2023, Vol. 74, No. 3

ISSN 1641-9251
eISSN 2081-3252

International Maritime Health, 2023, Vol. 74, No. 3

# INTERNATIONAL MARITIME HEALTH

IMH GDYNIA

INTERNATIONAL MARITIME HEALTH FOUNDATION

IMPACT FACTOR 2.2 2022

Official scientific forum of the:

International
Maritime
Health
Foundation

Indexed/abstracted in: CrossRef, DOAJ, EBSCO, ESCI, FMJ, Google Scholar, Index Copernicus, Medical Journals Links, Medline, Polish Ministry of Education and Science, Polish Medical Bibliography, Scopus, SJR, Ulrich's Periodicals Directory, WorldCat

VIA MEDICA

www.intmarhealth.pl

## INTERNATIONAL MARITIME HEALTH

**Former:** Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia, issued since 1949
**Owner:** International Maritime Health Foundation
The international multidisciplinary journal devoted to research and practice in the field of: maritime medicine, travel and tropical medicine, hyperbaric and underwater medicine, sea-rescue, port hygienic and sanitary problems, maritime psychology.

Supported scientifically or financially by:

Polish Society of Maritime, Tropical and Travel Medicine, Gdynia, Poland

HELSE BERGEN, Haukeland University Hospital, Bergen, Norway

Norwegian Centre for Maritime and Diving Medicine, Bergen, Norway

Norwegian Association of Maritime Medicine, Bergen, Norway

International Transport Federation Seafarers' Trust

The 'Magazine' section of this journal is supported by the Seafarers' Charity (www.theseafarerscharity.org).

See our website for information on sending manuscript, aims, scope, instructions for authors (reviewers), editorial board members, guidelines for scientific demands etc.: https://journals.viamedica.pl/international_maritime_health; www.intmarhealth.pl; www.imhf.pl

**Publisher of the International Maritime Health**
Publishing, Subscription and Advertising Office: VM Media Group sp. z o.o., Grupa Via Medica
ul. Świętokrzyska 73, 80–280 Gdańsk, Poland, tel. (+48 58) 320 94 94, fax (+48 58) 320 94 60
e-mail: imh.journals@viamedica.pl, www.viamedica.pl

22-6122.003.001

Subscription rates: Paper subscription, 4 issues incl. package and postage institutional — 210 euro.
The above prices are inclusive of regular postage costs. Payment should be made to: VM Media Group sp. z o.o., Grupa Via Medica, BNP Paribas Bank Polska SA account number: 15 1600 1303 0004 1007 1035 9021; SWIFT: PPABPLPK. Single issues, subsriptions orders and requests for sample copies should be send to e-mail: prenumerata@viamedica.pl. Electronic orders option available at: https://journals.viamedica.pl/international_maritime_health

Advertising: for details on media opportunities within this journal please contact the advertising sales: VM Media Group sp. z o.o., Grupa Via Medica, ul. Świętokrzyska 73, 80–280 Gdańsk, Poland, tel. (+48 58) 320 94 94, fax (+48 58) 320 94 60, e-mail: viamedica@viamedica.pl
The Editors accept no responsibility for the advertisement contents.

"International Maritime Health" is edited by: International Maritime Health Foundation (IMHF) and Polish Society of Maritime, Tropical and Travel Medicine in Gdynia (PSMTTM).
Address: 9B Powstania Styczniowego street, 81–519 Gdynia, Poland
Secretary: Leszek Mayer MD, e-mail: leszekm@gumed.edu.pl





"International Maritime Health" is indexed at: CrossRef, DOAJ (Directory of Open Access Journals), EBSCO, ESCI (Emerging Sources Citation Index), FMJ, Google Scholar, Index Copernicus, Medical Journals Links, Medline, Polish Ministry of Education and Science, Polish Medical Bibliography, Scopus, SJR, Ulrich's Periodicals Directory, WorldCat. Position in Index Copernicus ranking system is available at: www.indexcopernicus.com.
**Current Impact Factor of "International Maritime Health" (2022) is 2.2.**




Printed in the Republic of Poland
ISSN: 1641-9251
eISSN 2081-3252

INTERNATIONAL MARITIME HEALTH

## EDITORIAL ADVISORY BOARD:

# CONTENTS

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 3: 143–152
10.5603/imh.96652
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Health risk classification patterns among Filipino seafarers. Analysis from a pre-employment clinic in the Philippines: a 5-year review

**Margarita S. Huerte[1], Christian Lubaton[1], Michael Tongson[1], Monique Mendoza[1], Raniv Rojo[1, 2], Eric David B. Ornos[1, 3]**

[1]Nordic Medical Clinic, Manila, Philippines
[2]College of Medicine, University of the Philippines Manila, Manila, Philippines
[3]College of Public Health, University of the Philippines Manila, Manila, Philippines

## ABSTRACT

***Background:*** *Seafaring is a demanding profession that exposes individuals to unique health risks and challenges. This study investigates risk classification patterns among seafarers who underwent physical and medical examination at the Nordic Medical Clinic, a pre-employment clinic in the Philippines.*

***Materials and methods:*** *The analysis involved data obtained from medical records, including demographic information, diagnoses, medical risk classification, corresponding management, and occupational details. medical risk classification, based on guidelines from the Philippine Department of Labour and Employment, categorised fit to work seafarers into risk class A, B, or C. Descriptive statistics and statistical tests, with a significance level set at $p < 0.05$, were utilised for data analysis using R Studio (version 4.2.3).*

***Results:*** *The study population consisted of 11,831 seafarers seen at the Nordic Medical Clinic between 2018 and 2022. The results revealed a significant proportion of seafarers falling into higher risk classifications, with risk class C being the most prevalent at 48.16%. Pre-employment medical examinations (PEME) to fit to work duration demonstrated a significant association with risk classification, revealing that lower-risk classes had shorter fit-to-work times compared to higher-risk classes. Moreover, risk classification exhibited uneven distribution across specific demographic and occupational characteristics, with older seafarers, males, married individuals, and those in higher-ranking positions having a higher proportion of risk class C.*

***Conclusions:*** *Our findings highlight the need for comprehensive and customised pre-boarding medical screening standards for seafarers based on factors such as their specific role, vessel type, voyage, contract length, and work location. Moreover, health implementation of health promotion and preventive strategies that are based on the specific occupational and demographic needs of the seafarers are needed.*

*(Int Marit Health 2023; 74, 3: 143–152)*

**Keywords: Nordic Medical Clinic, occupational health, pre-employment medical examinations (PEME) to fit to work, risk classification, seafarers**

## INTRODUCTION

Seafaring is a demanding profession that exposes individuals to unique health risks and challenges due to the nature of their work and living conditions onboard vessels [1, 2]. Seafarers may encounter uncomfortable living conditions, including exposure to noise and vibrations while onboard ships. Extreme weather conditions, ultraviolet radiation, motion sickness, exposure to infectious diseases are common

Dr. Margarita S. Huerte, Nordic Medical Clinic, Manila, Philippines, e-mail: Margarita.Huerte@nordicmedical.no; Dr. Eric David B. Ornos, College of Public Health, University of the Philippines Manila, Manila, Philippines, e-mail: ebornos@up.edu.ph

Received: 25.07.2023 Accepted: 28.08.2023

issues experienced by seafarers. Furthermore, the lack of exercise opportunities, inadequate nutrition available on ships and poor sleep due to shifting schedules, can contribute to compromised health [3–5]. Seafarers work in shifts according to schedule when ships are sailing, in anchorage or berth. If personnel for the next shift cannot take over the work, seafarers on watchkeeping are required to continue to work [6]. Additionally, the demanding nature of their work for extended periods may result in psychological distress [7]. Work at sea is classified as one of ten most dangerous jobs in the world [8]. When faced with disease or injury, seafarers have poor access to healthcare due to the location of their vessels and unavailability of adequate medical facilities and certified medical personnel onboard non-passenger ships. Only ships with more than 100 people on board travelling for more than 3 days are required to have a qualified medical doctor on board [9]. When there is no doctor on board, at least one seafarer is in charge of medical care as part of their duties [9].

Consequently, it is important to evaluate seafarers' fitness for sea duty before they embark on their duties and board the ship. According to the International Labour Organization (ILO) Seafarer Service Regulations Article 832, the seafarer's employer is required to establish a health and safety prevention system which must include risk assessment of occupational health and safety of the seafarer, which includes training and instruction to seafarers [6].

The implementation of regular pre-employment medical examinations (PEME) plays an important role in identifying and addressing potential health issues for seafarers. Recognizing the significance of such examinations, the ILO has issued guidelines to provide medical practitioners with a framework for conducting thorough PEME [10].

The guidelines set by the ILO and the International Maritime Organization (IMO) published in 2013 on the medical examination of seafarers is a detailed set of standards that has been used under the provisions of the Maritime Labour Convention in 2006 and the Regulation I/9 and Section A-I/9 of the STCW code [10]. The assessment of fitness for service at sea are classified as:

— fit for sea service; or
— unfit for sea service; or
— fit with restrictions/limitations (e.g. no look-out duties).

The Norwegian Maritime Authority has established a similar assessment guidelines called Guidance to the Regulations of Medical Examinations of Employees on Norwegian Ships and Offshore Units [11]. The assessment or "decision" classifies the issuance of:

— medical certificate without limitations;
— medical certificate with limitations (position, trade area or duration of validity);
— permanent unfitness;
— provisional unfitness;
— temporary unfitness;
— postponed execution.

These standards are consistent in their goal to arrive at the same outcome:

— assuring deployed seafarers are functional at work when at sea;
— assuring deployed seafarers with medical conditions do not affect their work and the work of people around them when at sea;
— prevention of medical emergencies especially the cases that cannot be handled while onboard ships.

Similarly, the Department of Labour and Employment (DOLE) in the Philippines has also taken proactive measures by issuing guidelines on occupational safety and health standards [12]. Within these guidelines, the DOLE outlines a risk classification system designed to assist medical examiners in assessing the health risks of workers. The risk classification system comprises four distinct classifications: risk class A denotes individuals who are deemed fit to work without medical intervention, risk class B indicates those requiring short-term medical intervention, risk class C includes individuals with manageable chronic diseases or in need of long-term medical intervention, and risk class D comprises individuals who are unfit to work. These classifications provide a structured framework for medical professionals to assess and categorize the health risks posed by seafarers, ensuring appropriate placement and support for each individual.

Issuance of fitness for sea duty prior exposure to a spectrum of different working conditions is crucial when access to healthcare is poor and should be performed by physicians with training and familiarisation with maritime medicine. Among a large number of scientific papers on maritime medicine, focus is health and safety on board ships, both on physical and mental aspects of life at sea. Working conditions vary in every country and does not reflect the general working condition [13]. The health condition of the seafarer after each contract, during shore leave, and before embarkation should be collected as well [14]. Knowledge of the health of the seafarer does not only encompass the physical and mental, it also entails the work and life environment, as well as the socio-economic factors that contribute to the over-all health of the seafarer. This is the holistic health care approach in management of the Filipino seafarer.

Understanding the distribution of risk classifications among seafarers can help in identifying health issues and implementing appropriate preventive measures and interventions. This research presents an exploration of the health risk classification patterns observed in seafarers who underwent physical and medical examinations at the Nordic Medical Clinic from 2018–2022. The distribution of risk classifications is examined in relation to demographic and occupational characteristics. Furthermore, we conduct-

ed an analysis to investigate the relationship between risk classification and PEME to fit-to-work durations.

## MATERIALS AND METHODS

### STUDY DESIGN AND POPULATION

This research employed retrospective observational study design and applied total population sampling. The medical records of seafarers who underwent physical and medical examinations at the Nordic Medical Clinic between the years 2018 and 2022 were reviewed. Seafarers who are deemed fit to work and have complete clinical and demographic data was included in the analysis.

### DATA OBTAINED

Demographic information, including birthdate, age, sex, and civil status was obtained from the records. The seafarers' diagnoses (based on ICD-10 coding), medical risk classification, and corresponding management provided was collected. The date and time of the medical examination and the determination of fit-to-work status were recorded. Additionally, information on the seafarers' positions and the types of vessels they were assigned to was obtained.

### RISK CLASSIFICATION

Risk classification of seafarers were based on the guidelines provided by the Department of Labour and Employment, Philippines. The study included risk classes with fit to work status namely class A, class B and class C. Risk class A included seafarers without any medical issues who could be immediately deemed fit to work. Risk class B consisted of seafarers with medical issues that could be resolved through short-term medical management. Risk class C encompassed seafarers with chronic diseases who could be deemed fit to work once their conditions were controlled, as well as seafarers requiring specialist care to be rendered fit to work.

### DATA ANALYSIS

Descriptive statistics were employed to describe the distribution of health patterns among the seafarers. Means were calculated for continuous data, while proportions and percentages were used for discrete data. Mann-Whitney U test and Kruskal-Wallis test were employed to test differences between groups. The significance level was set at $p < 0.05$. The statistical analysis was conducted using R Studio (version 4.2.3).

## RESULTS

### DEMOGRAPHIC AND OCCUPATIONAL PROFILE OF SEAFARERS UNDERGOING PEME

A total of 11,831 seafarers who underwent physical medical examination (PEME) at the Nordic Medical Clinic between 2018 and 2022 were included in this study (Table 1). The age distribution of the seafarers revealed

**Table 1.** Demographic characteristics of Nordic Medical Clinic seafarers who underwent physical examination and medical examination from 2018–2022

| Characteristic | Frequency | Percentage |
|---|---|---|
| Total | 11831 | |
| Age group: | | |
| < 30 | 2129 | 18.00% |
| 30–39 | 3115 | 26.33% |
| 40–49 | 3858 | 32.61% |
| > 50 | 2729 | 23.07% |
| Sex: | | |
| Female | 645 | 5.45% |
| Male | 11186 | 94.55% |
| Civil status: | | |
| Married | 8504 | 71.88% |
| Single | 3327 | 28.12% |
| Department/position: | | |
| Deck department | 5395 | 45.60% |
| Engine department | 2918 | 24.66% |
| Master mariner | 226 | 1.91% |
| Medic/admin | 101 | 0.85% |
| Steward's department | 3191 | 26.97% |
| Risk classification: | | |
| Class A | 476 | 4.02% |
| Class B | 5657 | 47.82% |
| Class C | 5698 | 48.16% |
| Vessel type: | | |
| Accommodation vessel/platform | 157 | 1.33% |
| Bulk | 986 | 8.33% |
| Cable layer | 83 | 0.70% |
| Cargo | 165 | 1.39% |
| Chemical/oil tanker | 2330 | 19.69% |
| Container | 421 | 3.56% |
| Crane ship | 27 | 0.23% |
| Crew boat | 47 | 0.40% |
| Drilling vessel | 40 | 0.34% |
| Gas | 1311 | 11.08% |
| No vessels assigned | 88 | 0.74% |
| Passenger vessel | 1987 | 16.79% |
| Pipe layer | 312 | 2.64% |
| Research/survey vessel | 753 | 6.36% |
| Standby safety vessel | 26 | 0.22% |
| Supply/support vessel | 2723 | 23.02% |
| Vehicles carrier | 318 | 2.69% |
| Well stimulation vessel | 57 | 0.48% |

that the majority fell within the 30–39 and 40–49 age groups. Out of the total, approximately 11,186 were male seafarers, outnumbering female seafarers by a ratio of more than 17 to 1. The majority of seafarers were married, with a smaller proportion being single. All of the seafarers included in this study are employed under the same maritime manning agency.

In terms of occupational assignments, the deck department accounted for the highest number of seafarers, while the medic and administrative office had the fewest participants. When considering the type of vessels, the majority of seafarers worked on tankers (including gas, chemical, or oil tankers), followed by passenger vessels and offshore supply and support vessels.

Upon classifying the seafarers based on risk, it was observed that medical risk class C (48.16%) comprised the largest group of seafarers who underwent the PEME at the Nordic Medical Clinic. Risk class B (47.82%) closely followed in terms of the number of seafarers, while only a small number of seafarers were classified as risk class A (4.02%).

## FIT TO WORK AND DEMOGRAPHIC CHARACTERISTICS OF SEAFARERS

Mean fit-to-work days were assessed in relation to seafarer demographics. Notably, risk class A exhibited the shortest time, whereas risk class C demonstrated the longest duration. Younger age groups exhibited faster fit-to-work times compared to older age groups. Additionally, female seafarers displayed slightly faster fit-to-work times compared to their male counterparts. Furthermore, single individuals exhibited slightly quicker fit-to-work times compared to married individuals (Table 2).

Linear regression analysis was conducted to investigate the relationship between fit-to-work time and various demographic characteristics, aiming to identify predictors of fit-to-work duration (Table 3). Among the predictors examined, only risk classification yielded a statistically significant association.

## RISK CLASSIFICATION

The distribution of risk classes as a percentage of the total number of seafarers remained relatively constant throughout the years (Fig. 1). Risk class C consistently represented the highest percentage, ranging from 46.9% to 49.0% of the total seafarers per year. In contrast, there was a slight increase in the proportion of risk class B seafarers from 2018 to 2021, with the percentage rising from 41.79% in 2018 to 51.2% in 2021. Conversely, a noticeable decrease in the proportion of risk class A seafarers was observed during the same period, declining from 9.81% in 2018 to 0.65% in 2021. In the year 2022, there was

**Table 2.** Fit to work days according to seafarer demographic characteristics and risk classification. Kruskal-Wallis test (three groups or more) and Mann-Whitney U test (two groups) were utilized for statistical test

| Characteristics | Fit to work mean time [days] | P-value |
|---|---|---|
| Risk classification: | | **< 0.001** |
| Class A | 4.43 | |
| Class B | 13.39 | |
| Class C | 18.22 | |
| Age group: | | **< 0.001** |
| < 30 | 14.08 | |
| 30–39 | 13.88 | |
| 40–49 | 15.79 | |
| > 50 | 17.42 | |
| Gender: | | 0.2875 |
| Female | 14.68 | |
| Male | 15.4 | |
| Civil status: | | **< 0.001** |
| Married | 15.67 | |
| Single | 14.53 | |

**Table 3.** Linear regression classifying the relationship of fit to work with risk classification, age group, gender and civil status

| | Estimate | Standard error | P-value |
|---|---|---|---|
| Risk classification | 5.49 | 1.47 | **< 0.001** |
| Age | 0.025 | 0.019 | 0.2327 |
| Gender | –0.58 | 0.74 | 0.4538 |
| Civil status | –0.58 | 0.44 | 0.1838 |

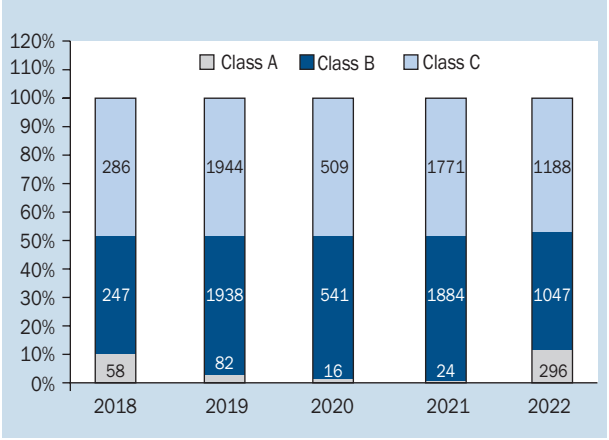



**Figure 1.** Risk classification from 2018–2022

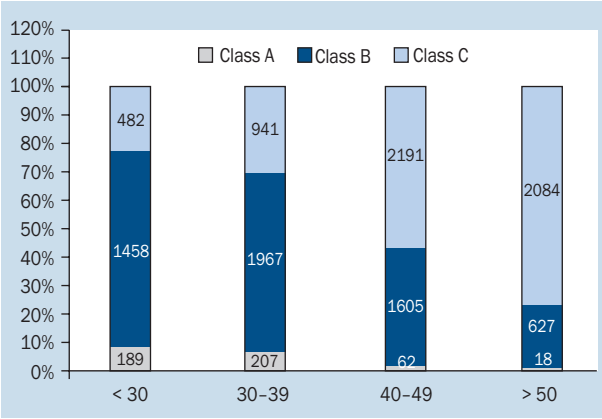



**Figure 2.** Risk classification according to age group

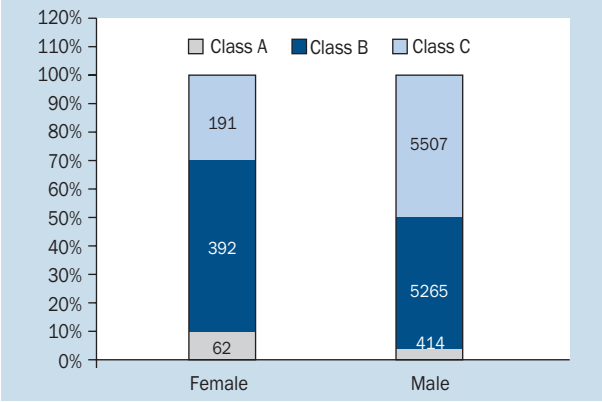



**Figure 3.** Risk classification according to sex

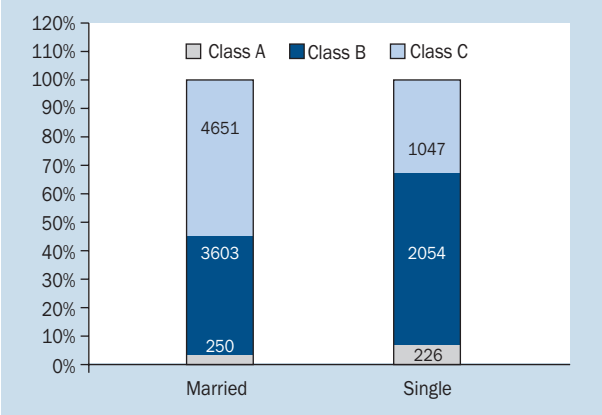



**Figure 4.** Risk classification according to civil status

a reversal of trends, with an increase in the proportion of risk class A seafarers and a decrease in the proportion of risk class B seafarers.

## RISK CLASSIFICATION BY DEMOGRAPHIC CHARACTERISTICS

An uneven distribution of risk classifications was observed among different age groups (Fig. 2), with higher age groups exhibiting a greater proportion of risk class C seafarers, while lower age groups had a lower risk classification distribution. Among individuals younger than 30 years, risk class C accounted for only 22.64% of the cases, whereas among those aged 50 and older, it represented a significant majority of 76.36%. In contrast, risk class A and risk class B constituted 8.88% and 68.48%, respectively, among individuals below the age of 30, but these percentages decreased to 0.66% and 22.98% among individuals aged 50 and over.

When examining the distribution of risk classes based on sex, a similar uneven pattern emerges (Fig. 3). Male seafarers have a higher proportion of risk class C (49.23%) compared to female seafarers (29.61%). Furthermore, when considering civil status (Fig. 4), married individuals exhibit a higher proportion of risk class C (54.69%) compared to singles (31.47%).

## RISK CLASSIFICATION BY OCCUPATIONAL CHARACTERISTICS

We investigated the distribution of risk classes among seafarers based on their occupation as seafarers. Figures 5 to 8 illustrate the risk class distribution among different departments, namely deck, engine, steward, and medic/administrative, while Figure 9 presents master mariner or the captain.

Our findings indicate that higher positions tend to have a greater proportion of higher-risk classifications. Notably, a significant percentage of master mariners (74.34%) fall into risk class C. Within the deck department, risk class C represents more than half of the second officers (52.38%), and chief officers (57.93%).

In the engine department, the second engineer and chief engineer have risk class C percentages of 58.89% and 68.93%, respectively. Similarly, positions such as mechanic or fitter show a notable proportion of seafarers classified as risk class C (62.08%). Within the steward's department, the chief steward and chief cook exhibit high percentages of risk class C seafarers, with 81.08% and 61.57% respectively.

Figure 10 displays the distribution of risk classifications among different types of vessels where seafarers are assigned. The percentage of risk class C across different types of vessels ranges from 35.00% to 70.21%. Risk class B has a proportion ranging from 27.66% to 65.00%, while risk class A ranges from 0% to 6.92%.

## DISCUSSION

This study showed the health patterns among seafarers seen in Nordic Medical Clinic from year 2018 to 2022. The results revealed a high prevalence of high-risk classifications, with risk class C comprising the larg-

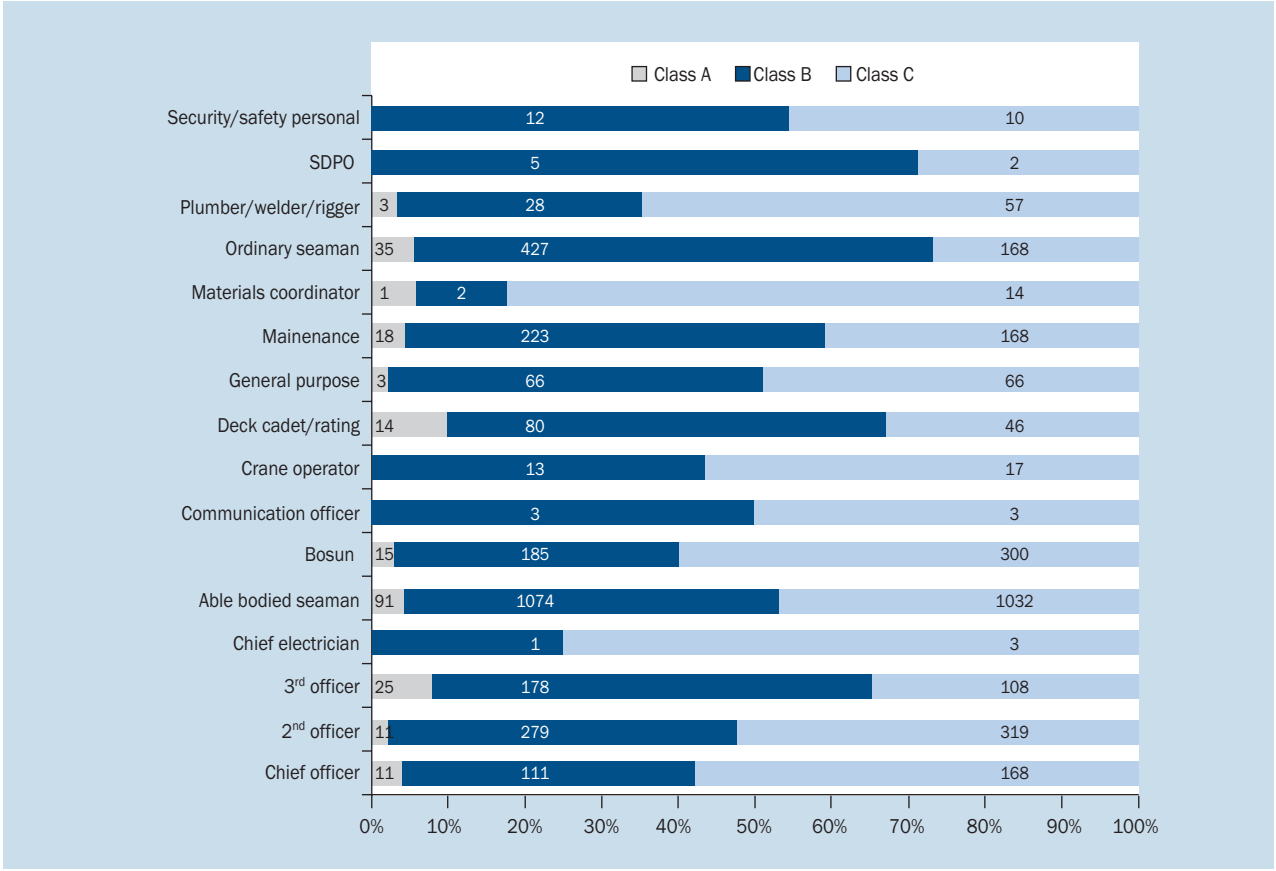



**Figure 5.** Risk classification of seafarers in deck department; SDPO – senior dynamic positioning operator

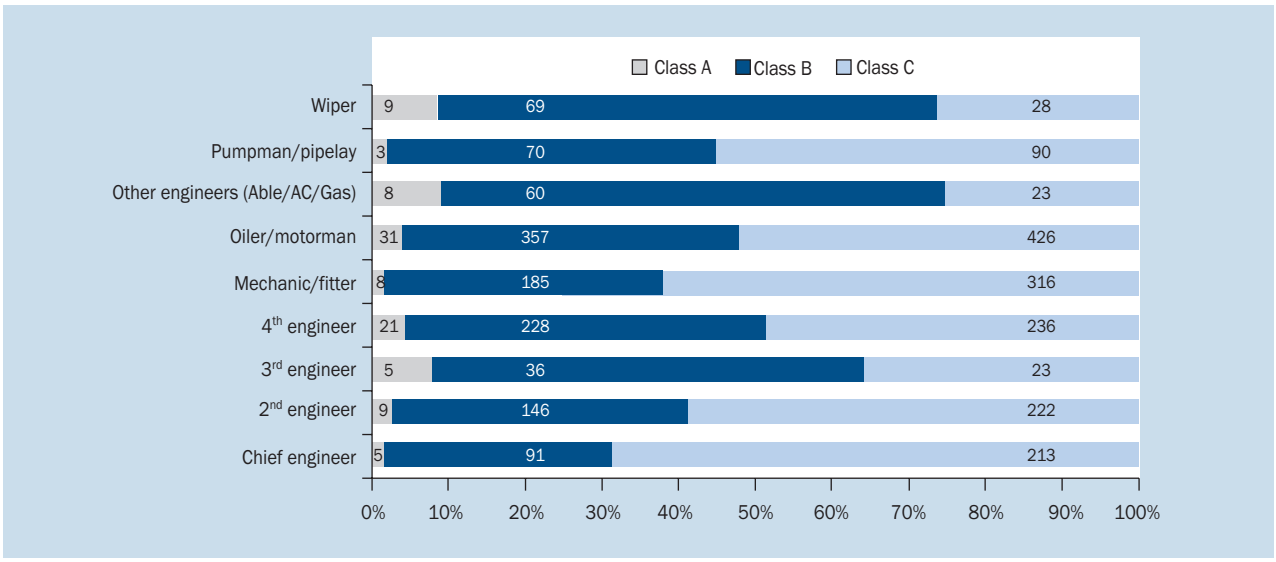



**Figure 6.** Risk classification of seafarers in engine department

est proportion (48.16%) among all risk categories. Fit-to-work duration was significantly associated with risk classification, with lower-risk classes having shorter fit-to-work times and higher-risk classes requiring longer fit-to-work durations. Older age, male gender, married status, and higher ranks exhibited higher proportion of risk class C.

The high proportion of risk classification C that is revealed in the study reflect the poor health of the seafarers. The findings indicate that a significant proportion needs

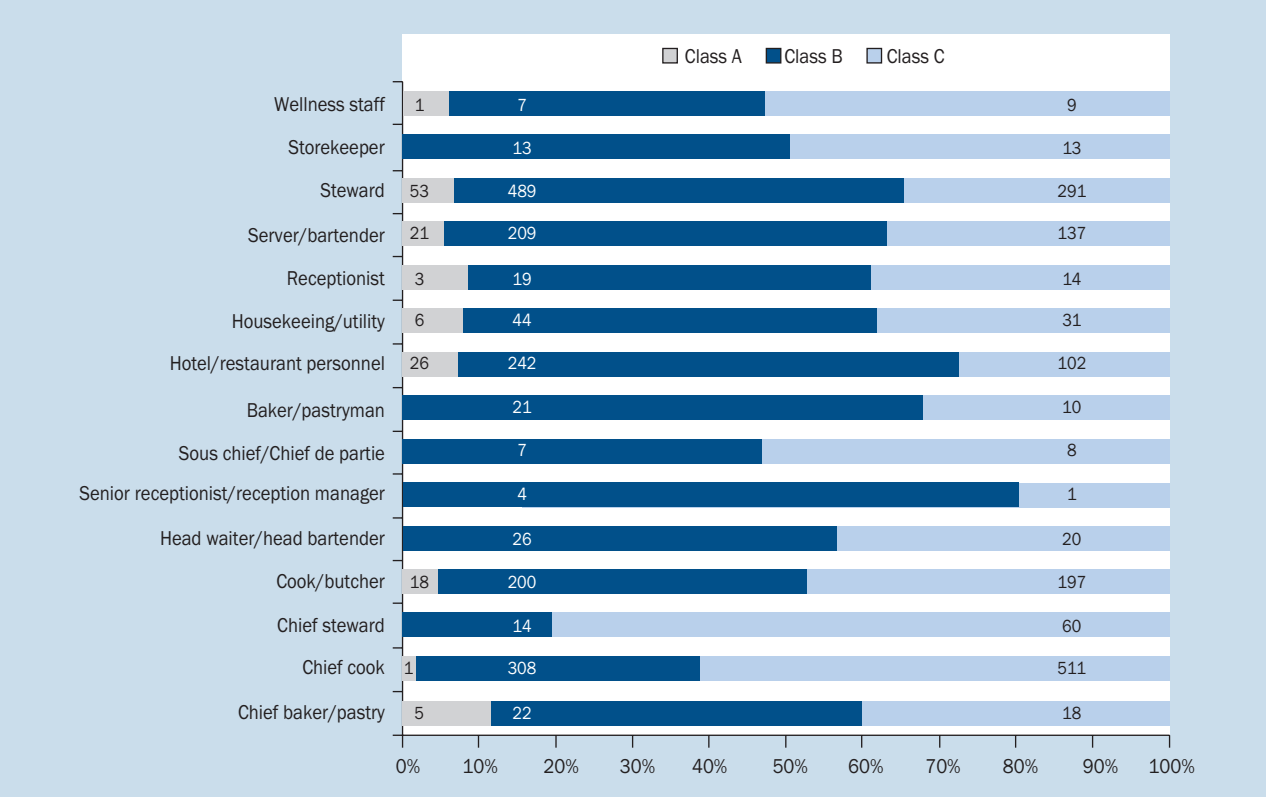



**Figure 7.** Risk classification of seafarers in steward's department

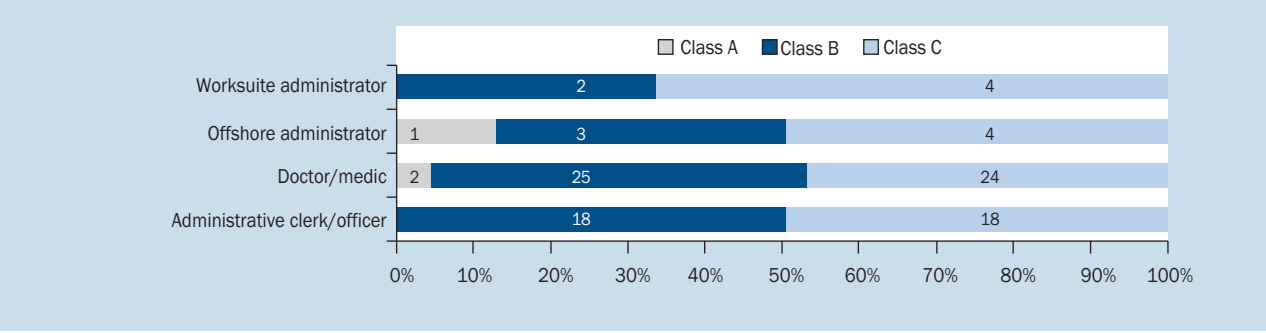



**Figure 8.** Risk classification of seafarers in medic/administrative department

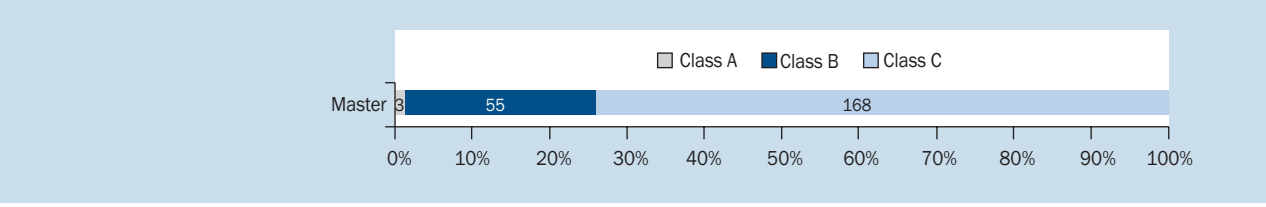



**Figure 9.** Risk classification of master mariners

a medical attention or intervention for them to be fit to work. Seafarers are exposed to uncomfortable living conditions while aboard ship, and may have limited opportunities for exercise and limited access to food with quality nutrition [1, 3, 5]. There is a need for effective health intervention to minimise health risks that seafarers experience. Comprehensive health screening packages and policy interventions from different stakeholders in the maritime industry are

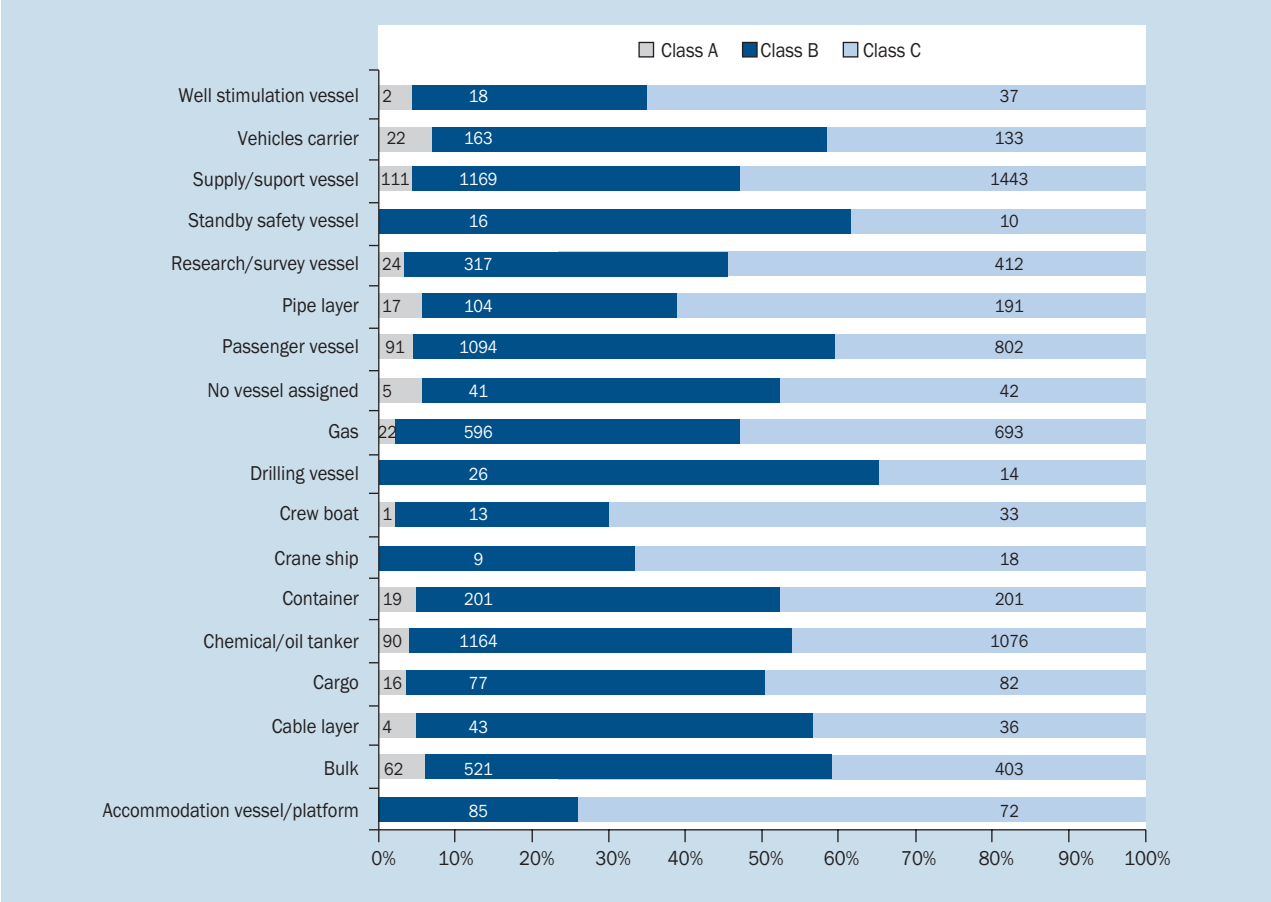



**Figure 10.** Risk classification according to vessels

essential to ensure the safety and well-being of seafarers. Shorter work contract duration and deployment in near coastal waters could present as an option for seafarers with a pre-existing but controlled medical condition, especially when they have a unique set of skills that is difficult to find among a small pool of specialised maritime workers.

Our results showed that risk classification is disproportionately distributed in certain demographic and occupational characteristics. These findings suggest that certain subgroups of seafarers may be more susceptible to health risks and require targeted interventions and support. Understanding these demographic and occupational patterns can inform the development of tailored health promotion strategies and occupational health programs for seafarers.

The higher prevalence of risk class C among older seafarers indicates the need for increased medical surveillance and interventions targeting age-related health conditions. As seafarers advance in age, they may experience a higher burden of chronic diseases that can affect their fitness for work [1, 15, 16]. Implementing more frequent health screenings and preventive measures specific to age-related conditions can help mitigate the impact of these health issues and ensure the continued well-being of older seafarers [17]. Gender disparity is also observed in the distribution of risk classes, with higher proportion of males in higher risk class. This finding agrees with the observation that males have higher risk for several diseases including cardiovascular and metabolic diseases [18, 19].

Furthermore, certain seafarer positions exhibit a higher proportion of risk class C. Specifically, higher-ranking officials tend to have a higher prevalence of this specific risk class. Multiple factors may contribute to this observation. One factor is that older seafarers tend to be employed in higher-ranking positions, and age itself may contribute to an increased risk of health issues. Additionally, specific stressors associated with occupational positions may also contribute to the poorer risk class [20]. Because these positions require several years of training and experience working at sea, there are less of these seafarers continuing their study to further their career. Hence, shipowners and maritime employers place more value in older, highly-skilled and loyal employees. Employers would be obliged to consider decreasing the duration of work contract and assign these specific seafarers near coastal waters where

medical assistance is more readily available in exchange for a highly-skilled and more experienced seafarer. Similarly, given an understanding of the medical risk classification, a vessel-specific, work location-specific or role-specific medical class could be applied analogous to the pilot class standards. Further exploration of these factors is necessary to effectively address the unique health needs of seafarers in these positions.

Other employment sectors such as the military has similar standards in the medical examination prior to enlistment [21]. The surgeon general outlined medical fitness standards for the army, ensuring that soldiers have fitness level to perform their duty. Soldiers have to complete the army combat fitness test at the minimum level of fitness, the occupational physical assessment test and the deployability based on individual medical readiness requirements and standards. Medical readiness in the army is classified into four risk classifications ranging from medically ready/deployable to not medically ready (Suppl. Table 1 — see journal website) [22]. Using this standard, medical requirements are based on deployment, mobilisation, and is assignment-specific. For instance, soldiers with dental conditions that can possibly result in dental emergencies cannot be assigned to the territories of American Samoa, Guam, the Northern Mariana islands, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia [21].

In the airline industry on the other hand, the medical classification is based on the type of aircraft to be flown by the pilot (Suppl. Table 2 — see journal website). The airline transport requires the most stringent criteria (first class), commercial aircraft requires second class medical classification, and private aircraft requires third class [23]. The vessel type based risk classification in the airline industry may be applied in seafarers, as our results showed differing risk classification on each vessel types.

## CONCLUSIONS

The findings of this study provide valuable insights into the health risk classification patterns among seafarers who underwent physical and medical examinations at the Nordic Medical Clinic. It is evident that a significant proportion of seafarers in this population fall into higher risk classifications, with risk class C being the most prevalent. The analysis also revealed a strong association between risk classification and pre-employment medical exam to fit-to-work durations, with higher-risk classes requiring longer durations to be fit to work. Demographic and occupational characteristics such as age, gender, marital status, and position have differential distribution of risk classifications among seafarers.

These findings emphasize the importance of comprehensive risk assessment and management strategies in the maritime industry. It is crucial to prioritize the health and well-being of seafarers by implementing proactive measures to mitigate health risks and promote timely medical interventions. This may involve targeted health promotion programs, regular health screenings, and appropriate medical support systems onboard vessels. Furthermore, the implementation of guidelines and accurate risk classification assessment can aid in ensuring the safety and productivity of seafarers.

Given the results of the study, the following recommendations are proposed:

- there is a need for further studies on the standards on proper pre-boarding medical screening of seafarers that is holistic and tailor-fit for the nature of the specific role at sea, type of vessel and voyage, length of contract and location of work at sea;
- given an understanding of the medical risk classification, a vessel-specific, work location-specific or role-specific medical class could be applied similar to the pilot medical certificate class;
- shorter work contract duration and deployment in near coastal waters could present as an option for seafarers with a pre-existing but controlled medical condition, especially when they have a unique set of skills that is difficult to find among a small pool of specialized maritime workers;
- implementing more frequent health screenings and preventive measures specific to age-related conditions can help mitigate the impact of these health issues and ensure the continued well-being of older seafarers;
- tailored health promotion strategies and occupational health programmes for seafarers are necessary preventive approaches to health and safety at sea.

**Conflict of interest:** None declared

## REFERENCES

1. Li X, Zhou Y, Yuen K. A systematic review on seafarer health: Conditions, antecedents and interventions. Transport Policy. 2022; 122: 11–25, doi: 10.1016/j.tranpol.2022.04.010.
2. Slade MD. Seafarer Health: Research to Date and Current Practices [Internet]. Seafarers Hospital Society & Yale University; 2022. https://safety4sea.com/wp-content/uploads/2022/08/Yale-Seafarer-Health-Research-to-Date-and-Current-Practices-2022_08.pdf (cited 2023 Feb 15).
3. Neumann FA, Belz L, Dengler D, et al. Eating behaviour and weight development of European and Asian seafarers during stay on board and at home. J Occup Med Toxicol. 2021; 16(1): 41, doi: 10.1186/s12995-021-00329-9, indexed in Pubmed: 34521438.
4. Neumann F. Nutritional status, dietary intake and factors influencing the eating behavior of seafarers working on merchant vessels: Results from the "e-healthy ship" cross-sectional study. 2019.
5. Youn IH, Lee JM. Seafarers' physical activity and sleep patterns: results from Asia-Pacific sea routes. Int J Environ Res Public Health. 2020; 17(19), doi: 10.3390/ijerph17197266, indexed in Pubmed: 33027892.

