 3 days to currently 1 day at the maximum).
- ▶ An increase in the gross tonnage of container ships with more than 15 000 standard container units (twenty-foot equivalent units, TEUs).
- ▶ The selection and preference of ports with increasing depths due to the ever-growing vessel sizes. These ports are normally far away from the cities and crew members are hardly able to go ashore during the short stays in port. Since 2004, the initially free access to the port area has been restricted to authorised persons. This restriction is regulated by the *International Ship and Port Facility Security Code*. As a consequence, leaving their ship during its stay in port and passing security controls is currently a complicated procedure for the ship's crew.³
- ▶ The increasing automation of the ship's operation and the associated reduction in crew manning. In container ships operating worldwide, crew manning has decreased from 30 to 24 seafarers. Container ships can be sailed by a crew of about 14, but due to many maintenance tasks, the crew is larger than the majority of maritime authorities actually demand.
- ▶ Multinational crews often consisting of seafarers from East Asian, eastern European and southern European cultural environments. Nearly 460 000 persons (33.5% of all seafarers worldwide) come from the Far East,⁴ especially from the Philippines. The stay on board varies between

What this paper adds

- ▶ Today, a seafarer's career is characterised by increasing stress, particularly psychosocial stress.
- ▶ The knowledge gained from scientific studies carried out so far is insufficient with regard to the severity of psychosocial strain and possibilities of its prevention. Therefore, comprehensive investigations of the stress and strain on board need to be carried out in the form of maritime field studies.

the cultural groups; while, in most cases, European seafarers have contract durations from 4 to 5 months, the Asian seafarers often stay on board for 9–12 months or even longer.⁵ However, in some countries, the length of employment periods is reduced to 12 or 13 weeks or even less. In regional trade and in the offshore oil industry, shorter periods of employment are normal. Thus, due to the different relief/replacement intervals, seafarers today often experience very different styles of leadership.²

- ▶ A reduction in physical demands associated with extremely hard physical work; high physical demands only arise in exceptional situations such as emergencies or disasters.
- ▶ Increasing violence due to piracy and kidnapping in recent years.

TASKS OF THE JOBS

A ship's crew in its hierarchic structure consists of the captain who is responsible for the ship, the first nautical officer who is deputy to the captain and the chief engineer. Subordinates are the second and third nautical officers and the second and third technical officers as well as the ratings from the deck and engine room. The crew's range of responsibilities comprises the command of the ship including navigation and watchkeeping at sea, cargo handling in ports as well as the care and securing of cargo on board, the inspection and maintenance of the technical systems, and the responsibility for and the activities connected with ship security and the protection of the marine environment.²

The workplace on board a ship is unique and not comparable with working conditions ashore. Nowadays, more than 1.3 million seafarers are employed in merchant seafaring.⁴

HAZARDS OF THE JOB AND THE WORKPLACE**Watch systems**

Watch systems do not correspond with the human circadian rhythm of day and night, so that regular watchkeeping during the usual sleeping time can elicit fatigue and concentration impairment and consequently pose a risk to the ship's safety.⁶ There are two different watch systems in merchant seafaring: in coastal trade, the two-watch system with two watchkeeping officers is common. This means that 6 h of watchkeeping alternates with 6 h of free time. In intermediate and long distance trade, the three-watch system with three watch officers is usually applied. These officers have a recurrent rhythm of 4 h of watchkeeping and 8 h of free time. In general, the manning requirements are set by the flag state, subject to the International Convention on Standards of Training, Certification and Watchkeeping for seafarers. Usually, the size of the ship is the most important factor for determining the crew size.

Fatigue-related accidents occur more often in two-watch than in three-watch systems. In a sample of 185 bridge officers, the officers working the two-watch system reported shorter sleep durations and more frequent nodding-off on duty compared with the officers of the three-watch system (7.3% vs 1.5%).⁷

Fatigue

The occurrence of fatigue in seafaring has only been reported in recent years, and the effects of fatigue have not yet been sufficiently investigated. Vessels' short stays in port and the large number of ports visited in quick succession have exacerbated the problem of fatigue over the past few years. A number of factors such as irritation of the physiological circadian rhythm (eg, through watchkeeping), high job demands, long working hours, time pressure, the lack of rest periods and relaxation, poor sleep quality and negative environmental conditions are known to cause fatigue.⁶ In the multi-factor evaluation of fatigue, combination effects, for example, the effects of noise and the ship's movement, must therefore also be taken into consideration. According to Allen *et al*,⁸ fatigue depends largely on the shipping route and the flag state of a vessel, the crew's nationality, as well as physical influences (eg, the ship's movement or noise on board).

