2022, Vol. 73, No. 3

ISSN 1641-9251
eISSN 2081-3252

International Maritime Health, 2022, Vol. 73, No. 3

INTERNATIONAL MARITIME HEALTH

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

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

VIA MEDICA

21-0523.003.001

Subscription rates: Paper subscription, 4 issues incl. package and postage institutional — 120 euro.
The above prices are inclusive of regular postage costs. Payment should be made to: VM Media sp. z o.o. VM Group sp.k., Grupa Via Medica, Bank BGŻ Paribas 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 sp. z o.o. VM Group sp.k., 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.

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

INTERNATIONAL MARITIME HEALTH

EDITORIAL ADVISORY BOARD:

CONTENTS

VIA MEDICA

EDITORIAL ANNOUNCEMENT

Int Marit Health
2022; 73, 3: 101
10.5603/IMH.2022.0018
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Letter from the Editor

Dear Readers,

After nearly 10 years of my activity as the International Maritime Health (IMH) Editor-in-Chief I am stepping down.

The work for the Journal was a great experience, honour and pleasure.

Working for the International Maritime Health brought me the opportunity to meet a lot of people engaged in the maritime medicine, new colleagues and friends. I am very thankful for our cooperation and friendly, personal meetings.

Editor-in-Chief position is a cooperation with Writers, Reviewers and Publisher to prepare the issue one by one. In my case it was approximately 40 volumes and 400 articles.

Let me remind you that the International Maritime Health is being issued since 1949. It is the scientific Journal and official scientific forum of the International Maritime Health Foundation (IMHF).

International Maritime Health is an important knowledge exchange platform for many Societies of maritime medicine in Europe and all over the world.

International Maritime Health mainly focuses on: maritime medicine but also on tropical medicine, hyperbaric and diving medicine, travel medicine, navy medicine, maritime psychology, maritime toxicology, hygienic problems on ships, harbour sanitary problems, fisherman health problems, mental health and health promotion at sea. The Journal accepts original articles, review papers, case studies, reports, pilot studies, letters to the Editor, comments, announcements and others.

The Journal is being issued quarterly, is highly indexed and has open electronical editing system and open — free access.

At the same time, I am pleased to announce that newly designated International Maritime Health Editor-in-Chief is Doctor Marta Grubman-Nowak from the Institute of Maritime and Tropical Medicine in Gdynia.

I wish her success and satisfaction. It is possible only in cooperation with readers, writers and reviewers. I am truly interested in the International Maritime Health further growth. The Journal is very close to my heart.

I would like to thank the entire Editorial Board of International Maritime Health and the Publisher, Via Medica. The cooperation with IMH Team was a great pleasure.

I hope that my editorial activity contributed to the development of International Maritime Health.

I wish the same to my successor and I promised to stay in the IMH Team.

Kindest regards

Maria Jeżewska
Honorary IMH Editor-in-Chief

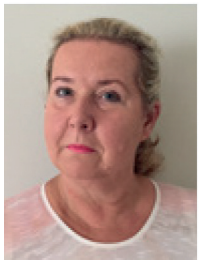
VIA MEDICA

EDITORIAL ANNOUNCEMENT

Int Marit Health
2022; 73, 3: 103
10.5603/IMH.2022.0019
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Editor-in-Chief of the International Maritime Health journal, Maria Jeżewska, is stepping down



Editor-in-Chief for the International Maritime Health (IMH) journal Maria Jeżewska, stepped down from her role by first July 2022. She will assume the title of Honorary Editor-in-Chief and will take part in the editorial process, even if stepping down from being the overall responsible editor.

Maria Jeżewska graduated from the University of Gdansk in 1984 and specialised in clinical psychology. She defended her doctorate thesis in 2001 at University of Stefan Wyszynski in Warsaw. Since 1986 she has been working at the Institute of Maritime and Tropical Medicine in Gdynia, as the Head of the Laboratory of Occupational Psychology — Clinic of Occupational and Internal Diseases.

Her clinical activity has included areas of clinical psychology and occupational psychology, mainly of people working at sea. She is a lecturer for students at the Medical University of Gdansk and Gdynia Maritime University, as well as for physicians of maritime and tropical medicine.

She is a member of the Polish Society of Maritime Tropical and Travel Medicine, where she is the current Vice President, and secretary of the Section of Maritime Medicine in the Polish Academy of Science.

She has been the Editor-in-Chief since 2012, when she succeeded Professor Bogdan Jaremin. Under her leadership the ownership for the IMH has been transferred from the Polish Society of Maritime, Tropical and Travel Medicine, to the newly formed International Maritime Health Foundation (IMHF). She has worked hard, always delivering the issues punctually. The IMH has grown and continued to inform maritime health professionals internationally on advances in maritime health research, as the only indexed scientific journal of maritime health in English in the world.

She will be succeeded by Doctor Marta Grubman-Nowak, who already has been working as an editor of IMH together with Maria for several years.

We are grateful that Maria Jeżewska's expertise, professionalism and commitment still will be available to the journal, in her new position as Honorary Editor-in-Chief and express our gratitude for her excellent work during more than 10 years of service to the journal, the IMHF and professionals of maritime health worldwide.

On behalf of the IMHF

Alf Magne Horneland
President of the IMHF Management Board

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2022; 73, 3: 105–111
10.5603/IMH.2022.0020
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Multi-purpose transport monitoring of passenger-cargo traffic in Ukraine

Mykola Kucherenko[1], Halyna Mostbauer[2], Oksana Strus[3], Victoria Glushchenko[4], Lina Kovalchuk[4], Elena Bobro[4], Tatyana Shelest[1]

[1]International Humanitarian University, Odesa, Ukraine
[2]Bogomolets National Medical University, Ukraine
[3]Lviv National Medical University named after Danylo Halytsky, Ukraine
[4]South Ukrainian National Pedagogical University named after K.D. Ushynsky, Odesa, Ukraine

ABSTRACT

Background: *The epidemiological and environmental security of states is the most important component for the functioning of the International Transport Corridors (ITC). The growing capacity of passenger and cargo flows increases the risk of the spread of dangerous infectious diseases in the territories of the countries on the route of the ITC. Preventing the introduction of dangerous infections by various vehicles and the activation of local natural foci are the priority in the anti-epidemic provision of the population of Ukraine.*

Materials and methods: *The study of the features of the functioning of border checkpoints (BCPs) for various types of transport in different regions of Ukraine made it possible to create their classification, taking into account the nature of the goods and the intensity of passenger traffic.*

Results: *The functioning of 204 checkpoints in 20 different localities, employing more than 29,000 specialists, was studied. When conducting a retrospective epidemiological analysis of documentation for maritime, aviation, road and rail transport for 2000–2013, non-compliance with sanitary-hygienic and anti-epidemic requirements to prevent the introduction and spread of dangerous infections and their carriers were revealed. The authors scientifically substantiated recommendations on sanitary-hygienic and anti-epidemic support of the BCP. Based on the results of a survey of 112 BCPs (54.9 ± 1.2%), taking into account the degree of epidemiological danger in the areas of their operation, indicators of the presence of rodents, blood-sucking insects and the nature of the goods transported, five epidemic zones were identified.*

Conclusions: *Inadequate operation of the BCP was expressed in non-compliance with sanitary and anti-epidemic requirements. Control of the personal property of passengers and luggage was less than 30%. The analysis of the functioning of the BCPs made it possible to unify their work and identify priority areas for improvement.*

(Int Marit Health 2022; 73, 3: 105–111)

Key words: biological safety, border checkpoints, epidemiological safety, international transport corridors, state border

INTRODUCTION

The Rules for the Sanitary Protection of the Territory of Ukraine No. 893 dated 22.08.2011 regulate the list of infectious (parasitic) diseases (as amended by the Decree of the Cabinet of Ministers of Ukraine No. 272 of 04/08/2020), requiring special measures for the sanitary protection of the territory.

The deepening globalisation plays a leading role in maintaining interstate economic, logistical, cultural, and tourism ties.

Dr. Mykola Kucherenko, International Humanitarian University, Fontanska Road 33, 6500 Odesa, Ukraine, e-mail: docnickolask@gmail.com

Received: 12.09.2022 Accepted: 30.09.2022

To improve the efficiency of foreign trade and transit relations, the interested European-Asian states formed the system of International Transport Corridors (ITC) [1–5].

The favourable geographical location of Ukraine in the centre of the Eurasian transport systems predetermines its role as a powerful transit state [6–8].

This is confirmed by the existing system of Pan-European transport corridors covering the territory of Ukraine, including the Western, Transnistrian, and Black Sea regions with their environmental and man-made changes in the environment that have been developed in recent years [9, 10].

According to World Health Organization (WHO), about 1 billion people globally are affected by parasitic diseases.

Two hundred forty-one million cases of malaria were reported worldwide in 2020 (227 million cases in 2019). The number of deaths from malaria in 2020 is estimated at 627,000 people.

The list of malaria endemic countries includes Bangladesh, Bhutan, Brunei, Vietnam, India, Indonesia, Yemen, Cambodia, Laos, Nepal, Oman, Pakistan, Timor-Leste, Philippines.

According to the Centre for Public Health of the Ministry of Health of Ukraine, malaria transmission occurs in 87 countries around the world. A significant proportion of the global incidence of malaria, according to WHO, occurs in the African Region. In 2020, the Region accounted for 95% of all malaria cases and 96% of fatal malaria cases worldwide. At the same time, children under the age of 5 years accounted for 80% of all deaths from malaria.

The number of imported cases of malaria in Ukraine in recent years has fluctuated widely from 168 cases in 2003, 34 cases in 2009, 14 cases in 2020, to 26 cases in 2021 which indicates an unpredictable and uncontrollable trend in this nosology.

Malaria infections in Ukrainian citizens reported in 2000–2014 mainly (90.0%) occurred in visitors to South-West Africa: Guinea, Liberia, Cameroon, Nigeria, and Benin.

An essential component of malaria control and elimination strategy is vector control. Unfortunately, this is significantly hindered by the growing resistance of Anopheles mosquitoes to modern insecticides. Mixed malaria infections, i.e. cases when 2–3 pathogens are simultaneously introduced into the human body are increasingly more common [11, 12].

Natural focal infections also pose a certain threat in places where a large number of vehicles and people are congested at the border. The main source of these infections is wild, agricultural, domestic animals and mouse-like rodents living in the open air or in residential buildings or outbuildings.

Infection occurs through contact with sick animals, environmental objects, drinking water or eating food contaminated with rodent secretions, as well as through animal bites and bites of blood-sucking insects.