6. International Labour Organization. Seafarer's Service Regulations [Internet]. https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/95759/112855/F506419826/CHN95759%20Eng.pdf (cited 2023 Jun 30).
7. Brooks SK, Greenberg N. Mental health and psychological well-being of maritime personnel: a systematic review. BMC Psychol. 2022; 10(1): 139, doi: 10.1186/s40359-022-00850-4, indexed in Pubmed: 35637491.
8. Kaushik M. Challenges of Shipping Jobs [Internet]. Marine Insight. 2019. https://www.marineinsight.com/life-at-sea/challenges-of-a-job-at-sea-difficulties-of-a-shipping-job/ (cited 2023 Jun 30).
9. McConnell M, Devlin D, Doumbia-Henry C. The Maritime Labour Convention, 2006: A Legal Primer to an Emerging International Regime [Internet]. Brill | Nijhoff; 2011. https://brill.com/view/title/18527 (cited 2023 Jun 30).
10. International Labour Office Geneva, International Maritime Organization. Guidelines on the medical examinations of seafarers [Internet]. 2013. https://www.samgongustofa.is/media/siglingar/ahafnir/WHO-Guidelines-on-Medical-Examinations-of-Seafarers.pdf.pdf (cited 2023 May 19).
11. Norwegian Maritime Authority. Guidance to Regulations on The Medical Examination of Employees on Norwegian Ships and Mobile Offshore Units [Internet]. 2018. https://www.sdir.no/contentassets/4d82128b4fd649e9921993d2073fc2f0/veiledning-til-helseforskriften.pdf?t=1687504147709 (cited 2023 Jun 30).
12. Department Of Labor And Employment Occupational Safety And Health Center. Department Circular No. 1 Series of 2009: Guidelines on Occupational Safety And Health in The Shipbuilding, Ship Repair And Ship Breaking Industry. 2009.
13. Jensen OC, Laursen FV, Sørensen FL. International surveillance of seafarers' health and working environment. A pilot study of the method. Preliminary report. Int Marit Health. 2001; 52(1-4): 59–67, indexed in Pubmed: 11817842.
14. Carter T. Mapping the knowledge base for maritime health: 2. A framework for analysis. Int Marit Health. 2011; 62(4): 217–223, indexed in Pubmed: 22544496.
15. Baygi F, Jensen OC, Qorbani M, et al. Prevalence and associated factors of cardio-metabolic risk factors in Iranian seafarers. Int Marit Health. 2016; 67(2): 59–65, doi: 10.5603/IMH.2016.0013, indexed in Pubmed: 27364169.
16. Papadakis M, Afendras A, Skiadas C, et al. Cardiovascular risk factors among 3712 Greek seafarers. Int Marit Health. 2020; 71(3): 181–183, doi: 10.5603/IMH.2020.0032, indexed in Pubmed: 33001429.
17. Yamakado M, Ichihara K, Matsumoto Y, et al. Derivation of gender and age-specific reference intervals from fully normal Japanese individuals and the implications for health screening. Clin Chim Acta. 2015; 447: 105–114, doi: 10.1016/j.cca.2015.04.037, indexed in Pubmed: 25987309.
18. Wakabayashi I. Gender differences in cardiovascular risk factors in patients with coronary artery disease and those with type 2 diabetes. J Thorac Dis. 2017; 9(5): E503–E506, doi: 10.21037/jtd.2017.04.30, indexed in Pubmed: 28616322.
19. Kannel WB, Hjortland MC, McNamara PM, et al. Menopause and risk of cardiovascular disease: the Framingham study. Ann Intern Med. 1976; 85(4): 447–452, doi: 10.7326/0003-4819-85-4-447, indexed in Pubmed: 970770.
20. Oldenburg M, Jensen HJ. Stress and strain among seafarers related to the occupational groups. Int J Environ Res Public Health. 2019; 16(7): 1153, doi: 10.3390/ijerph16071153, indexed in Pubmed: 30935082.
21. Department Of The Army Washington Dc. Medical Services: Standards of Medical Fitness [Internet]. Fort Belvoir, VA: Defense Technical Information Center; 2019. http://www.dtic.mil/docs/citations/ADA402408 (cited 2023 Jun 30).
22. Department Of The Army Washington Dc. Medical Services: Medical Readiness [Internet]. Fort Belvoir, VA: Defense Technical Information Center; 2019. https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN37126-AR_40-502-001-WEB-3.pdf (cited 2023 Jun 30).
23. Federal Aviation Administration. Synopsis of Medical Standards [Internet]. 2022 . https://www.faa.gov/ame_guide/media/synopsis.pdf (cited 2023 Jun 30).

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 3: 153–160
10.5603/imh.96365
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Prevalence of arterial hypertension in Vietnamese seafarers aboard merchant vessels: a cross-sectional study

**Tam Nguyen Van[1], Nam Nguyen Bao[2], Son Nguyen Truong[2], Chi Tran Thi Quynh[2], Ha Nguyen Thi Hai[3], Hue Do Thi[1], Duc Nguyen Hoang Viet[2]**

[1]Faculty of Marine Medicine, Hai Phong University of Medicine and Pharmacy, Vietnam
[2]Institute of Marine Medicine, Vietnam
[3]Ministry of Health, Vietnam

## ABSTRACT

***Background:*** *Hypertension is one of the leading causes of morbidity and mortality globally. It is a major risk factor for major cardiovascular events such as stroke, myocardial infarction, heart failure, kidney failure, and blindness. The aim of this research is to assess the prevalence and some factors related to arterial hypertension on Vietnamese seafarers aboard merchant vessels.*

***Materials and methods:*** *Seven hundred eight Vietnamese seafarers working aboard merchant ships were examined at the Institute of Marine Medicine before going to sea during the period from January 2022 to December 2022. It was a cross-sectional descriptive epidemiological study. The following parameters were measured: blood pressure, height, weight, waist circumference, buttock circumference to assess the prevalence of hypertension, overweight, and obesity. Seafarers we directly interviewed about workplace on ships and physical exercise, smoking tobacco, alcohol abuse, and anxiety symptoms to identify several factors associated with hypertension.*

***Results:*** *The prevalence of hypertension in seafarers was 32.9%, prehypertension 26.4%, overweight 32.4%, obesity 13.3%, abdominal obesity 47.7%. Factors related to hypertension of seafarers included: job duration at sea > 10 years, odds ratio (OR) = 8.23 (95% confidence interval [CI] 4.34–17.27); non-officers, OR = 2.11 (95% CI 1.45–2.82); engine room crew, OR = 2.11 (95% CI 1.45–3.58); obesity, OR = 3.34 (95% CI 2.15–5.63); abdominal obesity, OR = 9.12 (95% CI 4.23–18.45); current smoking, OR = 1.32 (95% CI 1.02–1.99); irregular exercise, OR =1.43 (95% CI 1.03–2.18); anxiety symptoms, OR = 1.56 (95% CI 1.08–2.27).*

***Conclusions:*** *Hypertension is a health problem for Vietnamese seafarers. To minimise hypertension, seafarers need to adjust their lifestyle, increase regular exercise and improve psychological issues on board.*

*(Int Marit Health 2023; 74, 3: 153–160)*

**Keywords: hypertension, seafarers, related factors, Vietnam**

## INTRODUCTION

Hypertension is one of the leading causes of morbidity and mortality globally. According to the statistics of the World Health Organization (WHO), in 2000, there were about 972 million people with hypertension in the world and 7.5 million people died from hypertension. It is estimat-

Dr. Tam Nguyen Van, Dr. Nam Nguyen Bao, 72A Nguyen Binh Khiem, Dang Giang, Ngo Quyen, Hai Phong, Vietnam, tel: +84.936 068 055, e-mail: nvtam@hpmu.edu.vn, drnguyenbaonam@gmail.com

Received: 5.07.2023 Accepted: 22.08.2023

ed that about 1.56 million people will have hypertension globally by 2025 [1, 2]. Hypertension is a major risk factor for serious cardiovascular events such as stroke, myocardial infarction, heart failure, renal failure, and blindness [1–3].

In Vietnam, the prevalence of hypertension tends to increase among adults. According to statistics, in 1960, the prevalence of hypertension in adults in the north of Vietnam was only 1% and more than 30 years later (1992) according to a nationwide survey of the Institute of Cardiology, this prevalence was 11.2% — increased more than 11 times [3]. According to the 2008 survey results, the prevalence of hypertension in people aged 25–64 is 25.1% [4]. According to the National Census on Risk Factors for Non communicable Diseases in Vietnam 2015, 18.9% of adults aged 18–69 years had hypertension, of which 23.1% were men and 14.9% women. Thus, 1 in 5 adults aged 25–64 years had hypertension [5].

Seafaring is a particularly strenuous and hazardous profession. When sailing at sea, the ship is both a living place and a working place for the seafarers. Working conditions at sea are extremely difficult, and the seafarers often have to work in harsh conditions of nature: big waves, high winds and working conditions are not up to the allowable standards such as: vibration, noise, high temperature, wet, slippery [6–9]. In addition, the duration of each seafarer's journey at sea is 9–12 months, or even longer. During the time of working at sea, workers have to suffer loneliness, isolation from the mainland, live and work in an abnormal micro-social environment such as the same-sex society. As a result, a psychophysical stress is created, which is favourable conditions for the increase of occupational diseases, including hypertension [6–8]. Pougnet et al. [10] studied 57,473 European sailors and 327 sailors from other continents through an analysis of 18 articles from the journals 'Medline and Medicine Maritime'. The results showed that the smoking rate of seafarer was 61.4%, overweight and obesity 60.9%, hypertension 30.1%, hypercholesterolaemia 34.6%, and diabetes 3.3–9.3%.

Tu and Jepsen [6] studied 629 Danish seafarers and found that the seafarer's prevalence of hypertension was 44.7%. Hypertension is strongly associated with alcohol abuse, smoking, overweight and obesity [6]. The prevalence of hypertension in seafarers according to the results of studies is higher than in adults on land [5, 11, 12]. The question arises, what is the prevalence of hypertension in Vietnamese seafarers and what factors affect seafarers' hypertension. To answer the above question, we conducted a research on the topic with the following objectives: Assess the prevalence and some factors related to arterial hypertension in Vietnamese seafarers aboard merchant vessels in 2022.

## MATERIALS AND METHODS

### MATERIALS

Seven hundred eight Vietnamese seafarers with ≥ 2 years of working experience, working onboard merchant ship, were given health checks at the Institute of Marine Medicine before going to sea during the period from January 2022 to December 2022. Research subjects were divided into three groups: deck group; engine room group; seafarers doing other positions (electrical group, service group...).

### METHODS

It was a cross-sectional descriptive epidemiological study. A list of seafarers was made and they had health check-ups and management at the Institute of Marine Medicine. Systematic random sampling method was applied in this study and we collected 708 seafarers.

The method of data collection: Seafarers were examined by specialised doctors of the Institute of Marine Medicine who measured blood pressure, height, weight, waist circumference, buttock circumference. Seafarers were required to rest 30 minutes, not use stimulants such as coffee or tobacco before blood pressure measurement. We interviewed directly seafarers about workplace group on the ship, physical exercise, smoking, alcohol abuse, and anxiety symptoms to identify several factors associated with hypertension.

Assessment of hypertension according to the criteria of the International Society of Hypertension 2020 (ISH 2020) [13]. Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg or being treated with antihypertensive drugs. Prehypertension is when systolic blood pressure is 130–139 mmHg and/or diastolic blood pressure is 85–89 mmHg [13].

Assessment of overweight and obesity was based on body mass index (BMI), which is calculated by the formula: weight [kg]/height [$m^2$]. According to WHO standards for adults in Asia [14]: underweight is defined as BMI < 18.5 kg/$m^2$, normal weight BMI 18.50–22.9 kg/$m^2$, overweight BMI 23.00–24.9 kg/$m^2$, and obesity BMI ≥ 25 kg/$m^2$ [14].

Assessment of abdominal obesity based on waist/hip ratio (WHR): According to WHO report applying to the Asia-Pacific region: abdominal obesity is defined as a WHR ≥ 0.90 for males and ≥ 0.80 for females [15].

Assessment of anxiety, depression, and stress of seafarers based on the Depression-Anxiety-Stress Scale-21 (DASS 21). DASS-21 consists of 21 questions on 3 issues related to psychological health: depression (7 questions), anxiety (7 questions), and stress (7 questions). Each symptom question corresponds to a psychological health condition within a past week on a scale of 0 to 3 for each response: Did not apply to me at all, applied to me to some degree or some of the time, applied to me to a considerable degree or a good part of time and applied to me very much or most

of the time. There are symptoms of anxiety when the score is ≥ 8 [16].

Abuse of alcohol: Interviewing seafarers about drinking alcohol in the past 7 days. Alcohol abuse is determined according to the standards of the WHO: drinking more than 3 units of alcohol/day or 21 units of alcohol/week for men and more than 2 units of alcohol/day or 14 units of alcohol/week for women. One unit of alcohol is equivalent to 10 grams of pure alcohol contained in drinking solution = 01 standard cup. One standard cup is equivalent to 1 can of 330 mL beer with 5% concentration, 1 cup of 125 mL wine with 11% concentration, 01 glass of 75 mL strong wine with 20% concentration, 1 cup of 30 mL spirit of 30% concentration [17].

Interviewing the seafarers' exercise status on the ship such as (walking, playing tennis, gym) for more than 1 week. Regular exercise: at least 30 minutes/day and for ≥ 5 days/week [18]. Smoking habit: A non-smoker is someone who has never smoked any tobacco. Having a habit of smoking is a person who currently smokes at least one cigarette a day.

## STATISTICAL ANALYSIS

The research data were processed by biomedical statistical methods based on SPSS for Window 20 software. Frequency and percent distributions were used to describe qualitative variables. The $chi^2$ test was used to compare two ratios. Mean values were used to describe quantitative variables. Mean values were compared using the t-test. The adjusted odds ratio (OR) and 95% confidence interval (CI) were used to determine the association between risk factors for seafarer hypertension. Risk factors were identified through multivariable logistic regression analysis.

## INFORMED CONSENT

This study was approved by the Ethics Committee in Biomedical Research of the Institute of Marine Medicine according to decision 05/2022/QD-YHB. All seafarers signed informed consent before the medical examination.

## RESULTS

The study included 708 seafarers. Clinical examination included: measuring blood pressure, height, weight, WHR and directly interviewing some factors related to hypertension. We obtained the following results.

**Characteristics of seafarers' age, job duration at sea, educational level and workplace.** The examined group included 708 Vietnamese seafarers aged 22–59 years old (Table 1). The average age of seafarers participating in the study was 35.5 ± 7.3; age distribution was as follows: 20–29 (23.0%), 30–39 (43.2%), 40–49 (30.6%), ≥ 50 (3.2%).

**Table 1.** Characteristics of seafarers' age, job duration at sea, educational level and workplace group (n = 708)

| Variable | |
|---|---|
| Age [years] | 35.5 ± 7.3 (22–59) |
| Age group [years]: | |
| 20–29 | 163 (23.0%) |
| 30–39 | 306 (43.2%) |
| 40–49 | 217 (30.6%) |
| ≥ 50 | 22 (3.2%) |
| Job duration at sea [year]: | 11.6 ± 6.9 (2–32) |
| 2–5 | 168 (23.7%) |
| 6–10 | 176 (24.9%) |
| 11–15 | 137 (19.4%) |
| 16–20 | 121 (17.0%) |
| > 20 | 106 (15.0%) |
| Education level: | |
| Intermediate | 367 (51.8%) |
| University/College | 341 (48.2%) |
| Workplace: | |
| Deck crew | 350 (49.4%) |
| Engine room crew | 220 (31.1%) |
| Other crew | 138 (19.5%) |

Data are shown as mean (standard deviation), (minimum–maximum) or number (percentage).

The average of job duration at sea was 11.6 ± 6.9 years; job duration at sea ≤ 10 years (48.6%), job duration at sea > 10 years (51.4%). The seafarers of the deck group accounted for the majority (49.4%), the engine room group (31.1%), other crews (19.5%).

**Body mass index, WHR of seafarers.** Assessment and classification of nutritional status (BMI) and WHR of seafarers according to the standards of the WHO for Asians showed that the prevalence of seafarers with overweight was 32.4% and obesity 13.3%. The prevalence of seafarers with WHR ≥ 0.90 was 47.7% (Table 2).

**Prevalence of hypertension and grade of hypertension of seafarers. T**he prevalence of artery hypertension of seafarers was 32.9%, of which, grade I hypertension accounted for 25.1%, grade II hypertension for 7.8%, there were no seafarer with grade III hypertension. The prevalence of seafarers with prehypertension was 26.4% (Table 3).

**Multivariate analysis of factors related to seafarers' hypertension.** Multivariate analysis of factors related to seafarers' hypertension (Table 4) showed that: seafarers with > 10 years of job duration at sea were 8.23 times

**Table 2.** Body mass index (BMI), waist/hip ratio (WHR) of seafarers (n = 708)

| Variable | |
|---|---|
| BMI: | 27.7 ± 2.3 |
| Underweight | 30 (4.2%) |
| Normal weight | 355 (50.1%) |
| Overweight | 229 (32.4%) |
| Obesity | 94 (13.3%) |
| Waist circumference [cm] | 87.1 ± 7.1 |
| Hip circumference [cm] | 91.7 ± 7.8 |
| WHR: | 0.95 ± 0.08 |
| ≥ 0.90 | 338 (47.7%) |
| < 0.90 | 370 (52.3%) |

Data are shown as mean (standard deviation), (minimum–maximum) or number (percentage).

**Table 3.** Prevalence of hypertension and grade of hypertension of seafarers (n = 708)

| Variable | Number (%) |
|---|---|
| Arterial hypertension: | |
| Yes | 233 (32.9%) |
| No | 475 (67.1%) |
| Grade of hypertension: | |
| Normal | 288 (40.7%) |
| Pre hypertension | 187 (26.4%) |
| Grade I hypertension | 178 (25.1%) |
| Grade II hypertension | 55 (7.8%) |
| Grade III hypertension | 0 (0.0%) |

more likely to have hypertension than seafarers with ≤ 10 years of job duration at sea (95% CI 4.34–17.27, p < 0.001). Non-officer had a 2.11 times higher risk of developing hypertension compared with the group of officer (95% CI 1.45–2.82, p < 0.001). Seafarers in the engine room group had a 2.11 times higher risk of hypertension than seafarers in other groups (electrical, service). Seafarers with WHR ≥ 0.90 were 9.12 times more likely to have hypertension than seafarers with WHR ≤ 0.90 (95% CI 4.23–18.45, p < 0.001). Seafarers with BMI > 25 had a 3.34 times higher risk of hypertension than seafarers with BMI < 23 (95% CI 2.15–5.63) (Table 4). Smoking and alcohol abuse increased the risk of hypertension by 1.32 and 2.1 times, respectively (p < 0.05). Seafarers with irregular exercise were 1.43 times more likely to have hypertension (95% CI 1.03–2.18, p = 0.035). Anxiety increased the risk of hypertension by 1.56 times on seafarers with 95% CI 1.08–2.27 (p = 0.019) (Table 4). There was no relationship between educational level and the prevalence of hypertension of seafarers (p > 0.05).

## DISCUSSION

Assessing the nutritional status of Vietnamese seafarers according to the standards of the WHO for Asians, the results of the study (Table 2) showed that the average BMI was 22.7 ± 2.3 kg/m$^2$; the prevalence of overweight and obese seafarers was 45.7%, of which overweight were 229/708 (32.4%) and obese were 94/708 (13.3%). The results of our study are higher than that of some authors on adults in Vietnam. Do et al. [12] surveyed 17,199 Vietnamese subjects aged 25–64, with a mean BMI of 20.7 kg/m$^2$. Binh et al. [19] studied 2,443 people in the Red River Delta of Vietnam and found that the central obesity prevalence was 12.3%. Vu et al. [20] studied Vietnamese people aged 25–64, showing that the prevalence of overweight and obesity was 20.57%. In a study by Quoc Cuong et al. [21] in Ho Chi Minh City, Vietnam, aged 18–69, the prevalence of overweight and obesity was 20.2%.

The prevalence of overweight and obesity in our study (Table 2) is corresponding to the authors' study on crew members in different countries [7]. Pougnet et al. [10] analysed 8 articles with 57,473 European sailors and 327 sailors from other continents and found that the rate of overweight and obesity was from 27.9% to 66.5%. The obesity rate according to Ayelo's study [22] on German crew members was 21.5%. Nittari et al. [7] studied 1,155 seafarers flying the Italian flag from 2013 to 2016 and found that 40.8% of seafarers were overweight and 11.2% of seafarers were obese. Nas et al. [23] studied Turkish crew members and showed that overweight and obesity tend to increase; the average BMI was 27.8 kg/m$^2$, the prevalence of overweight and obesity was 52.1%. Hansen et al. [24] studied 2,101 Danish seafarers, and the results showed that the prevalence of overweight and obesity was 66.0%.

Thus, the prevalence of overweight and obesity among seafarers is higher than that of adults living on land in Vietnam. To explain this, we think that each voyage usually lasts 9–12 months (in Vietnam, seafaring labour contracts for seafarers usually last from 9 to 12 months), the nutritional conditions on the ship are unbalanced: excess protein, fat and glucose but lack of green vegetables and fibre. On the other hand, seafarers working in shifts, have a lot of free time, and lack of training facilities on board, so the prevalence of overweight and obesity is higher. The Oldenburg's et al. study [25] on the nutritional status of seafarers also resembles our results. Zyriax et al. [26] studied the diets of crew members on four German merchant ships and found that the total amount of meat, fat

**Table 4.** Multivariate analysis of factors related to seafarers' hypertension

| Variable | Total | Seafarer with hypertension N (%) | Seafarer without hypertension N (%) | Adjusted OR (95% CI) | P-value |
|---|---|---|---|---|---|
| Job duration at sea: | | | | | |
| > 10 years | 364 | 198 (54.4) | 166 (45.6) | 8.23 (4.34–17.27) | < 0.001 |
| ≤ 10 years | 344 | 35 (10.2) | 309 (89.8) | | |
| Education level: | | | | | |
| Intermediate level | 367 | 115 (31.3) | 252 (68.7) | 1.15 (0.54–1.87) | 0.642 |
| University/ College | 341 | 118 (34.6) | 223 (65.4) | | |
| Rank: | | | | | |
| Non-officer | 486 | 181 (37.2) | 305 (62.8) | 2.11 (1.45–2.82) | < 0.001 |
| Officer | 222 | 52 (23.4) | 170 (76.6) | | |
| Workplace group: | | | | | |
| Other crews | 138 | 36 (26.1) | 102 (73.9) | Control group | |
| Engine room crew | 220 | 98 (44.6) | 122 (55.4) | 2.11 (1.45–3.58) | < 0.001 |
| Deck crew | 350 | 99 (28.3) | 251 (71.7) | 1.18 (0.86–1.72) | 0.625 |
| WHR: | | | | | |
| ≥ 0.90 | 338 | 159 (47.0) | 179 (53.0) | 9.12 (4.23–18.45) | < 0.001 |
| < 0.90 | 370 | 74 (22.0) | 296 (80.0) | | |
| BMI: | | | | | |
| < 23 | 385 | 88 (22.9) | 297 (77.1) | Control group | |
| 23–24.9 | 229 | 96 (41.9) | 133 (58.1) | 2.24 (1.51–3.27) | < 0.001 |
| ≥ 25 | 94 | 49 (52.1) | 45 (47.9) | 3.34 (2.15–5.63) | < 0.001 |
| Current smokers: | | | | | |
| Yes | 232 | 89 (38.4) | 143 (61.6) | 1.32 (1.02–1.99) | 0.041 |
| No | 476 | 144 (30.3) | 322 (69.7) | | |
| Alcohol abuse: | | | | | |
| Yes | 490 | 185 (37.8) | 305 (62.2) | 2.10 (1.42–3.26) | < 0.001 |
| No | 218 | 48 (22.0) | 170 (78.0) | | |
| Regular exercise: | | | | | |
| No | 499 | 177 (35.5) | 322 (64.5) | 1.43 (1.03–2.18) | 0.035 |
| Yes | 209 | 56 (26.8) | 153 (73.2) | | |
| Anxiety: | | | | | |
| Yes | 227 | 93 (41.5) | 131 (58.5) | 1.56 (1.08–2.27) | 0.019 |
| No | 481 | 140 (28.9) | 344 (71.7) | | |

BMI — body mass index; CI — confidence interval; OR — odds ratio; WHR — waist/hip ratio

and eggs provided more than doubled, while the proportion of fruits, vegetables, dairy products and cereals much lower than recommended.

The present study of 708 seafarers (Table 3), showed that the prevalence of hypertension was 32.9%; of which, grade I hypertension accounted for 25.1% and grade II hypertension for 7.8%. The results of our study are consistent with the study of some authors on seafarers in different countries about the prevalence of hypertension. Tu and Jepsen [6] studied 629 Danish seafarers in 2016 and found that the prevalence of seafarer with hypertension was 44.7%. Sagaro et al. [27] studied 603 seafarers, and the results

showed that the prevalence of hypertension and prehypertension was 39% and 16.6%. Pougnet's study [10] of European seafarers showed a prevalence of hypertension of 30.1%.

The prevalence of hypertension among seafarers is higher than that of adults living on land in Vietnam [12, 19, 28]. Meiqari et al. [28] in a review of 10 studies in Vietnam showed that the prevalence of hypertension was 21.1%. Do et al. [12] surveyed 17,199 subjects aged 25–64; the prevalence of hypertension was 20.7%. McGuire et al. [11] surveyed 121,273 people over 40 years old in Ho Chi Minh City, Vietnam; the prevalence of hypertension was 25.1%. Hoang et al. [5] surveyed 3,856 people aged 18–69 and showed that the prevalence of hypertension was 18.9%. Quoc Cuong et al. [21] did a cross-sectional study on 2,203 women and men in Vietnam aged 18 years and older; the prevalence of hypertension was 24.3% (20.9% in female and 20.9% in male participants) 29.1%). Hien et al. [29] studied 969 people living in urban Vietnam, from 40 to 69 years old, and the prevalence of hypertension was 44.8%. This prevalence was higher in men than in women (51.3% vs. 39.7%, $p < 0.001$). In a cross-sectional study conducted in Malaysia on subjects 18 years of age and older, the prevalence of hypertension was 34.6% in 2006, 33.6% in 2011 and 35.3% in 2015 [30].

The question arises why seafarers have higher prevalence of hypertension than labour on land in Vietnam. To explain this, we and some authors believe that seafaring is a particularly strenuous profession. During the voyage at sea, the seafarer not only have to endure the harsh conditions of the marine climate such as waves, wind, sudden climate change when the ship passes through areas with different weather, different time zones in a short time, making it difficult for the seafarer's body to adapt, but also the micro-conditions of the ships has many disadvantages for the crew's health, such as vibration, shaking, high fuel vapor. In addition, seafarers also have to bear mental and psychological burdens such as isolation from the mainland, being away from family, lack of cultural life, working in tight spaces, constrained posture, especially they must live and work for a long time in a same-sex society [9, 12]. All of these things cause a state of constant stress that lasts and strengthens the sympathetic nervous system, thereby causing a rapid heart rate and increased blood pressure.

Seven hundred eight seafarers were interviewed directly about a number of factors related to hypertension such as age, educational level, rank and title on board, overweight, obesity, smoking, alcohol consumption, exercise, anxiety symptoms. Research results (Table 4) show that seafarers with job duration at sea over 10 years have an 8.23 times higher risk of hypertension than seafarers with job duration at sea under 10 years (95% CI 4.34–17.27; $p < 0.001$). This result is consistent with the study of Sagaro et al. [31]. The job duration at sea of over 10 years had a higher risk of hypertension (OR = 2.73, 95% CI 2.09–3.57). Non-officer seafarers had a higher risk of developing hypertension than officer (OR = 2.11, 95% CI 1.45–2.82, $p < 0.001$). The results of this study are consistent with the research of some authors. The study by Sagaro et al. [27] conducted on 4,318 seafarers aged from 18 to 70 years old showed that there is a relationship between the non-officer and hypertension (OR = 1.36, 95% CI 1.09–1.70). Another Sagaro's study [31] researched on 603 seafarers about the association between BMI and hypertension also found that non-officers had a higher prevalence of hypertension compared with officers (55.6% and 44.4%). To explain this, we believed that non-officers often have higher physical efforts, combined with obstacles in their ranks on board, low income, more stress due to greater responsibilities. Therefore, the prevalence of hypertension of non-officers is higher than officers.

Table 4 shows that the engine room group have a higher risk of hypertension than seafarers with other groups (service, electrical) (OR = 2.11, 95% CI 1.45–3.58, $p < 0.001$). Research by David et al. [32] on 455 seafarers aged 40–55 (164 mechanics and 291 mariners) showed the prevalence of hypertension of engine room crew was 18.90% compared with 11.68% in deck crew ($p < 0.05$). The risk of hypertension is directly related to exposure to high noise levels > 85 dB(A) and duration of noise exposure for more than 20 years [32]. Skogstad et al. [9] pooled results from 12 articles, which showed that noise exposure in the workplace was positively associated with hypertension (OR = 1.68; 95% CI 1.10–2.57) and increased cardiovascular risk (OR = 1.34, 95% CI 1.15–1.56).

The study results (Table 4) showed that obese seafarers had a higher risk of developing hypertension (OR = 3.34, 95% CI 2.15–5.63). A study by Chowdhury et al. [33] on 7,839 adults over the age of 35 showed that being overweight or obese increases the risk of hypertension (OR = 2.19, 95% CI 1.87–2.57). Quoc Cuong's research [21] on people over 18 years old also showed that overweight, obesity, and high WHR were related to hypertension (OR = 1.64, $p = 0.005$ and OR = 2.07, $p < 0.001$). Research by some other authors also show an association between overweight, obesity and hypertension of seafarers [7, 23, 24].

Alcohol abuse and smoking increases the risk of hypertension for seafarers (OR = 2.10, 95% CI 1.42–3.26, $p < 0.01$ and OR = 1.32, 95% CI 1.02–1.99, $p = 0.041$) (Table 4). Tu and Jepsen [6] studied Danish seafarers and found that hypertension is strongly associated with alcohol abuse and smoking. Quoc Cuong's research [21] on Vietnamese people also shows that smoking and alcohol abuse increase the risk of hypertension (OR = 1.78, 95%

CI 1.40–2.25, p < 0.01 and OR = 1.40, 95% CI 1.12–1.75, p = 0.003) [21]. A study by Lee et al. [34] showed that smokers have a higher risk of hypertension than non-smokers (OR = 1.9, 95% CI 1.1–3.7). Moderate alcohol consumption reduces the risk of metabolic syndrome, but alcohol abuse increases the risk of metabolic syndrome, including hypertension.

According to WHO and the American Heart Association, physical activity includes regular activities and exercise: regular exercise 30 minutes/day with moderate intensity, at least 5 days/week, i.e. 150 minutes/week or at high intensity for at least 75 minutes/week. Regular exercise is considered a preventive therapy for hypertension, whereas sedentary lifestyle is considered to be the cause of 5–13% of current cases of hypertension [1, 18]. The results of the study in Table 4 show that irregular exercise is a risk factor for hypertension (OR = 1.43, 95% CI 1.03–2.18). Research results are consistent with some authors [24].

During the sea voyage, the seafarers are isolated from the daily social life on land. All their activities are limited in the narrow space of the ship. On the other hand, the micro-society environment on board ships is a special environment, with only one gender (same-sex society), difference in rank and rank on board, working in shift, and disproportionate social benefits create a psychophysical burden for seafarers. Research results (Table 4) show that anxiety is a risk factor for hypertension (OR = 1.56, 95% CI 1.08–2.27). The results of our study are consistent with those of Stansfeld and Candy [8] and Oldenburg et al. [25].

## LIMITATIONS OF THE STUDY

The study was conducted on 708 Vietnamese seafarers working onboard merchant ship about the prevalence of hypertension and some related factors. However, some risk factors for hypertension in seafarers have not been analysed: diet, nutrition on board; sleep disorders, seafarers with a history of smoking were also unexplored.

## CONCLUSIONS

Hypertension is a health problem for Vietnamese seafarers. This disease tends to be seen in young seafarers and the incidence is higher than adults in the mainland. In order to prevent and minimise the risk factors for hypertension in seafarers, it is necessary to adjust the lifestyle such as less intake of salt, limiting beer, alcohol and smoking; exercise regularly, reduce weight; improve psychological problems on board. Seafarers suffering from high blood pressure on the sea voyage should be controlled and take medicine regularly.

**Conflict of interest:** None declared

## REFERENCES


1. WHO; Hypertension 2023. https://www.who.int/news-room/fact-sheets/detail/hypertension (accessed June 28, 2023).
2. WHO; Noncommunicable diseases country profiles 2018. https://apps.who.int/iris/handle/10665/274512 (accessed June 28 2023).
3. Vietnam Ministry of Health; National Strategy on Prevention and Control of NCDs, 2015–2025; 2015.
4. Son PT, Quang NN, Viet NL, et al. Prevalence, awareness, treatment and control of hypertension in Vietnam-results from a national survey. J Hum Hypertens. 2012; 26(4): 268–280, doi: 10.1038/jhh.2011.18, indexed in Pubmed: 21368775.
5. Hoang VM, Tran QB, Vu TH, et al. Patterns of raised blood pressure in Vietnam: findings from the WHO STEPS survey 2015. Int J Hypertens. 2019; 2019: 1219783, doi: 10.1155/2019/1219783, indexed in Pubmed: 31871783.
6. Tu M, Jepsen JR. Hypertension among Danish seafarers. Int Marit Health. 2016; 67(4): 196–204, doi: 10.5603/IMH.2016.0037, indexed in Pubmed: 28009392.
7. Nittari G, Tomassoni D, Di Canio M, et al. Overweight among seafarers working on board merchant ships. BMC Public Health. 2019; 19(1): 45, doi: 10.1186/s12889-018-6377-6, indexed in Pubmed: 30626365.
8. Stansfeld S, Candy B. Psychosocial work environment and mental health: a meta-analytic review. Scand J Work Environ Health. 2006; 32(6): 443–462, doi: 10.5271/sjweh.1050, indexed in Pubmed: 17173201.
9. Skogstad M, Johannessen HA, Tynes T, et al. Systematic review of the cardiovascular effects of occupational noise. Occup Med (Lond). 2016; 66(1): 10–16, doi: 10.1093/occmed/kqv148, indexed in Pubmed: 26732793.
10. Pougnet R, Pougnet L, Loddé BL, et al. Cardiovascular risk factors in seamen and fishermen: review of literature. Int Marit Health. 2013; 64(3): 107–113, indexed in Pubmed: 24072535.
11. McGuire H, Van TB, Thi Thu HL, et al. Improving hypertension awareness and management in Vietnam through a community-based model. Sci Rep. 2022; 12(1): 19860, doi: 10.1038/s41598-022-22546-w, indexed in Pubmed: 36400798.
12. Do HTP, Geleijnse JM, Le MB, et al. National prevalence and associated risk factors of hypertension and prehypertension among Vietnamese adults. Am J Hypertens. 2015; 28(1): 89–97, doi: 10.1093/ajh/hpu092, indexed in Pubmed: 24862960.
13. Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020; 75(6): 1334–1357, doi: 10.1161/HYPERTENSIONAHA.120.15026, indexed in Pubmed: 32370572.
14. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004; 363(9403): 157–163, doi: 10.1016/S0140-6736(03)15268-3, indexed in Pubmed: 14726171.
15. Waist circumference and waist-hip ratio: report of a WHO expert consultation n.d. https://www.who.int/publications-detail-redirect/9789241501491 (accessed July 31, 2023).
16. Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): construct validity and normative data in a large non-clinical sample. Br J Clin Psychol. 2005; 44(Pt 2): 227–239, doi: 10.1348/014466505X29657, indexed in Pubmed: 16004657.
17. Global status report on alcohol and health 2018. https://www.who.int/publications/i/item/9789241565639 (accessed June 28, 2023).

18. Haskell WL, Lee IM, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc. 2007; 39(8): 1423–1434, doi: 10.1249/mss.0b013e3180616b27, indexed in Pubmed: 17762377.
19. Binh TQ, Phuong PT, Nhung BT, et al. Metabolic syndrome among a middle-aged population in the Red River Delta region of Vietnam. BMC Endocr Disord. 2014; 14: 77, doi: 10.1186/1472-6823-14-77, indexed in Pubmed: 25261978.
20. Vu LT, Bui QT, Khuong LQ, et al. Trend of metabolic risk factors among the population aged 25-64 years for non-communicable diseases over time in Vietnam: A time series analysis using national STEPs survey data. Front Public Health. 2022; 10: 1045202, doi: 10.3389/fpubh.2022.1045202, indexed in Pubmed: 36530703.
21. Quoc Cuong T, Van Bao L, Anh Tuan N, et al. Associated factors of hypertension in women and men in Vietnam: a cross-sectional study. Int J Environ Res Public Health. 2019; 16(23): 4714, doi: 10.3390/ijerph16234714, indexed in Pubmed: 31779236.
22. Ayelo PA, Loddé B. Health status of a sample of Beninese seafarers examined on the occasion of medical fitness for work at sea. Int Marit Health. 2019; 70(4): 226–231, doi: 10.5603/IMH.2019.0036, indexed in Pubmed: 31891176.
23. Nas S, Fışkın R. A research on obesity among Turkish seafarers. Int Marit Health. 2014; 65(4): 187–191, doi: 10.5603/IMH.2014.0036, indexed in Pubmed: 25522701.
24. Hansen HL, Hjarnoe L, Jepsen JR. Obesity continues to be a major health risk for Danish seafarers and fishermen. Int Marit Health. 2011; 62: 98–103.
25. Oldenburg M, Harth V, Jensen HJ. Overview and prospect: food and nutrition of seafarers on merchant ships. Int Marit Health. 2013; 64(4): 191–194, doi: 10.5603/imh.2013.0003, indexed in Pubmed: 24408139.
26. Zyriax BC, von Katzler R, Jagemann B, et al. Food offerings on board and dietary intake of European and Kiribati seafarers: cross-sectional data from the seafarer nutrition study. J Occup Med Toxicol. 2018; 13: 9, doi: 10.1186/s12995-018-0190-0, indexed in Pubmed: 29988947.
27. Sagaro GG, Battineni G, Di Canio M, et al. Self-reported modifiable risk factors of cardiovascular disease among seafarers: a cross-sectional study of prevalence and clustering. J Pers Med. 2021; 11(6): 512, doi: 10.3390/jpm11060512, indexed in Pubmed: 34199824.
28. Meiqari L, Essink D, Wright P, et al. Prevalence of hypertension in Vietnam: a systematic review and meta-analysis. Asia Pac J Public Health. 2019; 31(2): 101–112, doi: 10.1177/1010539518824810, indexed in Pubmed: 30678477.
29. Hien HA, Tam NM, Tam Vo, et al. Prevalence, awareness, treatment, and control of hypertension and its risk factors in (central) Vietnam. Int J Hypertens. 2018; 2018: 6326984, doi: 10.1155/2018/6326984, indexed in Pubmed: 29887994.
30. Ab Majid NL, Omar MA, Khoo YY, et al. Prevalence, Awareness, Treatment and Control of hypertension in the Malaysian population: findings from the National Health and Morbidity Survey 2006-2015. J Hum Hypertens. 2018; 32(8-9): 617–624, doi: 10.1038/s41371-018-0082-x, indexed in Pubmed: 29899376.
31. Sagaro GG, Di Canio M, Amenta F. Correlation between body mass index and blood pressure in seafarers. Clin Exp Hypertens. 2021; 43(2): 189–195, doi: 10.1080/10641963.2020.1836193, indexed in Pubmed: 33086896.
32. David L, Brice L, Richard P, et al. Seafarers' Occupational Noise Exposure and Cardiovascular Risk. Comments to Bolm-Audorff, U.; et al. Occupational Noise and Hypertension Risk: A Systematic Review and Meta-Analysis. 2020, 17, 6281. Int J Environ Res Public Health. 2021; 18(3): 1149, doi: 10.3390/ijerph18031149, indexed in Pubmed: 33525471.
33. Chowdhury MAB, Uddin MJ, Haque MR, et al. Hypertension among adults in Bangladesh: evidence from a national cross-sectional survey. BMC Cardiovasc Disord. 2016; 16: 22, doi: 10.1186/s12872-016-0197-3, indexed in Pubmed: 26809175.
34. Lee WY, Jung CH, Park JS, et al. Effects of smoking, alcohol, exercise, education, and family history on the metabolic syndrome as defined by the ATP III. Diabetes Res Clin Pract. 2005; 67(1): 70–77, doi: 10.1016/j.diabres.2004.05.006, indexed in Pubmed: 15620436.

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 3: 161–170
10.5603/imh.96970
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Five-year (2015–2019) follow-up study of 6,526 cases of medical repatriation of Filipino seafarers

**Antonio Roberto M. Abaya[1], Jonathan P. Chan[1], Jian Kenzo O. Leal[1], Raymond Francis R. Sarmiento[2], Saren Bongalonta-Roldan[1], Jaime Jose Lorenzo C. De Rivera[1]**

[1]Health Metrics Inc., Makati, Philippines
[2]National Telehealth Centre, National Institutes of Health, University of the Philippines Manila, Manila, Philippines

## ABSTRACT

***Background:*** *There is a limited number of studies on the medical repatriation of seafarers. The aim of the study was to follow up on the previous 2010–2014 study using data from 2015–2019 to evaluate the epidemiology of medical repatriation among Filipino seafarers.*

***Materials and methods:*** *Data from medical repatriation records of Filipino seafarers from January 2015 to December 2019 were collected from various claims departments of different manning agencies in Manila, Philippines.*

***Results:*** *Data from a total of 6,526 medical repatriation cases and 464,418 deployments in a 5-year period resulted in a medical repatriation rate calculated at 1.4%. We used the 10$^{th}$ revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) to determine the most common causes of repatriation. We found that these were musculoskeletal disorders, gastrointestinal problems, and traumatic injuries. The distribution of the specific illnesses per organ system is presented.*

***Conclusions:*** *Filipinos continue to represent the most numerous group of seafarers in the world. The continued profiling of health issues should lead to better health protocols and controlling medical costs. It should also lead to better prioritisation of health protection and care on board ships. Within the present 10-year database of medical repatriations coinciding with the implementation of Maritime Convention Labour Convention 2006, there is a compelling need to compare the two data sets to have an objective evaluation of the convention's projected goals.*

*(Int Marit Health 2023; 74, 3: 161–170)*

**Keywords: occupational health, medical repatriation, epidemiology, seafarers, occupational injury**

## INTRODUCTION

Seafarers from the Philippines are a vital and indispensable workforce worldwide, with the Philippines being a major supplier, accounting for 20% of all seafarers according to the International Labour Organization (ILO) [1]. This has also been supported by the Baltic and International Maritime Council/International Chamber of Shipping (BIMCO/ICS) Seafarer Workforce report from 2021, that Filipinos were reported as having the highest number of both officers and ratings among the other top 5 manning countries, including, China, Russia, Indonesia, and India [2]. In 2021, statistics from the Statista Research Department [3] showed that about 345,520 seafarers were deployed overseas from the Philippines.

All seafarers are continuously at risk of developing illnesses and injuries while at work on ships. Their health is still a concern and studies on profiling their health issues are still relevant in mitigating medical repatriations. This has been emphasized by the implementation of the Maritime Labour Convention (MLC 2006) in 2015, where one of the provisions is to ensure the health protection, medical care, welfare, and social security protection of all seafarers [4].

Dr. Antonio Roberto M. Abaya, Health Metrics Inc, 1157 Chino Roces Ave, Makati City, 1203 Philippines, e-mail: aabaya@healthmetrics.com.ph

Received: 15.08.2023 Accepted: 13.09.2023

Despite this, there are still few studies regarding medical repatriations [5–9].

This observational study aims to continue to describe the epidemiology of medical repatriation among seafarers in the Philippines by highlighting the most common causes of repatriation and disorders or diseases by organ system as initiated during the first study done by our group in 2015 [10]. We wanted to get the data after MLC 2006 was enforced to be able to see if there have been any differences since its implementation. MLC 2006 came into force in August of 2013 and the review of the repatriation cases in 2015–2019 could be a first evaluation of its effect on seafarer health and safety. Making the stakeholders aware of this data has helped some of our clinical decisions in Pre-Employment Medical Examination (PEME) guidelines. Having spread the data to shipowners, manning agents, and Protection and Indemnity (P&I) clubs has given them a better understanding of the realities on board the various ships causing medical repatriations. From our past research, data has been helpful in implementing screening protocols during PEME for risk-based clinical assessment to reduce the incidence of medical repatriations among seafarers from the Philippines. It is hoped that bigger sequential data will help form better policies to further lessen the various health risks to Filipino seafarers.

## MATERIALS AND METHODS

We collected aggregate data for the period of January 2015 to December 2019 from the claims and legal departments of various manning agencies in Metro Manila to get the most accurate and complete data on medical repatriation cases. Our analysis utilised de-identified and non-coded data, ensuring the privacy of individuals. The collected information included crew age, position, diagnosis, and the total number of seafaring deployments by the manning agencies from January 2015 to December 2019. We also obtained the total number of sea-based deployments published by the Philippine Overseas Employment Administration (POEA) to calculate the total repatriation rate.

No personally identifiable information was collected or used, and there was no direct interaction with individual crew members. To determine the most common causes of repatriation, we employed the 10$^{th}$ revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) [11]. Each entry was double-checked by two medical doctors. Data management and descriptive analyses were performed using Microsoft Excel® and Google Sheets®.

## RESULTS

Our study analysed 6,526 medical repatriation cases from January 2015 to December 2019 (Table 1).