Fatigue is assumed to be a frequent cause of ship accidents, which often occur between 00:00 and 04:00.⁹ The International Maritime Organization assumed that 80% of accidents on board cargo ships are caused by human factors.¹⁰

Separation from the family and loss of contact with the home country

In the majority of studies in the past 3 decades concerning shipping, separation from the family is mentioned as a critical burdening factor.¹¹ Today, social contacts are limited and difficult to establish due to the continuous reduction in crew sizes during the past decades and the composition of multicultural crews. A current study has revealed that 70.2% of non-European and only 54.0% of European seafarers experienced separation from the family due to long working periods on board as very straining.¹² Many seafarers fear that these periods of separation from their families will lead to a progressive loss of contact and to social isolation from the home country's society.^{13 14} The installation of shipboard telecommunication systems would be a measure to improve the possibilities for seafarers to contact their families and friends at home.

During their occupation on board, seafarers do not have the opportunity to practise different roles such as those of an employee or a family member. Thus, a critical psychogenic

protective factor is missing. Seafarers find this separation very stressful, particularly when they are unable to have a direct influence on the situation if problems arise within the family and they only experience their children's development to a very small extent.

Physical demands

The crew on ships are permanently exposed to environmental factors, for example, temperature, humidity, noise levels and vibration. Ship motion is also considered an important environmental factor. Ship movements can affect a person's ability to maintain physical balance, especially during harsh sea conditions.

Occupational accidents

Seafaring is known as a high-risk industry. The fatal incidence rate for the Danish merchant fleet was 11 times higher than for the shore-based industries.¹⁵ Severe environmental conditions on board, hazardous activities and lack of occupational safety on board increase the incidence of shipboard injuries. An international study including 11 countries revealed an incidence RR (IRR) of 37.6 per 100 000 days for cargo ships and tankers.¹⁶ The IRR for non-officers compared with officers was 1.57 (95% CI 1.14 to 2.15), and for seafarers <35 years compared with ≥35 years of age, the IRR was 2.11 (95% CI 1.57 to 2.86).

Rough weather, insufficient awareness of safety, lack of use of personal protective devices as well as inexperience are regarded as the main causes of fatal injuries related to work.

Increased workload and time pressure

Officers are significantly more often under extreme work stress through time pressure, a hectic pace and pressure related to decision-making.¹¹ Concerning the mean number of working hours per week on cargo ships, a recent questionnaire demonstrates no differences between the ranks (68 h for non-officers and 69 h for officers).¹⁷ According to Allen *et al*,⁸ incorrect statements regarding working hours and high work pressure in some studies lead to an underestimation of the work stress.

Extreme strain and crisis intervention

In comparison with the daily psychic strain from work as a seafarer, experiencing serious accidents with considerable injuries, deaths and suicides on board, vain efforts to rescue crew members, distress at sea, shipwreck, and pirate attacks (usually involving hostages) are extremely stressful situations, which have increased significantly in recent years.^{2 18} For example, according to the report by the International Bureau's Piracy Reporting Centre (2010), the threat of piracy at sea reached the peak level in 2009 with 406 incidents (113 more than in 2006). Due to a lack of research on this subject, no reliable conclusions can be drawn to date regarding the number of potentially traumatised seafarers after exposure to extreme stress, or concerning suitable networks providing psychosocial support and carrying out crisis intervention. Nevertheless, recommendations can be made on the basis of general experience.¹⁸

Multiethnic ships' crews

Approximately 65% of the world's merchant fleet is manned with multinational crews.¹⁹ Adapting to the unfamiliar work and social system on a ship can lead to a great deal of acculturative stress in new crew members from other cultural environments. Nowadays, a multicultural and often multilingual crew, coupled with a distinctly hierarchic structure, often leads to a contact and communication barrier and thus to a sense of

isolation.²⁰ Very diverse ethnic groups on board can pose an increased potential for conflict due to different socialisation and value orientation.