Recently, a number of authors have pointed to the need to organize urgent measures to prevent the introduction and spread of viral haemorrhagic fevers and other dangerous infections in Ukraine. To this end, it is proposed to create specialized diagnostic laboratories for the early detection of natural focal, tropical and exotic diseases directly at border checkpoints (BCPs) [13–23].

Another epidemiological problem associated with the functioning of the "Western Europe–Western China" ITC is the high risk of bringing a particularly dangerous infection — plague — into Ukraine.

According to WHO, only from 1989 to 2004, about 40,000 cases of plague were recorded in 24 countries, with a mortality rate reaching 7%. In a number of countries in Asia (Kazakhstan, China, Mongolia, Vietnam), Africa (Congo, Madagascar), and the Western Hemisphere (USA, Peru), human cases of plaque are recorded almost every year.

About 2,500 cases of plague are registered annually in the world. At the same time, most cases (about 1000 cases per year) are recorded in the small Congolese province of Ituri.

In Russia, a natural focus of plague exists within an area of more than 253,000 km^2. This means that more than 20,000 people living in the area are at risk of infection.

The situation is further complicated by the fact that every year new cases of the disease are detected in the states bordering Russia (Kazakhstan, Mongolia, China). There is a significant risk of importation of the plague vector *Xenopsylla cheopis* from Southeast Asia (traffic flows). From 2001 to 2006, 752 strains of the plague pathogen were identified in Russia.

From 2001 to 2003, 7 cases of plague were registered in the Republic of Kazakhstan (including 1 death), in Mongolia — 23 (including 3 deaths). In China in the period 2001–2002 109 people were infected (including 9 deaths). The forecast of the epizootic and epidemic situation in the natural foci of the Republic of Kazakhstan, bordering the Russian Federation, remains unfavourable today (where natural plague foci are present on 39% of the territory). A similar situation remains on the border with China and Mongolia.

There is a continuing risk of introducing plague from Mongolia and China by air transport.

The risk of plague importation from areas with high epizootic activity (taking into account the new ITC routes) makes the development of medical and environmental forecasts a priority task for the sanitary and epidemiological service of Ukraine [24].

Medico-biological and anti-epidemic protection of vehicles and territories adjacent to the ports of the Black Sea region of Ukraine, within the framework of the national doctrine of protection against dangerous infections and alien aquatic organisms, require further development of

preventive measures for the sanitary protection of maritime borders [25].

Thus, in the territories where various types of vehicles cross the state border of Ukraine, due to the increase in passenger and freight traffic, along with environmental pollution, taking into account the climatic, zoogeographical and faunistic features of the region, the risk of transboundary penetration and spread of viral, bacterial and parasitic infections remains high. This is evidenced by literature data on diseases associated with the transfer of pathogens over long distances by various vehicles [26, 27].

Therefore, the primary task of the sanitary and epidemiological service of Ukraine is the constant monitoring and forecasting of possible ways of importing dangerous infections from neighbouring countries by sea, air and land.

The authors studied the incidence and prevalence of the most significant natural focal infectious and parasitic human diseases (including malaria). Currently, the epidemiological and prognostic situation in Ukraine remains tense [28–32].

The incidence of certain diseases among the population of Ukraine and intensive indicators of nosology forms were studied in dynamics for the period 1986–2000. The dominant ones were: leptospirosis — 88.25% (Vinnytsia, Zaporizhzhia, Kirovograd, Lviv, Mykolaiv, Odesa regions), tularaemia — 8.12% (Mykolaiv, Odesa, Donetsk, Cherkasy regions), anthrax — 3.05% (Donetsk, Kherson, Cherkasy regions, Autonomous Republic of Crimea) a growing trend has been observed. In recent years, sporadic cases of rabies, ornithosis and Q fever have been noted: 1.53%, 1.19%, 2.29%, respectively. The incidence of imported malaria (87.93%) is increasing in Ukraine.

Since the beginning of 2020, 680 cases of rabies in animals have been registered in Ukraine, including 221 cases in wild animals, and 459 cases in domestic and farm animals. In general, the largest number of cases of rabies was registered in the Vinnytsia region — 147, Kyiv region — more than 90 cases (mainly among domestic animals) and Donetsk region — 61 cases.

It should be taken into account that various vehicles transporting dangerous goods from Asia, Africa and South America can also be a potential source of importation of pathogens and their ectoparasites.

Particular attention should be paid to the study of border areas on the routes of migratory flights of birds. There is a real threat of the introduction of viruses and their carriers from various wintering areas, where strains of West Nile fever from Culex mosquitoes were previously isolated on the territory of Ukraine. As of August 27, 2020, the European Centre for Disease Prevention and Control (ECDC) reports of 122 cases of West Nile fever including 10 fatalities. The cases have been reported in Greece (54 cases, including 8 deaths), Spain (44 cases, including 2 deaths), Italy (22) and Romania (2) [33].

According to the Centre for Public Health in Ukraine, there are also enzootic territories for West Nile fever. Compared to 2020 (1 registered case of the disease), in 2021, 6 cases of West Nile fever were registered in Ukraine.

The formation of such enzootic natural foci of infection is facilitated by the climatic and environmental features of the Ukrainian Black Sea region.

The risk of contracting diseases such as Lassa fever, Ebola virus disease, as well as Q fever, viral mosquito fevers, and viral meningitis is increasing (14 cases in 2021 against 48 in 2020). These diseases were identified and described in Ukraine in the 1980s. Sporadic cases of Q fever have been registered in almost all regions of Ukraine and in the Autonomous Republic of Crimea. In a number of regions (Chernivtsi, Ivano-Frankivsk, Zakarpattia, Mykolaiv, Odesa) epidemic outbreaks were observed (transmission from farm animals).

Natural foci of Q fever were found in 10 regions of Ukraine, and in the Autonomous Republic of Crimea, Dnepropetrovsk and Lviv regions, where they have been active for more than 40 years [34–37].

When conducting a sample survey of various types of water, road, rail and air transport, non-compliance with sanitary-hygienic and anti-epidemic requirements regulating the prevention of the introduction and spread of dangerous infections and their carriers were revealed. Accordingly, the maximum number of violations in terms of passenger traffic was detected on the border with Moldova, and in terms of cargo — on the border with Poland. The lowest number of violations in terms of passenger traffic was seen on the border with Romania, and in terms of cargo traffic — on the border with Hungary.

From the nomenclature of goods (in terms of epidemic danger), animals and products of animal origin imported from Russia prevailed.

For air transport, perishable foodstuffs and medicines were the most dangerous.

Water transport was mainly used for hazardous chemicals (ammonia, liquefied gas, sulphur), ores, metal, paper, timber, coal, oil products, as well as food and agricultural products [38].

In the process of sanitary and epidemiological zoning of the BCPs according to the degree of zoological and entomological hazard and environmental risk factors, five climatic and faunal biocenoses, as well as border areas were ranked.

A set of measures has been developed to ensure the safety of international transport corridors in accordance with the current doctrine of the prevention of dangerous infectious and parasitic diseases in Ukraine [39, 40].

MATERIALS AND METHODS

MATERIALS

A comparative analysis of the materials of annual inspections of regional BCPs and a retrospective epidemiological

analysis of statistical data received from departments that ensure the operation of maritime, road, rail and air transport for the period 2000–2013 were carried out.

Two hundred and four BCPs were surveyed and classified at state border crossing points in 20 regions of Ukraine, taking into account their daily intensity of passenger and freight traffic, features of work, geographical location.

Currently, the state of health and morbidity (including infection) of seafarers working both on Ukrainian ships and on ships under a foreign flag is being constantly monitored.

METHODS

The assessment of the functioning of individual BCPs was carried out by means of selective control and observation, epidemiological analysis directly at the checkpoint in cooperation with the relevant departmental specialists during on-site inspections in the regions.

Methods for monitoring disinfection, derating and pest control measures in epidemically difficult areas of passenger and freight traffic in various regions of Ukraine have been systematised and optimized, taking into account the nature of the transported goods and vehicles.

In the process of studying and grouping the results obtained, the methods of mathematical analysis and modelling adopted in healthcare were used.

RESULTS

The functioning of 204 BCPs at 20 different locations, employing more than 29,000 specialists, was analysed.

The daily passenger flow at the inspected locations amounted to 187,847 people transported by 45,347 transport units along the entire perimeter of the state border. In the course of the analysis of the workload of freight and passenger traffic in terms of the number of employees, it turned out that the number of the latter does not correspond to the BCP category (Table 1, Figs. 1, 2).

The daily load of passenger/freight traffic on the Ukrainian borders for various modes of transport has been established. The maximum load in terms of the number of passengers and cargo was seen on the border with Russia, Poland, and Moldova, and the minimum — was on the border with Slovenia and Romania. On average, most of the cargo is transported via water transport.

In the Vinnytsia region, at 16 operating BCPs (international: 6 — motor vehicles, 1 — rail, local — 9), with daily passenger/freight traffic of 12,002 people and 4,165 units, respectively, the number of employees was 93 people. In the Autonomous Republic of Crimea at the 12 inspected BCPs (international: 11 water and 1 air) with daily passenger/cargo traffic of 4,270 people and 73 units, respectively, the number of employees was 231 people. Daily load at the BCP for passenger transportation of automobile and rail

Table 1. The daily intensity of passenger/freight traffic at the borders with neighbouring states of Ukraine

Borders with countries	Per cent ratio	
	Passenger traffic	Freight traffic
Border with Russia	19.1%	30.3%
Border with Slovenia	2.9%	1.0%
Border with Hungary	9.3%	2.8%
Border with Moldova	29.2%	5.2%
Border with Romania	1.2%	1.3%
Border with Poland	19.3%	14.8%
Border with Belarus	9.6%	7.4%
Other destinations	9.4%	37.2%

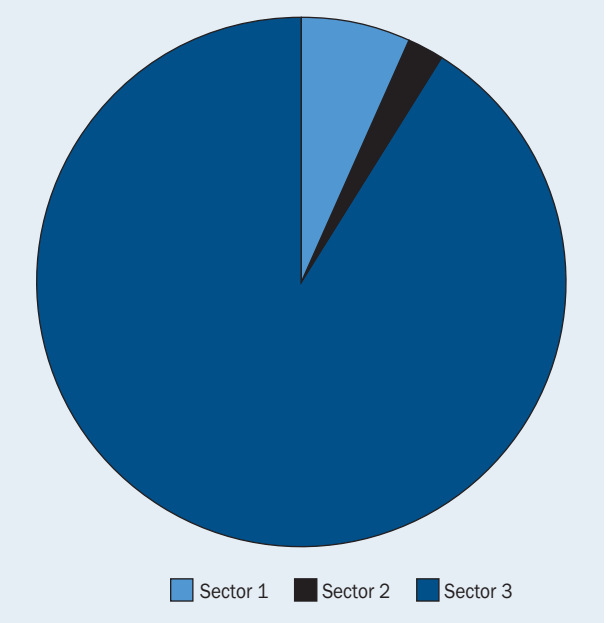


Figure 1. The ratio in per cent of passenger traffic through the border checkpoints of Ukraine: Sector 1 — aircraft — 6.7; Sector 2 — water (sea, river) vehicles — 2.4; Sector 3 — road, rail — 90.9

transport is from 90% to 20%, respectively, for other modes of transport — water and local — up to 10.0%.