**Table 1.** Distribution of deployments and repatriation cases

| Period | Number of deployments | Number of repatriation cases (%) |
|---|---|---|
| 2015 | 92,791 | 1,715 |
| 2016 | 92,554 | 1,396 |
| 2017 | 73,916 | 1,143 |
| 2018 | 100,128 | 1,068 |
| 2019 | 105,029 | 1,204 |
| Total | 464,418 | 6,526 (1.4%) |

The 14 manning agents where we collated the repatriation data represented 2,478 ships from 166 different shipping companies (both merchant and passenger). There was a total of 464,418 deployments across the corresponding shipping companies, which represents 20.3% of the reported 2,288,937 deployments noted by the POEA for the same period of 2015–2019. The large number of data from 20% of the total population of the seafarer deployments for the 5 year period makes this study significantly representative of the Filipino seafaring population.

The mean age of medical repatriation for our study was 40.9 years. Of these cases, 37.2% were from deck staff, 26.6% were from engine staff, 25.2% were from hotel staff, and 11.0% were from kitchen staff. Based on our analysis, the three most common causes for medical repatriation are musculoskeletal, gastrointestinal (GI), and trauma cases, as seen in Table 2 and Figure 1.

Musculoskeletal disorders including strains, sprains, tears, and nerve impingement accounted for nearly a quarter of repatriations at 23.2%, while GI problems were the second at 18.6%. The third most common cause was injuries such as fractures, lacerations, and contusions at 15.1%.

The top 3 causes comprise more than half of all repatriation cases. The contributions of all other organ systems are each in single-digit percentages. Cardiovascular diseases, such as hypertension, stroke or cerebrovascular disease, and coronary artery disease, accounted for 7%. Dermatological problems, such as dermatitis, abscesses, and lipomas, represented 6.7%. Genitourinary system problems (6.6%), ophthalmologic diseases (4.1%), respiratory disorders (3.3%), infectious (2.9%), and psychiatric issues (2.3%) completed the top 10 causes for medical repatriation in our data set.

Figure 2 shows the distribution of injured body parts in seafarers due to musculoskeletal problems. These cases mainly included sprains and strains and included injuries not due to trauma. About a third of all complaints (n = 458 cases; 30.2%) were due to low back pain, while 235 (15.5%) cases involved the leg or the knee. Concerns regarding the shoulder/arm (n = 196 cases; 12.9%), ankle/foot (n = 166 cases;

**Table 2.** Distribution of the causes of medical repatriation using ICD-10

| Cause of medical repatriation | ICD-10 code range | ICD-10 code category | Number of medical repatriations (%) |
|---|---|---|---|
| Musculoskeletal | M00-M99 | Diseases of the musculoskeletal system and connective tissue | 1516 (23.2%) |
| Gastrointestinal | K09-K93 | Diseases of the digestive system | 1213 (18.6%) |
| Injury (trauma) | S00-T98 | Injury, poisoning and certain other consequences of external causes | 988 (15.1%) |
| Cardiovascular | I00-I99 | Diseases of the circulatory system | 460 (7.0%) |
| Dermatological | L00-L99 | Diseases of the skin and subcutaneous tissue | 456 (7.0%) |
| Genitourinary | N00-N99 | Diseases of the genitourinary system | 430 (6.6%) |
| Ophthalmological | H00-H59 | Diseases of the eye and adnexa | 268 (4.1%) |
| Respiratory | J00-J99 | Diseases of the respiratory system | 212 (3.3%) |
| Infectious | A00-B99 | Certain infectious and parasitic diseases | 186 (2.9%) |
| Psychiatric | F00-F99 | Mental and behavioural disorders | 153 (2.3%) |
| Neoplastic | C00-D48 | Neoplasms | 133 (2.0%) |
| Otological | H60-H95 | Diseases of the ear and mastoid process | 129 (2.0%) |
| Neurological | G00-G99 | Diseases of the nervous system | 94 (1.4%) |
| Endocrinological | E00-E90 | Endocrine, nutritional and metabolic diseases | 86 (1.3%) |
| OB-Gyne | O00-O99 | Pregnancy, childbirth and the puerperium | 80 (1.2%) |
| Others | Not available | Not available | 60 (0.9%) |
| Dental | K00-K08 | Diseases of oral cavity, salivary glands and jaws | 55 (0.8%) |
| Haematological | D50-D89 | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 7 (0.1%) |

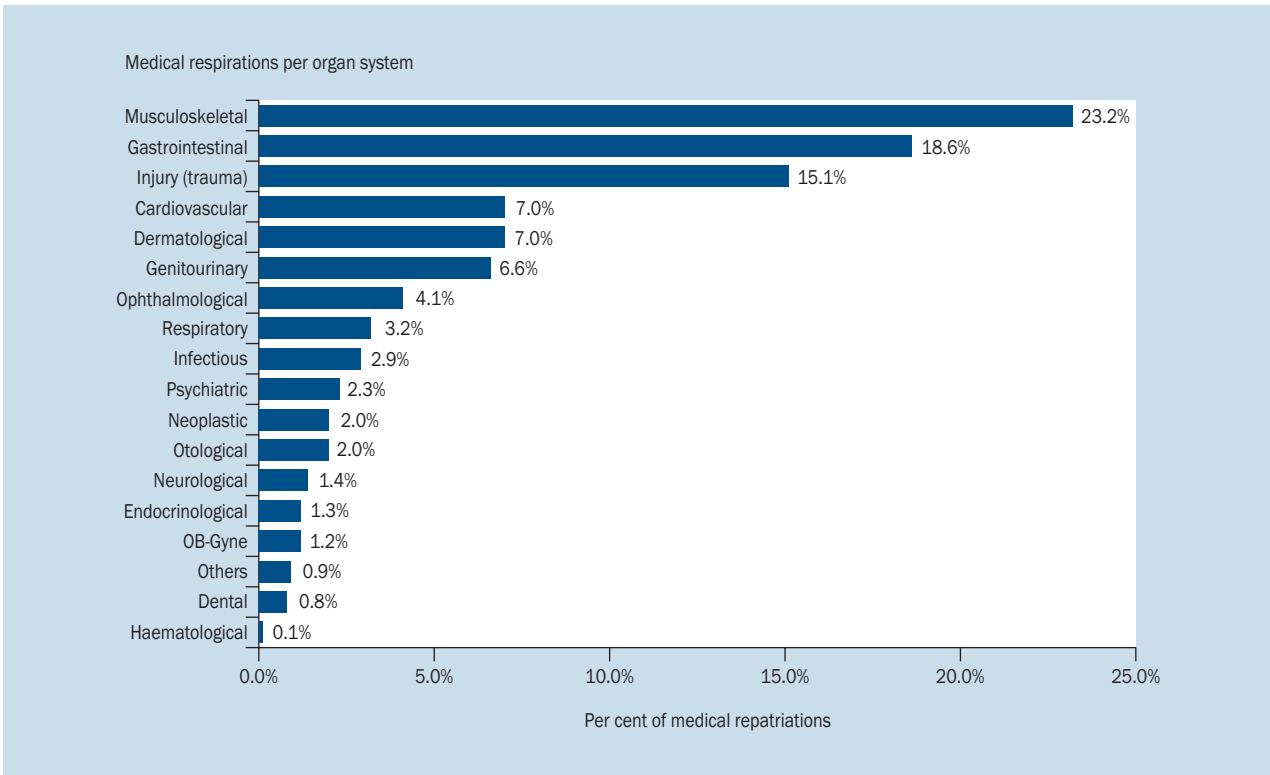



**Figure 1.** Distribution of the causes of medical repatriation using ICD-10

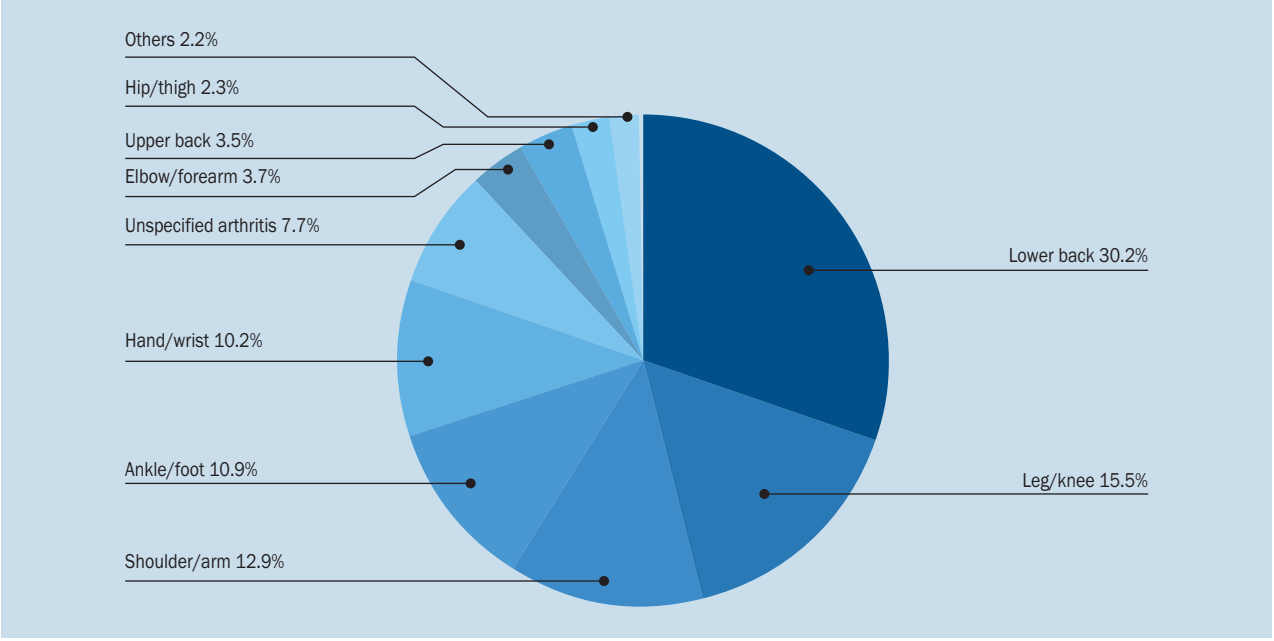



**Figure 2.** Distribution of affected body parts in seafarers due to musculoskeletal problems (n = 1,516)

10.9%), and hand/wrist (n = 154 cases; 10.2%) had similar contributions to the total number of cases. Those found with unspecified arthritis, such as gout and other rheumatisms, accounted for 7.7% of cases (n = 116), while those involving the elbow or forearm contributed 56 (3.7%) cases. Lastly, cases involving the upper back numbered 53 (3.5%), those involving the hip or thigh numbered 35 (2.3%), and those involving the chest numbered 14 (0.9%).

Figure 3 illustrates the different illnesses repatriated seafarers had due to GI disorders. The leading cause was appendicitis with 239 (19.7%) cases. Hernias and abdominal pain likewise had a similar number of cases at 161 (13.3%) cases and 156 (12.9%) cases, respectively. There were 133 (11.0%) cases of haemorrhoids, followed by 117 (9.6%) cases involving the gallbladder, including cholelithiasis and cholecystitis. Acid peptic disease, including dyspepsia, acid reflux, and gastroesophageal reflux disease, accounted for 96 (7.9%) cases. Causes of gastritis other than acid peptic disease were found in 66 (5.4%) cases. Anal problems other than haemorrhoids, including fistulas, were seen in 64 (5.3%) cases. There were 52 (4.3%) cases of acute gastroenteritis and infectious GI inflammation, including diverticulitis, colitis, etc., were found in 42 (3.5%) cases. GI bleed, including haematochezia, contributed to 36 (3.0%) cases. The other GI causes for repatriation included those involving the liver, including hepatitis, at 31 (2.6%) cases, pancreatitis at 9 (0.7%) cases, and those involving the oesophagus at 7 (0.6%) cases.

The third most common cause of medical repatriation are those due to injury, namely lacerations, contusions, burns, fractures, and amputations, among others, as seen in Figure 4. We divided the cases based on the injured body part, with the hand or wrist being affected in more than half of the total at 510 (51.6%) cases. This was followed by cases involving the head at 108 (10.9%) cases and the ankle or foot at 71 (7.2%) cases. Cases involving the leg or knee and elbow or forearm had similar counts at 63 (6.4%) cases and 62 (6.3%) cases, respectively. Those involving the chest and shoulder, or arm also had similar distributions at 48 (4.9%) cases and 47 (4.8%) cases, respectively. Heat exhaustion was the identified cause in 19 (2.9%) cases, while the lower back was affected in 18 (1.8%) cases, the hip or thigh in 14 (1.4%) cases, and the upper back in 4 (0.4%) cases.

Table 3 shows the distribution of injuries or illnesses classified by organ systems not part of the top 3 causes. Cardiovascular diseases accounted for 7% of all repatriation cases. The leading cause of cardiovascular disease was hypertension with 121 (26.3%) cases of repatriation. This was followed by coronary artery disease with 88 (19%) cases. There was a total of 69 (15%) cases of cerebrovascular disease. Dermatological diseases caused a similar share of all repatriations at 7%. Dermatitis and abscesses represent more than half of all dermatological problems with 175 (38%) and 120 (26%) cases, respectively. The third most common dermatologic problem was cysts at 43 (9%) cases.

The genitourinary system was affected in 6.59% of cases, with kidney stones accounting for 181 (42%) cases. This was followed by testicular disease, including

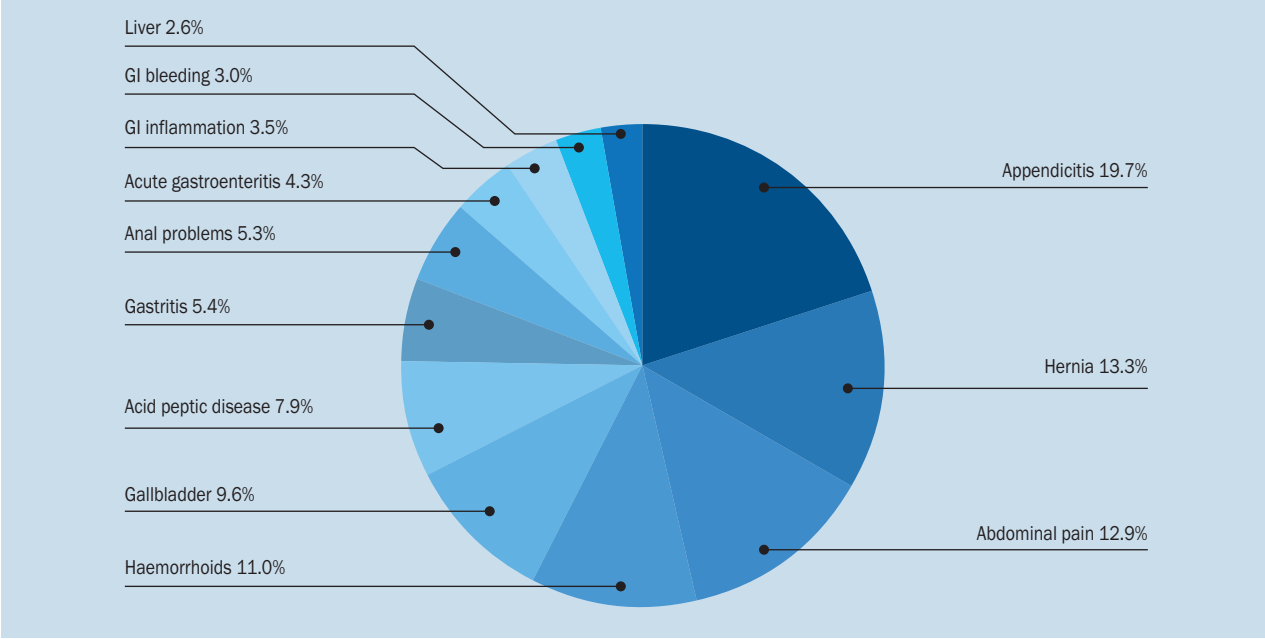



**Figure 3.** Distribution of illnesses in seafarers due to gastrointestinal problems (n = 1,213); GI — gastrointestinal

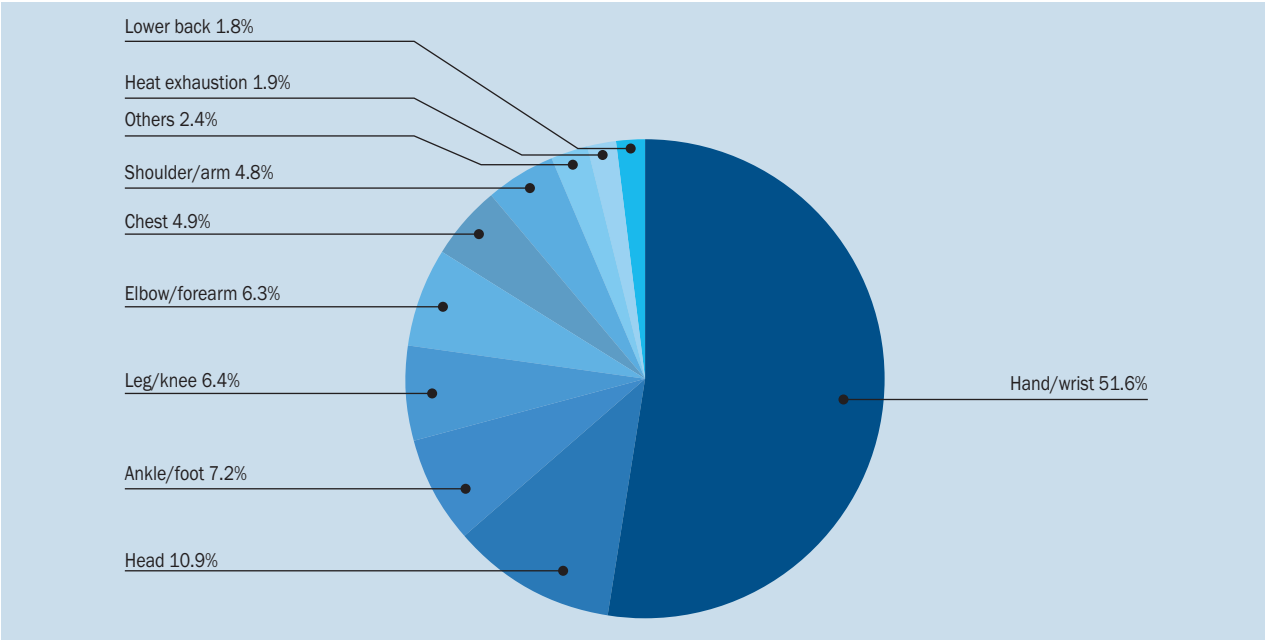



**Figure 4.** Distribution of injured body parts in seafarers due to injury (n = 988)

varicocele, epididymitis, and scrotal pain, at 116 cases (27%) and genitourinary infection or genitourinary infection at 66 (15%) cases. The most common ophthalmologic cause for repatriation was infection or inflammation, which included conjunctivitis, keratitis, and chalazion, at 66 (24%) cases. Cases involving the cornea, mainly due to foreign body injuries, followed at 53 (20%) cases, while cases involving the retina were the third most common at 30 (11%) cases.

Respiratory diseases accounted for 3.2% of cases, totalling 212. Infections involving the respiratory system, including pulmonary tuberculosis, comprised the most of these at 93 (44%) cases. Asthma or chronic obstructive pulmonary disease was second-most at 29 (14%) cases, while those involving the pharynx or upper airway, including obstructive sleep apnoea, tonsillitis, and sinusitis, were third at 26 (12%) cases. Infectious causes accounted for 2.85% of the total number of repatriations, with viral exanthems

**Table 3.** Distribution of illnesses by organ system

| Organ system and chief complaint or injured body part | Rate of medical respiration (%) |
|---|---|
| **CARDIOVASCULAR (n = 460)** | |
| Hypertension | 26.3% |
| Coronary artery disease | 19.1% |
| Cerebrovascular disease | 15.0% |
| Vascular | 12.6% |
| Angina | 11.3% |
| Arrhythmia | 6.3% |
| Heart failure | 3.0% |
| Syncope | 2.4% |
| Cardiomyopathy | 1.7% |
| Aortic dissection | 0.9% |
| Cardiac arrest | 0.9% |
| Rheumatic heart disease | 0.4% |
| **DERMATOLOGICAL (n = 456)** | |
| Dermatitis | 38.4% |
| Abscess | 26.3% |
| Cysts | 9.4% |
| Cellulitis | 9.0% |
| Lipoma | 5.7% |
| Allergy | 3.9% |
| Psoriasis | 2.2% |
| Nail | 1.3% |
| Tinea | 1.1% |
| Warts | 0.9% |
| Acne | 0.7% |
| Erysipelas | 0.7% |
| Alopecia | 0.4% |
| **GENITOURINARY (n = 430)** | |
| Kidney stones | 42.1% |
| Testicular disease | 27.0% |
| Genitourinary infection | 15.3% |
| Prostate | 8.6% |
| Acute/chronic kidney disease | 5.1% |
| Kidney (others) | 1.9% |
| **OPHTHALMOLOGIC (n = 268)** | |
| Infection/inflammation | 24.6% |
| Cornea | 19.8% |
| Retina | 11.2% |
| Pterygium | 10.8% |
| Visual defects | 10.1% |
| Cataract | 6.0% |
| Glaucoma | 4.1% |
| Haemorrhage | 3.7% |
| Others | 3.4% |
| Eye lid | 2.6% |
| Dry eye syndrome | 1.5% |
| Optic nerve | 1.1% |
| Vascular | 1.1% |
| **RESPIRATORY (n = 212)** | |
| Respiratory infection | 43.9% |
| Asthma/chronic obstructive pulmonary disease | 13.7% |
| Pharynx/upper airway | 12.3% |
| Nose (others) | 11.8% |
| Epistaxis | 8.5% |
| Pleura | 4.7% |
| Inhalation injury | 3.3% |
| Larynx | 1.9% |
| **INFECTIOUS (n = 186)** | |
| Viral exanthems | 44.1% |
| Malaria | 18.3% |
| Sepsis | 9.7% |
| Others | 5.9% |
| Tuberculosis (outside lung) | 5.9% |
| Dengue | 4.8% |
| Sexually transmitted disease | 4.8% |
| Fever of unknown origin | 2.7% |
| Leprosy | 1.6% |
| Meningitis | 1.1% |
| Rheumatic fever | 1.1% |
| **PSYCHIATRIC (n = 153)** | |
| Anxiety/adjustment disorder | 54.9% |
| Depression | 14.4% |
| Insomnia | 10.5% |
| Psychosis/schizophrenia | 9.2% |
| Post traumatic stress disorder | 8.5% |
| Bipolar disorder | 1.3% |
| Suicide | 1.3% |
| **NEOPLASTIC (n = 133)** | |
| Head or neck | 46.6% |
| Gastrointestinal | 18.8% |
| Bone/extremity | 8.3% |
| Breast | 8.3% |
| Genitourinary | 6.8% |

**Table 3 cont.** Distribution of illnesses by organ system

| Organ system and chief complaint or injured body part | Rate of medical respiration (%) |
|---|---|
| Lung | 4.5% |
| Haematological | 3.8% |
| Others | 3.0% |
| **OTOLOGICAL (n = 129)** | |
| Vertigo/dizziness | 35.7% |
| Ear infection/perforation | 31.8% |
| Hearing loss | 11.6% |
| Tinnitus | 9.3% |
| Ear pain | 8.5% |
| Cyst (otological) | 2.3% |
| Others | 0.8% |
| **NEUROLOGICAL (n = 94)** | |
| Migraine/headache | 40.4% |
| Bell's palsy | 25.5% |
| Neuropathy | 21.3% |
| Seizures/epilepsy | 10.6% |
| Coma | 1.1% |
| Degenerative | 1.1% |
| **ENDOCRINOLOGICAL (n = 86)** | |
| Thyroid | 57.0% |
| Type 2 diabetes mellitus | 38.4% |
| Dyslipidaemia | 4.7% |
| **OB-GYNE (n = 80)** | |
| Gynaecologic problems | 76.3% |
| Pregnancy/abortion | 23.8% |
| **DENTAL (n = 55)** | |
| Dental infection | 25.5% |
| Periodontal disease | 21.8% |
| Toothache | 14.5% |
| Jaw problems | 12.7% |
| Dental caries | 7.3% |
| Lost teeth | 7.3% |
| Impacted tooth | 5.5% |
| Teeth extraction | 5.5% |
| **HAEMATOLOGIC (n = 7)** | |
| Anaemia | 85.7% |
| Others | 14.3% |

being the leading cause at 82 (44%) cases. These included cases of chickenpox, varicella zoster, measles, mumps, and others. Malaria followed with 34 (18%) cases, with sepsis being the third most common at 18 (10%) cases.

Psychiatric or mental health concerns caused 2.3% of medical repatriations. Anxiety or adjustment disorder was the most common cause at 84 (54%) cases. Depression and insomnia then followed at 22 (14%) and 16 (10%) cases, respectively. Various neoplastic diseases caused 2.0% of cases, with those involving the head or neck being the most common at 46.6%. Those involving the GI system followed at 25 (19%) cases, with those involving the breast and bone or extremities being tied at 11 (8%) cases.

Medical repatriation cases involving the ear accounted for 1.98% of cases, with a number totalling 129 cases. Vertigo or dizziness was the most common otologic cause at 46 (36%) cases, followed closely by ear infection or tympanic membrane perforation at 41 (32%) cases. Hearing loss, tinnitus, and unspecified ear pain had a similar number of cases at 15 (11%) cases, 12 (9%) cases, and 11 (8%) cases, respectively. Neurological conditions caused 1.44% of cases and were mainly caused by migraine or headache at 38 (40%) cases. The second most common neurologic cause was Bell's palsy at 24 (25%) cases, followed closely by various neuropathies at 20 (21%) cases.

A majority of endocrinologic diseases (accounting for 1.3% of cases) were related to the thyroid at 49 (57.0%) cases and was followed by type 2 diabetes mellitus at 33 (38.3%) cases. Dyslipidaemia completed the list of repatriations due to endocrinologic disorders but represented a small minority of cases at 4.7% (or 4 cases) only. We classified obstetric-gynaecologic cases into pregnancy or abortion and gynaecologic problems. Gynaecologic problems were more common at 61 (76%) cases, while pregnancy or abortion were less common at 19 (24%) cases.

For dental (n = 55), many of the cases were dental infections and periodontal diseases, while for haematologic cases (n = 7), all but one was caused by anaemia (6 cases).

## DISCUSSION

Observational epidemiological studies continue to be relevant in the field of research in medicine. One purpose of observational studies is to establish the frequency of occurrence, prevalence, impact, and other characteristics of diseases or other conditions in populations or selected subgroups of the population, in this case, Filipino seafarers.

The initial study by our research group published in 2015 examined the underlying causes of medical repatriations among seafarers from the Philippines, utilising the largest dataset from 2010 to 1014 on this subject worldwide. Drawing on data provided by the POEA spanning the period from 2015 to 2019, a total of 2,288,937 deployments was recorded in the country. Consequently, the data analysed in this present study account for a substantial proportion, approximately 20.3%, of the overall deployments in the Philippines during the same period.

Prior studies have endeavoured to explore the reasons behind repatriation across different nationalities, with a predominant focus on accidents and trauma occurring on board ships. Additionally, investigations have been conducted on the causes of mortality among seafarers [12–15].

The findings of this study underscore the top 3 causes of medical repatriation, namely musculoskeletal injuries (23.2%), GI diseases (18.6%), and traumatic injuries (15.1%), as the top 3 causes. These factors account for more than half of all repatriations observed at 56.9%. This is consistent with a study done by Sagaro et al. [12], where they found that the top 2 causes of disease or injury for their population of 423 Italian seafarers were GI disorders, followed by musculoskeletal diseases. There is a difference in the top 3 causes of repatriations in our previous publication in 2015 [10] where injury, musculoskeletal, and GI system, respectively, were the top causes. There is a plan to analyse and discuss the differences further in a subsequent study our research group is presently preparing. In our present study, the musculoskeletal system emerged as the most frequent reason for repatriation, comprising more than one-fifth of all repatriated cases. This most likely reflects the repetitive labour component of the seafarer profession, with continuous motor and strength motions causing musculoskeletal injury. Exposure to ergonomic risk factors and repetitive motions may cause fatigue and when fatigue, in time, overcomes the natural recovery system of the body, muscular imbalance and an actual anatomic disorder may occur. Lumbar issues (30.2%) predominate most probably due to poor lifting techniques and non-recognition of individual lifting limits. This is supported by a 2023 study by Bilir et al. [13], where they attributed the high incidence of musculoskeletal disorders among seafarers to either poor posture for captains/officers or a high level of physical strain for engine room/deck personnel.

These outcomes align with a 2005 study by Jensen et al. [14], encompassing 6,461 participants, which reported an injury rate of 9.1%. Their research indicated that blows and wounds constituted 49% of injuries, followed by fractures at 12.4%. Furthermore, 70% of injuries transpired on the ship's deck or within engine rooms. In our investigation, hand trauma accounted for 51.62% of injuries leading to repatriation, which is unsurprising given the manual labour typically performed by seafarers. The predominance of injuries to the hand or wrist is consistent with the study done by Sagaro et al. [12] in which the hand or wrist was the most common body part injured at 29% of cases, followed by lower back or lumbar spine injuries at 12%.

The digestive system is the second-highest system for medical repatriations. The most prevalent case is still appendicitis in line with the study by Dahl in 2006 [15]. While surgery is still considered the golden treatment standard, more non-surgical options like early and aggressive antibiotic treatment are being recommended by several studies [16–20]. Perhaps better and early identification and having antibiotics on board could be part of the treatment protocols, decreasing emergency port diversions or even helicopter evacuations.

Abdominal pain accounts for a significant cause of repatriation. This is due to the cautious approach in managing pain of unknown origin, preferring to discharge the patient rather than sail out with a patient in distress. Due to logistical considerations such as port delays or prolonged periods at sea, authorities more commonly decide to repatriate affected crew members. Many of these cases then return to the Philippines pain-free.

The combination of musculoskeletal problems and traumatic injuries accounted for nearly 41% of all repatriations, as these issues often arise from work-related activities. This finding assumes significance, as these cases could potentially be attributed to occupational factors. The high prevalence of work-related injuries underscores the urgent need for comprehensive safety training for Filipino seafarers. Additionally, the implementation of precautionary measures and the establishment of safe working conditions are imperative for reducing and preventing accidents and traumatic incidents.

Considering the overall medical repatriation rate of 1.4% in this study, it can be viewed as low. This observation suggests that Filipino seafarers are generally a healthy group. When removing typical work-related injuries and musculoskeletal disorders, the repatriation rate of actual medical illnesses is approximately 0.86%. This outcome could again be attributed, at least in part, to the comprehensive health screenings conducted by pre-employment medical clinics in the Philippines and proper medical management of chronic diseases while seafarers are on board. Continued epidemiological monitoring is beneficial for observing trends and patterns for occupational health maintenance.

## STRENGTHS AND LIMITATIONS OF STUDY

The strengths of this observational study lie in the large number of cases over a 5 year period. Studying the data of 20.3% of an epidemiologic population study makes it significant and representative. With the amount of data which now can include our previous paper, we can stretch this into a 10 year study and/or analyse the differences or similarities between two five year periods. There can also be various studies that can further evolve from this database of information for further analysis into the various tissues regarding seafarer health and safety.

Several limitations should be considered. First, the data collection was limited to manning agencies located in Manila, Philippines. As a result, the findings of this study may

not accurately represent the overall burden of medical repatriations in the entire Philippines. Additionally, there is a likelihood of underreporting of repatriation cases because it is assumed that Filipino seafarers may be hesitant to seek medical assistance while on board and may prefer to seek treatment after returning to their home country. Furthermore, this study primarily focused on acute health disorders, potentially leading to an underreporting of latent chronic conditions. Moreover, the retrospective nature of the analysis and the use of aggregated data resulted in a lack of detailed and comprehensive information, which could have been ideal. Further research is required to conduct a more thorough analysis of the available data, particularly considering that this dataset represents the largest collection of medical repatriations to date. Certain regulatory restrictions (i.e., strict implementation of R.A. 10173, or the 2012 Data Privacy Act) prevented the study team from doing a longitudinal follow-up study of individual-level patient data.

## CONCLUSIONS

Observational studies serve the purpose of assessing the prevalence, consequences, outlook, and various attributes of diseases or conditions in populations or specific subsets of the population. These studies provide valuable data for prioritising research and control efforts, determining target areas for prevention, and identifying the appropriate treatment resources required. Profiling the health issues specific to Filipino seafarers can contribute to the optimisation of existing protocols, implementation of health surveillance programmes, and formulation of health policies tailored to seafaring personnel. Additionally, the outcomes of our study can aid pre-employment medical exam physicians in identifying and managing conditions that pose a heightened risk of necessitating medical repatriation.

Medical repatriations continue to place a significant liability on the largest demographic group of the global seafaring population. The highest prevalence of musculoskeletal injuries and trauma highlights the continued dangers and risks on board as well as the necessity of comprehensive safety protocols on ships. This present study's findings can continue to serve as a reference point for assessing the health status of seafarers from any shipping company in the Philippines. It would be ideal to get this kind of medical repatriation data from other seafaring nations to benchmark, evaluate and share best practices. The recently established MLC 2006 was created to improve the safety, living conditions, and health of the global seafarer. Since we now have 10-year data from a period before and after it went into effect, our group intends to make a comparative study looking at the repatriation data from both periods in a separate paper.

**Conflict of interest:** None declared

## REFERENCES


1. International Labor Organization. Decent work for Seafarers. https://www.ilo.org/manila/areasofwork/WCMS_379393/lang–en/index.htm (Last accessed 26 June 2023).
2. BIMCO ICS Seafarer Workforce report 2021. www.bimco.org/about-us-and-our-members?publications/seafarers-workforce-report.
3. Statista. Number of seafarers deployed overseas from the Philippines from 2016 to 2021. https://www.statista.com/statistics/1269763/philippines-amount-of-seafarers-deployed-overseas/#:~:text=In%202021%2C%20about%20345.52%20thousand,to%20the%20COVID%2D19%20pandemic (Last accessed 26 June 2023).
4. Maritime Labour Convention, 2006. International Labour Conference. https://www.ilo.org/wcmsp5/groups/public/—ed_norm/—normes/documents/normativeinstrument/wcms_090250.pdf (Last accessed 26 June 2023).
5. Lefkowitz RY, Slade MD, Redlich CA. Injury, illness, and work restriction in merchant seafarers. Am J Ind Med. 2015; 58(6): 688–696, doi: 10.1002/ajim.22459, indexed in Pubmed: 25939921.
6. Lefkowitz R, Slade M, Redlich C. Risk factors for merchant seafarer repatriation due to injury or illness at sea. Int Marit Health. 2015; 66(2): 61–66, doi: 10.5603/imh.2015.0016.
7. Ehara M, Muramatsu S, Sano Y, et al. The tendency of diseases among seamen during the last fifteen years in Japan. Ind Health. 2006; 44(1): 155–160, doi: 10.2486/indhealth.44.155, indexed in Pubmed: 16610553.
8. Ádám B. Association between nationality and occupational injury risk on Danish non-passenger merchant ships. Int Marit Health. 2013; 64(3): 121–125, indexed in Pubmed: 24072537.
9. Sagaro GG, Angeloni U, Marotta C, et al. The magnitude of cardiovascular disease risk factors in seafarers from 1994 to 2021: a systematic review and meta-analysis. J Pers Med. 2023; 13(5), doi: 10.3390/jpm13050861, indexed in Pubmed: 37241030.
10. Abaya AR, Roldan S, Ongchangco JC, et al. Repatriation rates in Filipino seafarers: a five-year study of 6,759 cases. Int Marit Health. 2015; 66(4): 189–195, doi: 10.5603/IMH.2015.0038, indexed in Pubmed: 26726888.
11. ICD-10 Version:2019 [Internet]. icd.who.int. 2019. https://icd.who.int/browse10/2019/en.
12. Sagaro GG, Dicanio M, Battineni G, et al. Incidence of occupational injuries and diseases among seafarers: a descriptive epidemiological study based on contacts from onboard ships to the Italian Telemedical Maritime Assistance Service in Rome, Italy. BMJ Open. 2021; 11(3): e044633, doi: 10.1136/bmjopen-2020-044633, indexed in Pubmed: 33727272.
13. Bilir NA, Scheit L, Dirksen-Fischer M, et al. Accidents, diseases and health complaints among seafarers on German-flagged container ships. BMC Public Health. 2023; 23(1): 963, doi: 10.1186/s12889-023-15943-x, indexed in Pubmed: 37237421.
14. Jensen OC, Flores A, Baygi F, et al. Follow-up of citations of maritime epidemiological injury studies. Int Marit Health. 2020; 71(1): 62–70, doi: 10.5603/IMH.2020.0013, indexed in Pubmed: 32212150.
15. Dahl E. Crew referrals to dentists and medical specialist ashore: a descriptive study of practice on three passenger vessels during one year. Int Marit Health. 2006; 57(1-4): 127–135, indexed in Pubmed: 17312701.
16. Flum DR, Davidson GH, Monsell SE, et al. CODA Collaborative. A randomized trial comparing antibiotics with appendectomy for appendicitis. N Engl J Med. 2020; 383(20): 1907–1919, doi: 10.1056/NEJMoa2014320, indexed in Pubmed: 33017106.

17. Yang Z, Sun F, Ai S, et al. Meta-analysis of studies comparing conservative treatment with antibiotics and appendectomy for acute appendicitis in the adult. BMC Surg. 2019; 19(1): 110, doi: 10.1186/s12893-019-0578-5, indexed in Pubmed: 31412833.
18. Sajjad MN, Naumeri F, Hina S. Non-operative treatment versus appendectomy for acute uncomplicated appendicitis: A randomized controlled trial. Pak J Med Sci. 2021; 37(5): 1276–1281, doi: 10.12669/pjms.37.5.4016, indexed in Pubmed: 34475898.
19. Moris D, Paulson EK, Pappas TN. Diagnosis and management of acute appendicitis in adults: a review. JAMA. 2021; 326(22): 2299–2311, doi: 10.1001/jama.2021.20502, indexed in Pubmed: 34905026.
20. Salminen P, Paajanen H, Rautio T, et al. Antibiotic therapy vs appendectomy for treatment of uncomplicated acute appendicitis: the APPAC randomized clinical trial. JAMA. 2015; 313(23): 2340–2348, doi: 10.1001/jama.2015.6154, indexed in Pubmed: 26080338.

VIA MEDICA

CASE REPORT

Int Marit Health
2023; 74, 3: 171–174
10.5603/imh.96932
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Deaths due to hydrogen sulphide on a jack up rig at Bombay High: an avoidable accident

**Ajit C. Kulkarni**

Medical Centre, Mumbai, India

## ABSTRACT

*An enclosed space is an area with poor or no natural ventilation which is not designed for continuous occupancy, where access is limited and which may contain a dangerous atmosphere. Enclosed space atmospheres can be hazardous due to one or a combination of the conditions which includes oxygen deficiency; presence of toxic and/or flammable gases. When it is intended that personnel should enter or work in an enclosed space, care should be taken to create and maintain safe working conditions.*

*The case report describes an incident on board an oil rig where the rig workers were exposed to noxious gases resulting in multiple fatalities. Work involved gas sampling/monitoring at various locations inside the "spud tanks" of the rig and certifying it free of noxious gases for marine surveyor's inspection.*

*Contributory factors that have been frequently identified following enclosed space accident investigations are non-compliance with procedures, inappropriate equipment, poor supervision, complacency and over familiarity leading to short cuts being taken, detection and monitoring equipment not used or not working properly and improper action in an emergency. Preventive measures to avoid such accidents and create a safe working area are discussed.*

*(Int Marit Health 2023; 74, 3: 171–174)*

**Keywords: hydrogen sulphide, jack up rig, enclosed space entry, permit to work, breathing apparatus, hyperbaric oxygen**

## INTRODUCTION

In every accident, there is a causative factor which is often preventable. Failure to adhere to safe working practices invariably end in an accident. Untrained worker or inadequate/inappropriate gear is often the root cause attributable in accident investigation.

Hydrogen sulphide ($H_2S$) is an extremely hazardous gas that occurs naturally in crude oil and natural gas. The gas is formed by the decomposition of organic matter containing sulphates by anaerobic bacteria. For the same reason, it is also found in sewers, paper and pulp mills etc. It is referred to as "sour gas", "sewer gas".

Hydrogen sulphide is a highly toxic, colourless, combustible gas. It has the unmistakable odour of rotten eggs at low concentration. However, the sense of smell is not a reliable warning because exposure to this gas results in paresis of olfactory nerve very quickly. It has a density of 1.5392 g/L and being heavier than air, tends to settle down in low lying areas. It is soluble in water and oil [1]. Presence of $H_2S$ at work place is a serious and hazardous work environment.

Offshore drilling in depths up to a maximum of 120 m of sea water (msw) is carried out by using a "jack up rig". They are fitted with long support legs that can be raised or lowered. Bottom of the legs are fitted with base cones, which are approximately 380 $m^3$ in volume and penetrate into the soil to give stability to the rig. They are like the feet of a rig and support the weight of the rig (15,000 tons) (Figs. 1, 2).

All marine structures have to undergo periodic inspection cycle every 5 years to ensure its efficiency within design parameters, so also spud cans. They are pulled out of water

Dr. Ajit C Kulkarni, Medical Centre, 3A, Siddhivinayak Chambers, Opp. MIG Cricket Club, Bandra East, Mumbai 400051, India, tel/fax: 91 (22) 2642 3428, e-mail: drackulkarni@gmail.com

Received: 11.08.2023 Accepted: 31.08.2023

**Figure 1.** Jack up rig

**Figure 2.** Spud can removed for maintenance

and undergo external and internal inspection. Unfortunate incident occurred during an inspection of a spud can.

## CASE REPORT

The rig was not working, legs were fully retracted and the spud cans were above the water and accessible for man entry. They were dewatered and forced ventilated for 2 days. "Gas free", i.e. no $H_2S$ present, "safe to enter" certificate had to be generated before a marine surveyor could enter the spud can for inspection. A diving team was present on board and the same consisting of three divers and one diving supervisor was nominated to enter the vast inside of a spud can and obtain gas samples using chemical tubes.

Diver had to climb down about 5 m using a vertical ladder into the spud can and then traverse to various corners. He was wearing SCUBA (self-contained underwater breathing apparatus) equipment. His life line was attended by another diver also wearing a breathing apparatus who stood at the bottom of the ladder and visible to the supervisor who was above. There was one "stand by" person fully dressed up with a breathing apparatus to intervene at short notice next to him. Few minutes after starting the operation, supervisor saw the attendant, who was at the bottom of the ladder, suddenly fell down and became unconscious. On seeing that, the supervisor, on an impulse, climbed down the ladder to assist him without a breathing apparatus. Before he could reach the attendant, he too became unconscious and collapsed. Alarm was raised and the rig engineer increased the ventilation rate to drive away "sour gas" from inside. Moment this was done, a large quantity of gas emerged out of the narrow opening on the spud can and the "stand by" person was affected and collapsed on the deck.

Emergency was sounded and the author was requested to proceed offshore by the contractor who had undertaken the job. Special helicopter was arranged for the same and author reached the rig in about 3 hours. But unfortunately all 3 persons who had entered the spud can were dead. "Stand by" person was resuscitated by the rig medic using amyl nitrite inhalation, oxygen resuscitator and intravenous ringer lactate as advised by the author. Helicopter that brought the author to the rig was standing by at a platform nearby and the patient was air evacuated and admitted in an intensive care unit of a hospital in Mumbai (Bombay) for further management.

Diver, his attendant and the diving supervisor died inside the spud tank. Stand by diver was rescued, revived and treated in the intensive care unit of a hospital.

## DISCUSSION

### CAUSE OF ACCIDENT

Cause of death as determined by coroner was asphyxia. Circumstantial evidence pointed to inhalation of $H_2S$ that was anticipated in the spud can. Spud can is almost 5 m in height and because of its typical internal construction, has numerous nooks and corners which are not well ventilated. In addition, there were puddles of mud sludge which contain dissolved $H_2S$. First person who went inside the spud can dislodged the collected $H_2S$ in low areas and also the sludge containing dissolved $H_2S$. Being exposed to this, he became unconscious and collapsed. Access to a spud can is very small and exhaust of continuous ventilation could escape to atmosphere through this single opening only. Attendant who was at the bottom of the ladder was thus affected by the toxic gas evolved and collapsed. Supervisor entered the spud can without a breathing apparatus and was affected by $H_2S$. "Stand by" person was affected by the gush of gas coming out of the opening due to forced ventilation but being in the open, quantity of gas inhaled was much less and could be revived.

There are various standards laid down for working in $H_2S$ environment. Permissible exposure limit of $H_2S$ is 10 parts per million (ppm) for 8 hour shift, 40 hours a week, called time weighted average. Short term exposure limit of 15 ppm for 15 min. A worker may be exposed to this level for 4 times

**Table 1.** Hydrogen sulphide effects on body

| Concentration [ppm] | Effects |
|---|---|
| 0.13 | Obvious and unpleasant odour generally at 0.13 ppm and quiet noticeable at 4.6 ppm |
| 10 | Unpleasant odour. Possible eye irritation. Threshold limit value (8-hour time weighted average) |
| 15 | Short term exposure limit averaged over 15 minutes |
| 20 | Burning sensation in eyes and irritation of the respiratory tract after 1 hour or more exposure |
| 50 | Loss of sense of smell after about 15 or more minutes exposure. Exposure over 1 hour may lead to headache, dizziness, and/or staggering. Pulmonary oedema reported following extended exposure to greater than 50 ppm. Serious eye irritation or damage |
| 100 | Coughing, eye irritation. Loss of sense of smell after 3 to 15 minutes. Altered respiration. Pain in eye, and drowsiness after 15 to 20 minutes, followed by throat irritation after 1 hour. Prolonged exposure results in a gradual increase in the severity of these symptoms |
| 300 | Marked conjunctivitis and respiratory tract irritation |
| 500 | Unconsciousness after short exposure, cessation of breathing if not treated quickly. Dizziness, loss of sense of reasoning and balance |
| 700 | Unconsciousness quickly. Breathing will stop and death will result |
| 1000 | Unconsciousness at once. Permanent brain damage or death may result |

in a shift provided there is an exposure free gap of 1 hour between each exposure. Acceptable ceiling concentration of 50 ppm for 15 min provided that rest of the shift period should be spent in $H_2S$ free environment [2].