PREVENTIVE MEASURES TO PROTECT THE HEALTH OF SEAFARERS

Up to now, the pressure and stress that seafarers experience on board have not been investigated sufficiently. In particular, there is a lack of current scientific field studies of the work and life situation of ships' crews. All above mentioned hazards in merchant seafaring often exist in coincidence and can interact. For example, the multiethnic ship crew may aggravate the seafarers' sense of isolation and can increase the psychosocial problems associated with the long separation from the family. Furthermore, participation in a watch system or the environmental factors on board can elicit fatigue. Therefore, it is important to examine the combined effects of the shipboard stressors.

When developing suggestions for preventive measures, the ocean vessel must be regarded as a sociotechnical system. The interaction between humans and technology takes place according to specified organisational requirements such as watch systems and work regulations. Thus, the ship encompasses the system components humans, technology and organisation as well as interdependencies between these components.²

Some preventive measures to reduce the stress and strain in shipping include:

- ▶ with regard to humans/crew members
 - Preparation of the seafarers for the job-specific stressors connected with ship operations is required. When assessing suitable coping strategies, culture-bound differences in coping with stress must be taken into consideration. Seafarers should learn how to relax for brief periods and, in particular, how to cope better with extreme strain caused by shipwreck, serious accidents involving persons on board or pirate attacks with hostages.
 - A multicultural crew also requires intercultural leadership. This means leadership behaviour that takes into account cultural differences in communication, in the socioeconomic status and with regard to the understanding of authority and leadership. It requires superiors to reflect on their own cultural standards, values, behavioural habits and ambiguity tolerance: they must have empathy and the ability to shift their perspective.
- ▶ with regard to organisation
 - Measures must be established for crisis intervention following extremely straining events such as shipwreck and serious accidents or piracy.
 - A multicultural staff orientation within the scope of diversity management means having an understanding of the crew member's socioeconomic situation and cultural conditioning. It often requires social support.
 - As fatigue is a considerable burdening factor in maritime shipping, the question arises whether the watch system should be reviewed and perhaps changed to give the crew member a longer continued period of sleep. Here, in addition to considering chronobiological aspects, the watch system should be organised according to the requirements of the three operating situations: sea voyage, canal/river navigation and port stays. For example, the possibility of simplifying administrative work on board during stays in port or transferring such duties to the land organisation should be checked.

- ▶ with regard to engine/technology (this concerns shipbuilding measures and technical/spatial features)
 - The private and inexpensive use by the crew members of information technology and telecommunication on board greatly facilitates communication with the family and home country and can thus considerably reduce stress caused by separation. It requires the installation of satellite-based information technology and communication systems on board, taking into consideration the already available application programs and means of communication between ship and shore.
 - In view of the comparatively long working time on board and the job-related stress, crew members should have the opportunity for relaxation and privacy in suitable surroundings. This requires that accommodation and recreation areas are designed and located to meet the needs, particularly with regard to reducing vibration and noise.