Up to 92% of cargo is usually transported by water, while only 8% is transported by rail, road, air and local transport (Table 2).

The authors scientifically substantiated the criteria for assessing passenger and cargo flows, daily traffic intensity, as well as recommendations for anti-epidemic support of the BCPs across the state border of Ukraine.

Based on the analysis of the operation of 204 operating BCPs (80 ± 0.9%), studies and observations performed (over

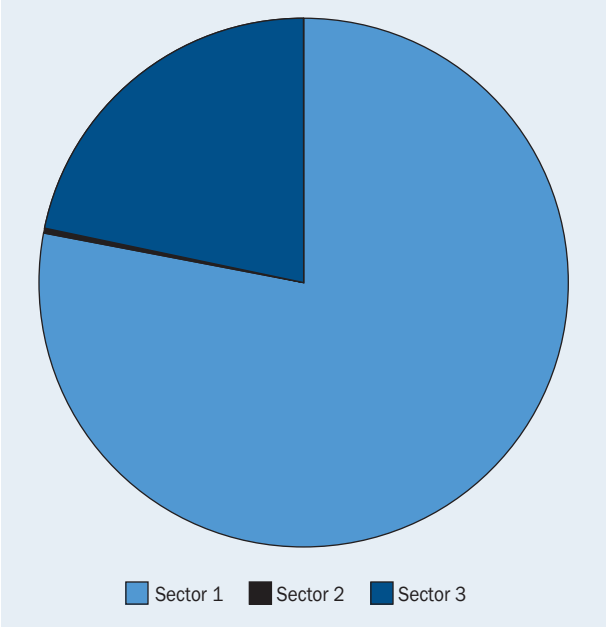


Figure 2. The ratio in per cent of cargo flows through the border checkpoints of Ukraine: Sector 1 — water (sea, river) vehicles — 78; Sector 2 — aviation — 0.3; Sector 3 — railway, road — 21.7

6000), the load on passenger transportation by road, rail and air was determined.

Potentially hazardous chemical cargoes (fuels and lubricants, fertilizers, detergents, etc.), as well as food products, are transported across the border of Ukraine mainly by rail and road. Conditionally dangerous goods (skins, down, animals and livestock products) are transported mainly from Russia and Poland. Perishable goods, medicines are mainly transported by air. Sea transport mainly transports hazardous chemicals (ammonia, sulphur, ore), as well as metal, paper, food and agricultural products.

Based on the results of the sanitary and epidemiological zoning of the border areas of Ukraine, the authors substantiated the concept of the functional structure of the outbreak and the circulation of potential sources and vectors of infections through direct and indirect links with natural factors.

According to the results of zoning of 112 BCPs (54.9 ± 1.2%), according to the degree of epidemiological danger, indicators of the presence or absence of mouse-like rodents, blood-sucking insects, taking into account the nature of the transported dangerous goods, five zones were identified: I — "entomogenic" zone (EZ), II — "zoogenic" zone (ZZ), III — "toxicogenic" zone (TZ), IV — "mixed" zone (MZ), V — "safe" zone (SZ). Of these, BCP operating on the territory of MZ — 99 BCP (88.4 ± 3.1%), TZ — 3 BCP (2.8 ± 0.1%), ZZ — 2 BCP (1.8 ± 0.05%), EZ — 2 BCP (1.8 ± 0.05%), SZ — 6 BCP (5.4 ± 0.7%) [41].

DISCUSSION

In the process of sanitary and epidemiological examination of the BCPs geographically located in heterogeneous biocenotic areas, data on regional climatic, landscape and flora and fauna characteristics were used as prerequisites for diseases. The concept of the active functional structure of the focus and the circulation of a potential pathogen (conditionally) has been developed.

Complex biocenotic connections of the landscape, physical conditions of the environment, as well as the human factor have been established.

Priority sanitary-regulated technologies for the transportation of goods and effective measures to ensure the epidemiological safety of the ITC have been optimised. The main conceptual directions of medical and environmental forecasting have been determined, and the system of measures aimed at identifying, diagnosing, and preventing natural focal diseases, the range of which is located both in the equatorial latitudes and territorially connected with the ITC, has been improved.

At the same time, the epizootic activity of plague foci is shown in Central Asia, where strains with a high epidemic potential circulate, which creates a real threat of plague importation through the territories bordering Russia. There is also a constant possibility of bringing plague from Mongolia and China by air transport corridors, where cases of pneumonic plague are recorded almost every year.

CONCLUSIONS

Taking into account the location and nature of transport communications (sea, river, air, road, rail), the characteris-

Table 2. Data on the number of ship calls and ships in the ports of Ukraine for the period from 2000 to 2007

Ship calls/ships	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Number of ship calls	12836	12899	17785	19159	17684	17822	17995	19653
Quantity ships with Ukrainian crew	3644	3489	3786	3805	4316	4174	3889	4094
Number of foreign vessels	9192	9410	13999	15354	13358	13648	14048	15559

tics of the natural environment and the characteristics of international and local passenger traffic, the methodology for epidemiological certification of BCPs has been developed.

Sanitary-hygienic and anti-epidemic algorithms of actions aimed at preventing the importation and spread of dangerous infections to Ukraine through the relevant BCPs have been determined.

Recommendations on anti-epidemic support for leptospirosis, tularaemia, anthrax, rabies and other dangerous infections (including tropical and exotic ones) have been corrected.

A roadmap has been developed for conducting sanitary and epidemiological reconnaissance on an ongoing basis, together with local and regional medical institutions.

The system for monitoring the health of sailors, drivers of vehicles, crews of airliners, and tourists has been unified.

ACKNOWLEDGEMENTS

The authors are grateful to all employees of institutions providing support during surveys of controlled territories and objects, personnel of the sanitary and epidemiological departments of the respective regions, medical personnel of diagnostic laboratories, employees of the BCP and other departmental organizations.

Conflict of interest: None declared

REFERENCES

1. Onishchenko GG, Semenov BF, et al. Biological safety [in Russian]. Medicine. 2006; 303.
2. London TR. Geomedical Systems: Intervention and Control. Routledge 1992.
3. Perrings C, Dehnen-Schmutz K, Touza J, et al. How to manage biological invasions under globalization. Trends Ecol Evol. 2005; 20(5): 212–215, doi: 10.1016/j.tree.2005.02.011, indexed in Pubmed: 16701371.
4. Zvonkova TV, Kasimov NS. Geographic forecasting and labor protection [in Russian]. 1990: 175.
5. Vinogradskaya ON. Geographic distribution of ISA vectors [in Russian]. Medicine. 1969; 150.
6. Gubler AV. Computational analysis and dissemination pathological processes [in Russian]. Medicine. 1978; 294.
7. Ryan ET, Wilson ME, Kain KC. Illness after international travel. N Engl J Med. 2002; 347(7): 505–516, doi: 10.1056/NEJMra020118, indexed in Pubmed: 12181406.
8. Upham P, Thomas C, Gillingwater D, et al. Environmental capacity and airport operations: current issues and future prospects. Journal of Air Transport Management. 2003; 9(3): 145–151, doi: 10.1016/s0969-6997(02)00078-9.
9. Dergachev V. A. International economic relations: a textbook for universities [Electronic resource] / V. A. Dergachev. M. : UNITI-DANA, 2005; 368 [in Russian]. http://www.dergachev.ru/book-10/16.html.
10. Kortepeter MG, Parker GW. Potential biological weapons threats. Emerg Infect Dis. 1999; 5(4): 523–527, doi: 10.3201/eid0504.990411, indexed in Pubmed: 10458957.
11. Lounibos LP. Invasions by insect vectors of human disease. Annu Rev Entomol. 2002; 47: 233–266, doi: 10.1146/annurev.ento.47.091201.145206, indexed in Pubmed: 11729075.
12. Giacomini T, Brumpt LC. Passive dissemination of Anopheles by means of transport: its role in the transmission of malaria (historical review). Revue Histoire Pharmacie. 1989; 36: 164–172.
13. Kilpatrick A, Randolph S. Drivers, dynamics, and control of emerging vector-borne zoonotic diseases. Lancet. 2012; 380(9857): 1946–1955, doi: 10.1016/s0140-6736(12)61151-9.
14. Khodykina ZS, Khmurova OP, Constant EG, et al. Zoological and parasitological characteristics of the natural focus of tularemia in the Crimea. Book: Regional parasitology and natural focus of vector-borne diseases. [in Russian]. 1966; 135.
15. Yanko NV, Yatsina MD, Gnityuk O. Ya., Gavrishchuk V.I. Natural features of Volyn and their influence on the epidemic process of tularemia // Proceedings of the conference [in Ukrainian. Lviv. 2007: 453–470.
16. Hubálek Z, Halouzka J. West Nile fever: a reemerging mosquito-borne viral disease in Europe. Emerg Infect Dis. 1999; 5(5): 643–650, doi: 10.3201/eid0505.990505, indexed in Pubmed: 10511520.
17. Nesterenko LP, Novokhatniy YO, Svita VM. On the need to intensify epidemiological monitoring of West Nile fever in Ukraine. Proceedings of conferences [in Ukrainian]. Lviv. 2007: 407–409.
18. Gubler DJ. The continuing spread of West Nile virus in the western hemisphere. Clin Infect Dis. 2007; 45(8): 1039–1046, doi: 10.1086/521911, indexed in Pubmed: 17879923.
19. Gubler DJ. The global emergence/resurgence of arboviral diseases as public health problems. Arch Med Res. 2002; 33(4): 330–342, doi: 10.1016/s0188-4409(02)00378-8, indexed in Pubmed: 12234522.
20. Effler PV, Pang L, Kitsutani P, et al. Hawaii Dengue Outbreak Investigation Team. Dengue fever, Hawaii, 2001-2002. Emerg Infect Dis. 2005; 11(5): 742–749, doi: 10.3201/eid1105.041063, indexed in Pubmed: 15890132.
21. Jelinek T. Dengue Fever in International Travelers. Clinical Infectious Diseases. 2000; 31(1): 144–147, doi: 10.1086/313889.
22. Mutebi JP, Barrett A. The epidemiology of yellow fever in Africa. Microbes and Infection. 2002; 4(14): 1459–1468, doi: 10.1016/s1286-4579(02)00028-x.
23. Naidoo A, Patric K. Cholera: a continuous epidemic in Africa. J R Soc Promot Health. 2002; 122(2): 89–94, doi: 10.1177/146642400212200209, indexed in Pubmed: 12134774.
24. World Health Organization Human plague in 2000 and 2001. Weekly Epidemiological Record. 2003; 78: 129–136.
25. Drake JM, Lodge DM. Global hot spots of biological invasions: evaluating options for ballast-water management. Proc Biol Sci. 2004; 271(1539): 575–580, doi: 10.1098/rspb.2003.2629, indexed in Pubmed: 15156914.
26. Tatem AJ, Hay SI, Rogers DJ. Global traffic and disease vector dispersal. Proc Natl Acad Sci U S A. 2006; 103(16): 6242–6247, doi: 10.1073/pnas.0508391103, indexed in Pubmed: 16606847.
27. Gutsevich AV. Carriers of viruses, insects, spreading human disease [in Russian]. Nature. 1962; 3: 29–34.
28. Revenko OP. On the entomological state in the region in relation to vectors of communicable diseases. Proceedings of the first international scientific-practical conference. Problems of hygiene and epidemiology on railway transport [in Ukrainian]. Lviv. 1998: 148–149.
29. Tarasyuk OO. Scientific achievements of the Lviv Research Institute of Epidemiology and Hygiene of the Ministry of Health of Ukraine. Proceedings of the conference [in Ukrainian]. Lviv. 2007: 417–476.
30. Russell RC. Transport of insects of public health importance on international aircraft. Travel Medicine International. 1989; 7: 26–31.