Immediately dangerous to life and health, an atmospheric concentration of any toxic, corrosive or, asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere. The National Institute for Occupational Safety and Health (NIOSH) considers 100 ppm as the limit. Effects of $H_2S$ on the body are enumerated in Table 1 [3].

## ROOT CAUSE ANALYSIS

The fatal accident took place because wrong breathing equipment was being used and untrained persons were carrying out the job. Divers are trained to work underwater using breathing apparatus. They were being used to take gas samples from an enclosed space. Breathing apparatus used underwater, is referred to with an acronym, SCUBA (self-contained underwater breathing apparatus). Compressed air is supplied from a cylinder carried on back and air supplied through a reducer. Face mask used in underwater breathing apparatus is not tight fitting and some water gets inside and equalizes pressure under the mask. If the mask was tight fitting, as the diver descends in water and there is an increase in ambient pressure, the mask will squeeze the face. To avoid this, the face mask should not be tight fitting. In this case, poisonous gas could enter the loose fitting face mask and was inhaled. Breathing apparatus used for enclosed space entry, called SCBA (self-contained breathing apparatus), the face mask is gas tight, preventing entry of toxic gas, fumes etc. from entering the face mask. As this is used on surface in ambient pressure, there is no pressure variation while using. Test for gas tightness is the basic test that needs to be performed by a worker before opening the air cylinder of the breathing apparatus. He can then enter an environment filled with toxic gas in a safe manner. Face masks do not have a proper fit in persons having thick beard and it was a prevailing practice to exclude persons with beard from working in "sour gas" fields. Both face masks look similar but have a fundamental difference between the two.

Crew was not trained for the job and had no idea of the risks involved. Risk analysis of the job was not undertaken and no tool box meeting was held. Contingency plan not prepared. As the gas testing work was out sourced, the safety officer of the rig also did not inspect the team that had arrived on board for the job.

## MECHANISM OF ACTION

Hydrogen sulphide when inhaled passes easily across the alveolar-capillary barrier and enters blood stream. It associates with haemoglobin; cytochrome enzyme system is compromised and oxygen transport is affected causing symptoms similar to asphyxia. This causes severe acidosis. $H_2S$ has a strong irritant effect on the mucous membrane especially that of respiratory tract resulting in

pulmonary oedema. For the same reason it causes excessive lacrimation and keratoconjunctivitis. It paralyses the olfactory nerve. At concentrations above 1000 ppm, loss of consciousness and death is immediate [4].

## TREATMENT OF $H_2S$ POISONING

Removing the victim from the exposure is the most important component of the treatment. Care must be taken that the rescuers are well protected and do not become a victim themselves as is observed often. Victim must be resuscitated with 100% oxygen by mask, ideally by using ambu bag or an automatic oxygen resuscitator. Hyperbaric oxygen therapy, if available should be administered immediately [5]. Hyperbaric oxygen leads to super saturation of serum and other body fluids with oxygen due to increased pressure. At 3 atmospheres absolute pressure (ATA), 6 vol % of oxygen is dissolved in the plasma which is sufficient to meet body's requirement of oxygen at rest [6].

Amyl nitrite capsules which are often found in emergency medical kit are inhaled for 30 s, one every minute, while intravenous access is established to start Ringer lactate.

Sodium nitrite is often used as an antidote because of similarity of mechanism of action of cyanide and $H_2S$ poisoning. Both form a reversible bond with cytochrome enzyme system.

Sodium nitrite (300 mg) is administered intravenously, 10 mL of 3% $NaNO_2$, over 4 min [4, 7]. Drop in systolic pressure has to be monitored. Acidosis should be corrected with sodium bicarbonate administered intravenously along with fluids. Patient should be transferred to an intensive care unit to treat pulmonary oedema and monitoring for the next 24 hours.

## POSSIBLE SOLUTIONS

Good planning and training programs for workers are the best ways to prevent exposure, injury, and death. $H_2S$ contingency plan needs to be prepared and followed carefully [3]. This includes the following as bear minimum:

- Actively monitor for $H_2S$ gas, including both personal and area monitoring. $H_2S$ being a heavy gas, gas monitors should be fitted at floor levels at numerous exposed parts of the rig connected to a central monitoring system. Workers should be advised to wear a personal detection monitor preferably over the chest pocket or on the collar, i.e. as close as possible to nose;
- Breathing apparatus: all personnel must be well versed in the use of breathing apparatus;
- Two workers should work together called "buddy" system;
- Oil free, electric compressors must be used to pressurize the cylinders and the air must conform to breathing air standards as specified in BS 15879:2009 [8];
- Emergency response team: trained personnel for extraction, rescue and first aid when required;
- Permit to work system must be incorporated and strictly followed. Safety guideline resolution passed by International Maritime Organization (IMO) for entering enclosed spaces should be followed [9];
- All personnel should be aware of emergency response procedures and corrective actions. Periodical drills should be carried out for the same.

**Conflict of interest:** None declared

## REFERENCES

1. Ballerino-Regan D, Longmire AW. Hydrogen sulfide exposure as a cause of sudden occupational death. Arch Pathol Lab Med. 2010; 134(8): 1105, doi: 10.5858/2010-0123-LE.1, indexed in Pubmed: 20670127.
2. Occupational Health Guideline for Hydrogen Sulfide, Occupational Safety and Health Administration, U.S. Department of Labor, September 1978.
3. Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide, American Petroleum Institute Recommended Practice 55. 2nd Edition, Feb 15,1995.
4. Guidotti TL. Hydrogen sulphide. Occup Med (Lond). 1996; 46(5): 367–371, doi: 10.1093/occmed/46.5.367, indexed in Pubmed: 8918153.
5. Whitcraft DD, Bailey TD, Hart GB. Hydrogen sulfide poisoning treated with hyperbaric oxygen. J Emerg Med. 1985; 3(1): 23–25, doi: 10.1016/0736-4679(85)90215-x, indexed in Pubmed: 4093554.
6. Bassett BE, Bennett PB. Introduction to the physical and physiological bases of hyperbaric therapy. In: Davis JC, Hunt TK (eds): Hyperbaric Oxygen Therapy. Maryland, Undersea Medical Society 1977: 19–20.
7. Beck JF, Bradbury CM, Connors AJ, et al. Nitrite as antidote for acute hydrogen sulfide intoxication? Am Ind Hyg Assoc J. 1981; 42(11): 805–809, doi: 10.1080/15298668191420738, indexed in Pubmed: 7315740.
8. Breathing Air Compressor Package-Specifications. Bureau of Indian Standards IS 15879:2009, 5879.
9. International Maritime Organisation (IMO), London, UK. Assemble Resolution A. 1050 (27) (Revised Recommendations for Entering Enclosed Spaces Aboard Ships).

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 3: 175–179
10.5603/imh.97185
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Intestinal parasitic infections in officers of the Border Guard in East Poland

**Krzysztof Korzeniewski, Wanesa Richert**

Department of Epidemiology and Tropical Medicine, Military Institute of Medicine – National Research Institute, Warsaw, Poland

## ABSTRACT

***Background:*** *Poland has experienced increased economic migration since 2021. Large waves of migrants, mostly from Asian and African countries, are trying to get into the European Union by crossing Poland's eastern border illegally. The influx of illegal migrants into Poland is the result of a policy adopted by the Belarusian and Russian regimes that are trying to provoke another migrant crisis in Europe. In the opinion of some Polish politicians illegal migration contributes to the spread of parasitic diseases in our country as many migrants arriving into Poland carry intestinal parasites. The aim of this study was to assess the prevalence of infections with intestinal parasites in the Polish Border Guard officers safeguarding Poland's eastern borders.*

***Materials and methods:*** *Parasitological diagnostics was carried out between April and May 2023. The study involved 218 Polish Border Guard officers from the Podlaski Border Guard Unit (PBGU) and 209 officers from the Bug Border Guard Unit (BBGU), whose task is to patrol and safeguard Poland's border with Ukraine and Belarus. Faecal examinations were performed using three different light microscopy testing methods (direct smear, decantation, flotation) at the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine – National Research Institute, Warsaw, Poland.*

***Results:*** *Considered to be potentially pathogenic intestinal parasites were diagnosed in 20 out of 218 officers serving in the PBGU (8.7% infected with Blastocystis spp., 0.5% with Dientamoeba fragilis) and in 9 out of 209 officers serving in the BBGU (3.8% infected with Blastocystis spp., 0.5% with Dientamoeba fragilis). There were no infections with nematodes, cestodes or trematodes in the study participants. No correlation was found between a parasitic infection and the presence of diarrhoea or other gastrointestinal symptoms within 6 months prior to the study in both groups.*

***Conclusions:*** *Although Polish Border Guard officers deployed to the eastern border are exposed to difficult environmental conditions and have frequent contacts (either directly or indirectly) with migrants arriving from countries which report high incidence of parasitic infections, the rates of infections with potentially pathogenic protozoa in officers from the PBGU and BBGU are low and mainly attributable to pathogens which are widespread in the general Polish population. Low rates of parasitic infections in officers serving in the border zone suggest that the epidemiological situation of parasitic diseases in East Poland is satisfactory and that the disease prevention strategies (including the use of personal protection gear) implemented by the Polish medical services are effective.*

*(Int Marit Health 2023; 74, 3: 175–179)*

**Keywords: intestinal parasites, epidemiology, Border Guard, illegal migrants, Poland**

Prof. Krzysztof Korzeniewski, MD, PhD, Department of Epidemiology and Tropical Medicine, Military Institute of Medicine – National Research Institute, ul. Szaserów 128, 04–141 Warszawa, Poland, e-mail: kkorzeniewski@wim.mil.pl

Received: 30.08.2023 Accepted: 12.09.2023

## INTRODUCTION

Mass migration is a natural social reaction to military conflicts, persecution, violence, and poverty. An influx of millions of refugees or asylum seekers into any country offering shelter poses major political, economic, and health-related issues [1]. In recent years many countries, including Poland, experienced increased economic migration. Most economic migrants originate from Asian and African countries. Illegal migration has rapidly increased since 2021 when Belarus started an operation organized by its secret services aimed at trafficking massive numbers of illegal migrants from Asia and Africa into the European Union (EU) via the Polish and Lithuanian borders. The operation was a response to sanctions imposed by the EU on Russia and Belarus [2]. In February 2022, Russia launched a large-scale military operation against Ukraine. Since then, the Russian and Belarusian regimes have been organizing and orchestrating the influx of large numbers of illegal migrants from developing countries into the EU, mainly across the Polish border. The aim of this policy is to provoke another migrant crisis in the EU and destabilize the situation in the region. According to the data from the Polish Border Guard Headquarters, there were more than 5,000 attempts to cross the Polish-Belarusian border illegally in 2022, and more than 16,000 such attempts in the first 6 months of 2023. Although the number of attempted border crossings is constantly growing, the actual number of illegal crossings has decreased in recent months, which was mainly possible thanks to the construction of an electronic barrier fitted with a system of video cameras and motion sensors on the border with Belarus. Immigrants attempting to force the Polish border and enter the EU illegally come from dozens of Asian and African countries. According to the World Health Organization reports many of those countries have a high incidence of infections with intestinal parasites. Some Polish politicians have publicly stated that illegal migrants arriving in Poland are carriers of intestinal parasites and that their presence may contribute to the spread of parasitic diseases in our country. Polish Border Guard officers deployed to safeguard Poland's border with Ukraine and Belarus are often exposed to direct contact with illegal migrants. The aim of this study was to assess the prevalence of infections with intestinal parasites in the Polish Border Guard officers serving in the eastern border zone.

## MATERIALS AND METHODS

Parasitological examinations were carried out between April and May 2023 in a group of 427 Polish border guards from the Podlaski Border Guard Unit (PBGU) and the Bug Border Guard Unit (BBGU). The officers serving in those units are tasked with patrolling and safeguarding Poland's eastern border. Of all study participants, 218 were members of the PBGU, which is composed of border guard units in Bialystok, Bobrowniki, Narewka, Bialowieza, Kuznica, Sejny, Augustow, Lipsk, and Krynki. Their area of responsibility covers 351 kilometres of the state border (104 km of the border between Poland and Lithuania and 247 km of the border between Poland and Belarus). The rest of the participants, i.e., 209 officers, served in the BBGU and came from the border guard units in Chelm, Hrubieszow, Horodlo, Dorohusk, Wola Uhurska, Terespol, Hrebenne, Slawatycze, Bohukaly, Lubycza Krolewska, Dolhobrody, Chlopiatyn. Their area of responsibility covers 467 km of the Polish state border (171 km of the border between Poland and Belarus and 296 km of the border between Poland and Ukraine) [3].

### LABORATORY PROCEDURES

Each participant was asked to provide 2 stool samples collected at 2–3-day intervals. The samples were fixed with SAF fixative (sodium acetate–acetic acid–formalin) and 70% ethanol. The samples were transported to the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine – National Research Institute, Warsaw, Poland (in accordance with the regulations for transporting biological material) for parasitological examination by light microscopy methods (direct smear in Lugol's solution, decantation in distilled water, Fülleborn's flotation) [4].

### ETHICAL CONSIDERATIONS

Each participant was required to submit informed written consent to participate in the study and be tested for intestinal parasites by researchers from the Department of Epidemiology and Tropical Medicine at Military Institute of Medicine – National Research Institute in Gdynia, Poland. Participants had to provide their personal details (age, sex, place of residence, place of employment, the name of their Border Guard unit) and were asked about the history of any gastrointestinal symptoms, such as diarrhoea, occurring within 6 months prior to the study. The information clause on personal data processing by the Military Institute of Medicine – National Research Institute, Warsaw, Poland was drawn up pursuant to Article 14 (1) and (2) of the Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, hereinafter referred to as General Data Protection Regulation (GDPR). The legal basis for the processing of personal data is defined in Article 6 (1) (e) of GDPR, which stipulates that the processing of personal data is necessary to perform a task carried out in the public interest.

## RESULTS

A total of 427 border guards were involved in this study; 218 served in the PBGU and 209 in the BBGU. Intestinal parasites were detected in 29 study participants (6.8%):

20 members of the PBGU and 9 members of the BBGU. All infections were caused by potentially pathogenic protozoa, mostly *Blastocystis* spp. (28 cases). There were 2 cases of *Dientamoeba fragilis* infection and 1 case of a co-infection (*Blastocystis* spp. + *Dientamoeba fragilis*). No infections with nematodes, cestodes or trematodes were found. Statistical analysis demonstrated that infections with protozoa were most often found in border guards living in urban areas and in officers aged 41–50 years old. No correlation was found between the presence of a parasitic infection and the presence of diarrhoea or other gastrointestinal symptoms within 6 months prior to the study (Tables 1, 2).

## DISCUSSION

Low rates of intestinal parasitic infections in officers of the Polish Border Guard safeguarding Poland's borders with Ukraine and Belarus suggest that the epidemiological situation of parasitic diseases is satisfactory in East Poland. Studies by Wasilewska et al. [5] and Żukiewicz et al. [6] which were conducted in North-East Poland (the area of operation of the Podlaski Border Guard unit) more than 10 years ago demonstrated high rates (over 20%) of parasitic infections in the region, mostly with *Ascaris lumbricoides*. In contrast, the present study of 427 Border Guard officers found no cases of ascariasis or other geohelminth infections. Although Border Guard officers are continuously exposed to direct or indirect contact with illegal migrants arriving from Asian or African countries (i.e., countries which report high rates of infectious diseases), the rates of protozoan infections in officers are low and, which should be emphasized, they are mainly caused by pathogens that are widespread in the general Polish population [7]. Low rates of parasitic infections in officers serving in the border zone suggest that the disease prevention strategies (e.g., the use of personal protection gear) implemented by the Polish medical services operating in the region are effective. In this context, it is worth pointing out that according to the reports in international medical journals the rates of parasitic infections in the population of refugees arriving from developing countries have been decreasing over the recent years.

According to Ceccarelli et al. [8], the decreased rates of parasitic infections among refugees may be the effect of mass de-worming campaigns conducted under the auspices of World Health Organization and the improvement in sanitation in most developing countries over the last few decades. A study of over 1000 refugees carried out between 2011 and 2016 in Canada demonstrated that although the rate of parasitic infections in the study group reached 40%, most of the infestations were clinically insignificant [9]. All the identified infections were found to have been caused by *Blastocystis* spp. or *Dientamoeba fragilis* protozoa. Infections with these protozoa are rarely symptomatic and are considered non-pathogenic by many researchers [10–13]. This fact has been supported by the findings of a study by Eiset et al. [14] who studied the prevalence of parasitic infections in Syrian refugees arriving in Denmark. They found that although the rates of *Blastocystis* spp. infections were high among the examined refugees, there was no correlation between infection and symptoms. The author's own study showed no correlation between gender and the prevalence rates of infections, which is consistent with the findings of Taamasri et al. [15]. The present study found a significant correlation between age and the rates of infections; protozoan infections were most often found in officers aged 41–50 years old, which might be attributable to a long-term, asymptomatic colonization of the gastrointestinal tract [16]. The study also demonstrated that infection rates correlated with the area of deployment. There were significantly more infections in officers serving in the PBGU than in officers serving in the BBGU (9.2% vs. 4.3%). There is a limited number of publications on the prevalence rates of intestinal parasitoses in Poland. This data scarcity is the consequence of the entry into force of the 'Act of 2008 on preventing and combating infections and infectious diseases in humans'. Under this law some infections were removed from the national list of notifiable diseases [17]. Studies conducted during the European migrant crisis showed that the mass influx of migrants and refugees into European countries resulted in an increase in the prevalence of intestinal parasitic infections in the general population in Europe [18]. In this context, it should also be noted that potentially non-pathogenic parasites, such as *Blastocystis* spp. or *Dientamoeba fragilis* may have pathogenic potential [13] and even asymptomatic carriage of parasites requires routine epidemiological surveillance.

## CONCLUSIONS

Although officers from the Polish Border Guard safeguarding the Polish border with Belarus and Ukraine are exposed to difficult environmental conditions and have frequent contacts with migrants (directly or indirectly) arriving from countries which report high prevalence of parasitic infections, the rates of infections with potentially pathogenic protozoa in officers of the Polish Border Guard were found to be low and mainly attributable to pathogens which are widespread in the general Polish population. Low rates of parasitic infections in officers serving on the east border suggest that the epidemiological situation of parasitic diseases in East Poland is satisfactory and that the health promotion and disease prevention strategies (including the use of personal protection gear) implemented by the Polish medical services are effective. However, we need to keep in mind that mass migration is associated with an increased

**Table 1.** Intestinal parasitic infections in officers of the Podlaski Border Guard Unit (n = 218)

| Podlaski Border Guard Unit | | | Gastrointestinal symptoms | | | | Place of residence | | | | Sex | | | | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Yes | | No | | Town/City | | Village | | Female | | Male | | < 30 | | 31–40 | | 41–50 | | > 51 | |
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Total | 218 | 100.0 | 61 | 28.0 | 157 | 72.0 | 164 | 75.2 | 54 | 24.8 | 76 | 34.9 | 142 | 65.1 | 20 | 9.2 | 88 | 40.4 | 93 | 42.6 | 17 | 7.8 |
| Positive (+) | 20 | 9.2 | 4 | 1.9 | 16 | 7.3 | 13 | 5.9 | 7 | 3.3 | 5 | 2.3 | 15 | 6.9 | 0 | 0.0 | 11 | 5.0 | 8 | 3.7 | 1 | 0.5 |
| Negative (–) | 198 | 90.8 | 57 | 28.8 | 141 | 71.2 | 151 | 76.3 | 47 | 23.7 | 71 | 35.9 | 127 | 64.1 | 20 | 10.1 | 77 | 38.9 | 85 | 42.9 | 16 | 8.1 |
| *Blastocystis* spp. | 19 | 8.7 | 4 | 1.9 | 15 | 6.9 | 12 | 5.5 | 7 | 3.3 | 4 | 1.9 | 15 | 6.9 | 0 | 0.0 | 10 | 4.6 | 8 | 3.7 | 1 | 0.5 |
| *Dientamoeba fragilis* | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| *Blastocystis* spp. + *Dientamoeba fragilis* | 1 | 0.5 | 0 | 0.0 | 1 | 0.5 | 0 | 0.0 | 1 | 0.5 | 1 | 0.5 | 0 | 0.0 | 0 | 0.0 | 1 | 0.5 | 0 | 0.0 | 0 | 0.0 |
| Nematodes | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Cestodes | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Trematodes | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |

**Table 2.** Intestinal parasitic infections in officers of the Bug Border Guard Unit (n = 209)

| Bug Border Guard Unit | | | Gastrointestinal symptoms | | | | Place of residence | | | | Sex | | | | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Yes | | No | | Town/City | | Village | | Female | | Male | | < 30 | | 31–40 | | 41–50 | | > 51 | |
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Total | 209 | 100.0 | 46 | 22.0 | 163 | 78.0 | 133 | 63.6 | 76 | 36.4 | 75 | 35.9 | 134 | 64.1 | 9 | 4.3 | 72 | 34.4 | 101 | 48.3 | 27 | 13.0 |
| Positive (+) | 9 | 4.3 | 1 | 0.5 | 8 | 3.8 | 7 | 3.3 | 2 | 1.0 | 4 | 1.9 | 5 | 2.4 | 0 | 0.0 | 0 | 0.0 | 9 | 4.3 | 0 | 0.0 |
| Negative (–) | 200 | 95.7 | 45 | 22.5 | 155 | 73.2 | 126 | 63.0 | 74 | 37.0 | 71 | 35.5 | 129 | 64.5 | 9 | 4.5 | 72 | 36.0 | 92 | 46.0 | 27 | 13.5 |
| *Blastocystis* spp. | 8 | 3.8 | 1 | 0.5 | 7 | 3.3 | 6 | 2.8 | 2 | 1.0 | 4 | 1.9 | 4 | 1.9 | 0 | 0.0 | 0 | 0.0 | 8 | 3.8 | 0 | 0.0 |
| *Dientamoeba fragilis* | 1 | 0.5 | 0 | 0.0 | 1 | 0.5 | 1 | 0.5 | 0 | 0.0 | 0 | 0.0 | 1 | 0.5 | 0 | 0.0 | 0 | 0.0 | 1 | 0.5 | 0 | 0.0 |
| Nematodes | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Cestodes | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Trematodes | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |

risk of transmission of infectious diseases, including parasitic diseases, therefore it is justified to conduct regular screening for intestinal parasites in officers of the Polish Border Guard safeguarding the Polish borders.

## ACKNOWLEDGEMENTS

The authors acknowledge help from the Heads of the Medical Services supporting the Podlaski Border Guard Unit and the Bug Border Guard Unit with conducting interviews and collecting samples from officers serving in the border zone in East Poland.

**Conflict of interest:** None declared

## REFERENCES

1. Sowizdraniuk J, Sowizdraniuk P. Analysis of the impact of migration on the incidence of infectious diseases in Poland [in Polish]. State and Society. 2019; 1: 91–101.
2. Konieczny M. Operation "sluice" – refugee crisis related to the transfer of illegal migrants across the Polish-Belarusian border [in Polish]. Annuals of the Administration and Law. 2022; 2(XXII): 89–102, doi: 10.5604/01.3001.0016.0948.
3. Border Guards. www.strazgraniczna.pl (Accessed: 07 Aug 2023).
4. World Health Organization. Basic Laboratory methods in medical parasitology, Geneva 1991.
5. Wasilewska J, Kaczmarski MG, Sawicka-Zukowska M, et al. Analysis of clinical symptoms and selected hematological indices in hospitalized children with Ascaris lumbricoides infection from the northeastern region of Poland. Wiad Parazytol. 2011; 57(1): 43–51, indexed in Pubmed: 21634234.
6. Żukiewicz M, Kaczmarski M, Topczewska M, et al. Epidemiological and clinical picture of parasitic infections in the group of children and adolescents from north-east region of Poland. Wiad Parazytol. 2011; 57: 179–187, indexed in Pubmed: 22165741.
7. Kowalewska B, Rudzińska M, Zarudzka D, et al. An evaluation of the intensity of intestinal parasitic infections among patients of out-patient Division of Maritime and Tropical Medicine in Gdynia over last 30 years [in Polish]. J Laboratory Diagnostics. 2013; 49(1): 9–15.
8. Ceccarelli G, Sulekova LF, Milardi GL, et al. Prevalence of intestinal parasitic infections among asylum seekers. Can Fam Physician. 2018; 64(2): 88, indexed in Pubmed: 29449227.
9. Müller F, Chandra S, Bogoch II, et al. Intestinal parasites in stool testing among refugees at a primary care clinic in Toronto, Canada. BMC Infect Dis. 2022; 22(1): 249, doi: 10.1186/s12879-022-07226-4, indexed in Pubmed: 35282824.
10. Stenzel DJ, Boreham PF. Blastocystis hominis revisited. Clin Microbiol Rev. 1996; 9(4): 563–584, doi: 10.1128/CMR.9.4.563, indexed in Pubmed: 8894352.
11. Wawrzyniak I, Poirier P, Viscogliosi E, et al. Blastocystis, an unrecognized parasite: an overview of pathogenesis and diagnosis. Ther Adv Infect Dis. 2013; 1(5): 167–178, doi: 10.1177/2049936113504754, indexed in Pubmed: 25165551.
12. Stark D, Barratt J, Chan D, et al. Dientamoeba fragilis, the Neglected Trichomonad of the Human Bowel. Clin Microbiol Rev. 2016; 29(3): 553–580, doi: 10.1128/CMR.00076-15, indexed in Pubmed: 27170141.
13. Sarzhanov F, Dogruman-Al F, Santin M, et al. Investigation of neglected protists Blastocystis sp. and Dientamoeba fragilis in immunocompetent and immunodeficient diarrheal patients using both conventional and molecular methods. PLoS Negl Trop Dis. 2021; 15(10): e0009779, doi: 10.1371/journal.pntd.0009779, indexed in Pubmed: 34613993.
14. Eiset AH, Stensvold CR, Fuursted K, et al. High prevalence of methicillin-resistant , and in asymptomatic Syrian asylum seekers in Denmark during 2016 through 2018. J Migr Health. 2020; 1-2: 100016, doi: 10.1016/j.jmh.2020.100016, indexed in Pubmed: 34405169.
15. Taamasri P, Leelayoova S, Rangsin R, et al. Prevalence of Blastocystis hominis carriage in Thai army personnel based in Chonburi, Thailand. Mil Med. 2002; 167(8): 643–646, indexed in Pubmed: 12188234.
16. Khaled S, Gantois N, Ayoubi A, et al. sp. Prevalence and subtypes distribution amongst Syrian refugee communities living in North Lebanon. Microorganisms. 2021; 9(1), doi: 10.3390/microorganisms9010184, indexed in Pubmed: 33467077.
17. Korzeniewski K, Augustynowicz A, Lass A. Intestinal parasites in Polish community on the example of military environment. Int Marit Health. 2014; 65(4): 216–222, doi: 10.5603/IMH.2014.0041, indexed in Pubmed: 25522706.
18. Krcmery V. Infectious diseases in refugees and migrants during the European Migrant Crisis 2015. Int J Infect Dis. 2016; 45: 57, doi: 10.1016/j.ijid.2016.02.170.

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 3: 180–185
10.5603/imh.95536
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# The predictive effect of basic military training and general health status on sleep quality

**Melek Güler[1], Emsal Öztürk[2], Nazlı Yanar[1]**

[1]Karamanoğlu Mehmetbey University, Sport Science Faculty, Türkiye
[2]Ankara Gendarmerie Coast Guard Academy, Ankara, Türkiye

## ABSTRACT

***Background:*** *Military universities and academies affiliated with the law enforcement provide education for students who are physically and psychologically suitable for this field, unlike other university educations. This education can affect general health because it requires discipline and special effort both practically and theoretically. In this context, the aim of our study is to examine the general health status of military students in terms of some variables.*

***Materials and methods:*** *One hundred twenty-two male students studying at the Gendarmerie and Coast Guard Academy participated in the study. The general health status of the participants was determined by the SF-12 Brief Health Questionnaire, and their sleep quality was determined by the Pittsburgh Sleep Quality Index (PSQI). In the analysis of the data, Spearmans' rho correlation, binomial logistic regression and scatter diagram analysis were used for independent groups. All analyses were performed in the Jamovi 2.3.21.0 analysis programme according to 95% confidence interval and 0.05 significance level.*

***Results:*** *Increased physical and mental health scores of the participants, not smoking, and having a good diet were found to increase the likelihood of improving sleep quality. It was concluded that initial active duty for training, alcohol use, and being in a school team did not predict the likelihood of improving sleep quality.*

***Conclusions:*** *As a result, it may be recommended that military students should have good general health, pay attention to nutrition and avoid smoking to improve low sleep quality.*

*(Int Marit Health 2023; 74, 3: 180–185)*

**Keywords: basic military training, health status, sleep quality**

## INTRODUCTION

All developed countries in the world have regular army and law enforcement (police and gendarmerie). The competence of the soldiers and law enforcement forces during their duties is related to the military training received by the personnel. Although individuals admitted to the military and law enforcement professions are likely to be healthier than individuals in the general population [1]. The physical and conditional skills required for these occupations are provided through basic military training [2]. The purpose of basic military training is to prepare students for military service and law enforcement by increasing both their physical fitness and psychological resilience [3]. Since the education given in military universities requires discipline and a special effort, the general health status of the students who study there may be affected.

The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being" [4]. Individuals should be healthy in every aspect in preparation for military service. They should be physically and mentally resilient to the challenges of life. In this respect, these military trainings are likely to have physical and mental deformations due to over use, as well as their contribution to military life. It is known that initial active duty for training

Assistant Professor Melek Güler, Karamanoğlu Mehmetbey University, Sport Science Faculty, Türkiye, e-mail: melekglr@kmu.edu.tr

Received: 11.05.2023 Accepted: 11.08.2023

is not only physically demanding, but also that a lack of balance between resting and training can lead to more stress, fatigue and poor sleep quality, which can be a risk factor for injuries [5]. Although studies on the military population have shown that musculoskeletal disorders are common, especially due to overload, this may not be the case for military students. Because the physiological and psychological processes experienced during cadetship and military service are different from each other.

Although it has been known since time immemorial that different emotions can be experienced during initial active duty for training [6], it can be argued that these emotions can also affect other health factors such as mental and physical health and sleep quality. In a study, it was found that there were strong relationships between subjective sleep quality and stress, rest, and fatigue in initial active duty for training for 12 weeks [7]. In addition, soldiers, firefighters, correctional officers, and paramedics experience more mental health problems as they are exposed to more psychological traumatic events in their lives than other individuals [8]. However, the physiological and psychological processes experienced during cadetship and military service are different from each other. In this respect, the initial active duty for training that military students receive may lead to physiologically lower sleep quality and lower sleep quality may lead to poorer mental health. In this context, this study aimed to examine the predictive effect of general health status on sleep quality of initial active duty for training students in terms of some variables.

## MATERIALS AND METHODS

### RESEARCH MODEL

The model of this research, the 'descriptive, relational screening (survey)' cross-sectional model, was used to reveal the predictability of basic military training on general health status and sleep quality.

### RESEARCH GROUP

One thousand twenty-two male students who received military education in Gendarmerie Coast Guard Academy participated in the research. Participants' mean age (24.18 ± 4.02), mean height (176.87 ± 6.1), and mean weight (73.54 ± 8.35) were values. Body mass index (BMI) was calculated by dividing the measured weight [kg] by height [m] square (BMI = weight ([kg] / / height [$m^2$]). The participants' mean BMI (23.47 ± 1.2) were calculated. According to the WHO, those with a BMI < 18.5 kg/$m^2$ are considered underweight, those with a BMI of 18.5 ≤ 25 kg/$m^2$ are considered normal, those with a BMI of 25 ≤ 30 kg/$m^2$ are considered overweight, and those with a BMI of ≥ 30 kg/$m^2$ obese.

### DATA COLLECTION TOOLS

**Personal information form.** In the research, in the form of personal information. The variables of gender, age, height, weight, smoking and alcohol use, nutritional status, and being in the school team were included.

**SF-12 Brief Health Questionnaire.** SF-12 is a questionnaire that can be used to show the current health status of the population and to reveal the workforce loss of chronic diseases [9]; it is even the most widely used [10]. The General Health Questionnaire is a questionnaire that examines mental illnesses and is used as a first-stage screening test in social studies. The 12-item general health questionnaire is widely preferred because it is short, has high sensitivity and specificity in distinguishing cases, and can be used in various socio-cultural settings. While it is stated that the scale can be used safely in the detection of non-psychotic depression and anxiety symptoms, it is not recommended to be used in the detection of psychotic and manic patients and chronic mental patients [11]. In order for the scale to be evaluated correctly, no data should be missing. First of all, it is checked whether there is missing data and then the coefficients created by the researchers and the physical and mental health scores are calculated [12].

**Pittsburgh Sleep Quality Index (PSQI).** It was developed in 1989 to assess sleep quality [13]. The scale consists of 24 questions to evaluate sleep quality in the last 1 month. The first 18 questions of the questionnaire are based on the person's self-evaluation, the other 6 questions are asked to be answered by the person's partner or roommate and these 6 questions are not included in the scoring. The PSQI scoring consists of 7 components (subjective sleep quality, sleep latency, sleep duration, habitual sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping pills, and daytime dysfunction). In the scoring of each problem, the numbers from 0" to 3" are scored according to the values they receive, and the total score is obtained by adding up the scores of the seven components. The total scale score is between 0 and 21, and between 0 and 4; sleep quality is good, if it is between 5 and 21, it means that the sleep quality is bad. While the Cronbach's alpha value of the scale is 0.80, the Cronbach's alpha value of the PSQI scale in this study is 0.70.

### ANALYSIS OF DATA

In the study, "frequency (n), percentage (%), arithmetic mean ($\bar{x}$) and standard deviation (SD)" are used for personal information. According to the Shapiro-Wilk normality test results, it has been determined that data are not distributed normally ($p < 0.05$). The relationship between the groups was used in Spearmans' rho correla-

**Table 1.** The number (N) and per cent (%) values of the descriptive variables of the participants

| | Group | N | % |
|---|---|---|---|
| BMI classification | Underweight | 3 | 0.29 |
| | Normal weight | 817 | 79.94 |
| | Overweight | 202 | 19.77 |
| Nutritional status | Sufficient | 567 | 55.48 |
| | İnsufficient | 455 | 44.52 |
| Use of alcohol | Yes | 73 | 7.14 |
| | No | 949 | 92.86 |
| Use of cigarette | Yes | 402 | 39.33 |
| | No | 620 | 60.67 |
| School team | Yes | 86 | 8.41 |
| | No | 936 | 91.59 |
| PSQI status | Good | 419 | 41.0 |
| | Bad | 603 | 59.0 |

BMI — body mass index; PSQI — Pittsburgh Sleep Quality Index

tion analysis and binomial logistic regression analysis for relational probability estimates. A scatter diagram was used to decipher the direction of the relationship between the variables.

## ETHICS APPROVAL CONSENT TO PARTICIPATE

Before starting the study, permission was obtained from the Scientific Research and Publication Ethics Committee of Karamanoğlu Mehmetbey University (Date: 24.05.2022, No: 71182).

**Table 2.** The average of the participants basic military training, total Pittsburgh Sleep Quality Index (PSQI), physical and mental health scores

| Variables | Mean | Standard deviation |
|---|---|---|
| Basic military training | 6.67 | 3.58 |
| Physical health | 57.28 | 5.76 |
| Mental health | 41.90 | 7.05 |
| Total PSQI | 5.48 | 2.42 |

## RESULTS

The descriptive variables, physical and mental health scores, and sleep quality results of the participants are presented below.

Table 1 shows that the majority of the participants were of normal weight, did not drink alcohol or smoke, were not on the school team, had poor sleep quality and their nutritional status was adequate. The average of the participants' basic military training, sleep quality and health scores are given below (Table 2).

Table 2 shows that the participants' had weekly basic military training averages (6.67 ± 3.58), total PSQI averages (5.48 ± 2.42), physical health score averages (57.28 ± ± 5.76) and mental health score averages (41.90 ± 7.05). The Spearmans' rho correlation test results of the participants' physical health, mental health, total PSQI and basic military training values according to some variables are given below (Table 3).

When Table 3 is examined, it can be observed that BMI and physical health values decrease as the amount of basic military training increases, mental health scores increase as physical health scores increase, and an increase

**Table 3.** The Spearmans' rho correlation test results of participants

| Variables | | Body mass index | Basic military training | Physical health | Mental health |
|---|---|---|---|---|---|
| Basic military training | r | –0.12 | | | |
| | p | < 0.000*** | | | |
| Physical health | r | –0.02 | –0.08 | | |
| | p | 0.63 | 0.01* | | |
| Mental health | r | 0.05 | –0.05 | 0.08 | |
| | p | 0.14 | 0.13 | 0.01** | |
| Total PSQI | r | –0.00 | 0.05 | –0.42 | –0.43 |
| | p | 0.90 | 0.13 | < 0.000*** | < 0.000*** |

*p < 0.05, **p < 0.01; ***p < 0.001; PSQI — Pittsburgh Sleep Quality Index

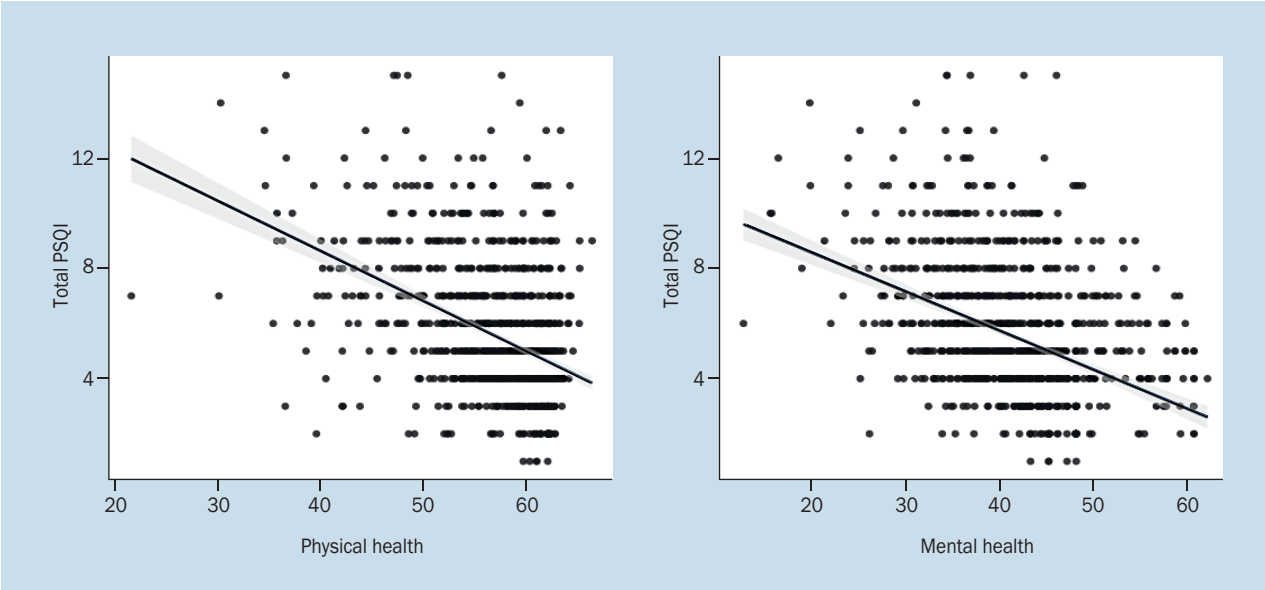



**Figure 1.** The scatter diagram of the variables; PSQI – Pittsburgh Sleep Quality Index

**Table 4.** The binomial logistic regression test results of the participants

| Predictor | Estimate | Standard error | Z | Confidence range 95% (lower–upper) | Odds ratio | P |
|---|---|---|---|---|---|---|
| İntercept | 16.8637308 | 1.49 | 11.34 | 1.44-3.88 | 2.1 | < 0.000** |
| Physical health | –0.1754594 | 0.02 | –9.04 | 0.81–0.87 | 0.8 | < 0.000** |
| Mental health | –0.1274394 | 0.01 | –9.88 | 0.86–0.90 | 0.9 | < 0.000** |
| Basic military training | 0.0063873 | 0.02 | 0.28 | 0.96–1.05 | 1.0 | 0.71 |
| Use of cigarette (No/Yes) | –0.3410118 | 0.15 | –2.21 | 0.53–0.96 | 0.7 | 0.03* |
| Use of alcohol (No/Yes) | –0.6606277 | 0.35 | –1.91 | 0.26–1.01 | 0.5 | 0.06 |
| School team (No/Yes) | –0.2384837 | 0.27 | –0.87 | 0.46–1.35 | 0.8 | 0.4 |
| Nutritional status (insufficient-sufficient) | 0.3167692 | 0.15 | 2.08 | 1.02–1.85 | 1.4 | 0.04* |

Model: N: 1022, $R^2$ = 0.32 (Negelkerkes), Model = $x^2(7)$ = 275.40, area under the curve: 0.80, p < 0.001, *p < 0.05, **p < 0.001

in physical and mental health scores reduces (improves) PSQI scores. The scatter diagram of the participants' are given below (Fig. 1).

As seen in Figure 1, as the participants' physical and mental health scores increase, their total sleep quality scores decrease. Total sleep quality scores increase as the amount of initial active for training increases. A lower sleep quality score means better sleep. The binomial logistic regression test results of the participants' are given below (Table 4).

When Table 4 is examined, the PSQI status model is statistically significant according to the physical and mental health scores in the model, as well as smoking and nutrition status ($p < 0.05$). Physical and mental health scores can increase the probability of a decrease in PSQI scores by 0.8 and 0.9 times, respectively ($R^2 = 0.32$, $p < 0.000$). Not smoking and adequate nutrition can increase the probability of a decrease in PSQI scores by 0.7 and 1.4 times, respectively. Decreased PSQI scores mean better sleep quality. In the model, it was found that basic military training, alcohol use and participation in the school team had no predictive effect.

## DISCUSSION AND CONCLUSIONS

In this study, which investigated the predictive effect of general health status and initial active duty for training on sleep quality of basic military training students in Gendarmerie Coast Guard Academy, the following results were obtained.

Military health selection criteria mean that candidates must fulfill certain criteria related to physical performance capacity, BMI, and general health status [14]. In previous

studies, it was observed that military students scored adequate scores in physical fitness parameters [15] and had good body composition [16, 17]. In this study, 79.94% of the military students had normal weight, 92.86% of them did not drink alcohol and 60.67% did not smoke. The military training given in these training institutions, where those with good physical fitness are accepted before starting military service, aim to improve the current status of the students. For example, the improvement in the physical fitness levels of students who received 20 weeks of initial active duty for training in South Africa shows the contribution of military training [18]. The fact that such military training is effective not only in the short term but also in the long term can be based on data from a 4-year longitudinal study of Spanish navy cadets [19].

The military training may not always have positive outcomes; cadets may also experience undesirable negative effects such as poor quality sleep as a result of excessive practical training. It was found that 59% of military students had poor sleep quality, and sleep quality decreased as the amount of initial active duty for training increased in this study. Military students are expected to adopt a healthy lifestyle, but the incidence of sleep problems can vary. This point brings to mind the idea that military training may have ignored the load-rest relationship or that failure to comply with the principle of individual loading may have been reflected in the sleep of military students. At this point, it can be considered that determining the type, scope, intensity, frequency, and acute and chronic workloads of the applied training before initial active duty for training [20] may help to eliminate this situation. In addition, the result that initial active duty for training was associated with sleep quality but did not predict sleep quality in this study indicates that more detailed research on sleep quality should be conducted. This is because sleep quality can be caused not only by physical fatigue but also by people's mental health status and bad habits such as smoking and alcohol consumption.

Although the majority of studies in the military field focus on psychological resilience [21], the mental state of military students and related factors are also extremely important. In a study conducted on military students, symptoms of depression were found less frequent in addition to the prevalent rate of anxiety [22], indicating that the mental health of military students is as important as their physical health. As in this study, mental health status is related to mental health status in military students, and interpreting these two factors separately from each other may not contribute. Mental health problems are known to increase smoking [23] and decrease the likelihood of quitting smoking [24]. Interestingly, the military population in this study had very low rates of smoking and alcohol consumption, which could be seen as a reason for better mental health.

It can be said that the fact that the military students in this study went through both theoretical and practical challenging physical and psychological initial active duty for training [25], did not negatively affect their physical and mental health, but it decreased their sleep quality. The elimination of this negative effect may predict the likelihood that military students will improve sleep quality by avoiding smoking and alcohol consumption.

## SUGGESTIONS

Considering that military students undergo rigorous training during the day, seminars can be organized for students and instructors by psychology and social work experts with a multidisciplinary approach to ensure that students are physically, mentally, socially, emotionally, and spiritually healthy. Medical evaluation teams can be established in academies, scans (physical and mental) can be made and the results can be recorded. These records ensure that the military student is always ready, and the risks that he may face when he starts his professional life can be minimized.

## LIMITATIONS OF THE STUDY

A questionnaire was used, not an assessment by an expert in a clinical setting when determining the physical and mental health status of military students. Even if individuals have existing health problems, in some cases, the person is not aware of them without the evaluation of a healthcare professional. The other limitation of the study is that the current physical and mental health data of the students before military education is not known and the data are collected in a cross-sectional way at a time.

## ACKNOWLEDGEMENTS

We would like to thank all the participants who voluntarily participated in the study.