Today, a seafarer's career is characterised by increasing stress, particularly psychosocial stress. As the knowledge gained from scientific studies carried out so far is insufficient with regard to the severity of this stress and possibilities of its prevention, comprehensive investigations of the stress and strain on board need to be carried out in the form of maritime field studies, despite the considerable personnel and logistical expenditure involved.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. **Corbett JJ**, Winebrake J. *The Impacts of Globalisation on International Maritime Transport Activity. Past Trends and Future Perspectives, Energy and Environmental Research Associates, the United States*. 2008. <http://www.oecd.org/dataoecd/10/61/41380820.pdf> (accessed 15 Jan 2012).
2. **Jensen HJ**, Hansen DP. Psychologie der Schifffahrt. In: Krüger HP, ed. *Enzyklopädie der Psychologie, Themenbereich D, Praxisgebiete Serie VI, Band 2 Anwendungsfelder der Verkehrspsychologie*. Göttingen, Germany: Hogrefe, 2009:779–812.
3. **Oldenburg M**. Schifffahrtsmedizin. In: Letzel S, Nowack D, eds. *Handbuch für Arbeitsmedizin*. Landsberg, Germany: ecomed MEDIZIN, 2010.
4. **BIMCO (The Baltic and International Maritime Council)**. *The Worldwide Demand for and Supply of Seafarers. Manpower 2010 Update*. 2010. <http://www.marisec.org/Manpower%20Study.pdf> (accessed 15 Jan 2012).
5. **Oldenburg M**, Baur X, Schlaich C. Occupational risks and challenges of seafaring. *J Occup Health* 2010;**52**:249–56.
6. **Smith A**, Allen P, Wadsworth E. *Seafarer Fatigue: The Cardiff Research Program*. Cardiff: Centre for Occupational and Health Psychology, Cardiff University, 2006.
7. **Haerma M**, Partinen M, Repo R, et al. Effects of 6/6 and 4/8 watch systems on sleepiness among bridge officers. *Chronobiol Int* 2008;**25**:413–23.
8. **Allen P**, Wadsworth E, Smith A. Seafarers' Fatigue. A review of the recent literature. *Internat Marit Health* 2008;**59**:1–4.
9. **Houtman I**, Miedema M, Jettinghoff K, et al. *Fatigue in the Shipping Industry*. TNO-report 20834/11353. <http://www.he-alert.org/documents/published/he00605.pdf> (accessed 15 Jan 2012).
10. **International Maritime Organization (IMO)**. *IMO'S 50th Anniversary - a record of success*. 2002. http://www.martel.pro/Researchers/Downloads/Measuring_students_competence_and_performance.pdf (accessed 15 Jan 2012).
11. **Jezewska M**, Leszczynska IM, Jaremin B. Work-related stress at sea. Self-estimation by maritime students and officers. *Internat Marit Health* 2006;**57**:66–75.
12. **Oldenburg M**, Jensen HJ, Latza U, et al. Seafaring stressors aboard merchant and passenger ships. *Int J Public Health* 2009;**54**:96–105.
13. **Knudsen F**. *If you Are A Good Leader, I Am A Good Follower*. Research Unit of Maritime Medicine. 2004. ISBN 87-90866-09-6.
14. **Beregova A**. *Respect on Board. Research Project German Seamen's Mission*. Hamburg, 2010.
15. **Hansen HL**. Surveillance of deaths on board Danish merchant ships, 1986–93: implications for prevention. *Occup Environ Med* 1996;**53**:269–75.
16. **Jensen OC**, Sørensen JF, Canals ML, et al. Incidence of self-reported occupational injuries in seafaring - an international study. *Occup Med (Lond)* 2004;**54**:548–55.
17. **Jensen OC**, Sørensen JF, Thomas M, et al. Working conditions in international seafaring. *Occup Med (Lond)* 2006;**56**:393–7.

World at work

18. **Hansen DP**, Jensen HJ. Crisis intervention. In Schreiner A, ed. *International Textbook of Maritime Medicine. Chapter 17*. Bergen: Norwegian Centre for Maritime Medicine, 2010.
19. **Lane AD**, Obando-Rojas B, Wu B, et al. *Crewing the International Merchant Fleet*. Redhill, UK: Lloyd's Register—Fairplay Ltd, 2002.
20. **Jensen HJ**. Extremsituationen in der Seeschifffahrt—Belastungsreaktionen und Präventionsmöglichkeiten bei einer multikulturellen Besatzung. In: Trummer M, Helm M, eds. *Implementierung und Weiterentwicklung der psychosozialen Notfallversorgung*. Frankfurt am Main, Germany: Verlag für Polizeiwissenschaften, 2008:101–16.



Merchant seafaring: a changing and hazardous occupation

Marcus Oldenburg and Hans-Joachim Jensen

Occup Environ Med 2012 69: 685-688 originally published online June 19, 2012

doi: 10.1136/oemed-2011-100619

Updated information and services can be found at:
<http://oem.bmj.com/content/69/9/685>

These include:

References

This article cites 8 articles, 3 of which you can access for free at:
<http://oem.bmj.com/content/69/9/685#BIBL>

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections

Articles on similar topics can be found in the following collections

[OEM World at work](#) (16)

Notes

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>