31. Wu X, Lu Y, Zhou S, et al. Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. Environ Int. 2016; 86: 14–23, doi: 10.1016/j.envint.2015.09.007, indexed in Pubmed: 26479830.
32. Kucheruk VV. The structure, typology and regionalization of natural foci of human disease. In the book: Results of the development of the doctrine of the natural foci of human diseases and further tasks [in Russian]. Medicine. 1972: 180–212.
33. Owen J, Moore F, Panella N, et al. Migrating birds as dispersal vehicles for West Nile virus. EcoHealth. 2006; 3(2): 79–85, doi: 10.1007/s10393-006-0025-9.
34. Lomov YM, Onishchenko GG, Moscvitin EA, et al. Epidemiology and Infectious Diseases. [in Russian]. 1999; 3: 11–17.
35. Prendel AR. The origin and characteristics of the fauna of blood-sucking mosquitoes of the Ukrainian SSR / Book: Regional parasitology and natural focus of transmassive diseases [in Russian]. 1966; 91.
36. Shchur L. Ye. On the patterns of distribution of ixodid ticks on the territory of the Ukrainian SSR. "Problems of Parasitology" - Proceedings of the VI National Conference of Parasitology of the Ukrainian SSR - K.: Naukova Dumka. [in Russian]. 1969; Vol. 4.: 205.
37. Kenney JL, Brault AC. The role of environmental, virological and vector interactions in dictating biological transmission of arthropod-borne viruses by mosquitoes. Adv Virus Res. 2014; 89: 39–83, doi: 10.1016/B978-0-12-800172-1.00002-1, indexed in Pubmed: 24751194.
38. Boldyreva YA, Onyshchcnko VA. In book: Sanitary supervision of transport, Ilyichevsk [in Russian]. 1999: 243–246.
39. Netsky GI. Some prerequisites for landscape-epidemiological zoning for obligate-transmissible diseases with natural focus [in Russian]. Book: The third scientific meeting on the problems of medical geography. 1965: 100–102.
40. Kucheruk VV. Some methodological issues of mapping natural focal human diseases [in Russian]. Sat: "Methods of medical and geographical research". 1965; 133.
41. Kant V. Mathematical methods and modelling in healthcare. Medicine. 1987; 294.

VIA MEDICA

CASE REPORT

Int Marit Health
2022; 73, 3: 112–114
10.5603/IMH.2022.0021
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Occupational asthma, rhinitis and contact urticaria in a salmon-processing worker

David Lucas[1, 2, 3], Greta Gourier[2, 3], Richard Pougnet[2, 3, 4], Jean-Dominique Dewitte[2, 3, 4], Brice Loddé[1, 2, 3]

[1]ORPHY Laboratory, University Brest, France
[2]Occupational and Environmental Diseases Centre, Teaching Hospital, Brest, France
[3]French Society of Maritime Medicine, Brest, France
[4]Laboratoire d'Etude et de Recherche en Sociologie (EA 3149), Université de Brest, France

ABSTRACT

We report a case of occupational allergy to salmon combining allergic asthma, allergic rhinitis and allergic contact urticaria in a 59-year-old salmon-processing worker. Parvalbumin is the most common allergen, but indeed sensitisation to tropomyosin, preservatives and spices could occur.

(Int Marit Health 2022; 73, 3: 112–114)

Key words: occupational diseases, occupational asthma, contact urticaria, case report, salmon

INTRODUCTION

Various seafood and fishes are known to cause occupational asthma (OA), contact urticaria (CU) and protein contact dermatitis. In the majority of published clinical cases, allergic occupational diseases are separately diagnosed [1, 2]. We report a case of occupational allergy to salmon combining allergic asthma, allergic rhinitis and allergic CU.

CASE REPORT

The patient was a 59-year-old smoking man working in a salmon-processing plant in Brittany for 11 years. He was referred to our department to investigate a 3-years history of cough exacerbated at the workplace. He was assigned to a fresh salmon-filleting line in a plant of smoked salmon production in Brittany. He was only in contact with fresh salmon. He reported daily symptoms of rhinitis followed by dry cough without sputum occurring minutes to hour after starting work tasks. He also described itchy wheals on his hands about 30 minutes after contact with water from salmon preservatives tanks. Intensity and frequency of symptoms increased during last 3 years. He had to left workplace after few hours at work and was out of work for 6 months before medical consultation. In January 2020, he recalled a severe episode of dyspnoea with wheezing necessiting monitoring at an emergency department. His symptoms improved when he was out of work. He was wearing gloves and mask at work but medical examination revealed the unsuitable wearing of the devices.

In February 2020, the patient underwent spirometry. Functional respiratory tests showed minimal airway obstruction with a forced expiratory volume in the first second (FEV1) of 2.2 l (66% of predictive value), forced vital capacity (FVC) of 3.2 l below the fifth percentile and FEV1/vital capacity of 0.69. He began a controller asthma treatment with a fixed combination of formoterol/fluticasone 20/500 µg/d. Two months later new functional spirometry tests showed an FEV1 of 3.63 l (108% of predictive value), FVC of 4.83 l (114% of predictive value), FEV1/vital capacity of 73% and total lung capacity of 7.96 L (115%).

Skin prick tests (SPT) to common aeroallergens, latex and professional cleaning products on a normal reactive skin (negative control, 0 mm; positive control, 5 mm) were negative. Skin prick tests in prick to prick with different

Dr. David Lucas, Occupational and Environmental Diseases Centre, Teaching Hospital, 4 Av Foch F-29200, Brest, France, tel: +33298223509, e-mail: david.lucas@chu-brest.fr

Received: 12.08.2022 Accepted: 30.09.2022

Figure 1. Prick tests to common allergens and salmon occupationally handled (near elbow)

types of fresh salmon (Norwegian, Scottish, organic) from her plant were all extremely positive, (respectively, 19 mm, 15 mm, 20 mm) with pseudopods (Fig. 1). Specific IgE were 10.5 kUA/L for salmon and 1.14 kUA/L for parvalbumin.

At the medical examination, the patient did not have any urticaria or angioedema. Testing for dermographism gave negative results. He described a dry cough and dyspnoea. Pulmonary examination did not find wheezing. The patient was counselled regarding avoidance of contact with salmon. Following this diagnosis, his management redirected him to an administrative work. Since starting this new job, symptoms have completely disappeared.

In February 2021, 1 year after allergen exposure avoidance, the patient underwent another spirometry. The functional parameters showed her asthma to be stable with FCV of 5.2 l, FEV1 of 3.1 l and FEV1/FCV of 60%.

History of work-related rhinitis and asthma symptoms, confirmation of bronchial asthma with improvement of airway obstruction (increase of FEV1), the clear positivity of skin prick tests and specific IgE, resolution of pulmonary and dermatological symptoms after exposure eviction allows us to conclude to an OA caused by salmon [3].

DISCUSSION

Occupational exposure to seafood and fish allergens occurs mainly in the food and fishing industry [1, 4]. Reactions can occur through inhalation of aerosols generated during cutting, scrubbing, cleaning, or through the skin as a result of direct handling of the seafood and fish itself [1, 4]. Wiszniewska et al. [5] reported a clinical case of a seafood production worker with severe asthma, rhinitis, conjunctivitis and CU caused by exposure to squid. For salmon-processing workers, most cases reported are IgE mediated OA. Occupational asthmatic reactions to salmon have been demonstrated with prevalence at 8% among automated salmon processing workers [6]. In a study including 70 workers of a Norwegian salmon-processing company, wheezing was noted for 5.7% on Mondays, and 7.1% of workers have been diagnosed with asthma [7]. In another study, 3 cases of OA to salmon were found in a population of 26 salmon-processing workers [8]. Exposure assessment in this salmon-processing plant showed elevated concentrations of salmon allergen at the filleting machine and table. Most OA related to fish are case-reports of sensitisation secondary to inhalation of wet aerosols in fish processing workers and fishmongers, but no case has been described in fishermen [9].

In a recent paper published by Mason et al. [10] on data from the Surveillance of Work-related and Occupational Respiratory Disease, authors found 58 cases of OA in seafood processors in period 1992–2017. They estimated the annual average incidence rate of OA in the United Kingdom seafood processing sector as 70/100 000 (95% confidence interval: 49–91) employees over the period 1992–2017. Prawns, salmon and trout are the most implicated agents and they found high airborne levels of tropomyosin and parvalbumin in occupational monitoring data.