**Conflict of interest:** None declared

## REFERENCES

1. Hall AL, MacLean MB, VanTil L, et al. Considering exposure assessment in epidemiological studies of chronic health in military populations. Front Public Health. 2020; 8: 577601, doi: 10.3389/fpubh.2020.577601, indexed in Pubmed: 33123510.
2. Melloni MAS, De Almeida Ávila J, Páscoa MA, et al. Can anthropometric, body composition, and bone variables be considered risk factors for musculoskeletal injuries in Brazilian military students? BMC Musculoskelet Disord. 2018; 19(1): 377, doi: 10.1186/s12891-018-2292-3, indexed in Pubmed: 30326875.
3. Bricknell MC, Williamson V, Wessely S. Understanding military combat mental health. Occup Med (Lond). 2020; 70(4): 216–218, doi: 10.1093/occmed/kqaa037, indexed in Pubmed: 32562492.

4. World Health Organization. Regional Office for Europe, Health promotion: a discussion document on the concept and principles: summary report of the Working Group on Concept and Principles of Health Promotion, 2019; Copenhagen, WHO Regional Office for Europe.
5. Tait JL, Drain JR, Bulmer S, et al. Factors predicting training delays and attrition of recruits during basic military training. Int J Environ Res Public Health. 2022; 19(12), doi: 10.3390/ijerph19127271, indexed in Pubmed: 35742522.
6. Biersner RJ, LaRocco JM, Ryman DH. Mood scales as predictors of discharge and sick call visits during basic military training. Mil Med. 1976; 141(12): 859–861, indexed in Pubmed: 826848.
7. Bulmer S, Aisbett B, Drain JR, et al. Sleep of recruits throughout basic military training and its relationships with stress, recovery, and fatigue. Int Arch Occup Environ Health. 2022; 95(6): 1331–1342, doi: 10.1007/s00420-022-01845-9, indexed in Pubmed: 35226165.
8. Oliphant RC. Healthy minds, safe communities: supporting our public safety officers through a national strategy for operational stress injuries: report of the Standing Committee on Public Safety and National Security. Ottawa (ON): House of Commons; 2016. https://www.publicsafety.gc.ca/lbrr/archives/cn37509-eng.pdf.
9. Kovacs FM, Muriel A, Abriaira V, et al. The influence of fear avoidance beliefs on disability and quality of life is sparse in Spanish low back pain patients. Spine (Phila Pa 1976). 2005; 30(22): E676–E682, doi: 10.1097/01.brs.0000186468.29359.e4, indexed in Pubmed: 16284579.
10. Burdine JN, Felix MR, Abel L, et al. The SF-12 as a population health measure: an exploratory examination of potential for application. Health Serv Res. 2000; 35: 885–904, indexed in Pubmed: 11055454.
11. Ünalan E. Üniversite öğrencilerinde ruh sağlığı, sağlık kaygısı ve sağlık davranışları arasındaki ilişkiler. Yüksek Lisans Tezi, Okan Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul 2014.
12. Ware J, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care. 1996; 34(3): 220–233, doi: 10.1097/00005650-199603000-00003, indexed in Pubmed: 8628042.
13. Buysse DJ, Reynolds CF, Monk TH, et al. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989; 28(2): 193–213, doi: 10.1016/0165-1781(89)90047-4, indexed in Pubmed: 2748771.
14. Mullie P, Vansant G, Hulens M, et al. Evaluation of body fat estimated from body mass index and impedance in Belgian male military candidates: comparing two methods for estimating body composition. Mil Med. 2008; 173(3): 266–270, doi: 10.7205/milmed.173.3.266, indexed in Pubmed: 18419029.
15. Bararpour E, Dabidi Roshan V, Fayyaz A. Monitoring of Army cadet's body composition, physical and motion fitness, and establishing national norms. Ebnesına. 2018; 19(4): 13–21.
16. Güler M, Öztürk E, Yanar N. Pandemi Süreci Jandarma Sahil Güvenlik Akademisi Öğrencilerinin Yaşam Tarzı Alışkanlıklarını Değiştirdi mi? [Has the Pandemic Process Changed the Lifestyle Habits of Gendarmerie Coast Guard Academy Students?]. Spor Eğitim Dergisi. 2021; 5(3): 205–219.
17. Güler M, Yanar N, Öztürk E. A survey on relationship between Gendarmerie Coast Guard Academy (GCGA) students' physical activity and COVID-19 infection. Int Marit Health. 2021; 72(4): 259–267, doi: 10.5603/IMH.2021.0050, indexed in Pubmed: 35146742.
18. Wood PS, Grant CC, du Toit PJ, et al. Effect of mixed basic military training on the physical fitness of male and female soldiers. Mil Med. 2017; 182(7): e1771–e1779, doi: 10.7205/MILMED-D-16-00218, indexed in Pubmed: 28810971.
19. de Oliveira IM, Vila MªH, Burgos-Martos FJ, et al. Physical fitness in Spanish naval cadets. A four-year study. Int Marit Health. 2021; 72(1): 10–17, doi: 10.5603/IMH.2021.0002, indexed in Pubmed: 33829468.
20. Lennox GM, Wood PM, Schram B, et al. Non-Modifiable risk factors for stress fractures in military personnel undergoing training: a systematic review. Int J Environ Res Public Health. 2021; 19(1): 422, doi: 10.3390/ijerph19010422, indexed in Pubmed: 35010681.
21. Bartone PT, Johnsen BH, Eid J, et al. Hardiness, avoidance coping, and alcohol consumption in war veterans: A moderated-mediation study. Stress Health. 2017; 33(5): 498–507, doi: 10.1002/smi.2734, indexed in Pubmed: 27885790.
22. Lucas D, Coadic N, Jégaden D. Assessment of mental health and psychosocial factors in French merchant officer cadets. Int Marit Health. 2023; 74(1): 62–69, doi: 10.5603/IMH.2023.0007, indexed in Pubmed: 36974494.
23. Weinberger AH, Kashan RS, Shpigel DM, et al. Depression and cigarette smoking behavior: A critical review of population-based studies. Am J Drug Alcohol Abuse. 2017; 43(4): 416–431, doi: 10.3109/00952990.2016.1171327, indexed in Pubmed: 27286288.
24. Gialluisi A, Bonaccio M, Di Castelnuovo A, et al. Lifestyle and biological factors influence the relationship between mental health and low-grade inflammation. Brain Behav Immun. 2020; 85: 4–13, doi: 10.1016/j.bbi.2019.04.041, indexed in Pubmed: 31055172.
25. Türk Silahlı Kuvvetleri İç Hizmet Yönetmeliği. Resmî Gazete Tarihi: 06.09.1961 Resmî Gazete Sayısı: 10899. https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5905&MevzuatTur=7&MevzuatTertip=5.

VIA MEDICA

REVIEW ARTICLE

Int Marit Health
2023; 74, 3: 186–191
10.5603/imh.91707
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Scuba diving and the stress response: considerations and recommendations for professional and recreational divers

**Christopher R. Kovacs**

Department of Kinesiology, Western Illinois University, Macomb, IL, United States

## ABSTRACT

*Scuba diving is an activity that people engage in both for recreational purposes as well as having professional, commercial, and military applications. Scuba diving has often been considered a high-risk activity but, overall, scuba diving has been shown to be a safe activity when divers participate within their experiential, physical, and psychological limits. However, increased physical and psychological stress can quickly arise during diving activities due to unexpected events and situations and may lead to the onset of panic in an unprepared diver. Dive safety is dependent on the ability of a diver to understand the primary signs of stress and panic and attempt to minimise their potential impacts on the immediate situation. The purpose of this review is to examine the stress response in divers, illustrate the role that panic plays in potential diving accidents and fatalities, and provide recommendations to both help understand and manage stress and panic in the diving community in an effort to further increase the overall safety of scuba diving across all applications.*

*(Int Marit Health 2023; 74, 3: 186–191)*

**Keywords: scuba, diving, stress, panic, behaviour**

## INTRODUCTION

Scuba diving has been a recreational activity since the early 1950s and continues to be a choice of activity for many avid divers across the globe. In addition to recreational scuba diving there are significant professional, technical, military, and commercial applications of the skills needed to be a successful and safe scuba diver. Although many individuals view scuba diving as a risky activity, when individuals are trained and follow common safety protocols, scuba diving has minimal risk associated with it [1, 2]. Competent and safe divers are usually highly skilled and trained by one of the major certifying agencies that oversee scuba diving certification. These agencies include the National Association of Underwater Instructors, the Professional Association for Diving Instructors, Scuba Schools International, as well as others. These organizations have been developed to standardise dive training for individuals who want to engage in diving practices and learn the skills needed to be a safe scuba diver. Although these organizations differ in the classes that are offered and the methods of instruction, their overall goal is the same; to teach the necessary diving skills one may need to practice safe diving.

One of the major considerations when deciding to dive is determining one's overall physical condition and overall fitness levels. Although the actual act of diving is often considered non-strenuous due to its use of specific equipment and environmental considerations, diving can also become extremely strenuous under different circumstances. Changes in environmental conditions, equipment limitations, emergency situations, or sudden physical stress can

Prof. Christopher R. Kovacs, PhD, Department of Kinesiology, Western Illinois University, Macomb, IL, United States, e-mail: cr-kovacs@wiu.edu

Received: 2.09.2022 Accepted: 14.08.2023

immediately increase the metabolic demands of the diver. Without the necessary physical conditioning, these situations can quickly lead to increased physiological stress and are often a precursor to a cardiac event. Statistics suggest that cardiac events are one of the leading causes of injuries or fatalities within the diving population [2]. Additionally, over the past several decades significant research has examined the role that exercise and physical training has on diving injury or mortality rates across different ages and skill levels of divers [3, 4].

Along with the importance that physical exercise and conditioning activities play in dive safety and performance, psychological considerations are also an area that needs to be more closely addressed and examined in the research literature. Diving can be inherently stressful at times and this increase in stress, if not managed successfully, may lead to an increased risk of an accident or fatality. Increased stress affects both physiological performance (increased stress on the cardiorespiratory system, for example), as well as the mental performance of the scuba diver. Situations that lead to increased anxiety, physiological arousal, slow reaction time, and a loss in situational awareness may significantly impair the diver and lead to dangerous or catastrophic results. Thus, the goal of this paper is to address some of psychological considerations that one may need to evaluate before choosing to engage in scuba diving activities. In addition, a short review of the research that has examined psychology and diving will be described in an effort to provide information that can improve the overall safety and performance of the active scuba diver, regardless of the type of diving that one engages in or the overall level of training that one may have received.

## STRESS AND THE SCUBA DIVER

Throughout the research literature, the term stress (or stressor) has had a lack of consistency in its definition and usage. Depending on the situation or experiences, the definition of stress may mean different things to different people. Historically, stress has been defined as "a nonspecific response of the body to any demand" [5]. However, this definition may be limited in nature. Stress can be referred to the physiological response of the body to a threat to its ability to maintain internal homeostasis [6]. This definition often focuses on physiological changes that occur due to some external stressor; these include alteration in heart rate, blood pressure, and respiratory rate. Other definitions have focused on the change in behaviour that occurs due to the cognitive processing of information that may be perceived as a threat [5]. These definitions have focused on the behavioural changes that occur when a person is faced with an external stressor, including avoidance of stressful situations [6]. For the purpose of this review, stress will be defined as a process of physiological and behavioural change to an unpredictable or uncontrollable threat to one's ability to manage a specific situation. In the case of the scuba diver, this may include environmental, physical, or cognitive changes that may disrupt the diver before, during, or after the completion of a dive.

Regardless of the definition that one may use to define stress, the stress response in a diver may lead to problems with the completion of a dive and potentially lead to a dangerous situation. When individuals are feeling increased stress, their observable behaviour may change from their "normal" behaviour to an altered form or pattern of movement. This change can often be observed and noted when trying to manage a stressful diver. According to Bachrach and Egstrom (1987) [7] there are multiple signs that a diver may be under increased stress. These include the following: excessive organizing behaviour, stalling, forgetfulness, increased rate of errors, perceptual narrowing, excessive use of humour, increased irritability, bravado, and superstitious behaviour. By understanding the specific signs of stress that a diver may display prior to or during a dive, one may be able to prevent a potential diving accident or fatality by helping that diver manage their stress or preventing that diver from continuing with a dive that they are unprepared to complete safely.

## PANIC AND THE SCUBA DIVER

When divers are faced with unexpected or overwhelming external events, stress levels will elevate quickly and significantly. Uncontrolled stress management may lead to increased fear and, ultimately, panic in a diver unprepared to manage an unexpected diving situation. Throughout the scuba community, panic is considered to be the most dangerous outcome of increased stress and is one of the leading causes, or precursors, of many diving incidents and fatalities [8]. In scuba diving, panic is often the result of an unexpected situation or triggering event that hasn't been previously experienced by the diver. Examples of situations that often lead to panic in divers include low gas reserves, disorientation, equipment malfunction, entanglements, exhaustion, and losing sight of an exit point [9]. Often times, panic leads to an uncontrolled emergency ascent to the surface while holding one's breath during that ascent. Preventing the exhalation of gas while surfacing or ascending will lead to lung injury and often results in a fatal arterial gas embolism. Uncontrolled emergency ascents have been identified at the primary disabling event in many dive emergencies and accidents and need to be avoided at all costs [10]. By managing the stress response, divers will be better able to focus on the necessary skills for a successful and safe emergency ascent and will be less likely to forget significant skills,

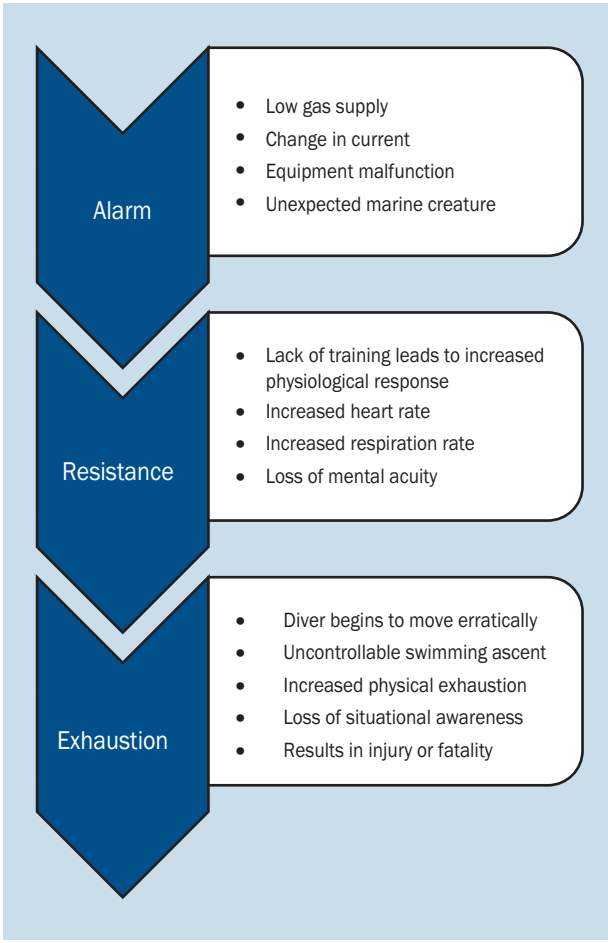



**Figure 1.** Stages of stress

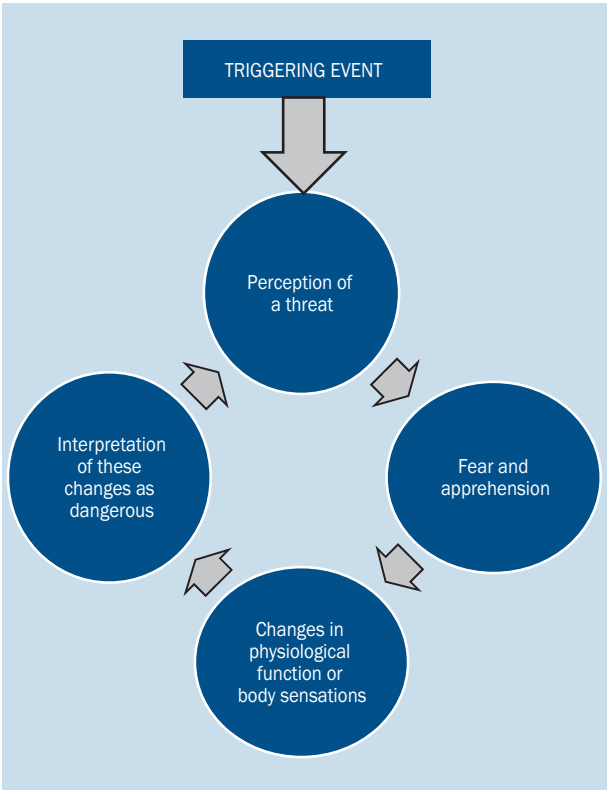



**Figure 2.** Threat response

such as continuous exhalation during ascent, which result in injury or death.

Panic is an example that is used to illustrate the generalised adaptation syndrome that has been examined in the psychological literature and applied stressors associated with scuba diving scenarios [7]. This reaction includes three distinct stages, including alarm, resistance, and exhaustion (Fig. 1). During the alarm stage, the diver is presented with a stressful situation or stimulus, such as a change in current or sudden appearance of a dangerous marine animal. This leads to the resistance stage in which the diver may try to manage this situation, but often in an uncontrolled or poorly directed manner; the diver may start to swim erratically or randomly reach for pieces of both necessary and unnecessary dive equipment. The continued physiological effort to manage the stressful situation, as well as the excessive energy expenditure that the panicked diver uses, may potentially leads to the exhaustion phase and the diver may become extremely tired and unable to maintain a particular depth or ascend to the surface safety. Particular to aquatic activities, exhaustion can result in severe injury or death due to the inability to remain buoyant in the aquatic environment and may lead to drowning. Panic can also be described as a cycle, or sequence of events and psychological and physiological responses to those events, which begins with a particular trigger or set of triggers (Fig. 2). This triggering event may lead to a diver feeling that their safety s threatened and lead to an increase in fear. Due to this sudden change, physiological functions such as an increase in heart rate and blood pressure may occur, along with changes in mental focus and acuity. These sudden changes may then be perceived by the diver as negative and potentially life threatening and increase the perception of threat to the diver. If this cycle is not interrupted, panic may quickly occur and unless managed immediately and effectively, these events can quickly lead to a catastrophic outcome such as a diving accident or death.

Panic is not uncommon in scuba diving. Morgan [8] conducted a national survey of scuba divers in the United States and the results of that study indicated that panic occurs in divers of various ages and experience levels. Additionally, researchers suggest that increased levels of trait anxiety in divers is associated with increased incidents of panic in surveyed divers. Along with the behavioural effects of panic, severe stress also has a significant impact on cardiovascular performance. Increased stress leads to an increased activation of the sympathetic nervous system (fight or flight system). This increased activation results

in an increase is cardiorespiratory stress and may lead to a myocardial infarction (heart attack) or other significant cardiac events. Research by Buzzacott and Denoble (2019) [2] suggests that cardiac events are one of the leading causes of death in the diving population. Additionally, the diving population has been shown to be significantly older than the general population [11] and often less inclined to engage in physical fitness activities [3]. These combined risk factors may result in an increased chance of a cardiovascular event when faced with a stressful or panic-inducing situation. Thus, the goal of any trained diver should be to prepare for and manage any stressful situation in an effort to avoid this panic response, as well as develop and maintain an exercise programme designed to improve cardiorespiratory function.

Preventing the onset of panic is critical to managing increased stress during scuba diving activities. The primary method of trying to manage or prevent panic in divers is to continually train and gain more experience in scuba diving skills and methods necessary for safe diving. Often divers achieve a specific certification and once that has occurred do not continually train under various conditions or situations. The more training and experience a scuba diver has, the less likely they will have a panic response to a changing situation, either because they previously have been in a similar situation or have simply gained the self-confidence to manage a new unpredictable event. Within the greater diving community, more emphasis needs to be placed on lifelong learning and practice of diving-related skills. Although many scuba certifying agencies recommend continuing education and lifelong practice of scuba-related movements and skills, many divers choose to ignore these previously learned skills because of a false sense of mastery or overall ability.

In addition to significant and continuous dive training, maintaining an effective exercise program is necessary in an effort to manage panic. The importance of exercise and physical fitness has been well documented in the research literature and all persons choosing to engage in scuba diving activities should be strongly encouraged to maintain an exercise programme and overall healthy lifestyle [4]. Through improvements in cardiorespiratory and muscular fitness, divers can physically manage stressful situation more effectively and with greater confidence. As previously stated, increased stress and panic results from one's perceived inability to manage unexpected situations and environmental conditions. Often times when diving, those situations are the result of changes in water current, unexpected surge, or potential separation from boats or other dive exit point. Under these circumstances, the stressed diver is forced to exert greater physiological effort to manage the situation (i.e. get back to the boat, swim against the current, etc.). Divers with greater cardiovascular reserves, resulting from structured exercise and conditioning programmes, will have both the physical means, as well as self-confidence, to manage these unexpected events more easily and manage potential stress more effectively, thus preventing the onset of panic.

Two often overlooked considerations when trying to examine stress and the panic response in a diving situation is the level of both environmental awareness and self-awareness of the diver, both towards themselves and the external environment. In the opinion of this author, both environmental awareness and self-awareness should be key components of any discussion of the necessary abilities and skills needed to manage a stressful aquatic situation. Endsley [12] has defined situational awareness as the "perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and a projection of their status in the near future". More simply, it may be defined as an appropriate awareness of a situation [13]. Poor situational awareness has been associated with a significant number of airline accidents in the aviation industry and is thought to be a significant precursor to the onset of uncontrollable events [14]. While diving, situational awareness is key to a safe and successful dive. A scuba diver should practice the necessary skills needed to improve situational awareness and learn to manage how one needs to continually shift their focus and attention during a dive. Attentional capacity is limited in the human being [15] and a good diver must learn how to manage those limitations and attentional focus while scuba diving. Specifically, a diver needs to monitor multiple aspects of the dive at all times, including environmental changes that occur in the water, such as tides, current, or depth. Additionally, a diver needs to maintain constant awareness of gas supply, equipment configurations, hazards (including entanglement risks from kelp, fishing nets, or wreck sites), and their dive buddy. When one is unable to efficiently manage all this information during a dive and there is an unexpected change in one or more of these factors, increased stress occurs, and the onset of panic may not be far off.

By definition, self-awareness represents the ability or capacity of an individual to be the object of their own attentional capacities [16]. Self-awareness requires the individual to identify, neurologically process, and store information about the self. This ability is critically important to the diver; not only does a diver need to consciously attend to what is actively happening in the external environment but must also be consistently monitoring his or her own biological processes that may be altered due to being at depth. These include respiration rate, heart rate, anxiety levels, or just overall general body sensations. Any changes in these factors may immediately result in a change in breathing which in turn will alter the amount of breathing gas the diver has at their disposal. As unexpected drops in breathing gas during a dive is a common panic-inducing trigger, self-awareness

of one's physiological function and its' effect on respiration is a key component of safe diving practices.

## RECOMMENDATIONS FOR THE ACTIVE SCUBA DIVER

As a diver becomes more familiar with stress and how it may present itself during a dive, what considerations or recommendations may be made to help prepare a diver and present the onset of panic? Are there training principles and protocols that may be used to manage stress and potential panic and how might those protocols be implemented into diver training?

As previously stated, one of the most important preventative measures that can be used to manage stress and panic during a dive is improved physical conditioning. All divers should participate in a structured exercise program that targets both cardiorespiratory and muscular endurance. Improved cardiorespiratory function will help the diver manage physiological responses to stressful diving situations and may help prevent a serious cardiac event. Another consideration regarding exercise and its role in managing diver stress are the normal physiological sensations associated with exercise. If a diver understands how the body reacts and the sensations associated with increased physical exertion, the diver is less likely to respond negatively to those sensations when they occur due to an external stressor while diving or in the water. Should a diver have an equipment malfunction and have a sudden increase in heart rate or respiration rate due to that sudden, unexpected stressor, they should be aware that this is a typical physiological response and will prevent any escalation into a panic event from occurring due to previous "comfort" and knowledge of those physiological changes.

In addition to improved physical fitness and conditioning, one of the most important ways to prepare for and manage stress and panic is continual training in the necessary skills needed for scuba diving. When individuals are first trained and certified, skills are practiced constantly and in many cases are overlearned. However, once divers successfully complete training and reach a desired level of certification, skill training and practice often are forgotten or minimally practiced. If a stressful situation occurs and the diver does not remember how to react, stress can increase exponentially and lead to the onset of panic. Therefore, it is highly recommended that divers continually practice the motor skills needed to manage unexpected situation. These skills may include equipment retrieval skills, buddy breathing, and signalling skills. This continued practice should lead to improvements in self-confidence and self-efficacy in a diver and allow for significant improvement in emergency management skills. From a practical perspective, it is recommended that divers begin and end every dive with a short practice session targeting skill retention in an effort to be prepared for the unexpected.

As part of a continuous learning and training program divers should also specifically focus parts of training on the practicing of the necessary scuba diving skills under differing conditions and environments. This refers to the specificity of practice principle that states practice should mimic the skills needed in competition (sport-related events) or real-world situations [17] and practicing under conditions of increased anxiety or arousal may have a positive effect on stress management during unpredictable conditions. Divers should train and practice their skills under differing conditions and environmental conditions. If a diver only trains under benign, predictable conditions, such as might be experienced under conditions of clear visibility and no current conditions, that diver will not necessarily be prepared for an incident under more challenging conditions that may present themselves while diving under low-visibility conditions. The more environmental conditions one has trained in and become comfortable with, the less likely an unexpected diving incident will cause uncontrollable stress and potential panic. The safe diver should always be looking to expand their training environments and practice under varying and moderately stressful conditions.

One final recommendation for the safe diver is to utilise a training mnemonic to visualise and focus during a dive emergency or unplanned event. In 2015, Kovacs [18] developed the A4 Principle as an assistive device for divers who are faced with an emergency situation. This principle focuses on four components; air, assess, acquire, and ascend, and was created be used to recall what needs to be done while underwater and under stress. Air refers to the first principle for a diver; make sure you have immediate access to air or another breathing gas. Once breathing gas has been secured then the diver needs to assess the specific situation in an effort to plan for how to immediately respond. Following this step, the divers should then acquire what is needed (equipment, buddy assistance, etc.) to manage the situation. Finally, once the situation has been managed, the diver may ascend to the surface or alternative depth. This mnemonic does two things for the diver; it allows the diver to remember simple steps on how to handle an emergency in an easy to use format and by mentally focusing and paying attention on these four components during an emergency, the diver will not be able to overly attend to external stressors and potential stressful triggers, thus preventing the onset of a potential panic response. Dive training should include this or similar teaching and learning tools to improve diver safety and help them mentally prepare for a stressful emergency event.

## CONCLUSIONS

Stress and panic are two significant considerations that every scuba diver should be aware of and make an effort

to manage during diving activities. There are multiple signs that indicate increased stress that may be occurring during a dive and lead to a potential panic response. Through proper management of triggers and stressors safe scuba divers are able to better handle unpredictable and stressful conditions and create a safer diving experience. In addition, there are multiple training and practice recommendations [18] for scuba divers that can be utilised in an effort to better prepare for potential stress. These include both physical and psychological training methods designed to improve physiological responses to stressors and mental conditioning for unpredictable situations through regular practice of the necessary skills needed for diver safely. Scuba diving can be a safe and relatively risk-free activity when scuba divers train and prepare effectively to manage unexpected situations and continued engagement in training activities can lead to more efficient and stress-free diving in both the recreational and professional diving communities.

**Conflict of interest:** None declared

## REFERENCES


1. Smith N. Scuba diving: how high the risk? J Insur Med. 1995; 27(1): 15–24, indexed in Pubmed: 10158133.
2. Buzzacott P, Denoble, P DAN Annual Diving Report 2018 edition: A report on 2016 diving fatalities, injuries, and incidents. 2019.
3. Kovacs C, Buzzacott P. Self-reported exercise behaviour and perception of its importance to recreational divers. Int Marit Health. 2017; 68(2): 115–121, doi: 10.5603/imh.2017.0021.
4. Pollock NW. Aerobic fitness and underwater diving. Diving and Hyperbaric Medicine South Pacific Underwater Medical Society. 2007; 37(3): 118.
5. Selye H. Confusion and controversy in the stress field. J Human Stress. 1975; 1(2): 37–44, doi: 10.1080/0097840X.1975.9940406, indexed in Pubmed: 1235113.
6. Koolhaas JM, Bartolomucci A, Buwalda B, et al. Stress revisited: a critical evaluation of the stress concept. Neurosci Biobehav Rev. 2011; 35(5): 1291–1301, doi: 10.1016/j.neubiorev.2011.02.003, indexed in Pubmed: 21316391.
7. Bachrach AJ, Egstrom GH. Stress and performance in diving. Best Publishing Company, San Pedro, CA 1987.
8. Morgan WP. Anxiety and panic in recreational scuba divers. Sports Med. 1995; 20(6): 398–421, doi: 10.2165/00007256-199520060-00005, indexed in Pubmed: 8614760.
9. Strauss MB, Aksenov IV. Diving Science. Human Kinetics, 2004.
10. Denoble PJ, Caruso JL, Dear G, et al. Common causes of open-circuit recreational diving fatalities. Undersea Hyperb Med. 2008; 35(6): 393–406, indexed in Pubmed: 19175195.
11. Ranapurwala SI, Kucera KL, Denoble PJ. The healthy diver: A cross-sectional survey to evaluate the health status of recreational scuba diver members of Divers Alert Network (DAN). PLoS One. 2018; 13(3): e0194380, doi: 10.1371/journal.pone.0194380, indexed in Pubmed: 29566018.
12. Endsley M. Toward a theory of situation awareness in dynamic systems. Human Factors: The Journal of the Human Factors and Ergonomics Society. 2016; 37(1): 32–64, doi: 10.1518/001872095779049543.
13. Smith K, Hancock PA. Situation awareness is adaptive, externally directed consciousness. Human Factors: The Journal of the Human Factors and Ergonomics Society. 2016; 37(1): 137–148, doi: 10.1518/001872095779049444.
14. Hartel CEJ, Smith K, Prince C. Defining aircrew coordination Sixth International Symposium on Aviation Psychology. Columbus, Ohio 1991.
15. Dux PE, Marois R. The attentional blink: a review of data and theory. Atten Percept Psychophys. 2009; 71(8): 1683–1700, doi: 10.3758/APP.71.8.1683, indexed in Pubmed: 19933555.
16. Morin A. Self-Awareness. Part 1: Definition, Measures, Effects, Functions, and Antecedents. Social Personality Psychology Compass. 2011; 5(10): 807–823, doi: 10.1111/j.1751-9004.2011.00387.x.
17. Lawrence GP, Cassell VE, Beattie S, et al. Practice with anxiety improves performance, but only when anxious: evidence for the specificity of practice hypothesis. Psychol Res. 2014; 78(5): 634–650, doi: 10.1007/s00426-013-0521-9, indexed in Pubmed: 24162389.
18. Kovacs C. A mnemonic for dealing with dive emergencies. J Underwater Education. 2015; 2: 52–54.

VIA MEDICA

SHORT COMMUNICATION

Int Marit Health
2023; 74, 3: 192–194
10.5603/imh.97239
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# The risk of an epidemic outbreak in southern Ukraine

**Małgorzata Marchelek-Myśliwiec[1], Jevhen Garan[2], Katarzyna Mańkowska[3], Krzysztof Korzeniewski[4]**

[1]Clinic of Nephrology, Transplantology and Internal Medicine, Pomeranian Medical University, Szczecin, Poland
[2]Deputy Director for Medical Affairs, Regional Clinical Hospital, Kherson, Ukraine
[3]Department of Microbiology, Immunology and Laboratory Medicine, Pomeranian Medical University, Szczecin, Poland
[4]Department of Epidemiology and Tropical Medicine, Military Institute of Medicine – National Research Institute, Warsaw, Poland

## ABSTRACT

*The humanitarian crisis that followed the military aggression against Ukraine is getting worse. The war which has continued since February 2022 has already caused irreparable health damage in the local community, which is affected by such acts of Russian terror as the destruction of the Kakhovka dam on the Dnieper River. As a result of the explosion and destruction of the dam, which occurred on 6 June 2023, over 2,500 square kilometres of land were flooded and around 17,000 residents had to be evacuated.*

*(Int Marit Health 2023; 74, 3: 192–194)*

**Keywords: Ukraine, war, humanitarian crisis, epidemiology**

The humanitarian crisis that followed the military aggression against Ukraine is getting worse. The war which has continued since February 2022 has already caused irreparable health damage in the local community, which is affected by such acts of Russian terror as the destruction of the Kakhovka dam on the Dnieper River. As a result of the explosion and destruction of the dam, which occurred on 6 June 2023, over 2,500 square kilometres of land were flooded (Fig. 1) and around 17,000 residents had to be evacuated (Fig. 2). Not everyone, however, was able to escape the flood. The exact number of casualties is not yet known. The damage to the local infrastructure and the ongoing combat operations prevent the provision of quick and effective aid to those who suffered from the flood [1].


**Figure 1.** The bottom of the Kakhovka reservoir on the way to the Kherson region. Source: Andriy Dubchak, Donbas Frontliner. June 2023


**Figure 2.** Locals on the on the central street of Kherson. Source: Andriy Dubchak, Donbas Frontliner. June 2023

Prof. Krzysztof Korzeniewski, MD, PhD, Department of Epidemiology and Tropical Medicine, Military Institute of Medicine – National Research Institute, ul. Szaserów 128, 04–141 Warszawa, Poland, e-mail: kkorzeniewski@wim.mil.pl

Received: 3.09.2023 Accepted: 5.09.2023

One may expect that the number of infectious diseases in the region will increase substantially. Contaminated water has the potential to spread infectious diseases as it can become a source of transmission to large groups of people within a relatively short time [2]. Contaminated water contains bacteria (*Vibrio* spp., *Salmonella* spp., *Shigella* spp., *Escherichia coli*), viruses (HAV, HEV, rotaviruses), and intestinal parasites (*Giardia intestinalis*, *Cryptosporidium parvum*) which are pathogenic to humans [3–5]. All of the above-named infections may be associated with increased morbidity and mortality, especially among children, the elderly, the immunocompromised or malnourished patients [6].

Currently, the epidemiological situation in the region is not clear. However, the analysis of the available environmental data from areas routinely affected by severe floods or from areas where floods had caused severe human and material losses suggests that an epidemic is likely to break out in Ukraine. The latest data published on the website of the Ukrainian sanitary services demonstrated that almost 35% of the water samples collected for inspection in the Kherson, Odesa and Mykolaiv Oblasts did not comply with the sanitary requirements. The region which is most at risk of an epidemic outbreak is the Odesa Oblast. The examination of water samples collected in this region revealed that all water quality parameters (physical, chemical, microbiological and toxicological) were much below the acceptable standards at all times the tests were carried out [7].

Special attention must be given to those pathogenic organisms which have a high potential to cause increased morbidity, especially *Vibrio*, *Salmonella*, *Shigella* bacteria and hepatitis A virus. Cholera outbreaks were reported in southern Ukraine as early as in the 19$^{th}$ century. In the Kherson region, cholera cases were recorded in 1994 and in 1995. In total, there were 525 recorded cholera cases in the Kherson, Odesa and Mykolaiv Oblasts [8]. Between May and July 2011 another 33 cholera cases were reported in Mariupol [9]. The analysis of the available epidemiological data covering the period from 2011 to 2018 shows that the incidence rates of salmonellosis in Ukraine are high and are markedly different from European statistics. When investigating outbreaks of salmonellosis in Ukraine, sanitary inspectors established that most mass catering establishments lacked the documents necessary to confirm the origin and to verify the quality and safety of the food products. They also found that the procedures for food handling, storage and transport were often violated, final inspections of the finished products were not carried out, and the deadlines for the periodic examination and vaccination of livestock were not respected [10]. The epidemiological reports prepared by the Ukrainian services that were released in June 2023 indicate noticeable cases of *Shigella* infections (71 cases in the first 5 months of 2023) [11]. *Shigella* bacteria are highly infectious since as few as around 100 microorganisms are capable of causing a disease. Hepatitis A is another health emergency which could potentially lead to an outbreak of an epidemic in the flooded areas. In the first 5 months of 2023, there were a total of 121 reported HAV infections (compared to 85 cases noticed in the same period of 2022) in the general Ukrainian population [11].


**Figure 3.** The queue for drinking water at the dispensing point in Nikopol. Source: Andriy Dubchak, Donbas Frontliner. June 2023


**Figure 4.** Four-year-old Matvii came to get drinking water with his father in Nikopol. Source: Andriy Dubchak, Donbas Frontliner. June 2023

## COMMENT

Currently it is impossible to determine the level of epidemiological risk for southern Ukraine. To do so it would be necessary to gather reliable epidemiological data from the flooded areas. According to media reports, the worst situation can be seen in the territories occupied by the Russian Federation (mass cholera vaccinations have already started in this area). The latest epidemiological reports available online did not reveal any new cholera cases or an increase in the number of salmonellosis, shigellosis and viral hepatitis A cases in the civilian population. Nevertheless, a large-scale anti-epidemic campaign is necessary to minimize the risk

of an epidemic outbreak. The campaign should primarily focus on a few critical disease prevention measures, i.e. delivery of safe drinking water (Figs. 3, 4), safe transport of water in water tanks specifically designed for this purpose, avoiding the consumption of food of unknown origin. According to the World Health Organization guidelines published in 2004 a person needs around 5 litres of water a day for drinking and food preparation, and around 15 litres a day for sanitary purposes. In field hospitals and emergency units a daily water requirement is 60 litres per person. When a natural disaster strikes, it should become a priority for emergency services to ensure the delivery of safe drinking water (15 litres per person/daily) as quickly as possible [12]. However, as combat operations continue in southern Ukraine, this may be difficult to achieve. Failure to deliver safe drinking water locally may increase the risk of an epidemic outbreak.

**Conflict of interest:** None declared

## REFERENCES


1. Public Health Center of the Ministry of Health of Ukraine. Water monitoring after the terrorist attack at the Kakhovskaya HPP: almost 35% of water samples do not meet hygienic standards. Available from: Naddaf M. Ukraine dam collapse: what scientists are watching. Nature. 2023; 618(7965): 440–441, doi: 10.1038/d41586-023-01928-8, indexed in Pubmed: 37296263.
2. Watson JT, Gayer M, Connolly MA. Epidemics after natural disasters. Emerg Infect Dis. 2007; 13(1): 1–5, doi: 10.3201/eid1301.060779, indexed in Pubmed: 17370508.
3. Satiti ID, Laksono B, Indriyanti DR. The relationship of clean water facilities and fecal discharge to incidence of diarrhea of the tidal floods area and not tidal flood in Pekalongan. Public Healh Perspect J. 2019; 4(1): 17–22.
4. Dixon BR. Giardia duodenalis in humans and animals - Transmission and disease. Res Vet Sci. 2021; 135: 283–289, doi: 10.1016/j.rvsc.2020.09.034, indexed in Pubmed: 33066992.
5. Schwartz BS, Harris JB, Khan AI, et al. Diarrheal epidemics in Dhaka, Bangladesh, during three consecutive floods: 1988, 1998, and 2004. Am J Trop Med Hyg. 2006; 74(6): 1067–1073, indexed in Pubmed: 16760521.
6. Hashizume M, Wagatsuma Y, Faruque ASG, et al. Factors determining vulnerability to diarrhoea during and after severe floods in Bangladesh. J Water Health. 2008; 6(3): 323–332, doi: 10.2166/wh.2008.062, indexed in Pubmed: 19108552.
7. Oprea M, Njamkepo E, Cristea D, et al. The seventh pandemic of cholera in Europe revisited by microbial genomics. Nat Commun. 2020; 11(1): 5347, doi: 10.1038/s41467-020-19185-y, indexed in Pubmed: 33093464.
8. Public Health Center of the Ministry of Health of Ukraine. Water monitoring after the terrorist attack at the Kakhovskaya HPP: almost 35% of water samples do not meet hygienic standards. https://phc.org.ua/news/monitoring-vodi-pislya-terktu-na-kakhovskiy-ges-mayzhe-35-prob-vodi-ne-vidpovidayut (Accessed: 07 July 2023).
9. Kuleshov KV, Kostikova A, Pisarenko SV, et al. Comparative genomic analysis of two isolates of Vibrio cholerae O1 Ogawa El Tor isolated during outbreak in Mariupol in 2011. Infect Genet Evol. 2016; 44: 471–478, doi: 10.1016/j.meegid.2016.07.039, indexed in Pubmed: 27480918.
10. Podavalenko A, Malysh N, Zadorozhna V, et al. Incidence and risk factors of salmonellosis in Ukraine. Folia Med Cracov. 2021; 61(2): 91–102, doi: 10.24425/fmc.2021.137226, indexed in Pubmed: 34510167.
11. Public Health Center of the Ministry of Health of Ukraine. Infectious disease in the population of Ukraine. https://phc.org.ua/kontrol-zakhvoryuvan/inshi-infekciyni-zakhvoryuvannya/infekciyna-zakhvoryuvanist-naselennya-ukraini (Accessed: 01 July 2023).
12. World Health Organization. Guidelines for Drinking-water Quality. Third edition. Geneva 2008. https://www.who.int/publications/i/item/9789241547611 (Accessed: 10 July 2023).

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2023; 74, 3: 195–204
10.5603/imh.96404
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Burnout syndrome of coastal fishermen

**Omar Laraqui[1, 2], Christine Roland-Lévy[1], Nadia Manar[3], Tarik Ghailan[4], Frédéric Deschamps[2], Chakib El Houssine Laraqui Hossini[3]**

[1]Laboratoire de Psychologie, Cognition, Santé, Société, Reims, France
[2]University Institute of Occupational Health and Environmental Medicine, Reims, France
[3]Graduate School of Health Engineering, Casablanca, Morocco
[4]Moroccan Society of Maritime Health, Tanger, Morocco

## ABSTRACT

***Background:*** *Coastal fishermen are particularly affected by occupational stress and burnout because they are exposed to high psychosocial factors at work and organizational constraints related to difficult working conditions.*

***Materials and methods:*** *This survey aimed to assess the prevalence of burnout syndrome (BOS) of fishermen and its relationship with sociodemographic and occupational parameters. This cross-sectional study involved a representative sample of 761 fishermen. We used an individual questionnaire including socio-demographic and occupational parameters, the Karasek's Job Content Questionnaire, and Maslach BO Inventory. BOS includes three dimensions: emotional exhaustion, depersonalisation, and loss of self-efficacy. The positive diagnosis of BOS is retained if the scores of the three dimensions are abnormal (high for the first two and low for the third).*

***Results:*** *Five hundred and twenty-six people agreed to answer the questionnaire. Of these, 16.1% had a high emotional exhaustion, 13.9% high depersonalisation, and 11.2% low personal accomplishment. Furthermore, 37.1% had at least one abnormal dimension of BOS: 16.9% had one abnormal dimension, 12.2% two, and 8% three (BOS). The prevalence of abnormal dimensions of BOS was significantly higher in pilots-copilots (67.9%), and in mechanics (63.5%) than in sailors (27.8%). It was higher in fishermen living alone (44.4%), having seasonal job (57.9%), suffering of job strain (42.1%) or isostrain (57.9%), and sleep disorders (55.4%). The multivariate logistic regression showed that job strain, isostrain, fatigue, sleep disorders, seasonal job and daily working > 14 h constituted a major risk factor of abnormal dimension of BOS.*

***Conclusions:*** *It is imperative to identify priority actions to improve the working conditions of fishermen, and to develop a genuine prevention policy.*

*(Int Marit Health 2023; 74, 3: 195–204)*

**Keywords: burnout, stress, fishermen, Morocco**

## INTRODUCTION

The combination of an unsafe work environment, job strain and socio-economic difficulties is a major risk factor for chronic stress that can lead to burnout syndrome [1]. Burnout syndrome (BOS) comprises three dimensions: emotional exhaustion, depersonalisation or dehumanisation, and loss of a sense of personal accomplishment, all of which can occur in people working in some way with other human beings [2]. According to Karasek [3], BOS is a consequence of everyday stress reactions that have worn the individual down. It has its roots in response to a number of long-lasting occupational stressors that exhaust people to the point where their energy resources are insufficient to survive the pressure of the situation [4–7]. Occupational stress is

Prof. Chakib El Houssine Laraqui Hossini, Graduate School of Health Engineering (ESISMP), 24 street La Fontaine, 20100, Casablanca, Morocco, e-mail: chlaraqui51@gmail.com

Received: 7.07.2023 Accepted: 11.08.2023

a physical and psychological condition resulting from the accumulation of stressors that impact on individuals on a daily basis [2–6, 8]. Chronic work-related tension contributes to unhealthy behaviours, mental illness and multiple organic disorders (cardiovascular, musculoskeletal, gastrointestinal, etc.) [9]. Inshore fishermen are particularly affected by stress and BOS, as they are exposed to numerous health risks due to increasingly demanding work situations, high workloads, poor work organization and unfavourable socio-economic factors [10, 11]. BOS has been associated with negative workplace behaviours, including resignation, increased psychoactive substances consumption and social and economic problems [12, 13]. However, few studies [10, 11] have analysed, in any way, the psychosocial risks of inshore fishermen in Morocco. The aim of this survey was to assess the prevalence of BOS of fishermen and its relationship with sociodemographic and occupational parameters.

## MATERIALS AND METHODS

### SCOPE AND TYPE OF STUDY

This cross-sectional study was conducted in 2019 in a port in northern Morocco.

### TARGET POPULATION

The survey involved a representative sample of 761 fishermen (33.3% of the exhaustive administrative list of 2,285 fishermen). All participants were male and had been fishing regularly for at least 2 years. They worked, every day except Friday, in the coastal sector in small embarkations (trawlers, longliners, sardiners).