Fish processors are also exposed to endotoxins with levels of airborne concentrations in the range between 6.8 and 136 EU/m^3 [11]. Shiryaeva et al. [7] found levels of endotoxin at 29 EU/m^3 in salmon-processing plants and more specifically a very high level of airborne endotoxin found in water from the transport tank (779 EU/mL) was

described [8]. Recent studies underlined high levels of endotoxin in several plants and for a salmon-processing plant high atmospheric levels of mould spores (*penicillium notatum*, *aspergillus aspergillus* and *cladosporium herbarum*) when filleting fresh salmon [8].

Parvalbumin is the most common allergen in salmon allergic reaction. However, sensitisation to other protein as tropomyosin, preservatives as sodium metabisulphite, formaldehyde and spices could occur [2, 12].

Most occupational skin diseases described in salmon-processing workers are CU and contact dermatitis from protein [1, 13]. In 8 cases of contact dermatitis from protein from a national network, majority was chief cook and linked to salmon [14]. The penetration of allergens is facilitated by irritant contact dermatitis or atopic skin. In our case, description of symptoms is more probably for a diagnosis of contact urticaria.

CONCLUSIONS

Occupational allergic diseases in salmon-processing workers could occur, as in our case, including asthma, rhinitis and dermatological diseases as contact urticaria or dermatitis from protein. Collective and individual prevention are needed to reduce atmospheric concentration of aeroallergen, contact with skin and damaged skin. Detection of early stage of diseases by occupational physicians is also important.

Conflict of interest: None declared

REFERENCES

1. Jeebhay MF, Lopata AL. Occupational allergies in seafood-processing workers. Adv Food Nutr Res. 2012; 66: 47–73, doi: 10.1016/B978-0-12-394597-6.00002-1, indexed in Pubmed: 22909978.
2. Lucas D, Lodde B, Jepsen JR, et al. Occupational asthma in maritime environments: an update. Int Marit Health. 2016; 67(3): 144–152, doi: 10.5603/IMH.2016.0027, indexed in Pubmed: 27681213.
3. Jolly AT, Klees JE, Pacheco KA, et al. Work-Related Asthma. J Occup Environ Med. 2015; 57(10): e121–e129, doi: 10.1097/JOM.0000000000000572, indexed in Pubmed: 26461873.
4. Jeebhay MF, Robins TG, Lehrer SB, et al. Occupational seafood allergy: a review. Occup Environ Med. 2001; 58(9): 553–562, doi: 10.1136/oem.58.9.553, indexed in Pubmed: 11511741.
5. Wiszniewska M, Tymoszuk D, Pas-Wyroślak A, et al. Occupational allergy to squid (Loligo vulgaris). Occup Med (Lond). 2013; 63(4): 298–300, doi: 10.1093/occmed/kqt025, indexed in Pubmed: 23535711.
6. Fidias E, Leon S. Salmon, ventilation, and mycotoxin inhalation. Lancet. 1995; 346(8991-8992): 1707, doi: 10.1016/s0140-6736(95)92873-1.
7. Shiryaeva O, Aasmoe L, Straume B, et al. Respiratory effects of bioaerosols: exposure-response study among salmon-processing workers. Am J Ind Med. 2014; 57(3): 276–285, doi: 10.1002/ajim.22281, indexed in Pubmed: 24310925.
8. Dahlman-Höglund A, Renström A, Larsson PH, et al. Salmon allergen exposure, occupational asthma, and respiratory symptoms among salmon processing workers. Am J Ind Med. 2012; 55(7): 624–630, doi: 10.1002/ajim.22067, indexed in Pubmed: 22576678.
9. Droszcz W, Kowalski J, Piotrowska B, et al. Allergy to fish in fish meal factory workers. Int Arch Occup Environ Health. 1981; 49(1): 13–19, doi: 10.1007/BF00380804, indexed in Pubmed: 7298210.
10. Mason HJ, Carder M, Money A, et al. Occupational asthma and its causation in the UK seafood processing industry. Ann Work Expo Health. 2020; 64(8): 817–825, doi: 10.1093/annweh/wxaa055, indexed in Pubmed: 32491156.
11. Jeebhay MF, Cartier A. Seafood workers and respiratory disease: an update. Curr Opin Allergy Clin Immunol. 2010; 10(2): 104–113, doi: 10.1097/ACI.0b013e3283373bd0, indexed in Pubmed: 20179585.
12. Lucas D, Gourier G, Pougnet R, et al. Letter to the Editor, 'Occupational Asthma and Its Causation in the UK Seafood Processing Industry'. Do Not Forget Preservatives and Endotoxins. Ann Work Expo Health. 2021; 65(6): 738–739, doi: 10.1093/annweh/wxaa137, indexed in Pubmed: 33616174.
13. Hajeb P, Selamat J. A contemporary review of seafood allergy. Clin Rev Allergy Immunol. 2012; 42(3): 365–385, doi: 10.1007/s12016-011-8284-9, indexed in Pubmed: 22045217.
14. Loddé B, Cros P, Roguedas-Contios AM, et al. Occupational contact dermatitis from protein in sea products: who is the most affected, the fisherman or the chef? J Occup Med Toxicol. 2017; 12: 4, doi: 10.1186/s12995-017-0150-0, indexed in Pubmed: 28203266.

VIA MEDICA

SHORT COMMUNICATION

Int Marit Health
2022; 73, 3: 115–116
10.5603/IMH.2022.0022
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Characteristics of fatal marine accidents

Emma P. DeLoughery

Oregon Health and Science University, Portland, OR, United States

ABSTRACT

Background: *Venturing onto the water for business or pleasure is not a risk-free activity. Despite the dangers facing crew and passengers there is little data on the characteristics of fatal accidents involving vessels in the water. The goal of this study was to review accident reports from the National Transportation Safety Board (NTSB) to determine characteristics of fatal marine accidents.*

Materials and methods: *Data was obtained from the Marine Accident Reports issued by the NTSB. Information regarding the number of people involved, fatalities and the accident itself was collected.*

Results: *Fifty-two accidents involving 5045 people from 1972 to 2019 were included in the study, with 468 fatalities reported. Of the fatalities, 155 (33.1%) were definitely on the vessel when they died, 49 (10.5%) were probably on the vessel, 65 (13.9%) were definitely or likely in the water, and the location of 199 (42.5%) was unknown. The most common cause of death was drowning (88, 18.8%), the most common accident cause was sinking (63.5%), and accidents most often started during nighttime hours (7pm–7am, 30, 57.7%).*

Conclusions: *This study found that sinking was the most common accident cause for fatal marine accidents, drowning the most common cause of death, and where fatality location was known most were on the vessel when they died. This suggests that, particularly when a ship is in the process of sinking, it is of paramount importance to ensure passengers and crew are familiar with exit routes, are able to exit the vessel, and are instructed to do so in a timely manner.*

(Int Marit Health 2022; 73, 3: 115–116)

Key words: water, drowning, immersion

INTRODUCTION

Venturing onto the water is not a risk-free activity. The commercial fishing industry has one of the highest occupational injury and mortality rates, with water, weather, and the ship itself posing hazards [1, 2]. Merchant shipping likewise poses risks [3]. Despite awareness of the dangers crew and passengers face there is little data on characteristics of fatal accidents involving vessels in the water. The purpose of this study was to review accident reports from the United States' National Transportation Safety Board (NTSB) to determine characteristics of fatal marine accidents with the goal of identifying areas for improvement to reduce marine fatalities.

MATERIALS AND METHODS

Data was obtained from the Marine Accident Reports issued by the NTSB. Reports were included if a PDF copy of the accident report was available, the accident involved a fatality, and the accident occurred while the vessel was moored or moving in the water [4]. Accident reports were excluded if they involved a vessel that was docked at the time of the accident or if the fatality was located on the shore. Information regarding date, time, location, nature of the accident, people on board, number of fatalities, and location and cause of the fatalities was collected. A fatality was classified as being "definitely" on the vessel if the body was found on the vessel, "probably" on the vessel if the

Emma P. DeLoughery, MD, Oregon Health and Science University, 3181 SW Sam Jackson Park Rd, Portland, OR, 97239, United States, e-mail: deloughe@ohsu.edu

Received: 17.08.2022 Accepted: 13.09.2022

individual was last seen on the vessel, "water" if the body was found in the water and they were not seen on the vessel during the incident, and "unknown" if the body was not found. Cause of death was classified as "unknown" if the body was not found or cause of death was not given in the report. Data was analysed using Microsoft Excel.

RESULTS

A total of 52 accidents involving 5045 people from 1972 to 2019 were included in the study. A total of 468 fatalities were reported. Of the fatalities, 155 (33.1%) were definitely on the vessel when they died, 49 (10.5%) were probably on the vessel, 65 (13.9%) were definitely or likely in the water, and the location of 199 (42.5%) was unknown. The causes of death included drowning (88, 18.8%), burns or smoke inhalation (44, 9.4%), trauma (20, 4.3%), hypothermia (20, 4.3%), and unknown (296, 63.2%). Accident causes included sinking (63.5%), capsizing (40.4%), and collision with another ship (17.3%). Accidents most often started during nighttime hours (7pm–7am, 30, 57.7%) and most often occurred in July (7, 13.5%), October (7, 13.5%), and December (6, 11.5%). Accidents tended to happen fast, with an average duration of 113 minutes and a median duration of 11 minutes (range: 0–1195).

DISCUSSION

This study found that vessel sinking is the most frequent cause of fatal marine accidents. When cause of death is known, drowning is unsurprisingly the most common. Although the location of many fatalities is unknown, over 40% of fatalities were definitely or likely on the vessel, suggesting that when an emergency occurs on a ship, it is of vital importance to get off the ship. Of course, many shipboard emergencies can be fixed without evacuating the vessel, giving rise to the difficult judgement call captains must make in determining when to abandon ship.

A study of accidents in British maritime shipping found seasonal variation in accidents and fatalities, with both being higher between September and April [3]. The current study also found that some months were more common for fatal accidents than others, but there was less of a clear trend.

A study of commercial fishing fatalities in the United States found that most occur during an event in which the crew must abandon the ship and that Alaska, the Northeast, and the Gulf of Mexico are the most common regions of fatalities [2]. Most reports in the current study also involved passengers and crew needing to abandon ship.

Limitations of this study include use of a single database, the exclusion of reports that did not have a copy of the report available, and the exclusion of marine accidents the NTSB did not investigate.

CONCLUSIONS

In this study of 52 fatal marine accidents, sinking was the most common accident cause, drowning the most common cause of death, and where fatality location was known most were on the vessel when they died. This data suggests that, particularly when a ship is in the process of sinking, it is of paramount importance to ensure passengers and crew are familiar with exit routes, are able to exit the vessel, and are instructed to do so in a timely manner.

Conflict of interest: None declared

REFERENCES

1. Byard RW. Commercial fishing industry deaths — forensic issues. J Forensic Leg Med. 2013; 20(3): 129–132, doi: 10.1016/j.jflm.2012.05.010, indexed in Pubmed: 23472787.
2. Lincoln JM, Lucas DL, et al. Occupational fatalities in the United States commercial fishing industry, 2000-2009. J Agromedicine. 2010; 15(4): 343–350, doi: 10.1080/1059924X.2010.509700, indexed in Pubmed: 20954029.
3. Roberts SE, Carter T. Causes and circumstances of maritime casualties and crew fatalities in British merchant shipping since 1925. Int Marit Health. 2018; 69(2): 99–109, doi: 10.5603/IMH.2018.0015, indexed in Pubmed: 29939386.
4. Marine Accident Reports. National Transportation Safety Board. https://www.ntsb.gov/investigations/AccidentReports/Pages/marine.aspx (Accessed March 5 2021).

VIA MEDICA

SHORT COMMUNICATION

Int Marit Health
2022; 73, 3: 117–118
10.5603/IMH.2022.0023
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Self-medication practices among seafarers: a bibliometric review

Yusuff Adebayo Adebisi[1], Nafisat Dasola Jimoh[2], Isaac Olushola Ogunkola[3], Temitope Folashade Aroyewun[4], Maureen Oseghale[1], Esther Bosede Ilesanmi[5], Precious Fadele[6], Alaka Hassan Olayemi[7], Don Eliseo Lucero-Prisno III[8]

[1]Faculty of Pharmacy, University of Ibadan, Nigeria
[2]Department of Chemistry, Federal University of Technology, Minna, Nigeria
[3]Department of Public Health, University of Calabar, Nigeria
[4]Department of Psychology and Counselling, Universiti Pendidikan Sultan Idris, Perak, Malaysia
[5]Faculty of Nursing Science, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[6]Department of Medicine, University of Nigeria, Nsukka, Nigeria
[7]Department of Microbiology, Obafemi Awolowo University, Ile-Ife, Nigeria
[8]Department of Global Health and Development, London School of Hygiene and Tropical Medicine, United Kingdom

ABSTRACT

Self-medication could be a public health concern if done inappropriately, and additional research is required to better comprehend the population-wide nature of the problem. Seafarers are more inclined to self-medicate due to the nature of their work. We performed a rapid bibliometric analysis to determine the volume of research on self-medication habits among seafarers. Our analysis revealed a major knowledge gap regarding self-medication practices among seafarers. There is an urgent need to address this paucity of data and formulate appropriate interventions.

(Int Marit Health 2022; 73, 3: 117–118)

Key words: seafarers, self-medication, public health

Inappropriate self-medication is a public health concern, and more research is needed to better understand the scope of the problem across populations [1]. Because of the nature of their work, seafarers are more likely to self-medicate. The strict application of medical standards to seafarers has two significant implications for scientific inquiry. First, identifying occupational health issues related to seafaring is extremely difficult because any study of seafarers will not reveal unhealthy seafarers, but rather the opposite (all sick seafarers having been "grounded"). Second, sailors are likely to be extremely hesitant to report health problems for fear of 'discovery' consequences. They run the risk of being repatriated and losing their possibilities for a career at sea if they disclose a personal health concern to a researcher and it is later reported to their employer. These points further lend credence to possibility of increased and underreported inappropriate self-medication practices among seafarers.

We conducted a rapid bibliometric review to gain an understanding of the volume of research output on self-medication practices among seafarers. We searched the title, abstract, and keywords of articles in Web of Science and Scopus using the keywords "seafarers" and "self-medication" without regard to date, year, or language. Despite the dangers of self-medication among seafarers, no original research was found in the database. The only article found was correspondence that did not provide original data but only argued the need to take actions regarding the dearth of information on the misuse of antibiotics and other antimicrobials among seafarers [2]. This adds to the evidence of disparities in health research output in the maritime sector.

Dr. Yusuff Adebayo Adebisi, Faculty of Pharmacy, University of Ibadan, Nigeria, tel/fax: +2348064110844, e-mail: adebisiyusuff23@yahoo.com

Received: 12.09.2022 Accepted: 22.09.2022

To gain a broader perspective on the topic, we also searched Google scholar for articles indexed in the database between January 1st, 2020, and September 6th, 2022, using the keywords "seafarers" and "self-medication" without regard for language. Despite the widespread misuse of medications during the coronavirus disease (COVID-19) pandemic [3], we found no original data contribution on the topic in a peer-reviewed journal. However, we found two non-peer-reviewed old reports on self-medication practices among seafarers using Google Scholar without any date restrictions [4, 5].

According to one of the studies [4], 63% (650) of seafarers reported having taken at least one non-prescription medication or herbal cure at sea over the preceding 12 months. Similarly, 58.8% (603) of respondents reported practicing self-medication while on leave. The most commonly used self-medication drugs at sea were vitamins or supplements (53.2%), followed by pain killers (26%). The second study [5] revealed that seafarers also reported using self-prescribed medications less frequently in 2016 compared to 2011; their mean self-medication score decreased from 1.0741 in 2011 to 0.7911 in 2016 (an independent t-test revealed a significant difference [p = 0.000], and Cohen's D revealed a small/medium effect [0.28]).

Self-medication practices have numerous potential risks and negative outcomes, including incorrect self-diagnosis, delays in seeking medical advice when needed, infrequent but severe adverse reactions, dangerous drug interactions, incorrect method of administration, incorrect dosage, incorrect choice of therapy, antimicrobial resistance, masking of a severe disease, and the risk of dependence and abuse, among others [6]. With the importance of the work of seafarers and the already existing risk of diseases among seafarers, immediate action is required. This situation highlighted the critical roles of pharmacists and Telemedical Maritime Assistance Service (TMAS) in the maritime industry [7, 8]. Due to a weak network connection, seafarers are unable to get adequate, trustworthy, and current drug information online, which causes them to make less educated decisions. Pharmacists and TMAS can assist with this by setting up awareness programmes among sailors and other seafarers to inform them of the negative effects and risks of self-medication. In addition to this, TMAS can serve as an opportunity to disseminate drug and medicine information to seafarers leveraging on the digital technologies.

There is an urgent need for recent large-scale research on this topic. Understanding the current landscape of the issue will help to drive strategies and interventions to reduce medication misuse among seafarers.

Conflict of interest: None declared

REFERENCES

1. Tuyishimire J, Okoya F, Adebayo AY, et al. Assessment of self-medication practices with antibiotics among undergraduate university students in Rwanda. Pan Afr Med J. 2019; 33: 307, doi: 10.11604/pamj.2019.33.307.18139, indexed in Pubmed: 31692864.
2. Adebisi YA, Oladunjoye IO, Tajudeen YA, et al. Self-medication with antibiotics among seafarers: a public health issue. Int Marit Health. 2021; 72(3): 241–242, doi: 10.5603/IMH.2021.0045, indexed in Pubmed: 34604997.
3. Adebisi YA, Jimoh ND, Ogunkola IO, et al. The use of antibiotics in COVID-19 management: a rapid review of national treatment guidelines in 10 African countries. Trop Med Health. 2021; 49(1): 51, doi: 10.1186/s41182-021-00344-w, indexed in Pubmed: 34162445.
4. Acejo I, Sampson H, Turgo N, Wadsworth E. The health and self-medication practices of seafarers. InSIRC Symposium 2011; pp. 89–107.
5. Sampson H, Ellis N, Acejo I, Turgo N. Changes in seafarers' health 2011–16: A summary report. https://travelmedicina.com/wp-content/uploads/blog/Blog%20pomorci/Changes%20in%20seafarers'%20health%20%202011-2016.pdf (Accessed on 9 September 2022).
6. Bennadi D. Self-medication: A current challenge. J Basic Clin Pharm. 2013; 5(1): 19–23, doi: 10.4103/0976-0105.128253, indexed in Pubmed: 24808684.
7. Babatunde Y, Lucero-Prisno Iii DE, Adegbite MA, et al. The role of pharmacists in global maritime health. Int Marit Health. 2022; 73(2): 96–97, doi: 10.5603/IMH.2022.0016, indexed in Pubmed: 35781687.
8. 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, doi: 10.5603/IMH.2020.0018, indexed in Pubmed: 32604452.

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2022; 73, 3: 119–124
10.5603/IMH.2022.0024
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Medical treatment of seafarers in the Southern Indian Ocean — interaction between the French Telemedical Maritime Assistance Service (TMAS) and the medical bases of the French Southern and Antarctic Lands (TAAF)

Jennifer Hunt[1], David Lucas[2], Paul Laforet[3], Mathieu Coulange[2], Jean-Pierre Auffray[2], Emilie Dehours[1]

[1]Centre de Consultations Médicales Maritimes, French TMAS, CHU Toulouse, France
[2]Société Française de Médecine Maritime (French Society for Maritime Medicine), Brest, France
[3]Service Médical TAAF/IPEV (French Polar Institute) (Medical Service), Paris, France

ABSTRACT

Background: *The waters surrounding the French Southern Lands are a fishing zone, accessible only by sailing for several days in a region where weather conditions are often difficult. The scientific bases of the region have medical staff whose services can be called upon if seafarers require assessment and rapid medical treatment. We conducted an epidemiological study of the maritime teleconsultations carried out by the French Telemedical Maritime Assistance Service (TMAS), where patients navigating in the Southern Indian Ocean zone were advised to disembark on the medical bases in the French Southern Lands, between 2015 and 2020, to receive medical treatment.*

Materials and methods: *We extracted data from all of the maritime records from 1 January 2015 to 31 December 2020 relating to patients who attended a maritime teleconsultation with a French TMAS doctor in the Southern Indian Ocean zone and who had been redirected to the medical bases in the French Southern Lands. Data were collected on the patients' age, gender, nationality, rank, type of vessel, teleconsultation diagnosis, patient management on board and in the French Southern Lands medical bases, as well as the medical outcome. We carried out a descriptive data analysis.*

Results: *French TMAS doctors managed 11,908 cases including 76 in the Southern Indian Ocean zone (0.6%). Nineteen (25%) patients were redirected to the French Southern Lands over the study period. Eighteen patients were men with an average age of 45 ± 10 years. Eighteen patients were on board a trawler and 11 of them were sailors. Nine patients were treated for a trauma-related condition, 8 for a medical condition and 2 for a surgical disease. Eleven (58%) patients were evacuated to Reunion Island and 8 (42%) patients received medical treatment and were able to re-embark aboard their vessel.*

Conclusions: *Relatively few patients are redirected to the French Southern Lands for medical assistance, but referrals occur on a regular basis. The presence of these medical bases is unusual in a maritime setting, but they can be a valuable asset when maritime medical assistance is required in this region. The type*

Emilie Dehours, MD, Centre de Consultations Médicales Maritimes, SAMU 31, CHU Toulouse, Pavillon Lareng, Place du Dr Baylac, TSA 40031, F-31059 Toulouse cedex 9, France, tel/fax: +33682414698, e-mail: dehours.e@chu-toulouse.fr

Received: 8.07.2022 Accepted: 19.09.2022

of condition encountered, and the patient profile, were typical of the fishing community. The presence of these bases and communication between the various stakeholders delivering maritime medical assistance provided these patients with optimal care despite their isolated location.