### QUESTIONNAIRE

We used an individual questionnaire inspired by those of the Institut National de Recherche et de Sécurité de France [14], the Karasek Job Content Questionnaire (KJCQ) [3], and the Maslach BO Inventory (MBI) [4, 15]. It consists of four parts:

— Socio-demographic and occupational parameters: age, family situation, job seniority, daily and weekly working hours, type of employment (permanent or seasonal), history of incidents or accidents in the last 12 months, and work-related stress factors;

— Health parameters: regular physical activity — sports (at least 3 times a week), consumption of psychoactive substances, psychosomatic manifestations of stress and reported chronic diseases. Daily consumption of coffee or tea was considered excessive when it exceeded 4 cups or glasses. For stress-related psychosomatic symptoms, items were assessed by responses on a 4-point Likert-type scale between never and often. "Never" and "rarely" responses were considered as rejected, and "always", "sometimes" and "often" responses as present;

— Karasek's Job Content Questionnaire (KJCQ) identifies three dimensions of the psychosocial work environment. Psychological demand (PD) assesses the quantity, speed, complexity, intensity, fragmentation and predictability of work. Decision latitude (DL) assesses the ability to make work-related decisions, use of prior learning and skills development. Social support (SS) values occupational and emotional support from superiors and colleagues. The questionnaire comprises 26 questions: 9 for PD, 9 for DL and 8 for SS. Responses are given on a discontinuous 4-point Likert-type scale ranging from "strongly disagree" to "strongly agree". These three dimensions are used to identify at-risk situations. Job strain is the combination of low DL (score below 71) and high PD (score above 20). Isostrain is the combination of a job strain situation and a low SS (score below 24) [3];

— Maslach's BO inventory: the MBI comprises 22 questions and is made up of three dimensions: emotional exhaustion (EE), dehumanisation or depersonalisation (DP) and sense of personal accomplishment (PA) at work. Responses are rated on a 7-point Likert-type scale ranging from 0 (never) to 6 (every day). The sum of responses defines a low or high level for each dimension. The EE, which comprises 9 items, ranges from 0 to 54, with a low score of less than 27 and a high score of 27 or more. The DP, with 5 items, ranges from 0 to 30, and is low if its score is below 13 and high if it is greater than or equal to 13. The feeling of PA, with 8 items, is evaluated from 0 to 48. It is low if its score is less than 31 and high if it is greater than or equal to 31. A positive diagnosis of BOS is made if scores on all three dimensions are abnormal (high for the first two and low for the third) [16, 17]. In this study, we opted to compare the group of fishermen with no abnormal BOS dimensions with those with at least one abnormal BOS dimension.

### ETHICAL AND DEONTOLOGICAL ASPECTS

Beforehand, we contacted the delegate from the Ministry of Fisheries, representatives of fishermen's associations and occupational physicians from the seafarers' health offices, to explain the purpose of the study and obtain their support. The interviews took place at the fishermen's occupational health department and lasted around 20 minutes for each person. The individual discussions with each fisherman took place in the strictest confidence.

### STATISTICAL ANALYSES

The statistical analysis was performed using the SPSS version 11.5 software package. The differences between groups were compared using t-tests (Student) for continuous variables and chi-square tests for categorical ones. The sta-

**Table 1.** Socio-demographic and occupational data

| Parameters | Total N = 526 | Pilots/copilots N = 78 (14.8%) | Mechanics N = 52 (9.9%) | Sailors N = 396 (75.3%) |
|---|---|---|---|---|
| Age [years]: | | | | |
| ≤ 30 | 112 (21.3%) | 8 (10.3%) | 5 (9.6%) | 99 (25%) |
| 31–40 | 108 (20.5%) | 14 (17.9%) | 19 (36.5%) | 79 (19.9%) |
| 41–50 | 152 (28.9%) | 36 (46.2%) | 17 (32.7%) | 102 (25.8%) |
| > 50 | 154 (29.3%) | 20 (25.6%) | 11 (21.2%) | 116 (29.3%) |
| Average age | 41.6 ± 9.1 | 43.7 ± 9.4 | 41.5 ± 8.9 | 40.9 ± 8.6 |
| Family status: | | | | |
| Living in a couple | 348 (66.2%) | 60 (76.9%) | 27 (51.9%) | 262 (66.2%) |
| Living alone | 178 (33.8%) | 18 (23.1%) | 25 (48.1%) | 134 (33.8%) |
| Living with dependents | 315 (59.9%) | 34 (43.6%) | 25 (48.1%) | 256 (64.6%) |
| Work seniority [years]: | | | | |
| ≤ 5 | 84 (16%) | 5 (6.4%) | 3 (5.8%) | 76 (19.2%) |
| 6–15 | 147 (27.9%) | 21 (26.9%) | 21(40.4%) | 105 (26.5%) |
| > 15 | 295 (56.1%) | 52 (66.7%) | 28 (53.8%) | 215 (54.3%) |
| Average | 14.5 ± 4.2 | 16.2 ± 4.5 | 15 ± 4.6 | 14.1 ± 4.9 |
| Average daily working hours | 11.9 ± 0.4 | 12.1 ± 0.5 | 12.2 ± 0.6 | 11.8 ± 0.3 |
| Average weekly working hours | 71.4 ± 1.2 | 72.6 ± 1.3 | 73.2 ± 1.1 | 70.8 ± 0.9 |
| Type of job: | | | | |
| Seasonal | 231 (43.9%) | 0 (0%) | 3 (5.8%) | 228 (57.6%) |
| Permanent | 295 (56.1%) | 78 (100%) | 49 (94.2%) | 168 (42.4%) |
| History of incidents and occupational injuries | 136 (25.9%) | 36 (46.2%) | 23 (44.2%) | 77 (19.4%) |
| Work stressors: | | | | |
| High psychological demand | 431 (81.9%) | 69 (88.4%) | 44 (84.6%) | 318 (80.3%) |
| Low decision latitude | 299 (56.8%) | 30 (38.5%) | 24 (46.2%) | 245 (61.9%) |
| Low social support | 259 (49.2%) | 40 (51.3%) | 25 (48.1%) | 194 (49%) |
| Job strain | 222 (42.2%) | 27 (34.6%) | 22 (42.3%) | 173 (43.7%) |
| Isostrain | 149 (28.3%) | 26 (33.3%) | 18 (34.6%) | 105 (26.5%) |

tistical level of significance was established at 5%. In order to assess the association between BOS and several other factors, we calculated odds ratio (OR) and 95% confidence intervals (CI). Multivariable logistic regression analysis including the factors that were statistically significant in bivariate analysis were calculated. The OR adjusted (ORa) of each of the factors that we found in the final model, independently of the other factors, were computed.

## RESULTS

Five hundred and twenty-six fishermen agreed to answer the questionnaire; the participation rate was 69.1%.

Average age was 41.6 ± 9.1 years. Two-thirds (66.2%) lived with a partner and 59.9% had dependents. Average length of service was 14.5 ± 4.2 years. The average daily working time was 11.9 ± 0.4 hours, and the average weekly working time was 71.4 ± 1.2 hours. More than half were permanent workers, while 43.9% were seasonal. The prevalence of work stress risk factors was 81.9% for high PD, 56.8% for low LD and 49.2% for low SS. The prevalence of job strain was 42.2% and isostrain 28.3% (Table 1).

For doping behaviours, the prevalence was 97.9% for excessive tea-coffee consumption, 37.8% for tobacco, 31.7% for cannabis, 29.3% for alcohol, 4.6% for psychotropic drugs (antidepressants, tranquilizers and sedatives) and 18.6% for analgesics. Almost a third (31.9%) regularly took part in sport or physical activity outside work. The prevalence of psychosomatic manifestations of stress reported was 67.9%: neurovegetative disorders (55.9%), nervous tension (57.4%), mood disorders (50%), cognitive disorders (21.7%) and sleep disorders (37.5%). Chronic diseases or comorbidities were reported by 36.3%: musculoskeletal disorders (32.5%), respiratory diseases (18.1% with 16.8% for rhinitis, 7.6% for asthma, 4.3% for chronic obstructive pulmonary disease and 6.1% for chronic bronchitis), cardiovascular diseases (16.9% with 14.9% for arterial hypertension and 12.3% for phlebitis), neuropsychiatric disorders (16.5%: headache, depression), digestive disorders (13.9%: gastritis, heartburn, gastric ulcer) and metabolic diseases (13.3%: 7.2% for diabetes and 8.1% for hypercholesterolemia) (Table 2).

The prevalence of BOS in the total population was 8%. It was significantly higher ($p < 0.01$) among pilots/copilots (12.8%) and mechanics (17.3%) than among sailors (5.8%). In the total population, mean scores for EE, DP and PA were 16.2 ± 5.2, 8.2 ± 3.3, and 30.6 ± 7.2, respectively. Abnormally high scores for EE and DP were noted in 16.1% and 13.9%,

**Table 2.** Health parameters according to the occupational categories

| Parameters | Total N = 526 | Pilots/copilots N = 78 (14.8%) | Mechanics N = 52 (9.9%) | Sailors N = 396 (75.3%) |
|---|---|---|---|---|
| Toxic habits: | | | | |
| Tea–coffee | 515 (97.9%) | 72 (92.3%) | 51 (98.1%) | 391 (98.7%) |
| Tobacco | 199 (37.8%) | 21 (26.9%) | 21 (40.3%) | 157 (39.6%) |
| Cannabis | 167 (31.7%) | 14 (17.9%) | 18 (34.6%) | 135 (34.1%) |
| Alcohol | 154 (29.3%) | 22 (28.2%) | 24 (46.2%) | 108 (27.3%) |
| Other psychotropic | 24 (4.6 %) | 6 (7.6%) | 5 (9.6%) | 13 (3.2%) |
| Antalgic drugs | 98 (18.6%) | 17 (21.8%) | 14 (26.9%) | 67 (16.9%) |
| Regular physical activities and/or sports | 168 (31.9%) | 15 (19.2%) | 14(27%) | 142 (35.9%) |
| Self-reported psychosomatic symptoms: | 357 (67.9%) | 58 (74.4%) | 44 (84.6%) | 255 (64.4%) |
| Neuro-vegetative disorders | 294 (55.9%) | 54 (69.2%) | 39 (75%) | 201 (50.6%) |
| Muscle pains, cramps, or sensations of muscle stiffness | 184 (35%) | 45 (57.7%) | 31 (59,6%) | 108 (27.3%) |
| Nervous tension | 302 (57.4%) | 55 (70.5%) | 34 (65.4%) | 213 (53.8%) |
| Mood disorders | 263 (50%) | 52 (66.7%) | 21 (40.4%) | 190 (48%) |
| Cognitive disorders | 114 (21.7%) | 32 (41%) | 28 (53.8%) | 54 (13.6%) |
| Sleep disorders | 197 (37.5%) | 39 (50%) | 21 (40.4%) | 137 (34.6%) |
| Self-reported chronic diseases | 191 (36.3%) | 28 (35.9%) | 29 (55.8%) | 134 (33.8%) |
| Musculoskeletal | 171 (32.5%) | 24 (30.8%) | 27 (51.9%) | 120 (30.3%) |
| Respiratory | 95 (18.1%) | 22 (28.2%) | 21 (40.4%) | 52 (13.1%) |
| Cardiovascular | 89 (16.9%) | 8 (10.3%) | 25 (48.1%) | 56 (14.1%) |
| Neuropsychiatric | 87 (16.5%) | 25 (32.1%) | 20 (38.5%) | 42 (10.6%) |
| Digestive | 73 (13.9%) | 17 (21.8%) | 22 (42.3%) | 34 (8.6%) |
| Metabolic | 70 (13.3%) | 14 (17.9%) | 19 (36.5%) | 37 (9.3%) |

**Table 3.** Prevalence of burnout syndrome (BOS), and the levels of its dimensions

| Dimensions | Total N = 526 | Pilots/copilots N = 78 (14.8%) | Mechanics N = 52 (9.9%) | Sailors N = 396 (75.3%) |
|---|---|---|---|---|
| Emotional exhaustion: | | | | |
| Low | 441 (83.9%) | 47 (60.3%) | 36 (69.2%) | 359 (90.4%) |
| High | 85 (16.1%) | 31 (39.7%) | 16 (30.8%) | 38 (9.6%) |
| Average score | 16.2 ± 5.2 | 28.4 ± 8.3 | 27.8 ± 8.8 | 12.9 ± 8.2 |
| Depersonalisation: | | | | |
| Low | 453 (86.1%) | 56 (71.8%) | 30 (57.7%) | 368 (92.9%) |
| High | 73 (13.9%) | 22 (28.2%) | 22 (42.3%) | 29 (7.3%) |
| Average score | 8.2 ± 3.3 | 10.9 ± 5.6 | 12.8 ± 9 | 7.2 ± 2,1 |
| Personal accomplishment: | | | | |
| Low | 185 (35.2%) | 41 (52.6%) | 21 (40.4%) | 123 (31.1%) |
| High | 341 (64.8%) | 37 (47.4%) | 31 (59.6%) | 273 (68.9%) |
| Average score | 30.6 ± 7.2 | 26.4 ± 6.3 | 29.3 ± 7.4 | 31.5 ± 7.3 |
| Abnormal dimensions: | | | | |
| 1 abnormal dimension | 89 (16.9%) | 24 (30.8%) | 18 (34.6%) | 47 (11.8%) |
| 2 abnormal dimensions | 64 (12.2%) | 19 (24.4%) | 8 (15.4%) | 37 (9.3%) |
| 3 abnormal dimensions (BOS) | 42 (8%) | 10 (12.8%) | 9 (17.3%) | 23 (5.8%) |
| Total | 195 (37.1%) | 53 (67.9%) | 35 (67.3%) | 107 (26.9%) |

respectively, and low scores for PA in 35.2%. The prevalence of abnormal scores was significantly higher in pilots/copilots and mechanics than among sailors ($p < 0.01$) (Table 3).

The age group most affected by at least one abnormal dimension of BOS was between 41 and 50 (56.6%). The prevalence of people with at least one abnormal BOS dimension was higher among those living alone (44.4% vs. 33.3%, $p < 0.01$). The proportion of fishermen with at least one abnormal BOS dimension was significantly higher among pilots/copilots (67.9%) and mechanics (63.5%) than among sailors (27.8%). 56.3% of seasonal and 22% of permanent PMs had at least one abnormal BOS dimension. Among fishermen with at least one abnormal dimension, 53.3% had had an incident or accident in the last 12 months, 42.1% suffered from job strain and 57.9% from isostrain (Table 4).

**Table 4.** Relationships between sociodemographic and occupational parameters and burnout syndrome (BOS)

| Parameters | Total N = 526 | NAD BOS N = 331 (62.9%) | AD BOS N = 195 (37.1%) | P |
|---|---|---|---|---|
| Age [years]: | | | | |
| ≤ 30 | 112 (21.3%) | 78 (69.7%) | 34 (30.3%) | 0.0001 |
| 31–40 | 108 (20.5%) | 65 (60.1%) | 43 (39.9%) | 0.004 |
| 41–50 | 152 (28.9%) | 66 (43.4%) | 86 (56.6%) | 0.029 |
| > 50 | 154 (29.3%) | 120 (77.9%) | 34 (22.1%) | 0.0001 |
| Average age | 41.6 ± 9.1 | 40.5 ± 8.9 | 41.5 ± 9 | 0.216 |
| Family status: | | | | |
| Living in a couple | 348 (66.2%) | 232 (66.7%) | 116 (33.3%) | 0.0001 |
| Living alone | 178 (33.8%) | 99 (55.6%) | 79 (44.4%) | 0.044 |
| Living with dependents | 315 (59.9%) | 146 (46.3%) | 169 (53.7%) | 0.08 |
| Professional category: | | | | |
| Pilots/copilots | 78 (14.8%) | 25 (32.1%) | 53 (67.9%) | 0.0001 |
| Mechanics | 52 (9.9%) | 19 (36.5%) | 33 (63.5%) | 0.011 |
| Sailors | 396 (75.3%) | 286 (72.2%) | 110 (27.8%) | 0.0001 |
| Work seniority [years]: | | | | |
| ≤ 5 | 84 (16%) | 49 (58.3%) | 35 (41.7%) | 0.045 |
| 6–15 | 147 (27.9%) | 70 (47.6%) | 77 (52.4%) | 0.484 |
| > 15 | 295 (56.1%) | 212 (71.9%) | 83 (28.1%) | 0.0001 |
| Average seniority | 14.5 ± 4.2 | 15.2 ± 4.5 | 12.8 ± 3.6 | 0.0001 |
| Average daily working hours | 11.9 ± 0.4 | 10.1 ± 0.2 | 14.9 ± 0.7 | 0.0001 |
| Average weekly working hours | 71.4 ± 1.2 | 60.6 ± 1.1 | 89.4 ± 1.4 | 0.0001 |
| Type of work: | | | | |
| Seasonal | 231 (43.9%) | 101 (43.7%) | 130 (56.3%) | 0.017 |
| Permanent | 295 (56.1%) | 230 (78%) | 65 (22%) | 0.0001 |
| History of incidents and occupational injuries | 136 (25.9%) | 32 (9.7%) | 104 (53.3%) | 0.0001 |
| Work stressors: | | | | |
| High psychological demands | 431 (81.9%) | 250 (75.5%) | 181 (92.8%) | 0.0001 |
| Low decision latitude | 299 (56.8%) | 169 (51.1%) | 130 (66.7%) | 0.0001 |
| Low social support | 259 (49.2%) | 87 (26.3%) | 172 (88.2%) | 0.0001 |
| Job strain | 222 (42.2%) | 140 (42.3%) | 82 (42.1%) | 0.0001 |
| Isostrain | 149 (28.3%) | 36 (10.9%) | 113 (57.9%) | 0.0001 |

NAD — no abnormal dimensions of BOS; AD — abnormal dimensions of BOS

Among seafarers with at least one abnormal dimension of the BOS, sporting practices were less frequent (7.7% vs. 25.4%, $p < 0.01$) and doping behaviours more important. The prevalence of psychosomatic manifestations of stress and reported chronic illnesses was respectively and significantly higher among seafarers with at least one abnormal dimension of the BOS (77.4% and 62.6%) than among those with none (62.2% and 20.8%) (Table 5).

Multivariate logistic regression showed that iso-strain, job strain, fatigue, seasonal work, sleep disorders and daily working hours greater than 14 hours were independent risk factors associated with the presence of abnormal BOS dimensions (Table 6).

## DISCUSSION

### CONCEPTS

For designers, BOS can result from overwork in emotionally demanding occupations suchas fishermen, caregivers, teachers and so on. Occupational exhaustion, which particularly affects fishermen, is a psychological and physiological state in which individuals become exhausted due to the daily accumulation of chronic stress factors. It has its roots in response to a number of stressors over a long period of time [4–6]. BOS combines three symptoms (emotional exhaustion, depersonalisation and loss of sense of personal fulfilment) and is likely to occur in anyone working with other human beings in any way [2]. Emotional exhaustion is the major dimension of BOS, and corresponds to a loss of motivation and a feeling of annihilation of emotional resources. It translates into an impression of affective and emotional saturation with regard to the suffering of others. Depersonalisation includes the development of impersonal and negative attitudes towards colleagues, as well as a loss of empathy and cynicism. This disinvestment in relationships manifests itself in negative attitudes and feelings towards those around us. The reduced sense of personal fulfilment at work implies a loss of confidence in one's skills and in the idea of being able to fulfil oneself

**Table 5.** Relationships between health data and burnout syndrome (BOS)

| Parameters | Total N = 526 | NAD BOS N = 331 (62.9%) | AD BOS N = 195 (37.1%) | P |
|---|---|---|---|---|
| Toxic habits: | | | | |
| Tea–coffee consumption | 515 (97.9%) | 320 (96.7%) | 195 (100%) | 0.024 |
| Tobacco smoking or snuff | 199 (37.8%) | 102 (30.8%) | 97 (49.7%) | 0.0001 |
| Cannabis smoking | 167 (31.7%) | 83 (25.1%) | 84 (43.1%) | 0.0001 |
| Alcohol consumption | 154 (29.3%) | 73 (22.1%) | 81 (41.5%) | 0.0001 |
| Other psychotropic substances | 24 (4.6%) | 13 (3.9%) | 11 (5.6%) | 0.488 |
| Antalgic drugs | 98 (18.6%) | 39 (11.8%) | 59 (30.3%) | 0.0001 |
| Regular physical activities and/or sports | 99 (18.8%) | 84 (25.4%) | 15 (7.7%) | 0.0001 |
| Psychosomatic symptoms: | 357 (67.9%) | 206 (62.2%) | 151 (77.4%) | 0.001 |
| Neuro-vegetative disorders | 294 (55.9%) | 153 (46.2%) | 141 (72.3%) | 0.0001 |
| Muscle pains, cramps, or sensations of muscle stiffness | 184 (35%) | 51 (15.4%) | 133 (68.2%) | 0.0001 |
| Nervous tension | 302 (57.4%) | 154 (46.5%) | 148 (75.9%) | 0.0001 |
| Mood disorders | 263 (50%) | 128 (38.7%) | 135 (69.2%) | 0.0001 |
| Cognitive disorders | 114 (21.7%) | 46 (13.9%) | 68 (34.9%) | 0.0001 |
| Sleep disorders | 197 (37.5%) | 89 (26.9%) | 108 (55.4%) | 0.0001 |
| Self-reported chronic diseases: | 191 (36.3%) | 69 (20.8%) | 122 (62.6%) | 0.0001 |
| Musculoskeletal | 171 (32.5%) | 68 (20.5%) | 103 (52.8%) | 0.0001 |
| Respiratory | 95 (18,1%) | 22 (6.6%) | 73 (37.4%) | 0.0001 |
| Cardiovascular | 89 (16.9%) | 34 (10.3%) | 55 (28.2%) | 0.0001 |
| Neuropsychiatric | 87 (16.5%) | 25 (7.6%) | 62 (31.8%) | 0.0001 |
| Digestive | 73 (13.9%) | 14 (4.2%) | 59 (30.3%) | 0.0001 |
| Metabolic | 70 (13.3%) | 31 (9.4%) | 39 (20%) | 0.0001 |

NAD — no abnormal dimensions of BOS; AD — abnormal dimensions of BOS

**Table 6.** Risk factors of abnormal dimensions of burnout syndrome (BOS): multivariate logistic regression

| Risk factors | ORa | 95% CI | P |
|---|---|---|---|
| Isostrain | 4.6 | 3.48; 5.5 | < 0.001 |
| Job strain | 3.8 | 1.89; 5.1 | < 0.001 |
| Fatigue | 3.7 | 2.2; 4.17 | < 0.002 |
| Seasonal job | 3.6 | 2.44; 5.4 | < 0.002 |
| Sleep disorders | 3.4 | 2.9; 4.2 | < 0.001 |
| Daily working > 14 h | 3.3 | 2.7; 5.1 | < 0.007 |

CI — confidence interval; ORa — odds ratio adjusted

through work, with a tendency towards negative professional self-assessment [18]. The links between BOS and anxiety disorders are often cited, with some scientists believing that burnout is a form of depression [19–21].

## ANALYSIS OF OUR RESULTS

Compared with the majority of land-based occupations, the risk of PE among seafarers appears moderate, despite maritime fishing being recognised as a particularly demanding and dangerous occupation [22]. Several studies have shown that the prevalence of BOS among caregivers and teachers is higher, ranging from 20% to 30% [23–27]. In a study among Moroccan healthcare workers, 59.7% had at least one abnormal dimension of the BOS: 33.8% had a single abnormal dimension, 19.6% two abnormal dimensions and 6.3% three abnormal dimensions [28]. Many authors have reported that occupations with a lot of interpersonal contact are at risk. However, they seem to be more likely to involve showing or repressing emotions, or showing empathy [6, 29]. Some authors argue that the fisherman's job operates a kind of selection of subjects with particular characteristics. Indeed, sailors are motivated above all by adventure, passion and freedom [30, 31]. What's more, weakness is generally frowned upon in this male environment, where endurance, robustness and courage are considered attributes of masculinity and constitute the representative sample and benchmark. Unhappiness and mental disorders remain taboo [32]. Only 15% of sail-

ors worldwide are affected, which means that these pathologies remain under estimated in this population [33]. Among German sailors, high EE and DP scores were noted in 10.8% and 14%, respectively [17]. In our total population, the prevalence of BOS was 8%. It was significantly higher ($p < 0.01$) among pilots/copilots (12.8%) and mechanics (17.3%) than among sailors (5.8%). The formers were under greater stress due to their responsibility for personnel, equipment and the importance of the catch [34]. A Chinese survey showed that the prevalence of BOS was 63.3% among fishermen with greater professional responsibility [35]. In our study, the prevalence of abnormal BOS dimensions was higher in people aged between 41 and 50 (56.6%) and in those with between 6- and 15-years professional seniority (52.4%). This prevalence did not exceed 22.1% for people over 50 and 28.1% for those with more than 15 years' seniority. These results may be explained by the healthy worker effect, or by the adaptation of seafarers to their lifestyle through the development of protective methods against the various risk factors. Age may be a protective factor for certain ageing and resilient workers in the face of burnout. But it can also be a risk factor, with the gradual increase in exposure load correlated with advancement in the professional career [6, 36].

Our fishermen living in couples were less likely to have at least one abnormal dimension of BOS, at 33.3% ($p = 0.0001$), than those living alone, at 44.4% ($p = 0.04$). Living with a partner inhibits anxiety, whereas being single or separated increases the risk of BOS [37].

More than half of our fishermen (56.1%) worked on a seasonal basis during the fishing season for certain varieties of lucrative catch. As a fisherman's income is linked to the size of the catch, seasonal peaks in fish availability represent their best income opportunity of the year. This necessitates long work periods with minimal and irregular rest opportunities responsible for fatigue, sleep and alertness disorders, and chronic stress exposing them to BOS and occupational injuries [10, 11, 38]. In addition, 56.2% of seasonal workers had at least one abnormal BOS dimension, compared with 25.2% of permanent workers ($p < 0.001$). In addition, our fishermen's income is mainly based on a shared remuneration system conditioned by the size of the catches. Their activity is marked by several periods of interruption during the year due to unfavourable weather conditions, seasonality (biological rest) and religious events (Eid celebrations). Insufficient income to meet the necessities of life, job insecurity, unfavourable socio-economic conditions, precariousness and an unpleasant working environment (dilapidated boats, faulty equipment) often lead to suffering at work, stress and burnout [9].

Sea fishing is universally recognised as one of the most dangerous and accident-prone professions. Around a quarter (25.9%) of our seafarers have suffered an incident or accident in the last 12 months. This proportion rose to 53.3% among those with at least one abnormal dimension of BOS. The BOS of fishermen is responsible for many incidents and accidents at sea [8]. A seafarer is three times more likely to suffer a work-related accident than a shore worker, and 44 times more likely to die on the job [39–41]. In Morocco, the number of incident cases in 2021 was 164 occupational injuries for 118,541 active seafarers, i.e. a cumulative incidence of 1.4 accidents per 1,000 seafarers. 37 accidents were fatal, representing a fatality rate of 22.6% (37/164) and a cumulative incidence of 31/100,000 seafarers. It should be pointed out that the frequency of accidents was underestimated due to under-reporting, and only those involving fatal accidents were reliable. The frequency of occupational accidents in 2021 was lower than in 2019 and 2020 (46/100,000), but higher than in 2018 (32/100,000). Nevertheless, cumulative incidences worldwide were higher, at between 90/100,000 and 150/100,000. The human factor, in particular failure to observe on-board safety rules, accounts for 80% of the causes of work-related accidents. The large number of fatalities following events at sea is most often explained by the loss of almost the entire crew in the event of shipwreck.

Among our fishermen, 16.1% had a high EE score, 13.9% a high DP score, 40.4% a low PA score, 16.9% had one abnormal dimension, 12.2% two and 8% three. In a study of merchant navy sailors in Germany, the prevalence of high EE score was 10.8%, high DP 14% and low PA 62.2% [17]. Among our fishermen sailors with at least one abnormal dimension of BOS, 57.9% had job strain and 42.1% had isostrain. Indeed, this syndrome is a psychological and physiological condition resulting from the accumulation of occupational stress factors. It has its roots in response to a number of long-term stress factors, and is a consequence of daily stress reactions that have worn the individual down [5, 6].

The dimension of emotional exhaustion and fatigue would be the one with the greatest pejorative predictivity. Chronic fatigue could evolve into anxiety-depressive disorders, with a drop in self-esteem. Subjects with BOS often adopt doping or compensatory behaviours and consume psychoactive substances (PAS) to confront an obstacle, real or perceived, and/or improve their professional performance (physical, cognitive, etc.) [6]. The main PAS used by fishermen are tobacco (smoked, snuffed, chewed), cannabis, alcohol, tea, coffee and certain medicines (tranquilizers, anxiolytics, amphetamines, analgesics, etc.).

In all the studies we conducted among fishermen, the prevalence of PAS consumption among fishermen was significantly higher than that of the Moroccan male in general population aged over 20, which was 34.5% for tobacco

smoking, 14% for alcohol consumption and 9% for cannabis [42]. Prevalence ranged from 52.3% to 79% for tobacco smoking, from 10.6% to 64.4% for alcohol consumption and from 23.9% to 41% for cannabis [10, 43–46]. In our study of PAS use by fishermen, among users, misuse was 49% for smoked tobacco, 61.2% for cannabis and 86% for alcohol. Only 9.4% had no toxic habit, 56.4% had one toxic habit, 20.4% two toxic habits, 11.9% three toxic habits and 1.9% four toxic habits. The most frequent associations were tobacco-cannabis (10.5%) and tobacco-alcohol (6.1%) [40]. In our study of stress among fishermen, the prevalence of PAS consumption was significantly higher for those under stress than for those not under stress [10]. The presence of addictive behaviours or psychosomatic or somatic manifestations is sometimes considered a constitutive element of BOS, sometimes a complication [6]. In our study, the prevalence of substance use was higher in those with at least one abnormal dimension of BOS. Fishermen were classified as heavy users of PAS [47].

Fishing is a demanding profession, with heavy workloads, high stamina and energy levels, reducing the ability of fishermen to engage in physical and sporting activities beneficial for stress prevention. Only 18.8% of our fishermen took part in regular sport or physical activity. In a Greek study, 66% of fishermen did not engage in any type of exercise outside work [48]. In our survey, the prevalence of having at least one abnormal BOS dimension was lower in people who regularly took part in sport or leisure activities. In our survey, only 7.7% of fishermen with at least one abnormal BOS dimension regularly took part in sports or leisure activities. These two practices play an important role in creating a state of equilibrium by boosting self-esteem, absorbing excess stress and reinforcing emotional impermeability. Numerous publications have highlighted their importance in the prevention of BOS [6]. In our study, just over two-thirds of people (67.9%) had reported psychosomatic manifestations of stress (77.4% in the group with at least one abnormal dimension vs. 62.2% in the group with no abnormal dimension, $p = 0.001$). Mood disorders were reported by 50% of our fishermen: 69.2% in the group with at least one abnormal BOS dimension vs. 38.7% in the group with no abnormal BOS dimension, $p = 0.001$). These mood disorders can have disastrous consequences, particularly suicidal, especially in susceptible individuals [49]. Besikci et al. [50] found that distress is not detected by seafarers' self-reports. Although sailingis a demanding and dangerous profession, the high risk of depression is controversial [51]. Depression and suicide have been reported in numerous studies, with 13.1% of recorded deaths from diseases resulting from suicide [52]. More than a third of our fishermen (32.5%) reported chronic diseases (62.6% in the group with at least one abnormal dimension of BOS vs. 14.8% in the group with no abnormal dimension; $p < 0.0001$). The literature confirms that fishing is an exhausting occupation, which includes musculoskeletal disorders linked to significant physical and psychological constraints [17, 53].

## INTERESTS AND LIMITS

Our study has certain limitations. Its cross-sectional nature is responsible for a selection bias in relation to the healthy worker effect because those with impaired health are assumed to be absent. Moreover, we can't infer causality; longitudinal research is needed. Weaknesses in self-reporting must be emphasized, particularly with regard to the use of psychoactive substances, especially alcohol. Furthermore, the KJCQ and MBI are tools for the perception of working conditions, not their objective measurement. Thus, a fisherman responding to the questionnaire may give a negative description of his working environment, and it is difficult to distinguish between real suffering at work and mere professional grievances. There is no way of avoiding or limiting individual variation in self-declaration. Furthermore, it should be pointed out that the 1982 version of the MBI does not provide a cut-off for diagnosing BOS, and distinguishes between low, medium and high levels for each of its three dimensions [54]. Nevertheless, the aim of our study was a global quantification and approach, and not a precise assessment of the prevalence of BOS of fishermen.

## CONCLUSIONS

The location of psychosocial risks at the intersection of the professional and private spheres increases the difficulties of their conceptual delimitations and accentuates the complexity of their apprehension [55]. While it is impossible to totally eliminate situations that put fishermen at risk of stress and BOS, it is imperative to identify priority actions to improve the working and living conditions of fishermen. Psychosocial and organizational constraints in the inshore maritime fishing sector constitute a highly topical occupational risk, justifying the development of a genuine prevention policy. The planning of tasks within the fishing crew and the coordination of their activities are part of the preventive actions for BOS. In the boats, several professionals work in a reduced space with more or less specific tasks. The transition from coaction to collaboration can only be achieved through the construction of a common work organization frame of reference [56]. While some initiatives fall within the remit of occupational health services (awareness-raising campaigns, analysis of working conditions, screening, etc.) and shipowners (work organization), the majority fall within the remit of the executive (national policy on occupational health among fishermen).

**Conflict of interest:** None declared

## REFERENCES


1. Chamoux A, Paris C, Desheulles J. Stress et travail: rôle de la pénibilité psychique du travail. Arch Mal Prof. 1999; 60(6): 570–573.
2. Maslach C, Jackson SE. The Maslach Burnout Inventory. 2nd ed. Consulting Psychologist Press, Palo Alto, CA 1986.
3. Karasek R. Job demands, job decision latitude, and mental strain: implications for job redesign. Adm Sci Q. 1979; 24(2): 285, doi: 10.2307/2392498.
4. Maslach C. Understanding burnout: Definitional issues in analyzing a complex phenomenon. In: Paine WS (ed.) Job Stress and Burnout. Sage Publications, Beverly Hills, California, US 1982: 28–40.
5. Maslach C, Leiter MP. Burn-out: le syndrome d'épuisement professionnel. Les Arènes, Paris 2011: 270.
6. Olié JP, Légeron P. Le burn-out. Bulletin de l'Académie Nationale de Médecine. 2016; 200(2): 349–365, doi: 10.1016/s0001-4079(19)30765-4.
7. Galanakis M, Stalikas A, Kallia H, et al. Gender differences in experiencing occupational stress: the role of age, education and marital status. Stress and Health. 2009; 25(5): 397–404, doi: 10.1002/smi.1248.
8. Chung YS, Lee PW, Lee JK. Burnout in seafarers: its antecedents and effects on incidents at sea. Maritime Policy & Management. 2017; 44(7): 916–931, doi: 10.1080/03088839.2017.1366672.
9. Landsbergis P, Dobson M, LaMontagne A, et al. Occupational stress. Oxford Scholarship Online. 2017, doi: 10.1093/oso/9780190662677.003.0017.
10. Laraqui O, Manar N, Laraqui S, et al. Occupational risk perception, stressors and stress of fishermen. Int Marit Health. 2018; 69(4): 233–242, doi: 10.5603/IMH.2018.0038, indexed in Pubmed: 30589062.
11. Laraqui O, Roland-Levy C, Manar N, et al. Health status, sleeping habits and dyssomnia of coastal fishermen. Int Marit Health. 2022; 73(4): 163–171, doi: 10.5603/imh.2022.0029.
12. Bakker A, Schaufeli W, Demerouti E, et al. Using equity theory to examine the difference between burnout and depression. Anxiety, Stress & Coping. 2000; 13(3): 247–268, doi: 10.1080/10615800008549265.
13. Leiter MP, Day A, Harvie P, et al. Personal, and organizational knowledge transfer: Implications for work-life engagement. Human Relations. 2007; 60: 259–283.
14. Pichené A. Screening for chronic psychological stress using a questionnaire. Notes techniques et scientifiques de l'INRS. Institut national de recherches et sécurité. N° ISSN 0397-4529, Paris 1995: 64.
15. Lourel M, Gueguen N, Mouda F. L'évaluation du burnout de Pines: adaptation et validation en version française de l'instrument Burnout Measure Short version (BMS-10). Pratiques Psychologiques. 2007; 13(3): 353–364, doi: 10.1016/j.prps.2007.06.001.
16. Maslach C, Jackson S. The measurement of experienced burnout. J Organizational Behavior. 1981; 2(2): 99–113, doi: 10.1002/job.4030020205.
17. Oldenburg M, Jensen HJ, Wegner R. Burnout syndrome in seafarers in the merchant marine service. Int Arch Occup Environ Health. 2013; 86(4): 407–416, doi: 10.1007/s00420-012-0771-7, indexed in Pubmed: 22526089.
18. Brotheridge C, Grandey A. Emotional labor and burnout: comparing two perspectives of "people work". J Vocational Behavior. 2002; 60(1): 17–39, doi: 10.1006/jvbe.2001.1815.
19. Bianchi R, Schonfeld IS, Laurent E. Burnout-depression overlap: a review. Clin Psychol Rev. 2015; 36: 28–41, doi: 10.1016/j.cpr.2015.01.004, indexed in Pubmed: 25638755.
20. Lily YL, Stewart K, Woo C, et al. The relationship between burnout and depressive symptoms in patients with depressive disorders. J Affect Disord. 2015; 172: 361–366, doi: 10.1016/j.jad.2014.10.029, indexed in Pubmed: 25451438.
21. Nyklícek I, Pop VJ. Past and familial depression predict current symptoms of professional burnout. J Affect Disord. 2005; 88(1): 63–68, doi: 10.1016/j.jad.2005.06.007, indexed in Pubmed: 16054229.
22. Agterberg G, Passchier J. Stress among seamen. Psychol Rep. 1998; 83(2): 708–710, doi: 10.2466/pr0.1998.83.2.708, indexed in Pubmed: 9819944.
23. Nyssen AS, Hansez I, Baele P, et al. Occupational stress and burnout in anaesthesia. Br J Anaesth. 2003; 90(3): 333–337, doi: 10.1093/bja/aeg058, indexed in Pubmed: 12594147.
24. Cubrilo-Turek M, Urek R, Turek S. Burnout syndrome: assessment of a stressful job among intensive care staff. Coll Antropol. 2006; 30(1): 131–135, indexed in Pubmed: 16617587.
25. Gingras J, de Jonge LA, Purdy N. Prevalence of dietitian burnout. J Hum Nutr Diet. 2010; 23(3): 238–243, doi: 10.1111/j.1365-277X.2010.01062.x, indexed in Pubmed: 20642639.
26. Quattrin R, Ciano R. Burnout in teachers: an Italian survey. Ann Ig. 2010; 22(4): 311–318.
27. Fernández JD, Clavero FH, Gutiérrez MV, et al. Síndrome de desgaste profesional en trabajadores de atención a la salud en el área sanitaria de Ceuta. Atención Primaria. 2012; 44(1): 30–35, doi: 10.1016/j.aprim.2011.01.004.
28. Laraqui O, Manar N, Laraqui S, et al. Risques psychosociaux et syndrome d'épuisement professionnel des professionnels de soins hospitaliers. Archives des Maladies Professionnelles et de l'Environnement. 2019; 80(5): 386–397, doi: 10.1016/j.admp.2019.05.001.
29. Lloyd C, King R, Chenoweth L. Social work, stress and burnout: A review. J Mental Health. 2009; 11(3): 255–265, doi: 10.1080/09638230020023642.
30. Jegaden D, Lemoine C, Paris P, et al. Do fishermen have a particular psychological profile leading to risky behavior? ErgoMare International Symposium. 2006; October 5-6-7(Lorient, France).
31. Mellbye A, Carter T. Seafarers' depression and suicide. Int Marit Health. 2017; 68(2): 108–114, doi: 10.5603/IMH.2017.0020, indexed in Pubmed: 28660614.
32. Clouette F. Marins-pêcheurs : des masculinités à coudre bord à bord. Sociologie du Travail. 2021; 63(3), doi: 10.4000/sdt.39770.
33. Lefkowitz RY, Slade MD, Redlich CA. Rates and occupational characteristics of international seafarers with mental illness. Occup Med (Lond). 2019; 69(4): 279–282, doi: 10.1093/occmed/kqz069, indexed in Pubmed: 31094424.
34. Oldenburg M, Jensen HJ, Latza U, et al. Seafaring stressors aboard merchant and passenger ships. Int J Public Health. 2009; 54(2): 96–105, doi: 10.1007/s00038-009-7067-z, indexed in Pubmed: 19288290.
35. Shi LC, Dai JJ, Wang HR, et al. [Current status of job burnout in in-service sailors from 13 provinces and cities in China]. Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi. 2017; 35(12): 893–897, doi: 10.3760/cma.j.issn.1001-9391.2017.12.003, indexed in Pubmed: 29495149.
36. Van Daele A. Stress, work and age: what relationships? Paper at the colloquium of the Association des Licenciés en Sciences de la Santé Publique de l'Université de Liège on: Le Stress au Travail: les groupes à risque du troisième millénaire, 2018. https://staff.umons.ac.be/agnes.vandaele/pubsfr.html.
37. Ahola K, Honkonen T, Isometsä E, et al. Burnout in the general population. Soc Psychiatry Psychiatr Epidemiol. 2006; 41(1): 11–17, doi: 10.1007/s00127-005-0011-5.

38. Olafsdóttir L. The relationship between fishermen's health and sleeping habits. Work. 2004; 22(1): 57–61.
39. Kowalski JM. Sailors and death. Actualité d'un mythe. La Revue Maritime. 2011; 492: 90–102.
40. Laraqui O, Laarej H, Manar N, et al. Dépistage de la bronchopneumopathie chronique obstructive et qualité de vie dans un échantillon de gens de mer à Kenitra. Revue des Maladies Respiratoires. 2017; 34: A170, doi: 10.1016/j.rmr.2016.10.402.
41. Recanati H. The living, the dead and those who go to sea. La Rochelle, La Découvrance, France 2015: 169.
42. Jalal T, El Omari F, Sabir M. Rapport annuel de l'Observatoire national des drogues et addictions. Maroc, Rapport officiel 2014:108. www.onda-drogues.com.
43. Laraqui O, Laraqui S, Manar N, et al. Prevalence of consumption of addictive substances amongst Moroccan fishermen. Int Marit Health. 2017; 68(1): 19–25, doi: 10.5603/IMH.2017.0004, indexed in Pubmed: 28357832.
44. Laraqui O, Laraqui S, Manar N, et al. Risk-taking behaviours among fishermen in Morocco by the evaluation of "ordalique" functioning. Int Marit Health. 2017; 68(2): 83–89, doi: 10.5603/IMH.2017.0016, indexed in Pubmed: 28660610.
45. Laraqui O, Hammouda R, Laraqui S, et al. Prevalence of chronic obstructive respiratory diseases amongst fishermen. Int Marit Health. 2018; 69(1): 13–21, doi: 10.5603/IMH.2018.0003, indexed in Pubmed: 29611609.
46. Laraqui OO, Deschamps F, Roland-Lévy C. Apport de la psychologie du travail et des organisations pour la prévention des risques psychosociaux des marins pêcheurs. 33rd International Congress on Occupational Health, ICOH2022, Melbourne, Australia. Safety and Health at Work. 2022, doi: 10.1016/S2093-7911(22)00108-1.
47. Goullé JP, Morel F. Addictions en milieu professionnel. Académie nationale de médecine, Paris. Report, 2017; October 10. https://www.academie-medecine.fr/wp-content/uploads/2017/10/Addictions-en-milieu-professionnel-ANM-10-10-2017.pdf.
48. Frantzeskou E, Kastania AN, Riza E, et al. Risk factors for fishermen's health and safety in Greece. Int Marit Health. 2012; 63(3): 155–161, indexed in Pubmed: 23129097.
49. Szymańska K, Jaremin B, Rosik E. Suicides among Polish seamen and fishermen during work at sea. Int Marit Health. 2006; 57(1-4): 36–45, indexed in Pubmed: 17312692.
50. Beşİkçİ EB, Tavacıoğlu L, Arslan O. The subjective measurement of seafarers' fatigue levels and mental symptoms. Maritime Policy & Management. 2015; 43(3): 329–343, doi: 10.1080/03088839.2015.1047426.
51. Carotenuto A, Malino I. et al. A Broader Vision of Seafarer Wellbeing: Survey of ITF Maritime Affiliates on HIV/Aids, Health and Wellbeing. ITF 2012 . http://www.itfglobal.org/media/819789/hiv_survey.pdf.
52. Carotenuto A, Molino I, Fasanaro AM, et al. Psychological stress in seafarers: a review. Int Marit Health. 2012; 63(4): 188–194, indexed in Pubmed: 24595974.
53. Piniella F, Novalbos JP, Nogueroles PJ. Artisanal fishing in Andalusia (II): Safety and working conditions policy. Marine Policy. 2008; 32(4): 551–558, doi: 10.1016/j.marpol.2007.10.005.
54. Truchot D. Professional exhaustion and burn-out. Concepts, methods, interventions. Dunod, Paris 2015.
55. Chakor T. Les consultants dans la prévention des risques psychosociaux au travail : proposition d'une typologie de pratiques. GRH. 2014; 10(1): 37–58, doi: 10.3917/grh.141.0037.
56. Caroly S. Différences de gestion collective des situations critiques dans les activités de service selon deux types d'organisation du travail. Perspectives interdisciplinaires sur le travail et la santé. 2002(4-1), doi: 10.4000/pistes.2696.

VIA MEDICA

LETTER TO THE EDITOR

Int Marit Health
2023; 74, 3: 205–206
10.5603/imh.94545
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Navigating the challenges in remote medical care for mariners during disasters and pandemics: integration of mHealth and drone technology

**Manik Sharma**

Department of CSA, DAV University Jalandhar, India

## INTRODUCTION

Mariners work in remote areas with limited access to medical facilities, which creates unique challenges in accessing medical care. The integration of mobile health (mHealth) and drone technology presents a promising solution that can offer remote medical consultation, monitoring, and digital intervention services to mariners. Furthermore, drones can be used to provide timely transportation of medical supplies and equipment to the ships, especially during emergencies. However, the implementation of mHealth and drone technology for mariners' health also presents challenges, such as connectivity issues, regulations, safety, weather conditions, and privacy and security concerns related to medical data. This research work addresses the potential benefits and challenges as well as implications of integrating m-health and drone technology for mariners' health.