(Int Marit Health 2022; 73, 3: 119–124)

Key words: French Telemedical Maritime Assistance Service (TMAS), teleconsultation, maritime, Indian Ocean, French Southern and Antarctic Lands (TAAF)

INTRODUCTION

In the maritime setting, seafarers are most exposed to accidents at work [1]. In France, the accident and mortality rate for seafarers is 5 times higher than that of construction workers [1]. It is rare to have medical or paramedical personnel on board as this only becomes a mandatory requirement when over 100 people are on board for a crossing lasting more than 48 hours. If there is no doctor on board, the ship's captain is responsible for on-board care [2]. Even if the captain has maritime medical training, the on-board management of patients may require rapid medical advice. The person in charge of treatment will initially seek medical advice by teleconsultation from the French Telemedical Maritime Assistance Service (TMAS) doctor in Toulouse, which exists since 1983 [3]. Following the teleconsultation, the patient may require assistance ashore.

Since 1979, the Hamburg Search and Rescue (SAR) Convention [4] has outlined the areas of responsibility of the Maritime Rescue Coordination Centres (MRCCs) of different states, and has organised their collaboration. In the Southern Indian Ocean zone, France is responsible for the Reunion SAR, which extends from Reunion Island to the southern islands, namely Kerguelen, Crozet, Saint-Paul and Amsterdam (Fig. 1).

The scientific and fishing expeditions undertaken in this extremely isolated area (between 3 and 9 days sailing time from Reunion Island) warrant a medical presence and local treatment provision. Three medical bases have therefore been created on the French Southern Islands and four doctors are permanently stationed there: two in Kerguelen, one in Crozet and one in Saint-Paul/Amsterdam. In addition, the supply ship serving these islands, the Marion Dufresne, has a doctor on board during its rotations in the southern hemisphere as well as on-board hospital. All of these medical bases are well equipped for practice in an isolated environment: consultation room, dentistry equipment, hospitalisation rooms, imaging room, dedicated laboratory testing facility and a functional operating theatre.

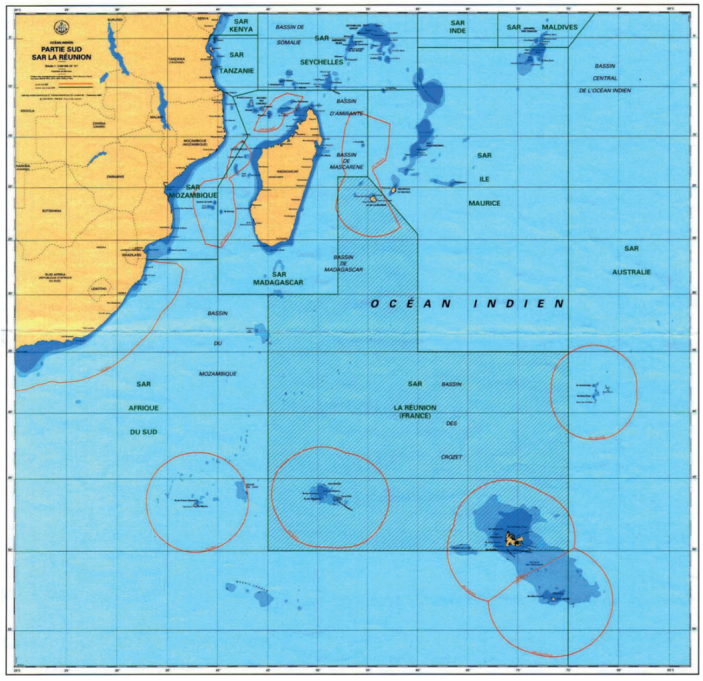


Figure 1. French Search and Rescue zone in the Southern Indian Ocean [Source: Arrêté n° 74/2009 du 13 Janvier 2009. Préfecture de La Réunion]

We conducted an epidemiological study to analyse the maritime teleconsultations carried out by the French TMAS in the Southern Indian Ocean zone between 2015 and 2020. The patients disembarked to receive treatment at the medical bases in the French Southern Lands.

MATERIALS AND METHODS

We conducted an observational, descriptive, cross-sectional and retrospective study from 1 January 2015 to 31 December 2020.

STUDY POPULATION

We included all patients who attended a French TMAS maritime teleconsultation in the Southern Indian Ocean zone and who were subsequently redirected to one of the French Southern Lands bases. We also included patients for whom maritime evacuation from the Southern Lands bases had been requested.

DATA COLLECTION

Each teleconsultation performed by the French TMAS is recorded in a medical record within a dedicated app (AppliCCMM®). The following data are collected on each call: the patient's details (age, gender, nationality, rank, symptoms, on-board medical care, care on the medical bases), the type of vessel and its geographical location, and the final treatment decision. The data for our study were extracted from these records and then anonymised.

ETHICS

During the teleconsultation, the patients were informed that their anonymised data could be used for research purposes. The procedure complied with the Declaration of Helsinki [5]. In compliance with the French Public Health Code, this retrospective study follows the MR-004 regulatory procedure on the processing of personal data for study, assessment and research purposes not involving human persons. It is recorded in the internal MR-004 registry of Toulouse University Hospital (CNIL [French Data Protection Act] number: 2206723 v 0).

DATA ANALYSIS

The data were extracted and anonymised from AppliCCMM® in Microsoft Excel 2007® format (Microsoft Corporation, Redmond, WA). A TMAS doctor verified and validated the data extracted from the app prior to their inclusion. The statistical analysis was conducted using Microsoft Excel 2007® software (Microsoft Corporation, Redmond, WA).

The categorical data were expressed in frequencies and percentages. The continuous variables were expressed as mean standard ± deviation.

RESULTS

Between 1 January 2015 and 31 December 2020, the French TMAS doctors managed 11,908 cases including 76 in the Southern Indian Ocean zone (0.6%). Nineteen (25%) of these cases were redirected to one of the French Southern Lands bases for medical treatment.

SOCIODEMOGRAPHIC DATA

Most of the patients were men (n = 18; 95%) with an average age of 45 ± 10 years. The youngest patient was 20 years of age and the eldest 63 years of age. Eight (42%) patients were French. Eighteen (95%) patients were on board a trawler. The other characteristics are presented in detail in Table 1.

CONDITIONS AND TREATMENTS

Nine (47%) patients presented with a trauma-related condition (Table 2, patients 1 to 9), 8 (42%) patients had medical disease (Table 2, patients 10 to 17), and 2 (11%) patients had surgical disease (Table 2, patients 18 and 19).

Thirteen (68%) patients were initially treated on board by the crew on the advice of the French TMAS doctor before arriving in the French Southern Lands.

Table 1. Characteristics of the study population

		Population (n = 19; 100%)
Age ± SD [years]		45 ± 10
Gender ratio; M/F		18/1
Rating	Sailor	10 (53%)
	Qualified fisherman	2 (11%)
	Mechanic	2 (11%)
	Lieutenant	1 (5%)
	Chef	1 (5%)
	Boatswain	1 (5%)
	Scientist	1 (5%)
	Other	1 (5%)
Nationality	French	8 (42%)
	Indonesian	4 (21%)
	Australian	2 (11%)
	Russian	2 (11%)
	Madagascan	1 (5%)
	Ukrainian	1 (5%)
	Not specified	1 (5%)
Type of ships	Trawler	18 (95%)
	Research vessel	1 (5%)

F — female; M — male; SD — standard deviation

Table 2. Conditions and overall management

Patient	Diagnosis	Treatment administered by the French TMAS	Treatment on the TAAF	Final decision
1	Abscess following a hook wound	Amoxicillin and clavulanic acid, paracetamol, chlorhexidine	Abscess debridement, antibiotics, topical treatment	Return to ship
2	Traumatic amputation, lower limb		Debridement of lacerated wound, lower limb	EVASAN
3	Glenohumeral dislocation	Amoxicillin and clavulanic acid, paracetamol, tramadol	Consultation	Return to ship
4	Foreign body	Amoxicillin and clavulanic acid, paracetamol, tramadol	Foreign body removal	Return to ship
5	Foreign body	Amoxicillin and clavulanic acid, paracetamol	Foreign body removal	Return to ship
6	Upper limb injury	Ketoprofen, omeprazole, paracetamol	Consultation	Return to ship
7	Neck injury	Paracetamol	Consultation, neck collar, radiography	EVAMED
8	Abscess	Amoxicillin and clavulanic acid, paracetamol	Abscess debridement	EVASAN
9	Abscess		Abscess debridement, antibiotics, topical treatment	EVAMED
10	Decompensation, infected oedema/ascites	Omeprazole	Hospitalisation, lab, fluid therapy	EVAMED
11	Chest pain of cardiac origin		ECG, treatment of coronary syndrome, monitoring	EVAMED
12	Epididymo-orchitis		Consultation, antibiotic therapy	EVAMED
13	Chest pain of cardiac origin	Amoxicillin and clavulanic acid, acetylcysteine, nitrendipine, paracetamol, nitroglycerine	ECG, treatment, monitoring	EVASAN
14	Gastritis	Omeprazole	Consultation, monitoring	Return to ship
15	Abdominal pain	Paracetamol, phloroglucinol	Consultation	Return to ship
16	Pulmonary embolism		Ultrasound, laboratory tests, oxygen therapy, curative anticoagulation, ECG, monitoring	EVAMED
17	Gastritis	Metopimazine, omeprazole, paracetamol	Medication, monitoring	Return to ship
18	Appendicitis	Paracetamol, tramadol	Ultrasound, laboratory tests, antibiotic therapy	EVAMED
19	Appendicitis		Ultrasound, laboratory tests, antibiotic therapy	EVAMED

ECG — electrocardiogram, EVAMED — evacuation with medical doctor, EVASAN — evacuation without medical doctor; TAAF — French Southern and Antarctic Lands; TMAS — Telemedical Maritime Assistance Service

At the end of the medical treatment at the Southern Lands base, 8 patients required medical evacuation to Reunion Island, either on board the Marion Dufresne or on board their ship accompanied by a base doctor. The treatment received by each patient is described in Table 2.