In the last two decades, approximately eight thousand distinct disasters and catastrophic events have been recorded. Each disaster has an immense impact on the physical, cognitive and emotional health of individuals, especially seafarers and mariners [1]. The scary and horrific situation of the disaster generally induces different kinds of infections such as hepatitis, typhoid, diarrhoea, acute respiratory infections, malaria, leptospirosis, and measles [2]. In the critical situation of the disaster (hydro-meteorological, geo-morphological, and geophysical disasters), the on-time support provided through mHealth and drone technology can surely mitigate the risk of infections and can save masses of human lives. As per prior studies, the case mortality rates (CMR) of different pandemics, H1N1, H5N1, Ebola, Middle East respiratory syndrome coronavirus (MERS-CoV), and severe acute respiratory syndrome coronavirus (SARS-CoV) strain, were 3%, 60%, 50%, 34%, and 15%, respectively. However, to date, the CMR for coronavirus disease 2029 (COVID-19) is 2.16% which is quite lower than H5N1, Ebola, MERS-CoV, and SARS-CoV [3].

## IMPLICATIONS OF MHEALTH

The mHealth services are proven to benefit in self-diagnosis, treatment, remote monitoring, telemedicine, and chronic illness. Over the next 10 years (2021-2030), the current value of the mHealth industry is anticipated to rise at a 30 per cent compound annual growth rate. It has been perceived that in the coming years, the key services (remote monitoring and patient tracking services) of mobile apps will surely assist in accomplishing a lucrative growth [4]. The health-related data (temperature, blood pressure, saturation rate, heart rate etc.) captured through m-health apps can be examined to reveal the physical and mental state of the victims. The mHealth services have the potential to reinforce communication and health management services for victims of disasters and outbreaks. These services offer a cost-effective, paperless, and rapid action to deal with disaster management. The mHealth services can be utilized to offer digital intervention to ameliorate the physical and psychological impact of the disaster which would subsequently hold back the triggering effect of the disastrous conditions and helps in reducing the number and intensity of infections [5]. The mHealth services can also be utilized to educate and train the victims to make them healthy and safe during disaster and pandemics.

## IMPLICATIONS OF UAV

The disaster or pandemic conditions offers a real opportunity to use these robotic unmanned aerial vehicle (UAV)

Dr. Manik Sharma, Department of CSA, DAV University Jalandhar, India, e-mail: manik_sharma25@yahoo.com

Received: 6.03.2023 Accepted: 29.06.2023

to control the rate of infection during pandemic and disasters [6]. These drones have the potential to provide daily needs and emergency healthcare (drugs and medication) support. During catastrophes, the contactless delivery of drone found to be more productive in averting mass infectious diseases and their consequences. In case of emergency and to save human lives, these UAVs can quickly transport the critical medical kits to the disaster-afflicted areas. Moreover, the on-time support of UAVs help in reducing the infection and mortality rate of the disaster. The UAVs found to be productive in controlling and mitigating the COVID-19 infection rate by providing rapid and reliable services for sample collection and disbursing the vaccination in the remote and slummy areas.

To summarize, the hybridization of mHealth and drone technology both found to be an optimal solution in case of disaster and pandemic situations. The use of mHealth services assists in giving the medical prescription and remote digital intervention; whereas, UAVs helps in delivering the right and fast medical kits to control the rate of infection and their consequences. UAVs can also be used as a surveillance tool to locate and control the social distancing in the hot-spot areas. Along with vaccination, the use of m-health and drone technology seems to be the key reasons behind the low CMR of COVID-19.

## CHALLENGES FOR MHEALTH AND DRONE TECHNOLOGY

The safety, power, autonomy, legislation, air traffic, poor climate conditions, privacy and security are the sole challenges in the deployment of drone technology. As power plays an important role in the overall functioning of the UAVs; therefore, it needs to be optimized. Likewise, the usability, network (access, bandwidth, fluctuation, reliability), data (security, privacy) and the integration of the mHealth framework with the Internet of Things are the challenging areas for the implementation of these services [7]. Despite this, individuals need to be aware of the usage and the potential implications of mHealth and medical drones. Above all, to get the productive results of mobile and drone health services, the issues regarding the mistrust of technology has to be successfully resolved.

The integration of mHealth and drone technology offers a promising solution for providing remote medical services to mariners and disaster victims. This technology can provide medical consultation, monitoring, and intervention services to individuals working in remote areas with limited access to medical facilities. It can also facilitate the transportation of medical supplies and equipment during emergencies. However, the successful implementation of these technologies faces challenges such as connectivity, safety, regulatory frameworks, weather conditions, and privacy and security issues. Overcoming these challenges and promoting awareness about these technologies is essential for their effective utilisation. Ultimately, the deployment of mHealth and drone technology can mitigate the risk of infections and save countless human lives, making it a valuable solution for the health and well-being of individuals in disaster-prone areas.

**Conflict of interest:** None declared

## REFERENCES

1. Gautam R, Sharma M. 2019-nCoV pandemic: a disruptive and stressful atmosphere for Indian academic fraternity. Brain Behav Immun. 2020; 88: 948–949, doi: 10.1016/j.bbi.2020.04.025, indexed in Pubmed: 32289366.
2. Kouadio IK, et al. Infectious diseases following natural disasters: prevention and control measures. Expert Review of Anti-infective Therapy. 2012; 10(1): 95–104.
3. Worldometer. https://www.worldometers.info/coronavirus/ (Accessed on 19 Feb 2023).
4. Case T, Morrison C, Vuylsteke A. The clinical application of mobile technology to disaster medicine. Prehosp Disaster Med. 2012; 27(5): 473–480, doi: 10.1017/S1049023X12001173, indexed in Pubmed: 22892104.
5. Sharma M. m-health services for COVID-19 afflicted and infected victims. EAI Endorsed Transactions on Pervasive Health and Technology. 2021: 170232, doi: 10.4108/eai.11-6-2021.170232.
6. Sharma M. Drone technology for assisting COVID-19 victims in remote areas: opportunity and challenges. J Med Syst. 2021; 45(9): 85, doi: 10.1007/s10916-021-01759-y, indexed in Pubmed: 34322759.
7. Gurupur VP, Wan TTH. Challenges in implementing mHealth interventions: a technical perspective. Mhealth. eCollection 2017. 2017; 3(32), doi: 10.21037/mhealth.2017.07.05, indexed in Pubmed: 28894742.

VIA MEDICA

LETTER TO THE EDITOR

Int Marit Health
2023; 74, 3: 207–208
10.5603/imh.95924
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# Another point of view to complete the Rinaldy's article about shipping industry safety

**Richard Pougnet[1, 2], Laurence Pougnet[1, 3], Brice Loddé[1]**

[1]French Society of Maritime Medicine, Brest, France
[2]Laoratoire d'Etudes et de Recherches en Sociologie (LABERS), EA 3149, Sociology Research Unit, University of Western Britany, Brest, France
[3]Military Hospital, Clermont-Tonnerre, Brest, France

Rinaldy's article about shipping industry safety was very relevant [1]. The subject is delicate and critical because of the number of accidents and severe accidents among seafarers [2, 3]. The author has thus made a review of the literature. This will help for future research and to improve safety policies in the Indonesia shipping industry. However, as the author points out, the review has limitations inherent in its method: the quality of the data thus collected depends on the database, keywords, etc. But there is also another bias: using Scopus, the humanities may be underrepresented. It's why, we would like to complete Rinaldi's research by providing some notions from the human sciences.

For example, the author highlights the importance of the literature about human error, which would be responsible for 80% to 85% of accidents. In French-language humanities, there are interesting resources for taking a step back from this type of data.

On the one hand, it should be remembered that human error can sometimes be the apparent cause of an accident. The work context itself could explain that a person commits imprudence or makes a mistake. Time pressure, economic issues, fatigue, jet lag during expensive freight transport can favour this ultimate mistake made by a person. Beyond these organizational and economic aspects, there may be individual factors of human error: one person may perform less well in one task than another. In France, the current of work psychology and ergonomics have clinically studied how employees, whatever their work environment, can compensate for a disparity in performance. They could sometimes develop another way of working, in a more individual and yet just as efficient [4].

On the other hand, the literature about air transport allows having a more critical reading about the role of the human factor. Overall, two schools of thought exist. One of it defends the idea the work should be controlled strictly. It might reduce the risk of human error. The second "school" privileges an environment of work less controlled. Human is the ultimate barrier before an accident, so that he needs more freedom and autonomy in work [5].

Finally, the currents of psychodynamics and psychoanalysis of groups offer interesting tools to better understand certain reactions to rejection of safety instructions or of the wearing of protection. Depending on the work groups, it may happen that the people most respectful of the rules and safety instructions are rejected by the other members of the work team. Remembering back on safety rules can generate anxiety against to which some small groups will implement inappropriate coping strategies, such as denial [6].

Rinaldi's article could thus be enlightened by these approaches of psychology, science of education and sociology, in order to complete the many lines of research identified by the author.

**Conflict of interest:** None declared

## REFERENCES

1. Rinaldy DY. Bibliometric and systematic literature review on safety management in the shipping industry and further development in Indonesia. Int Marit Health. 2023; 74(1): 24–35, doi: 10.5603/IMH.2023.0003, indexed in Pubmed: 36974490.
2. Koçak H, Altıntaş HK. Evaluation of maritime accident reports of main search and rescue coordination centre between 2001

Richard Pougnet, MD, PhD (Philosophy), Centre de Pathologies Professionnelles et Environnementales, CHU Morvan, 2 av Foch, 29200 Brest France, e-mail: richard.pougnet@live.fr

Received: 8.06.2023 Accepted: 28.06.2023

and 2012. Int Marit Health. 2021; 72(3): 163–171, doi: 10.5603/IMH.2021.0032, indexed in Pubmed: 34604984.
3. DeLoughery EP. Characteristics of fatal marine accidents. Int Marit Health. 2022; 73(3): 115–116, doi: 10.5603/IMH.2022.0022, indexed in Pubmed: 36217975.
4. Clot Y, Leplat J. La méthode clinique en ergonomie et en psychologie du travail. Le travail humain. 2005; 68(4): 289, doi: 10.3917/th.684.0289.
5. Barnier LM. Former aux facteurs humains pour exorciser le risque aérien. Éducation Permanente. 2020; N° 224(3): 67–75, doi: 10.3917/edpe.224.0067.
6. Jegaden D, Jégo C, Delbrouck P, Bihioux A, Lucas D. La santé mentale des gens de mer. Bod; Norderstedt, 2022.

Int Marit Health
2023; 74, 3: 209–234
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

# MAGAZINE

# Table of contents

# Editorial

Dear Colleagues,

we proudly present to you another International Maritime Health magazine!

Once again we succeeded in collecting a lot of information that — hopefully — will find your interest and be a valuable contribution to your work.

Thanks to all who contributed!

Some of you may have read the perspective of our Camerino University/International Radio Medical Centre (CIRM) colleagues on the options of employing the metaverse including the use of avatars for healthcare at sea. While most of that probably still is far out, the International Maritime Health Foundation's (IMHF) Expert Panel held a workshop in Berlin on the options of transforming telemedical advice into telemedical assistance at sea. The internet nowadays provides the possibility for telemedical maritime assistance service (TMAS) professionals to almost stand by the first responders on board as the increasing satellite coverage allows for realtime audio-/videostreaming.

Ships already use these features for many purposes, the International Maritime Organization (IMO) is about to implement that into its provisions for the new "maritime services". Telemedicine is part of it (MS 09).

While this creates room to improve medical care at sea (in a foreseeable future) there are obstacles to overcome. Among them the regulations on data protection.

Read the report on IMHF's 4$^{th}$ workshop in this magazine! — IMHF plans a follow-up workshop next year that hopefully will present solutions.

Another follow-up workshop in December this year will deal with the challenge of developing "pathways" for the management of medical incidents at sea — reflecting the special maritime environment. It will be IMHF's 6$^{th}$ workshop based on IMHA's 2015 London workshop and IMHF's 3$^{rd}$ workshop last year in Hamburg (see IMH magazine 2/2023). As developing such "pathways" probably is the most groundbreaking (and demanding) work to improve the quality of health care at sea we look back at the London workshop in this magazine.

We also look back at now 3 years of IMHF Expert Panel (IMHF-EP).

Past and present are addressed in our presentation of the London-based Seafarer Hospital Society (SHS). The article illustrates to what degree seafarer health and wellbeing was and still is carried by charity organizations. See also the presentation of the International Transport Federation's Seafarer's Trust. The article starts our loose serial presenting organizations relevant to the health of seafarers.

In this magazine we continue our serial on institutes involved in maritime medicine by presenting the Norwegian Centre for Maritime and Diving Medicine (NCMDM).

I hope that once again we can provide an inspiring reading matter.

If yes tell other colleagues. If not tell us!

*Klaus Seidenstücker*
*Temporary magazine editor*
*International Maritime Health Foundation's Expert Panel*

# News

## WORLD HEALTH ORGANIZATION (WHO) LAUNCHED THE WHO ONLINE REPOSITORY OF EVIDENCE-INFORMED DECISION-MAKING (EIDM) TOOLS

**Contributed by Nebojsa Nikolic**

The World Health Organization (WHO) online repository of evidence-informed decision-making (EIDM) tools (https://evidence-impact.org/) is the first of its kind to highlight WHO tools and external tools utilized by WHO to facilitate knowledge translation and partner organizations involved in planning, managing, monitoring, and evaluating the process of evidence use and implementation. This tool will be of importance to health planning in maritime industry too (i.e. vaccination programmes, quarantine programmes, etc.).

The easy-to-navigate online platform enables users to search and access EIDM methods and tools corresponding to each step of the policy/action cycle. In addition to searching across the cycle, users can refine their searches using advanced functionalities to filter by document type, language, and publication date. The platform offers tools that span the clinical (or practice), public health, and health system domains.

The repository actively houses and maintains 75 tools and is continuously being updated as new tools emerge. The Evidence to Policy and Impact Unit will be actively adding more tools to the repository, employing a scoping literature review and other steps. EVIPNet and the Evidence to Policy and Impact Unit will integrate the online repository of EIDM tools into their other capacity-sharing activities.

If you would like to learn more about the online repository of EIDM tools, please contact WHO experts at: eidm@who.int.

## NEWS ON COVID-19 FROM WHO

**Contributed by Nebojsa Nikolic (Non-Governmental Organizations [NGO's])**

Globally, as of 12:20pm CEST, 30 August 2023, there have been 770,085,713 confirmed cases of coronavirus disease 2019 (COVID-19), including 6,956,173 deaths, reported to the World Health Organization (WHO). As of 20 August 2023, a total of 13,499,865,692 vaccine doses have been administered.

On WHO press conference on global health issues held on 9 August 2023, Secretary General of WHO, Dr. Tedros Adhanom Ghebreyesus reported that since May 5$^{th}$ 2023, when an end to COVID-19 as a global health emergency has been declared, the number of reported cases, hospitalisations and deaths globally has continued to decline.

However, he emphasized that the number of countries reporting data to WHO has also declined significantly. In the past month, only 25% of countries and territories have reported COVID-19 deaths to WHO, and only 11% have reported hospitalisations and intensive care unit admissions. This doesn't mean that other countries don't have deaths or hospitalisations, it means they are not reporting them to WHO.

There is no question that the risk of severe disease and death is vastly lower than it was a year ago, thanks to increasing population immunity from vaccination, infection or both, and from early diagnosis with better clinical care. Despite these improvements, WHO continues to assess the risk of COVID-19 to the global public as high.

The virus continues to circulate in all countries, continues to kill and it continues to change. WHO is currently tracking several variants including EG.5. The risk remains of a more dangerous variant emerging that could cause a sudden increase in cases and deaths.

Starting from the week of 7 August 2023, the Region of the Americas has paused its specific COVID-19 Epidemiological Update. Subsequent COVID-19 surveillance will continue through the Influenza and Other Respiratory Viruses bulletin and dashboards available here: https://www.paho.org/en/topics/influenza-and-other-respiratory-viruses.

## WHO WEBINARS

**Contributed by Klaus Seidenstücker**

For all maritime health care professionals, it is essential to keep abreast of epidemiological/infectious disease developments. The World Health Organization offers at regular intervals webinars. See for more information and registration/subscription: www.who.int/teams/epi-win/epi-win-webinars.

## ILO/IMO MEETINGS 2024

**Contributed by Nebojsa Nikolic**

The Joint International Labour Organization/International Maritime Organization (ILO/IMO) Tripartite Working Group to identify and address seafarers' issues and the human element will convene in the first and last quarter of 2024. Date and place still to be confirmed.

Also, in the first quarter in Geneva: Meeting of Experts to produce joint ILO/IMO Guidelines for Medical Examination of Fishers.

## ITF TARGETS FOUR WORST FLAGS ACCOUNTED FOR MORE THAN 100 CREW ABANDONED IN THE LAST TWO YEARS

**Contributed by Nebojsa Nikolic**

The International Transport Workers' Federation (ITF) announced that up to a thousand ships flagged to the Cook Islands, Palau, Sierra Leone, and Togo will be targeted for safety, maintenance and seafarer welfare inspections across the Mediterranean Sea in the coming 8 weeks by an army of inspectors from the ITF, seafarers' unions and port authorities.

"Substandard shipping in the Mediterranean Sea is driving down seafarers' wages and conditions, its endangering the lives of crew and risking our environment," said ITF Inspectorate Coordinator Steve Trowsdale. "These flags take money from shipowners to register ships that other countries wouldn't touch. Many are old vessels and are poorly maintained by their owners. Many of these ships are dangerous and should not be trading," he said. The blitz comes off the back of new analysis showing the four flags of convenience registries together accounted for more than 100 crew abandoned in the last 2 years, with millions of dollars wages not paid to crew by the flags' shipowners that the ITF then had to recover on seafarers' behalf.

Trowsdale said often when the ITF or its affiliated unions called on the flags to fix problems caused by irresponsible shipowners, such as in cases of abandonment — "that's when these flags are nowhere to be seen — they take the money and run."

In just 3 years, the Cook Islands, Palau, Sierra Leone, and Togo flags were responsible for:

— 33 cases of crew abandonment, affecting more than a hundred seafarers, leaving many without pay, food, water, or a way to get home;
— over $5,500,000 USD in unpaid wages cheated from crew, that the ITF then had to recover from the flags' shipowners on seafarers' behalf;
— 5,203 deficiencies or detentions issued by European Port State Control enforcement agencies.

**Managing stress.** ITF published factsheet on stress management for seafarers on its webpage. Stress is the body's reaction to any change that requires an adjustment or response. The body reacts to these changes with physical, mental, and emotional responses. When external and internal demands are greater than the resources we have to meet those demands, we experience stress.

The earlier we recognize the signs and symptoms of stress, the better we will be able to manage it. These are some common signs and symptoms:

— difficulty in sleeping, and insomnia;
— abnormal appetite and weight changes;
— frequent headaches;
— stomach upsets and frequent urination;
— trembling, sweating and restricted breathing;
— periods of being tearful or crying;
— increased heart/respiratory rate;
— dehydration, dizziness and fainting;
— blurred eyesight, or sore eyes;
— inability to get things done;
— isolation and increased conflict in relationships;
— substance abuse;
— problems with memory and concentration, and difficulty making decisions;
— feeling nervous, anxious, angry, irritable or easily frustrated.

Whole factsheet with key facts, and practical tips for managing stress is available at: https://www.itfseafarers.org/en/health/managing-stress.

## MENTAL HEALTH AND THE IMPACT OF ABUSE HIGHLIGHTED AS KEY CONCERNS FOR YACHT CREW IN ANNUAL HELPLINE REPORT FROM ISWAN

**Contributed by Nebojsa Nikolic**

The International Seafarers' Welfare and Assistance Network (ISWAN) launched its Yacht Crew Help service in November 2020, in order to provide accessible, specialised support to help those working in the yachting industry to cope with the unique challenges of life at sea. Yacht Crew Help is a free, multilingual, 24/7/365 service operated by a team of helpline officers with broad-ranging experience of providing emotional support and practical guidance. Demand for the service has continued to grow, with Yacht Crew Help supporting 300 crew members from at least 42 different nationalities in 2022, up by 31.0% year-on-year.

Mental health difficulties were the most frequently raised issue, accounting for 16.6% of all issues raised and for 19.1% of those raised by women. Yacht crew who contacted the helpline frequently talked about the impact on their mental health of long working hours, lack of sleep, the impact of alcohol or drugs onboard or difficulty fitting into the crew culture.

However, ISWAN's helpline data suggests that experiences of abuse, bullying, harassment or discrimination (ABHD) are collectively the issue that has the greatest impact on the mental health of yacht crew. Almost a quarter (24.3%) of yacht crew who contacted Yacht Crew Help in 2022 in relation to mental health challenges also raised an experience of some form of abuse. Overall, experiences of ABHD accounted for 9.2% of all issues raised, in comparison to 3.0% of issues raised to SeafarerHelp, ISWAN's long-established helpline for all seafarers across the maritime sector and their families. Contacts relating to ABHD increased by 81.3% on the 2021 level.

Amongst women, experiences of abuse accounted for 13.5% of issues raised to Yacht Crew Help, as opposed to 5.8% of issues raised by men. In many cases, yacht crew contacted the helpline for support to cope with bullying, aggression and at times assault, frequently by more senior crew members. Amongst women yacht crew, half of all ABHD-related contacts involved sexual abuse or harassment.

A year in data of Yacht Crew Help 2022 can be downloaded at: https://www.seafarerswelfare.org/assets/documents/resources/Yacht-Crew-Help-2022-a-year-in-data_2023-07-07-150420_prad.pdf.

# Presentations

## INTERNATIONAL TRANSPORT WORKER'S FEDERATION'S SEAFARERS' TRUST (ITF ST)

**By Luca Tommasi**

The International Transport Worker's Federation's Seafarers' Trust (ITF ST) is a grantmaking trust registered as a charity in the United Kingdom. We have a small secretariat based in the United Kingdom and overseas, and an international Board of Trustees. Specifically working in the maritime sector, the Trust is the charitable arm of the ITF, a global federation of transport workers' unions with over 20 million worker members. The Trust was established by the ITF in 1981 to fund programmes that advance the wellbeing of maritime workers, seafarers and their families. Our mission is to support the provision of services to maritime workers; we invest in long-term programmes that improve seafarers' and their families' health and wellbeing; and we act as a catalyst for positive change in the maritime community. Our core business is to make grants that support projects such as seafarers' centres and other port-based welfare, research into issues affecting seafarers, and the provision or development of welfare and wellbeing services to seafarers and maritime workers. We also provide a small number of scholarships each year at the International Maritime Organization's World Maritime University and International Maritime Law Institute. We fund and work with a wide variety of partner organizations who share our charitable aims such as other maritime charities, trade unions and non-governmental organizations. We also carry out work in the maritime medical sector. On top of providing grants for research and intervention aiming to improve seafarers' health and wellbeing, we have been working closely with a number of European telemedical maritime assistance service (TMAS) providers in order to harmonize data collection and improve cooperations. We involved national TMAS from Denmark, Finland, Germany, Italy, the Netherlands, Norway, Poland, Sweden, Turkey and the United Kingdom in order to agree common definitions and record comparable anonymised data sets and to develop a standardised method of data collection with a view to facilitating an annual report of selected consolidated statistics.

At the moment, our most visible project is the Life At Sea seafarer photography competition, started during the early months of the COVID-19 pandemic while seafarers remained trapped on board, and now in its fourth year. This popular seafarer photography competition has resulted in a large catalogue of images that represent the reality of seafaring, as seen by seafarers, and we are now working with maritime museums and other organizations worldwide to bring this honest insight into the seafarers' world to the general public.

Whilst the majority of our work is focused on seafarers, we also support some work with other maritime workers. Our OSH Ports app-based training project aims to improve occupational health and safety in ports across the Arab World, Latin America and Caribbean through training and empowering dock workers to engage with OSH issues in their workplace.

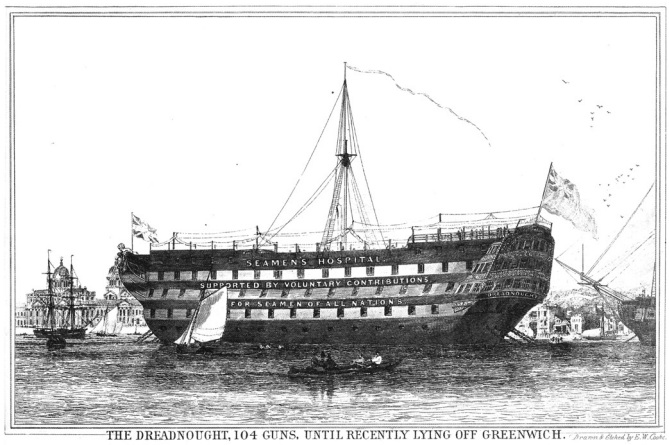
You can find out more about the work of the Trust at our website: https://www.seafarerstrust.org/ or find us on social media.

## THE SEAFARERS HOSPITAL SOCIETY — PAST AND PRESENT

**By Tim Carter (Society Trustee)**

*On September 23rd, 1842, George Nimmo, a fourteen year old apprentice on a ship plying from Newcastle to London, probably laden with a cargo of coal, was taken ill with a fever. He was admitted to the 'Dreadnought' hospital ship moored on the River Thames at Greenwich and spent three weeks being treated there.*[1] *He fortunately recovered and later in his life qualified as a mate. At this time the different diagnostic features of the two fevers typhus and typhoid were only beginning to be recognised, but the term 'fever' was usually applied to typhoid, an infection that the doctors at the hospital knew to be common on the ships carrying coal to London.*

[1] Great-great-grandfather of my partner Anne, and one of several generations of seamen. The hospital admission books for this period still survive and have been digitised.




HMS Dreadnought at hospital ship 1870s

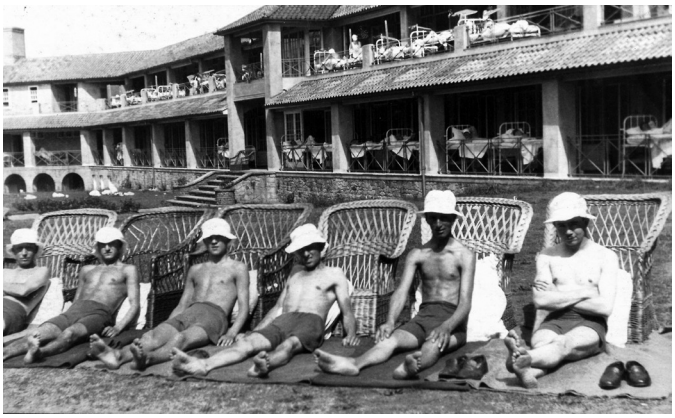
A hospital ship on the Thames had been set up by the Seaman's Hospital Society in the 1820s at a time when there was unemployment and destitution among seamen in the port of London.[2] Benefactors had contributed to its costs, and it provided free care for seafarers of all nationalities in the port. From the outset, the Society and its hospital were pioneers in the health care of seafarers. The hospital 'came ashore' to premises in Greenwich in the 1870s.

Bringing a sick seafarer ashore for transfer to hospital early 1900s

Pioneering activities in the nineteenth century included responding to the repeated outbreaks of cholera among seamen, and active monitoring of ships for new cases to protect the population ashore. Doctor Harry Leach, from the hospital, contributed to new laws protecting the health of seamen and wrote 'The Ship Captain's Medical Guide' in 1868, an updated version of which is still the medical guide carried on many United Kingdom and other ships. Towards the end of the century as British imperialism flourished and as knowledge of the causes of infectious diseases and their vectors developed, Doctor Patrick Manson, recently returned from the investigation of diseases in British Colonies, based the first United Kingdom Hospital for Tropical Diseases at a new Society hospital built downstream, where larger vessels could be docked.

Education was central to the work of the hospitals and both a nursing and a postgraduate medical school were instituted. The importance of tuberculosis as a leading cause of death in seamen came to be recognised early in the twentieth century and the hospital had a pioneering role in its prevention and treatment. An open-air ward was set up when this was the preferred treatment, followed by a newly built sanatorium in the countryside. The use of mass miniature chest X rays for screening seamen was developed during the 1940s.

[2] For more details of the history of the Society see: https://seahospital.org.uk/about-us/our-history/.



Seafarers with tuberculosis having sun and open air treatment at King George Sanatorium for Seafarers 1925

Following the creation of the National Health Service in 1948 the hospital services became integrated with those for the local community, and this remains the case to the present, although the decline in London as a port and changes in medical practice now mean that a limited service for today's seafarers is provided within one of London's major hospital groups.

Since 1948 the Seamen's (now Seafarers) Hospital Society has moved away from direct provision of hospital services to provide a range of other health related support services for seafarers. Seafarers' Advice and Information Line (SAIL) is a specialised advisory service that helps seafarers, current and retired, gain access to benefits and to avoid debt.[3] The Society also makes grants to individuals to help with needs such as mobility aids and adaptations. Health promotion initiatives, especially among fishing communities, have been a major part of its recent work as have targeted aspects of clinical support such as quick access physiotherapy and dental services.[4]

The Society is a charity and is still able to benefit from the generosity of those who founded and supported it over the last 200 years. It is the only United Kingdom-based charity specifically concerned with the health of seafarers and is always on the lookout for new ways to contribute to this, for instance its recent review of gaps in current seafarer health care and the steps now being taken to encourage the development of quality and performance indicators for seafarer health, as described in the last issue.

## THE NORWEGIAN CENTRE FOR MARITIME AND DIVING MEDICINE

**By Jon Magnus Haga**

The Norwegian Centre for Maritime and Diving Medicine (NCMDM) is the national centre of excellence for maritime medicine in Norway. The centre was established in 2005 by an act of the Norwegian Parliament and is organized as an integrated part of the Haukeland University Hospital, the second largest hospital in Norway. The NCMDM cooperates closely with the Norwegian Maritime Authority, the Norwegian Coastal Administration, the Coastal Radio Service, the Norwegian Joint Rescue Coordination Centres (JRCC) and the Norwegian Navy.

The mission of the NCMDM is to promote health among seafarers. Main activities include research and innovation projects, coursework in selection medicine and medical

[3] Details of SAIL advisory service (part funded by the Society): https://sailine.org.uk.
[4] For information on the current work of the Society see: https://seahospital.org.uk.

consultancy of maritime authorities, authorities, ship-owners, and seafarers' organizations. NCMDM chairs the appellate body of the Norwegian Maritime Authority and acts as experts in the vetting of seafarers' doctors in Norway. NCMDM has national responsibility for occupational examination of professional divers and operates the Norwegian telemedical assistance service (Radio Medico Norway). In 2022, NCMDM provided telemedical services for 2275 seafarers and assisted in 204 medical evacuations.

The NCMDM Course Centre provides all compulsory training for medical doctors seeking approval as seafarer's doctors, petroleum doctors and diving doctors (renewal) in Norway. In 2022, NCMDM organized 18 courses, based on 6 different curricula approved by the Norwegian Maritime Authority and the Norwegian Directorate of Health. A total of 526 doctors participated in courses at NCMDM in 2022.

The Appellate Body is the legal body of the Norwegian Maritime Authority which considers appeals of decisions made by Norwegian seafarer's doctors regarding health certificates for seafarers. The body is chaired by a medical doctor from the NCMDM and includes representatives from the Norwegian Maritime Authority and the seafarers' trade unions. A total of 73 cases were concluded by the appellate body in 2022.

The NCMDM is the point of contact for international collaboration in maritime medicine and collaborates closely with maritime medical experts all over the world and maintains and updates the Textbook of Maritime Health (https://textbook.maritimemedicine.com). The textbook is a comprehensive collection of articles covering the field of maritime medicine available online free of charge.

In cooperation with the maritime insurance company Gard and the Norwegian Maritime Administration, the NCMDM developed the Mariners Medico Guide (www.medicoguide.com, published in 2022) which is a step-by-step, digital and quality assured medical guide for seafarers. The guide is available free of charge to seafarers worldwide and is recognised by a number of maritime flag states.

The maritime industry is evolving fast. As we continue to develop our medical services into the future, we welcome closer cooperation a with partners in Norway and abroad. Please reach out. Together we can make a difference to health at sea.

# Reports

## 4TH IMHF WORKSHOP ON MARITIME HEALTH ON BOARD "TELEMEDICINE FOR SHIPS IN FUTURE"

### 11–12 November 2022, Berlin, Germany

**Report by Jens Tülsner and Nebojsa Nikolic**

### Introduction

Following its statutory objectives, the International Maritime Health Foundation (IMHF) decided to conduct a series of expert workshops following the proposals of its Expert Panel (EP) [1]. The IMHF-EP consists of medical professionals, all of them engaged in various aspects of healthcare for seafarers [2]. In parallel to IMHF's primary project, the journal International Maritime Health (IMH), these workshops shall collect relevant expertise and knowledge to provide state of art guidance for maritime health practice [3].

The International Labour Office's (ILO) Convention 2006 (as amended) states that seafarers' medical care should be "as comparable as possible to that which is generally available to workers ashore". While this may leave room for interpretation the IMHF-EP held the opinion that the implementation of this rule would need specific definition and that in the end medical guidelines should be established that would reflect the conditions of the maritime environment as well as those of actual best medical practice.

The management of medical incidents of any severity on board commercial ships mainly depends on three pillars: 1) the skills of the medical responsible officer on board, 2) the quality of advice and recommendations given by telemedical service provider, and 3) the quality of the medical equipment on board [4–7]. Whilst 1) and 3) are discussed in separate workshops, the reported one aimed for evaluation of future improvement of the telemedical advice given itself as well as for training and education for all parties involved, considering the implications for technical requirements and training of medical responsible officers.

Tools for collecting, structuring, transmitting and validating data are rapidly developing. This may open possibilities for collecting structured individual patient data in medical incidents on board. The collection of a wider range of vital parameters is possible too, possibly also interpretation and the best-found diagnosis [8]. The technological development may influence the direction of this communication and give new opportunities for collecting information to be used for guiding the medical officer [9, 10].

The aim of the workshop has been to reach consensus of what telemedical support to ships should look like in future, to evaluate how telemedicine for ships may and should adopt options that are available ashore, and to define consequences that apply to training and education of medical responsible officers on board ships and medical assistance providers on shore.

## Materials and methods

The workshop "Telemedicine for ships in future" was held at the Unfallkrankenhaus (Occupational Trauma Centre), Berlin, Germany, November 11$^{th}$–12$^{th}$, 2022. The following 14 experts were identified, invited and attended the workshop: Jon Magnus Haga (Norwegian Centre for Maritime and Diving Medicine; IMHF-EP); Nebojsa Nicolic (IMHF-EP); Alf Magne Horneland (IMHF-Management Board [MB]); Beate Stelzer (Master of container vessels; Maersk); Jens Tülsner (Marine Medical Solutions; IMHF-EP; DGMM), Joanna Ewa Szafran (TMAS Poland); Patrick Roux (TMAS France); Francsesco Amenta (CIRM Italy); Guiliano Pesel (CIRM Italy), Margarita Huerte (Nordic Medical Clinic, OSM, Philippines; IMHA Board); Dennis Gümbel (Unfallkrankenhaus Berlin); Admir Kulin (m.Doc); Sascha Burggraf (Marine Medical Solutions) and Spike Briggs (MSOS) — by virtual presence.

For initial overview and as a basis for the following explorations and discussions, five presentations were given by participants depending on their particular area of expertise: "IMHF and IMHF Workshops" (Alf Magne Horneland), "Definition and scope of Telemedicine for ships" (Jens Tülsner), "Telemedicine — applications: what is available ashore and how does it fit into a 'holistic care model'?" (Admir Kulin); "Telemedical Service — experience and gaps in information provided" (Francesco Amenta) and "How must the vision of future Telemedical Services reflect on training and education?" (Jon Magnus Haga). These presentations were supplemented by three remote (Teams) presentations and demonstrations of some digital tools and platforms that already are available globally: BINAH — Israel (https://www.binah.ai/); MedAssist Online — Netherlands (https://medassist.online/); QT Medical — USA (https://www.qtmedical.com/).

To achieve the aim of the workshop, three Working Groups (WG) were constituted to separately discuss relevant topics identified as potential drivers for future developments of telemedicine for ships. Each topic was analysed, discussed, and prepared for presentation by a WG, and presented in a plenary session for further discussion. A report/consensus statement was drafted based on the views expressed in the discussion and later tuning process, after the workshop. This document was sent to IMHF-EP panel for their opinion before its approval by the IMHF-MB.

## Results

WG 1: WHAT PARAMETERS AND INFORMATION SHOULD BE STANDARD TO BE RECEIVED FROM THE SHIPS IN THE FUTURE?

Initial information to be transmitted from the vessel requesting medical advice:

- IMO Code of the vessel;
- name of vessel;
- flag state;
- type of vessel;
- number of the persons on board;
- position of the vessel;
- departure and arrival port and date;
- who is calling? (name/rank).

Patient — relevant information:

- name, surname;

— date of birth/age;
— sex;
— nationality;
— rank.

Data relevant to assess the situation (the list is non exhaustive):

— medical problem:
  • the reason why they call the telemedical support?,
  • when did it start, how has it developed, treatment thus far?,
  • vitals (height/weight, heart rate, blood pressure, frequency of breathing, temperature, blood sugar),
  • consciousness (Glasgow-Coma-Scale); Pain Scale;
— context:
  • what the person did before the injury/illness, symptoms (when the symptoms started?; other persons with the same symptoms on board),
  • actual problems;
— previous history:
  • previous medication (dosage/days),
  • allergies,
  • previous diseases/medical treatment,
  • did the patient receive medical support already? If yes, what was done,
  • additional information's: $SpO_2$ (after doctor advice).

WG 2: SCOPE OF TELEMEDICINE FOR SHIPS

The scope of future telemedicine should include **preventive, diagnostic and therapeutic** approach, using tools available to achieve the best possible medical care for seafarers on board ships — to the level that can be managed on board using the available facilities.

Future telemedicine for ships should be based on following four premises:

— know the patient concept;
— telemedicine "completes the cycle" to the next pre-employment medical examination (PEME);
— organized portal that supports online exchange of data and enables the "know the patient" and "complete the cycle" concept;
— trained personnel (universal certification?).

Knowledge and access to medical records of the patient significantly improves understanding of the case, facilitates its management and clinical decisions in situations where telemedical maritime assistance service (TMAS) doctors for the first time treat the patient in an offshore situation. An application that enables the individualised storage of data for each crew-member will guarantee continuity of care and the creation of a progressive medical record. Those data must always be encrypted — so that access rights could be controlled. It will be the seafarer's decision to agree or not to give the access. In case the shipowner will be included to some level — data must be protected in order to keep compliance with data privacy regulations and to keep intact the doctor-patient relationship.

A digital telemedical portal would provide opportunities to achieve a clear picture of the case, including follow up of the course of treatment. Implemented application for storage and exchange of data should be multilingual/multicultural and enable reporting of medical data/endorsement of patient to treating doctor on shore (e.g. workflow of data to be available to another doctor in next port; incentive-based data on endorsement by master).

Audio and video option, transmission of pictures; connectivity to medical devices should be enabled (i.e. the widening portfolio of point of care testing devices).

The Medical Chest Inventory may also be considered a part of such a platform — instant access with given review of the medicines required to be on board.

WG 3: WHAT IS TO BE EDUCATED AND TRAINED FOR STAFF ON BOARD AND ASHORE?

Considering upcoming broader technical options and solutions, as well as the need for training and education of all involved parties has been agreed. This not only for the onboard medical responsible staff; but for the shoreside consulted doctors, and rescue services.

The topics identified are:

— for the telemedical assistance providing doctor:

- ships medical chest/equipment,
- skills of the medical officer,
- use of the medical guide on board,
- skills in communication, maritime and medical English, use of interpreter,
- able to advise on exercises ('train the trainer'),
- knowledge of maritime context/environment,
- know how to work with the rescue services/MRCC/rescue services/SAR,
- proficiency in offering advice and giving medical directions via telephone, text and video,
- awareness of legal/ethical aspects — including GDPR,
- documentation,
- know about PEME requirement?,
- regular clinical skills update,
- update on new technical update;

— for the medical officer and master:

- refer to the learning outcomes agreed during IMHF's 2nd workshop on the medical training of seafarers (see article in IMH 1/2023),
- skills in communication: medical English,
- awareness of the ship's medical chest/equipment and its maintenance,
- know the pertinent medical guide for ships,
- know how to communicate with TMAS/SAR/MRCC,
- advice in exercises ('train the trainer'),
- how to prepare a case for TMAS,
- legal/ethical issues,
- documentation,
- medical history, observation, examination, technical procedure.

The training should always consist of a combination of courses and continuous training on board, including scenario training. Portal, as described by WG 2 should also have the options for training of onboard personnel and instructions on how to handle different medical activities. Concept of the outcome-oriented learning with competences as defined for current needs by the 2nd IMHF-EP Workshop on Maritime Health on Board — Medical Training of Seafarers (18–19 March 2022, Bergen, Norway) should be used in creating future training programmes.

## Discussion — identified obstacles, open issues and further recommendations

The following points have led into some discussion.

— The involvement of the shipowner/ship management company (SO/SMC) and/or its representatives (e.g. Crew Dept.) raised some questions that impede the aims as defined in this workshop. Considering the fact that the SO/SMC has a wide responsibility for the seafarer's health and its management, the issue of data privacy and confidentiality came up and has been discussed. No solution was found (yet) how to keep compliance with GDPR/HIPPA regulations on one hand and the involvement of the SO/SMC in the loop of information and the medical care provided; especially in case of further management like shoreside referrals and/or medical disembarkation with shoreside treatment. This is highlighted as a specific issue in the general problem of confidentiality issues in medical telecommunications.

— The usefulness and/or need for video — options in medical telecommunication on board was discussed with aim to explore its validity, usefulness and realism of its use on board. Whilst a virtual impression of a patient is always considered useful in the examination aiming to find the appropriate diagnosis and respectively appropriate treatment, reality is that not all ships will have the required bandwidth for this tool. Considering the character of the industry it is not realistically to expect such a bandwidth on majority of ships in the near future. Beside this limitation it was recognised that only a few cases have a real need and substantial benefit for video transmission. It has been agreed that the option for video-consulting should be given; the technical basis provided by the SO/SMC.

— The need for point of care testing (POCT) was evaluated having in mind future developments of such a technology. Some options for simple POCT — testing are already given (e.g. malaria, influenza, COVID-19-testing). As the portfolio of POCT — testing has tremendously extended during the last years (simple machines detecting various parameters in whole blood/serum/urine/stool; simple electrocardiogram — devices and much more), still the costs are comparably high while the use of such devices on board is very limited due to few cases on board per year; training needed to use them and their maintenance.

— The availability of pre-embarkation medical information was discussed in the context of data usefulness on board. Whilst it has been agreed that future telemedicine on board should implement "know your patient", "complete the cycle" to the next PEME concept, no consensus was achieved regarding the validity of PEME related information in the telemedical setting: especially as the „advanced PEME-profiles" are not considered as always compliant to the flag state regulations. It was discussed if such information once available, would be manageable in compliance with data privacy and confidentiality rules.
— During the presentation of the results of WG 1 on necessary data to be transmitted to the medical advisor on shore, it was explored if, and to what extent other information might be needed or useful like $SpO_2$. While standard in emergency rooms on shore there was no agreement, whether $SpO_2$ is a useful parameter in an onboard context or if it's rather potentially misleading for the consulted doctor and designated medical persons on board. The discussion lead into agreement that this topic refers to two major aspects: the conclusions already taken during the IHMF workshop on training and educational outcomes (Bergen, March 2022) and the need for a further exploration by an additional workshop on quality control and assurance for telemedical services provided for ships.
— Competences and some further aspects for the work of telemedical providers have been mentioned and discussed: Are all shoreside doctors providing telemedical advice to ships familiar with the ship's/shipping environment and conditions? What should duties/shifts for telemedical doctors look like? Should it be doctors only providing telemedical advice? How can combined ship side/shoreside exercises be organized and executed? There is a clear need to define competences of telemedical providers and tune them with the future system of medical help on board.

## Conclusions

International participants from various organizations and companies have discussed and reached consensus on foreseeable future needs of telemedicine for ships, considering recently available and/or future technical and digital options. Requirements for future services have been agreed upon and open issues that need to be overcome and resolved were identified.

The need for further workshops with following defined subjects was suggested:

— data privacy and confidentiality in the telemedical services for the shipping industry;
— quality control and assurance for telemedical services for the shipping industry;
— definition and creation of diagnostic and treatment pathways for telemedical assistance providers for ships.

## References

1. Jensen OC. Expert Panel Group of the International Maritime Health Foundation (IMHF). Available from: https://portal.findresearcher.sdu.dk/da/activities/expert-panel-group-of-the-international-maritime-health-foundatio (Accessed on 17.02.2023).
2. Horneland AM, Jeżewska M, Jaremin B, et al. Establishment of the International Maritime Health Foundation: the next step in scientific publishing in maritime health. Int Marit Health 2018; 69(3): 153–156.
3. International Maritime Health, Via Medical Journals. Available from: https://journals.viamedica.pl/international_maritime_health (Accessed on 06.11.2022).
4. Brebner EM, Brebner JA, Ruddick-Bracken H, et al. The importance of setting and evaluating standards of telemedicine training. J Telemed Telecare 2003; 9 (Suppl. 1): 7–9.
5. Blignault I, Kennedy C. Training for telemedicine. J Telemed Telecare 1999; 5 (Suppl. 1): S112–S114.
6. Sood S, Mbarika V, Jugoo S, et al. What is telemedicine? A collection of 104 peer-reviewed perspectives and theoretical underpinnings. Telemed JE Health 2007; 13(5): 573–590.
7. Guitton MJ. Telemedicine at sea and onshore: divergences and convergences. Int Marit Health 2015; 66(1): 18–21.
8. Amenta F. The Centro Internazionale Radio Medico Symposium "The Way Forward of Maritime Telemedicine". Int Marit Health 2016; 67(1): 56.
9. Sagaro GG, Amenta F. Past, present, and future perspectives of telemedical assistance at sea: a systematic review. Int Marit Health 2020; 71(2): 97–104.
10. Battineni G, Amenta F. Designing of an expert system for the management of seafarer's health. Digit Health. 2020; 7; 6: 2055207620976244. eCollection 2020 Jan–Dec.

# IMHF WORKSHOP AND CONFERENCE ON "SEAFARER MENTAL HEALTH — A SYSTEMS PERSPECTIVE"

**Report by Alison Kay, Joanne McVeigh and Bill Kavanagh**

## Background

The International Maritime Health Foundation's (IMHF) International Workshop/Conference on Seafarer Mental Health was convened at the National Maritime College of Ireland, Munster Technological University, Cork, Ireland, on 27th–28th April 2023. The aim of the workshop and conference was to contribute to the current body of knowledge on how the maritime industry can most effectively support the mental health and broader well-being of seafarers.

The 2-day workshop and conference were organized by members of the IMHF's Expert Panel (IMHF-EP), established in 2020. The IMHF-EP, as an expert scientific panel, aims to leverage scientific and academic expertise to continually monitor and address relevant health issues and developments to help solve or ameliorate problems in the maritime environment.

The workshop and conference were funded by the International Maritime Health Foundation; the Cork Convention Bureau; Geoquip Marine; the Institute of Marine Engineering, Science and Technology; the Irish Institute of Master Mariners; Lloyd's Register Foundation; Munster Technological University; the Nautical Institute; and Tidal Marine Management. All contributions were gratefully received.

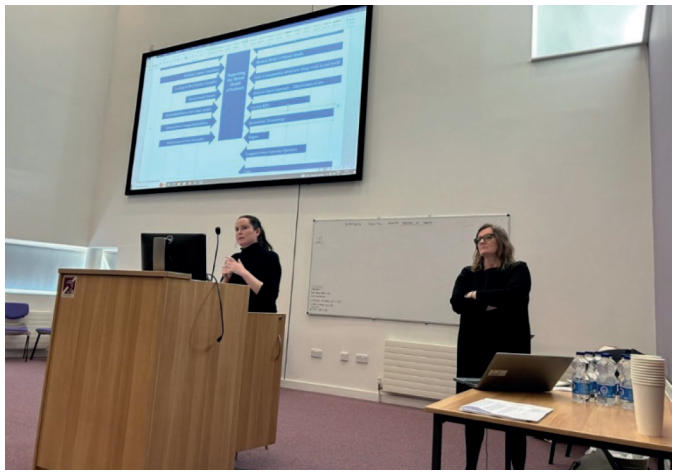
On day 1, a workshop was held with members of the IMHF-EP and other industry experts, with a total of ten participants. On day 2, the main conference was convened with all conference presenters and attendees, comprising 48 participants in total.

The purpose of the workshop and conference was to address facilitators and challenges in relation to the mental health of seafarers at the systems level. Conference themes included well-being, suicide awareness and prevention, public health management, bullying and harassment, and organizational justice, from a policy, legal, and human rights/social justice perspective.

Conference speakers included academics, captains, legal practitioners, and health practitioners from Shell London, International Transport Workers' Federation, Lloyd's Register Foundation, International Maritime Organization, IMHF, North Standard, Marine Benefits, Simply Blue Group, Medical University of Gdansk (Poland), Ordu University (Turkey), Maynooth University (Ireland), Linnaeus University (Sweden), Trinity College Dublin (Ireland), and MTU (Ireland).

## Consensus session

The final session of the conference featured an interactive consensus workshop to facilitate knowledge exchange between attendees. The aim of this consensus session was to solicit the opinions of conference participants in relation to factors that support or impede changes in the maritime sector to optimally support the mental health of seafarers and to capture input on how to translate recommendations into policy. Some very useful and insightful discussion emerged during this session, from which further collaboration and publication are envisaged.



Joanne McVeigh and Alison Kay facilitate the consensus session using force field analysis

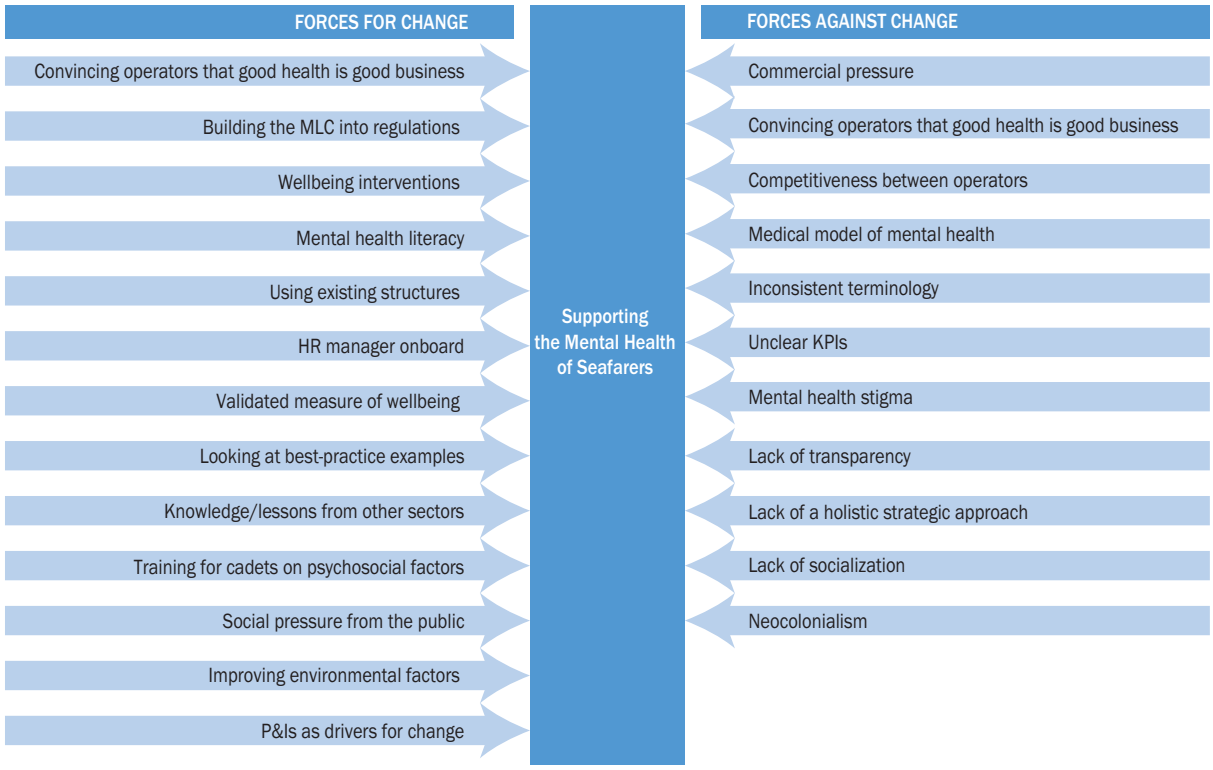



**Figure 1.** Force field analysis findings from consensus session

Force field analysis was used to collate the opinions of participants. Participants were asked questions on the main factors both **supporting** and **hindering** the mental health of seafarers. Within the confines that time allowed, 75 minutes was allocated to the consensus session including the force field analysis. Figure 1 schematically presents findings from the force field analysis exercise with participants. These factors are not presented in order of importance and do not imply a hierarchy.

For example, with regard to 'Forces FOR Change', participants emphasised the importance of **convincing operators that good health is good business**. Participants agreed that a **financial hook** is therefore needed to motivate operators, as indicated by evidence from the aviation industry. Robust evidence is required to demonstrate the impact of improved wellbeing on operational risk, to provide this incentive for organizations to invest in seafarer wellbeing.

Participants also discussed 'Forces AGAINST Change', including **commercial pressure**. Participants noted that the commercial pressure placed on ships' masters is a major contributor to stress and risk-taking by senior officers and captains. The imposition of unrealistic objectives increases stress and in many cases results in workarounds, which may compromise safety and place additional pressure on crew. This may also result in the transfer of blame to subordinates, thus fuelling a blame culture, which is endemic in shipping.

**The full findings of the workshop and consensus session will be published in an upcoming issue of International Maritime Health journal.**

# Retrospectives

## THREE YEARS OF THE INTERNATIONAL MARITIME HEALTH FOUNDATION'S EXPERT PANEL

**By Klaus Seidenstücker, Alf Magne Horneland and Jon Magnus Haga**


Development of the International Maritime journal since 1973

Best medical practice greatly relies on structures continuously generating evidence-based knowledge on the one hand. On the other it requires means to transfer that knowledge into practice with as little delay as possible. Publishing journals for a long time was the one pillar of such effort — next to education and training. The internet has added many other routes of knowledge transfer. At the same time, it has made knowledge accessible so much easier than via the print media of earlier times.

The journal[1] you are reading right now has made a first step into this new digital world that has contributed to an enormous acceleration of generation as well as distribution of knowledge. Since 2019 International Maritime Health (IMH) is available online and free of charge. That year the International Maritime Health Foundation (IMHF) took ownership of the journal looking primarily for a reliable financial basis to carry it into a sustainable future. However, it soon became obvious that ownership would also include content management such as acquisition of submissions and setting up effective editorial routine. In its statutes the foundation also obliged itself to consider alternative ways of knowledge transmission such as supplying training opportunities, organizing workshops, conferences etc. Finally, the foundation intends to use the internet's opportunities by setting up interactive options on its website and entering the social media.

It was clear that the foundation for this purpose would need structures beyond its two governing bodies. Consequently, it welcomed the proposal of a handful of 'seniors' to set up an expert panel to assist and advise the IMHF governing bodies (Board of Governors [BoG] and Management Board [MB]).

Statutes for such an expert panel were drafted and authorized by IMHF's MB on July 28th, 2020. An invitation went out to 25 colleagues identified at that time as possible candidates to join the panel. First members were appointed on August

[1] International Maritime Health's history can be traced back until 1949, when the Polish Institute of Maritime and Tropical Medicine (Gdynia) published its first "Bulletin".

26th, 2020[2]. The expert panel started into 2021 with 8 appointed members and 4 candidates. Today the panel consists of 13 full and 2 corresponding members. Further members are welcome! (point of contact: Jon Magnus Haga, e-mail: jon.magnus.haga@helse-bergen.no).

Since its establishment the panel meets via videoconference on a monthly basis (with 1- or 2-months summer release) and engaged in a steady dialogue with the foundation's MB.

Our statutes entrust the expert panel with the following activities:

— identifying conditions with relevant impact on the health of communities exposed to the sea and options of a medical remedy of such conditions;
— transfer of such knowledge into education of professionals engaged in maritime medicine and advice to authorities, decisionmakers and responsible executives on maritime medical matters;
— advising students, researchers as well as grant providers on the prioritization and execution of research projects on maritime medicine and adjacent fields;
— participation in organizing seminars, events, workshops, conferences and scientific conventions;
— cooperation with national and international institutions and organizations with the same or similar interests;
— participation in other IMHF activities as appropriate, e.g. as reviewers and advisors to the IMH journal.

The first three panel meetings were devoted to establishing focal points for the panel's future engagement. The foundation's first and foremost objective at that time was to create sustainable financial conditions for itself and for the IMH journal. The expert panel supported these efforts through 2021. They resulted in a donation from the German Association for Maritime Medicine to ensure that year's 4th issue of the journal.

In October 2021 an expert workshop (first in a row of presently five IMHF workshops) on the development of the journal was conducted. It was organized by the Polish Society of Maritime, Tropical and Travel Medicine. Based on a prior situation analysis the 2 days of intense discussion and consecutive review rounds resulted in a report to IMHF-MB and BoG with a multitude of recommendations for a sustainable future as well for the journal as for the foundation in general.

Based on these recommendations the foundation drafted a strategy document for the period 2022–2024 titled "Ensuring Knowledge and its Dissemination in Maritime Health".

The objectives and activities addressed were presented to the International Transport Workers' Seafarers' Trust (ITF-ST) and the trust could be convinced to join the IMHF as the fourth "cooperating institution" (a constituting member according to §16 of IMHF Statutes).

With support of ITF-ST and aided by the IMHF-Expert Panel (EP) the foundations MB applied for grants and was successful with the Torben Karlshoej Foundation (TK Foundation) and the Seafarers Charity.

With such backup the foundation decided to extend its activities beyond the dissemination towards the creation knowledge. The IMHF-EP was tasked to organize and conduct a series of further workshops. The first (numbered 2 IMHF workshop) was held in March 2022 in Bergen, Norway, with organizational and financial support of the Haukeland University Hospital and especially the Norwegian Centre of Maritime and Diving Medicine (NCMDM). It addressed the medical training of seafarers. A consensus document was drafted and recently published in this journal[3]. It will provide the basis for an IMHF initiative at International Maritime Organization (IMO) (preferably the Subcommittee on Human Element, Training and Watchkeeping [HTW]).

The next workshop (numbered 3 IMHF workshop) was held in September 2022 in Hamburg, Germany with organizational and financial support from the University Clinic Eppendorf, the Hamburg Centre of Occupational and Maritime Medicine and the German Association of Maritime Medicine. It addressed the management of medical incidents at sea and thus reiterated on an IMHA workshop held in London 2015[4].

Again, a report[5] was drafted and following three review rounds submitted to IMHF-MB. The consensus statement now is an IMHF position paper stating strongly the need for research studies delivering objective data on the quality and quantity of medical incidents at sea in order to create adequate rules for structures, education and training, equipment and procedures. Regarding the latter, it was consensus that the development of "management pathways" would be mandatory that reflect the special conditions at sea. In its September 2023 meeting IMHF decided on a follow up workshop in December this year to identify applicable procedural recommendations.

[2] Professor John Timothy Carter, Doctor Nebojsa Nikolic, Doctor Klaus Seidenstücker, Professor Eilif Dahl in a corresponding function.
[3] Nikolic N, Haga JM, Tuelsner J et al. Medical training of seafarers: International Maritime Health Foundation (IMHF) Expert Panel Consensus Statement. Int Marit Health 2023; 74(1): 15–23.
[4] A revised version of the IMHA workshop report is published in this magazine below.
[5] Workshop Report: Seidenstücker K, Nikolic N. The 3rd IMHF Workshop "Management of Medical Incidents at Sea". Int Marit Health 2023; 74(2): 135–137.

The 4 IMHF workshop was organized in cooperation with "Marine Medical Solutions" and supported by the Occupational Trauma Centre Berlin-Marzahn in November 2022 in Berlin. It addressed future options for telemedicine at sea and their possible consequences. This workshop also reiterated on an IMHA workshop of 2013 and later IMHA activities at the IMO Subcommittee on Navigation, Communications, Search and Rescue (NCSR).

A report (see report in this magazine above) was drafted and presently is under consideration by IMHF-MB and IMHF-BoG. The complexity of the issue and the speed of technical development probably also requires a follow up workshop. There is some urgency in order to still influence the current discussions on Maritime Services at IMO, Subcommittee on NCSR.

In April 2023 the IMHF-EP organized its 5th workshop in Cork, Ireland in cooperation with the National Maritime College of Ireland. This time the organizers added to the workshop format a conference in order to address a wider audience and to promote awareness of its subject: "Seafarer Mental Health Challenges". A first impression report is part of this magazine (see above). It is planned to devote a special issue of this journal to the subject in 2024.

In 2024 the EP also faces a possible handover to another chairperson, and we shall have to focus on the foundation's financial continuity once again!

By courtesy of the International Maritime Health Association (IMHA)

IMHA

## IMHA WORKSHOP "THE MANAGEMENT OF MEDICAL EMERGENCIES AT SEA"
### February 2nd – 3rd 2015, London, United Kingdom

**Report by Sue Stannard[1] and Tim Carter[2]**

### Background

This article reproduces the work and recommendations of an International Maritime Health Association (IMHA) workshop held in 2015, funded by ITF Seafarers' Trust. It is re-issued here as it is not readily accessible and is relevant to other current maritime health initiatives.

The Maritime Labour Convention (MLC) 2006 Standard A.4.1 (b)[3] states that: *'seafarers are given health protection and medical care as comparable as possible to that which is generally available to workers ashore, including prompt access to the necessary medicines, medical equipment and facilities for diagnosis and treatment and to medical information and expertise'*.

On ships without a doctor the management of medical emergencies and other immediate medical care requirements depends on a number of provisions which include:

— training of the ship's crew in first aid and medical care on board;
— the medical equipment and medication on board;
— the literature available to ships officers on board, i.e. The International Medical Guide for Ships (IMGS) (3rd edition) or accepted equivalent;
— the availability of remote telemedical assistance services (TMAS).

These provisions are specified in a number of international conventions agreed at the International Labour Organization (ILO) or the International Maritime Organization (IMO), but the responsibility for implementing each of them lies with national authorities, and it is for ship operators to ensure that they meet the requirements of the state where the ship is

[1] Workshop rapporteur (Norwegian Centre for Maritime Medicine at time of workshop, now UK Maritime and Coastguard Agency)
[2] Workshop organiser (Norwegian Centre for Maritime Medicine)
[3] https://www.ilo.org/global/standards/maritime-labour-convention/text/WCMS_763684/lang–en/index.htm.

flagged. Concerns have been raised among those who provide TMAS services, those working in port clinics and hospitals who give follow up treatment, and from seafarers and ship operators, regarding the quality and consistency of care provided to seafarers on board ship in case of a medical emergency. However, the multiplicity of conventions and recommendations and the fact that the provisions for medical emergency management form only a small part of each, mean that the scope for coherent change is severely limited. It has been suggested that one approach could be the development of treatment pathways such as those used in the military, prehospital care and in developing countries[4].

With the support and funding of the International Transport Federation (ITF) Seafarer's Trust a workshop was convened by the International Maritime Health Association (IMHA). The aim of the workshop was to discuss the current status of medical care at sea on ships without medical practitioners on board and to ascertain support for the development of an approach based on treatment pathways, including the identification of the resource requirements for carrying such a programme of work forward. This workshop followed on from the work done at an earlier IMHA workshop on one aspect of medical care: the provision of TMAS services.

## Programme

The workshop ran over 2 days and included a number of presentations and sessions of small group work. The presentations gave background information and different subject areas were then explored in more detail within the small groups.

### *Presentations*

Doctor Tim Carter (Norwegian Centre for Maritime Medicine) looked at the current status of medical care at sea and the different conventions covering this area of life at sea. In addition to MLC these include:

— International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended ("STCW")[5, 6] (Chapter VI: Emergency, occupational safety, medical care and survival functions);
— International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS)[7];
— Directive 92/29/EEC — medical treatment on board vessels[8].

These conventions came after national practices had already been established in major maritime nations and hence existing practices in these states were adjusted to them. This has led to a lack of international consistency and many flag and coastal states do not in practice meet the convention requirements, e.g. with regards to TMAS and Search and Rescue (SAR) services. The problems of incompatibility between training, guides and medications/equipment are exacerbated when officers serve on ships flagged in a different country from the one in which they have trained and then possibly treat crew of a third nationality who may have different health beliefs and expectations.

Uncertainties about the accuracy of information relayed to them and concerns about the quality of care on board often make TMAS adopt precautionary approaches. This may lead to costly diversions, medevacs and repatriations that are potentially avoidable.

Doctor Rudi Stiltz (Shell International) presented a case series demonstrating that the earlier involvement of TMAS and the availability of/increased use of point of care diagnostics may have prevented costly disembarkations amongst the crews of a single ship operator. The case series also showed that on average a ship experiences one serious medical incident every 2 years, so each seafarer trained in medical care can only expect to see such a case every 4 years.

Figures presented by doctor Jim Ferguson (Aberdeen Royal Infirmary and Scottish Centre for Telehealth and Telecare) showed that over recent years there has been a change in the type of cases the Scottish Centre for Telehealth and Telecare are assisting. Trauma has decreased, medical cases and particularly issues related to chronic disease have increased and the average age of seafarers requiring disembarkation has also increased. He also stressed that experience is key to the management of medical incidents, alongside training and knowledge. This is not only the case for the seafarer providing care but also for the TMAS doctor, who must be aware of the medical capability on board a vessel, the limitations of care and the options for further care. Whilst additional equipment and different types of medication, e.g. thrombolysis may improve treatment and outcome there is a cost associated with this.

[4] Carter T, Stannard SL. Healthcare at sea: are regulations a guarantee of minimum standards or a barrier to improved practice. Int Marit Health 2014; 65(4): 1–4.
[5] http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-on-Standards-of-Training-Certification-and-Watchkeeping-for-Seafarers-(STCW).aspx.
[6] International Maritime Organization; International Convention on Standards of Training, Certification and Watchkeeping for Seafarers Including 2010 Manila Amendments. ISBN: 978-92-801-1528-4.
[7] http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx. ISBN 978-92-801-15949 (English).
[8] https://osha.europa.eu/en/legislation/directives/sector-specific-and-worker-related-provisions/osh-directives/17.

Doctor Spike Briggs (Poole Hospital and Medical Support Offshore Limited) spoke about the use and development of treatment pathways. They have been shown to have many advantages and are used successfully within maritime and other remote healthcare environments. They provide a guide to medical decision making and treatment which can be used to standardise and improve the application of treatments, reducing uncertainty. However, they are NOT a replacement for education, clinical knowledge, physician judgement or common sense. They are also not protocols but a set of guidelines within which to think. Treatment pathways can be presented in various formats to suit the user requirement including:

— hard paper-based copy;
— apps for tablets, smart phones etc.;
— computer programmes;
— voice controlled applications;
— telemedicine vehicles.

They can also be searchable by voice or content list and can contain hyperlinks to additional useful information.

Doctor Marie Hamming (Danish Radiomedical Services) provided an overview of the case load handled by the services of Radio Medico Denmark. Her presentation emphasised the importance of training for ships' officers and the benefits of using scenarios that also incorporated links with TMAS providers. Ms. Connie Gehrt (Seahealth Denmark) built on this with a presentation of the current Danish project to rewrite their national version of the International Ships Medical Guide, incorporating training, the use of TMAS and, in some cases, treatment pathways.

### *Small group work*

The presentations were complemented by small group sessions to review specific facets of medical care at sea. During each session the four groups each considered one particular topic in more detail. To encourage a multidisciplinary approach each group included individuals with different areas of expertise. Each group in turn fed back to the whole workshop and further discussion followed where required. However, it should be noted that there was almost always universal agreement on the key points raised and suggestions made by the individual groups.

### *First group session: Current status, strengths, weaknesses and means of/barriers to improvement of*

#### *Training in medical care and medical first aid*

It is recognized that there are differences in the expectations and quality of training, ranging from very low with simple attendance guaranteed to receive the correct certificate, to a very high level with good practical involvement of the seafarers on the course. Whilst the minimum requirements are outlined in the Standards of Training, Certification and Watchkeeping (STCW) convention, these are not always enforced by the individual nations and there remains a large gap between these minimum requirements and the extensive guidelines used by a number of nations. Whilst some countries have a small number of training providers, often associated with the maritime regulators, others have a large number of individual providers, and this can make it difficult to ensure appropriate quality assurance of the organizations and the courses they are running. Equally the content of the courses often varies, and this can cause practical difficulties when the seafarer then sails on a ship flagged to a different nation. Standardisation of the courses and particularly their content, accompanied by audit of the providers and courses by people with a background in maritime medicine, would be beneficial in ensuring good quality and appropriate training.

It was also felt that the standardisation of training with the use of common words and agreed actions to be taken on the presentation and recognition of specific signs and symptoms would be beneficial. The use of preprinted questions to be used for some symptoms would aid the responsible ship's officer in making an appropriate assessment of the patient and being able to provide the relevant information to the TMAS doctor.

It was also accepted by all that the level of recall of knowledge is poor when a seafarer returns for refresher training in first aid or medical care at sea. More frequent training would be beneficial to ensure the retention of knowledge and the maintenance of skills. However, there is a cost associated with additional training and this must be taken into consideration. E-learning modules and/or the use of drills on board, perhaps even coordinated with a TMAS provider, may help in this area.

#### *Medical stores, equipment, and facilities on board, including 'doctor's bag' on ferries*[9 10 11]

It was agreed that one of the main issues in this area is the fact that the guidelines for the contents of the medical chest have been produced by the World Health Organization (WHO), but unfortunately these are not in line with current best

[9] http://whqlibdoc.who.int/publications/2010/9789241547994_eng.pdf.
[10] International Maritime Organization MSC/Circ.1172.
[11] International Maritime Organization MSC/Circ.1042.

practice and often do not accord with the practical needs of crewmembers or with those of TMAS when advising ships. Discussions between all interested parties, including the three United Nations agencies, flag state authorities, ship operators, TMAS providers and marine pharmacists, would be of benefit and help to ensure consistency between nations and therefore allow consistency in the content of the training courses. Again, whilst there is a minimum requirement set out, compliance to this is variable between flag states, ship owners etc., and enforcement of these standards differs between states. There are also significant shortcomings in the quality of medications supplied to ships in some countries and this may lead to ineffective or dangerous products being present on board. Cost is of course an issue, but a simple list of required medication and equipment and advice on the need to obtain supplies from quality assured pharmacies would assist in improving the level of medical care received by seafarers at sea.

### *National and international medical guides, including advice on dangerous cargoes*[12] [13]

Again, all agreed that there is a 'system' in the form of the IMGS, a WHO publication, now in its 3rd edition. In many cases individual nations have developed their own publication(s) as an equivalent to the international guide. There are weaknesses with the original guide that include:

— issues with accessing the contents quickly and easily;
— the original document is only available in a limited number of languages;
— it is not aligned with the training syllabuses produced by IMO;
— it is not clear and concise in its guidance on the management of medical emergencies;
— it does not include guidance on the use of point of care diagnostics.

The limitations in the list of recommended contents for the ships medical chest that is included in an addendum to the IMGS 3rd edition are covered above. Again the publication and use of national equivalents to the international guide does not aid consistency in training or the delivery of medical care at sea by officers of one nationality, trained in one country but sailing on a ship under a different flag and treating seafarers of a third nationality.

Ideally the IMGS should now be revised and rewritten in a simple to use format, based on agreed international best practice. The principles of medical practice are largely shared between states and many of the practical aspects can be learnt from the experience available within the industry itself. The same guide should be accepted by all states. It will require time, money, and appropriate legislation to make this a reality but first the need for such an approach must be recognized and agreed by all relevant interest groups.

### *Telemedical advice and medevac arrangements*

There is an international framework, and this is specified in several of the conventions mentioned above. However, the level of training for staff is often low and very variable and there is often miscommunication due to language issues. This may be reduced using pictures and written instructions. Other issues include:

— miscommunication due to language issues;
— training differences between countries;
— cultural barriers;
— the use of trade names for medicines.

With the improvements in satellite technology there is scope for improving the service offered by TMAS providers to seafarers and this was the subject of an IMHA workshop held in February 2013.

## ***Second group session: Would an approach based on treatment pathways aid the management of medical incidents at sea?***

Each group looked at a different set of medical conditions that may arise at sea and considered the use of treatment pathways in the management of these situations.

### *Major injuries — threatening life, limb, or sense organs*

The management of these situations relies on good first aid and basic airway management with the control of bleeding. It was agreed that pathways would be useful to focus on initial care. Whilst shore based equivalents have been shown to have benefit if the patient can reach advanced medical care within 6–8 hours this may not be possible in all cases of a major injury at sea. However, pathways would be appropriate for cases at sea up to and including the first recommended point

[12] International Medical Guide for Ships. 3rd ed. http://apps.who.int/iris/handle/10665/43814. ISBN 978-92-801-15444.
[13] International Maritime Dangerous Goods Code Supplement. ISBN 978-92-801-1598-7.

of contact with a TMAS provider. They would have to continue past this point in case such contact was not possible, but it should be recognized that after this point the many variables in a particular situation may mean that the pathway will become too complicated to be of use. The pathways should be symptom based and assist in improving training, not just increase the requirement for more pieces of equipment. They should also be generic wherever possible to reduce confusion. They may also be particularly useful in training drills and role play scenarios.

### *Acute life-threatening illness*

Again, it was agreed that pathways could be beneficial in the management of these cases. They should be symptom based in a similar way to those used by the British Association of Immediate Care and must include indications on when to call for help. However, the use of pathways in this and any other situation must be accompanied by appropriate training, and they must not be seen as an obstacle to independent thinking. Neither should they be considered a substitute for effective training and the regular practice of skills in basic resuscitation. Training should help to ensure that the correct pathway is followed, and that care is delivered quickly in a structured and effective way. The use of pathways needs to be implemented in parallel with changes to the training modules and alongside review of the contents of the medical chest to ensure that all are integrated. Integration with the training of TMAS doctors may also help to improve communication at this stage.

### *Minor injuries — temporarily disabling*

There are many examples of situations where the use of pathways in these situations has been shown to work well, e.g. 'walk-in centres' for primary care in the United Kingdom. The pathways may require some adaptation to reflect the very different environment of the seafarer, but the approach could easily be replicated. Here the aim is to get people back to work and the initial care could be supplemented by pathways that include appropriate follow-on care, e.g. exercises, wound dressing etc., perhaps with video clips to demonstrate these. Again, the group stressed that pathways must not become a reason not to think and that there must be integration with training and the contents of the medical chest. It was also pointed out that documentation showing that a particular pathway was followed appropriately by the officer responsible for medical care may be of benefit to the ship owner and P&I club with regards to ongoing treatment and any need for repatriation, retraining or compensation.

### *Less severe and immediate illness, including health concerns, physical and mental*

These are often pre-existing conditions, and it is a commonly held opinion that such conditions now form the majority of medical conditions that require care at sea. Although there may not be similar pathways in use on shore it was again felt that treatment based on pathways would be beneficial to understand the priorities and objectives of care and to assist in effective communication with TMAS providers.

In the general discussion that followed several key points were raised and reiterated:

- the use of pathways would be useful in all situations where medical care is delivered at sea;
- seafarers are used to using checklists and they work in this way all the time; hence pathways will be a familiar way of thinking;
- all pathways need to be simple, in a number of languages and fully integrated with training, the contents of the medical chest and the expectations and requirements of TMAS providers;
- language and ease of communication is always a barrier and TMAS doctors, trainers etc. must use the same pathways; not only is it essential to train the seafarers in the use of pathways but also the instructors and TMAS doctors;
- the structure of the training will have to change slightly but this shouldn't mean additional time or money;
- the use of clinical cases to train seafarers in the use of pathways would be beneficial and effective;
- pathways must be generic where possible rather than producing too many specific pathways and they should contain check-points to help the officer responsible for medical care and TMAS doctor to ensure that the correct one is being followed.

## ***Third group session: The development of a programme for maritime health care pathways***

### *Formats and styles*

It was agreed that a paper manual/handbook of some description is probably necessary to ensure that all seafarers, whatever vessel they are serving on, will have access to the relevant information. However, all the information should also be available on a computer-based system as these are much easier to keep up to date and more cost effective to develop and maintain. A computer system would also enable the use of videos that could form part of a revised training course. Any system of presentation should be symptom based and have easy and obvious links to the more detailed medical guidance.

### *Priority topics for development work*

It is difficult to see how one area can be prioritised over another. All efforts should be aligned to ensure consistency and the introduction of pathways must be integrated with changes in training (of the seafarer, trainer and TMAS doctor) and with review of the contents of the medical chest. All changes should have the support of TMAS doctors as they are the shore-based staff who interact most often with seafarers involved in the management of medical emergencies at sea. Hence, they are in a unique position to advise on what is required. Ideally this would be supported by relevant research.

### *Interactions with current provisions for medical care at sea*

How do we develop from where we are now towards a future based on improved systems for medical care at sea? The aim should be to raise the baseline and ensure consistency in all areas. This can only be done with a holistic and integrated approach involving all interested parties and providers, state and commercial. Whilst it is accepted that the proposed change in approach may take several years to implement there are small changes that could be made quickly to bring some areas of care at sea in line with recognized best practice on shore, e.g. the inclusion of Tranexamic Acid in the medical chest for use in major haemorrhage. Adopting the practice of some of the best providers of training, reviewing the contents of the medical chest, revising medical guides to use treatment pathways, and improving TMAS support would all be good starting points. There is no need to be revolutionary, but rather to encourage evolution and adoption of the best in current practices.

### *How to gain acceptance for the care pathway approach from the maritime sector and how to incorporate it within the relevant international conventions*

Once a selection of pathways specific to the maritime environment have been developed it will be necessary to obtain the support of all the key organizations within the maritime industry. These include the United Nations agencies, ship owners, representative bodies for seafarers, the training providers, TMAS providers, marine pharmacists and of course the governments of individual states. The benefits of such an approach will primarily be improved care at sea, hopefully with a secondary reduction in the frequency that shore based advisers recommend evacuation or diversion, and hence reduced costs for evacuations, repatriations, and the associated tasks of replacing staff and potential interruption to the ship's schedule and function. Whilst there will be costs associated with the development of the system it is expected that over a number of years these will be more than offset by the advantages outlined.

## Conclusions and the next steps

There is currently a system underpinning provisions for the delivery of medical care at sea, but the provisions are included in many conventions. The standards required are low and these are often not adequately enforced.

We need research to demonstrate the frequency and type of medical situation encountered by seafarers. This will enable us to prioritise the development of pathways, the need for training etc. Moving forward we would ideally establish a common medical reporting form to be used on all ships and shared on a regular basis to allow ongoing monitoring of the cases managed at sea.

The management of a medical incident at sea should be a seamless process from the presentation of the crewmember with a medical complaint to the officer with medical responsibilities, to contact with TMAS services and appropriate management. All components should be integrated to ensure that medical incident management is optimal.

The management of a medical incident is itself part of the whole medical system which may include medical selection of seafarers, health and safety at sea, health promotion, medical incident management, TMAS support, evacuation if required, shore-based care, repatriation, and rehabilitation.

Seafarers are international. Regardless of the flag of the ship, the nationality of the owner etc., the target group for improved care is international and any change must be international to address this. Hence guidelines must be international.

With reference to the MLC statement, health care on board a ship is most comparable to that received in a pre-hospital setting on shore. The adoption of treatment pathways for use at sea could help make this a reality.

The development of a system based on treatment pathways would be suitable in all types of medical and trauma cases seen on board ship.

The starting point in the development of a new system should be the development of symptom-based pathways relevant to the maritime environment and the likely case mix, based on the results of research.

The introduction of treatment pathways needs to be integrated and form the basis of change to training, review, and revision of the contents of the medical chest, review, and revision of the international medical guide available to seafarers and the approach of TMAS providers in a 'one package' approach.

All users of the new system will need training in its aims, priorities, and use. This includes seafarers, the trainers themselves and the TMAS doctors to ensure familiarity of the system to all involved.

This itself will need harmonization of training between different countries and different organizations within each country. It should be recognized from the outset that each of the 175 members of the IMO will have their own priorities and that to move forward with change will require new legislation and one common framework acceptable to all the United Nation's agencies concerned.

The new system itself will require regular review, quality assurance and modification as necessary. Again, the whole system will need to be integrated so that a change in one area is reflected and incorporated into all of the other components.

There will be barriers to change, and these will include economic, cultural, and regulatory issues. Full engagement with all interested parties will be necessary to ensure the success of any new system.

The development and introduction of a system based on treatment pathways will require financial support and a working group of interested, experienced persons to take the initiative forward. Any programme development will need to work to a pre-defined timeline with milestones and key performance indicators. A reference group made up of representatives from the maritime authorities and social partners should be established to oversee the working group.

Although this is a large task it has precedent. The revision of the IMO/ILO medical guidelines for seafarers started as an IMHA initiative and over time has become accepted and adopted internationally. We have a starting point and shore-based experience on which to build. The enthusiasm present during the workshop indicates that change is required and is feasible and that this is a good time to begin the process.

The discussions and conclusions were summarized in a consensus statement that was agreed by all participants at the end of the meeting.

## Consensus statement

### *Background*

The ILO/IMO Maritime Labour Convention sets the requirements for on board health protection and medical care. Its Code includes standards for measures aimed at providing seafarers with health protection and medical care as comparable as possible to that which is generally available to workers ashore.

IMHA convened a workshop to address concerns raised in the management of medical incidents at sea. Current management includes the following aspects that are not always integrated in their delivery:

— training in medical care and medical first aid at sea;
— medical stores, equipment and facilities on board, including 'doctors' bag' on ferries;
— national and international medical guides;
— telemedical advice and medevac arrangements.

In consequence of this health care for seafarers is far from optimal and there are considerable difficulties in ensuring international consistency.

There is a common regulatory framework although this involves a number of conventions and recommendations. These are then redrafted as national regulations and guidance. As medical care at sea is a small part of a number of conventions change will not be easy.

### *Current experience*

A case series of medical incidents at sea presented at the workshop demonstrates that earlier involvement of TMAS and the availability of/increased use of point of care diagnostics will increase diagnostic certainty and may potentially reduce over triage and costly disembarkations.

It is estimated that on average a ship experiences one serious medical incident every 2 years so each seafarer trained in medical care can only expect to see such a case every 4 years.

Trends reported verbally from TMAS vary but tend to indicate a reduction in trauma cases and an increase in medical cases, particularly issues related to chronic disease. The average age of seafarers requiring disembarkation has also increased.

Experience, training, and knowledge are key to the management of medical incidents. This is not only true for the trained officer but also for the TMAS doctor.

Treatment pathways are used successfully in a number of remote care environments. However, they are NOT a replacement for education, clinical knowledge, physician judgment or common sense. They are also not protocols but a set of guidelines within which to work.

### *Issues identified*

There is a system and the strength of that is that it does give minimum standards. However, these are low, and they are not always enforced by the relevant authorities.

Most incidents involve dealing with common problems although most of the training is concerned with the management of emergencies. There is little research to demonstrate the number and types of incidents that are handled on board.

There are language and cultural barriers between officers and crew of different nationalities and with doctors of yet another nationality.

There are sometimes barriers to joint initiatives between the United Nations agencies.

#### *Training*

There is huge variability in the training given, both the content and the method of training. Currently there is audit of trainers in some countries but not by people with a background in maritime medicine.

The standard of knowledge and skills of seafarers when they attend for refresher training after 5 years is often poor and alternative models for maintaining, and potentially improving, knowledge and skill levels should be considered.

#### *Medical chest and equipment*

There is variation in the requirements for the contents of the medical chest internationally. These are also often not consistent with current best practice. This leads to significant difficulties in providing appropriate training and in communication with TMAS services. Many officers are not familiar with the contents of the medical chest and the use of proprietary names for medication may lead to additional confusion. In addition, there are major concerns about the standard of medication and the means of transportation and storage.

#### *Medical guide*

The current edition of the International Medical Guide for Ships is outdated with regards to many recognized best practice guidelines. National equivalents vary in style, content, and quality.

#### *TMAS*

Language is frequently an issue. Although English is the recognized language of the maritime industry the English capability of many seafarers does not include medical terms.

There are inconsistencies in the quality of information that seafarers are able to provide to TMAS.

### *The way forward*

The management of a medical incident at sea should be a seamless process from the presentation of the crew member with a medical complaint to the medical officer, to contact with TMAS services and appropriate management. All components should be integrated to ensure that medical incident management is optimal.

The management of a medical incident is itself part of the whole medical system which may include medical selection of seafarers, health and safety at sea, health promotion, medical incident management, TMAS support, evacuation if required, shore-based care, repatriation, and rehabilitation.

Seafarers are international. Regardless of the flag of the ship, the nationality of the owner etc., the target group for improved care are international and any change must be international to address this. Hence guidelines must be international.

#### *Treatment pathways*

The introduction of treatment pathways must be part of an integrated approach to the management of medical incidents at sea and must have international agreement.

They could be used in all areas of medical incidents at sea — trauma, acute life-threatening illness, minor injuries, and less severe and immediate illness. It may be possible to adapt treatment pathways that are currently available for use in other settings, e.g. walk in centres, the military and pre hospital care. However, it would need to take into consideration the training and skill level of a seafarer and the logistics of a ship at sea.

These should be simple and relevant to what the seafarer encounters. They should be available in different languages. Provision should be made for standardised collection and documentation of information for transmission to TMAS. Pathways may be particularly useful to guide care up to the point of contact with TMAS and in alerting seafarers to ‘red

flags' (conditions or presentations of illness or injury which may be life or limb threatening) and when to seek further assistance. They will need to extend past the first recommended point of TMAS contact in case this is not possible.

Should be symptom based and aimed at practical case handling rather than diagnosis.

### *Training*

Training needs to be based around the treatment pathways and there is a need to train the trainer in their use as well as the seafarer and the TMAS staff. More regular and in-depth training is required anyway, and the introduction of treatment pathways should not have a huge impact on this. Training should be supported by e-learning and practical drills to ensure the maintenance of skills and knowledge. Clinical cases and scenario training should be incorporated into the training.

Training is an essential component and implementation of pathways should start there.

### *Medical chest and equipment*

The contents of medical chests must be reviewed, their contents and presence on board regulated and standardized. Any review should be guided by the treatment pathways but also by input from TMAS providers.

### *Medical guide*

The pathways must be supported by additional information in the form of a manual.

The medical guide should be an international publication based on best practice. There should be one international guide only. There are many lessons that can be learned from publications already available within the medical field.

The use of IT systems should be maximised in the delivery of information, but we still need a hard copy.

### *TMAS*

The increased use of written emails, pictures, and video consultations where appropriate would help to reduce misunderstanding in communication particularly now satellite communication has been improved.

## ***Potential challenges to overcome***

Note: It is essential to engage all interested parties at an early stage.

### *Economic*

It will be necessary to demonstrate financial benefits to the interested parties. This system should decrease the current harmful and wasteful variation in practice, e.g. a reduced number of evacuations and diversions, improved health care outcomes for seafarers with reduced insurance claims and safer ships.

The sale of a medical guide is revenue generating for maritime nations, this needs to be addressed should the guide be produced internationally.

### *Cultural and political*

Nations would need to sacrifice a certain amount of autonomy in order to adopt an international system.

### *Regulatory*

A change to the regulations resulting from cooperation and collaboration of the international agencies is essential. Other sectors of the industry also need to recognize the importance of this area and that change is needed.

## ***The next steps***

After wider discussion a working group will need to be established with clear guidelines and timelines. A reference group will also need to be established with representatives from the relevant international agencies, social partners, and national maritime authorities in an appropriate timeline.

Research is necessary to establish the numbers and types of cases that the seafarer encounters. This can guide the priorities for pathway development and for training.

Any new system of medical incident handling must be reviewed on a regular basis with appropriate audit, feedback, and research. Quality assurance and enforcement is key to the success of.

# INFORMATION FOR AUTHORS

The International Maritime Health will publish original papers on medical and health problems of seafarers, fishermen, divers, dockers, shipyard workers and other maritime workers, as well as papers on tropical medicine, travel medicine, epidemiology, and other related topics.

Typical length of such a paper would be 2000–4000 words, not including tables, figures and references. Its construction should follow the usual pattern: abstract (structured abstract of no more than 300 words); key words; introduction; participants; materials; methods; results; discussion; and conclusions/key messages.

Case Reports will also be accepted, particularly of work-related diseases and accidents among maritime workers.

All papers will be peer-reviewed. The comments made by the reviewers will be sent to authors, and their criticism and proposed amendments should be taken into consideration by authors submitting revised texts.

Review articles on specific topics, exposures, preventive interventions, and on the national maritime health services will also be considered for publication. Their length will be from 1000 to 4000 words, including tables, figures and references.

Letters to the Editor discussing recently published articles, reporting research projects or informing about workshops will be accepted; they should not exceed 500 words of text and 5 references.

There also will be the section Chronicle, in which brief reports will be published on the international symposia and national meetings on maritime medicine and health, on tropical parasitology and epidemiology, on travel medicine and other subjects related to the health of seafarers and other maritime workers. Information will also be given on training activities in this field, and on international collaborative projects related to the above subjects.

**All articles should be submitted to IMH electronically online at www.intmarhealth.pl where detailed instruction regarding submission process will be provided.**

Only English texts will be accepted.

Manuscripts should be typed in double line spacing on numbered pages and conform to the usual requirements (Ref.: International Committee on Medical Journals Editors. Uniform Requirements for Manuscripts Submitted to Biomedical Journals, JAMA, 1997; 277: 927–934).

Only manuscripts that have not been published previously, and are not under consideration by another publisher, will be accepted.

Full texts of oral presentations at meetings (with abstracts printed in the conference materials) can be considered.

All authors must give written consent to publication of the text.

Manuscripts should present original material, the writing should be clear, study methods appropriate, the conclusions should be reasonable and supported by the data. Abbreviations, if used, should be explained.

Drugs should be referred to by their approved names (not by trade names). Scientific measurements should be given in SI units, except for blood pressure, which should be expressed in mm Hg.

Authors should give their names, addresses, and affiliations for the time they did the work. A current address of one author should be indicated for correspondence, including telephone and fax numbers, and e-mail address.

All financial and material support for the reported research and work should be identified in the manuscript.

## REFERENCES

References should be numbered in the order in which they appear in the text. At the end of the article the full list of references should give the names and initials of all authors (unless there are more than six authors, when only the first three should be given followed by: et al.).

The authors' names are followed by the title of the article; the title of the journal abbreviated according to Medline; the year of publication, the volume number; and the first and last page numbers. **Please note:** References you should include DOI numbers of the cited papers (if applicable) – it will enable the references to be linked out directly to proper websites. (e.g. Redon J, Cifkova R, Laurent S et al. Mechanisms of hypertension in the cardiometabolic syndrome. J Hypertens. 2009; 27(3): 441–451, doi: 10.1097/HJH.0b013e32831e13e5.).

Reference to books should give the title, names of authors or of editors, publisher, place of publication, and the year.

Information from yet unpublished articles, papers reported at meetings, or personal communications should be cited only in the text, not in References.

For full information for authors refer to the web page: www.intmarhealth.pl.

# CONTENTS



"International Maritime Health" is indexed at: CrossRef, DOAJ, EBSCO, ESCI, FMJ, Google Scholar, Index Copernicus, Medical Journals Links, Medline, Polish Ministry of Education and Science, Polish Medical Bibliography, Scopus, SJR, Ulrich's Periodicals Directory, WorldCat.