DISCUSSION

The study of these data over a period of 6 years highlights the importance of the medical presence in the French Southern Lands for seafarers in the Southern Indian Ocean who require medical assistance whilst at sea. Indeed,

a quarter of the individuals who consulted the French TMAS for medical advice were redirected to the southern bases where they were treated by a doctor.

The characteristics of the patients treated are consistent with our knowledge of seafarers and fishermen since most of the patients were on board fishing trawlers [6, 7]. The vast majority of patients were male, with only one female having to be redirected. This explains the absence of gynaecological conditions. The patients were all relatively young, of working age, with a mean age of 44.5 years. The youngest patient was 20 years of age and the eldest 63 years of age.

Only 42% of the patients were French. This emphasises the importance of having an international maritime medical assistance organisation as patients with at least six different nationalities required treatment. It also highlights difficulties associated with the language barrier, the likelihood of discovering exotic pathologies hitherto unknown in France and the follow-up of these seafarers by an occupational health system that may be very different from the French system.

Most of the seafarers were treated for trauma (47%). This is not surprising given the difficult working conditions of seafarers. The main reason for requesting a French TMAS teleconsultation in a maritime setting is of a medical nature, except for fishing vessels, where consultations are mostly trauma-related [1, 8]. The majority of these traumas required a medical procedure (wound debridement, abscess incision, removal of a foreign body) and the intervention of a doctor from one of the bases. Indeed, when procedures were concluded successfully, patients were able to rejoin their vessel without the need for evacuation. Only the most serious cases (amputation, major infection, etc.), which exceeded the medical bases' hospital resources, required evacuation. However, treatment was initiated on site in all cases. It is interesting to note that 11% of the conditions involved surgical diseases. Appendicitis was diagnosed in all cases. This is not surprising since the most common surgical disease in under 50-year-olds in the general population is appendicitis [9]. The conservative (medical) treatment of appendicitis has a 90% success rate [10]. It is therefore very interesting to note that a seafarer presenting with appendicitis can have a relatively rapid assessment by a doctor followed by medical treatment, before going ashore where a surgical procedure may be indicated at a later date.

Among the medical conditions, most of the patients for whom redirection was requested presented clinical signs of heart disease or epigastralgia. Only 2 patients had another medical condition. However, we know that some coronary artery diseases manifest as epigastric pain – hence these patients should indeed have an electrocardiogram and medical assessment as soon as possible if the pain is indicative of coronary artery disease. Although not all pain proved to be of coronary origin, the harsh working conditions and the profile of the patients on board are factors that suggest the onset of myocardial ischaemia. In these situations, intervention by the medical base doctors culminated in patients being diagnosed and treated much earlier than if they had stayed on board a ship until returning ashore, given the close proximity of these bases. Evacuation to Reunion Island, possibly with medical assistance, can also be arranged.

It is interesting to note that in 68% of the regulated, redirected cases, treatment and monitoring were initiated on board at the request of the French TMAS regulator. This highlights the merits and importance of having access to teleconsultations as well as the significance of having at least some medically trained staff on board [11]. Crew members should be trained in monitoring vital signs and assessing patients in order to provide the French TMAS with the best possible assessment.

Finally, in all cases, collaboration between the French TMAS, French Southern Land doctors (base doctors, doctors based on Reunion Island and on the Marion Dufresne) and the MRCC of Reunion Island ensured that all patients received the best possible care, from arriving at the bases to possible evacuation to Reunion Island with a medical team on hand to treat the patients on arrival. We can clearly see the patient benefits of this maritime medical assistance organisation in conjunction with the specific features of the French Southern Lands medical bases operating in this region. Patients can be secure in the knowledge that medical assistance is at hand despite the extreme isolation of their workplace.

CONCLUSIONS

Although relatively few patients are redirected to receive medical treatment on the French Southern Lands bases, referral regularly occurs and is vital for the individual. This pathway is even more valuable because of the precarious situation in which patients find themselves. The presence of these bases is still unusual in a maritime setting but, despite the fact that this is not their primary role, they are proving to be a valuable asset in providing maritime medical assistance for seafarers navigating the surrounding waters and who find themselves in difficult and extremely isolated conditions. For the patients treated, access to the bases has been beneficial and has provided them with access to quality care or even medical evacuation despite their remote location. This medical presence is therefore not negligible. Indeed, it is a precious asset not only for those on site but also for all seafarers in the region who require urgent medical assistance.

Communication between French TMAS, French Southern Lands doctors, MRCC and possibly specialised medical teams on Reunion Island has enabled patients to receive the right treatment at the right time.

Conflict of interest: None declared

REFERENCES

1. ENIM [Internet]. Report 2017: Maritime Occupational Injuries and Diseases. https://www.enim.eu/sites/default/files/diaporama/enim_rapportactivite_bd.pdf (cited 2022 May 05).
2. French department of the sea [Internet]. Order of July 2, 1999 concerning the medical training of personnel serving on board commercial and pleasure vessels armed with a crew role. https://www.legifrance.gouv.fr/ affichTexte.do? (cited 2022 May 05).
3. Prime Minister's Circular [Internet]. Instruction on the organisation of medical assistance at sea, 29 August 2011. http://circulaires.legifrance.gouv.fr/pdf/ 2011/11/cir_34077.pdf (cited 2022 April 29).
4. United Nations [Internet]. Convention on the Carriage of Goods by Sea, Hamburg, 31 March 1978. https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XI-D-3&chapter=11&clang=_en (cited 2022 May 05).
5. Declaration of Helsinki [Internet] Ethical Principles for Medical Research Involving Human Subjects. https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/ (cited 2022 September 21).
6. ENIM [Internet]. Activity Report 2013. https://www.enim.eu/sites/default/files/fichier_insert/enim-ra2013-bd_imp_diff.pdf (cited 2022 May 05).
7. Dehours E, Tourneret ML, Roux P, et al. Benefits of photograph transmission for trauma management in isolated areas: cases from the French tele-medical assistance service. Int Marit Health. 2016; 67(2): 83–87, doi: 10.5603/IMH.2016.0017, indexed in Pubmed: 27364173.
8. Cécile Gabart [Internet]. Traumatology in ocean racing: an epidemiological survey from 2008 to 2015. Human Medicine and Pathology. 2016. https://dumas.ccsd.cnrs.fr/dumas-01425232 (cited 2022 May 05).
9. Addiss DG, Shaffer N, Fowler BS, et al. The epidemiology of appendicitis and appendectomy in the United States. Am J Epidemiol. 1990; 132(5): 910–925, doi: 10.1093/oxfordjournals.aje.a115734, indexed in Pubmed: 2239906.
10. Wojciechowicz KH, Hoffkamp HJ, van Hulst RA. Conservative treatment of acute appendicitis: an overview. Int Marit Health. 2010; 62(4): 265–272, indexed in Pubmed: 21348022.
11. Pujos M, Roux P, Tabarly J et al [Internet]. Maritime telemedical consultation and regulation. Maritime Medical Consultation Center. Urgences 2013. https://www.sfmu.org/upload/70_formation/02_eformation/02_congres/Urgences/urgences2013/donnees/pdf/031_Pujos.pdf (cited 2022 May 05).

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2022; 73, 3: 125–132
10.5603/IMH.2022.0025
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Dental caries, oral hygiene status and treatment needs of fishermen and non-fishermen population in South Goa, India

Varkey N.S., Rhea Vas, Humsika Uppala, Nazleen Valerie Vas, Sagar Jalihal, Anil V. Ankola, Ram Surath Kumar K.

Department of Public Health Dentistry, KAHER's KLE Vishwanath Katti Institute of Dental Sciences, Karnataka, India

ABSTRACT

Background: *Occupation plays a major role in the well-being of an individual and has an influence on oral health. Fishing is one such occupation that entails a lot of physical labour and encourages habits that lead to poor oral health. Therefore, it is critical to shed light on the oral health of this isolated population to improve their quality of life by various means. The aim of the study was to assess and compare the prevalence of dental caries, oral hygiene status and treatment needs of fisherman and non-fisherman population in South Goa, India.*

Materials and methods: *Study design was cross-sectional in nature. After a pilot study, multi-stage random sampling technique was employed and 400 study participants were recruited. World Health Organization Oral Health Assessment Form (1997) and Oral Hygiene Index-Simplified (OHI-S) were used to record the study variables. Inter-examiner reliability assessed using Kappa statistics were found to be 90% and 88%, respectively. The data was analysed using descriptive analysis, Chi-square test, Mann-Whitney U test, Kruskal-Wallis test, and linear and logistic regression analysis.*

Results: *Fishermen had significantly higher caries prevalence (82%) and poor oral hygiene (46%) than non-fishermen. Extraction (42.2%) and pulp care (23.6%) were the highest treatment need among fishermen. They were 2.08 times more prone to dental caries than non-fishermen. Fishermen who used a toothbrush were 4.5 times less susceptible to caries. The dependence of caries prevalence and OHI-S score on occupation, oral hygiene aid and age were 14% and 25.8%, respectively.*

Conclusions: *Fishermen in South Goa had high caries prevalence, poor oral hygiene status and they required extensive dental treatment when compared to non-fishermen.*

(Int Marit Health 2022; 73, 3: 125–132)

Key words: dental caries, fishermen, occupational health, oral health, oral hygiene

INTRODUCTION

Oral health gives a general picture of the overall health and quality of life of a person. Every major disease has certain oral manifestations. Good oral health significantly improves the standard of living [1]. The body's inbuilt defences along with good oral hygiene practices significantly reduce the risk of oral disease [2]. Low socio-economic status and systemic diseases can also have detrimental impact on oral health-related quality of life, while some research shows that physical activity and a high socioeconomic position are possible protective factors for good oral health [3]. These factors are influenced by the occupation of an individual.

Occupation has a major role on the well-being of an individual. White collar jobs, which have more of a sedentary

Dr. Rhea Vas, Department of Public Health Dentistry, KAHER's KLE Vishwanath Katti Institute of Dental Sciences, Belagavi-590010, Karnataka, India, tel: +918600624042, e-mail: rheavs100@gmail.com

Received: 29.07.2022 Accepted: 28.09.2022

lifestyle is associated with lower back pain and obesity [4], whereas blue collar jobs are more prone to early onset of non-communicable diseases such as diabetes and hypertension. Some blue-collar jobs are strongly linked with the risk factors of cardiovascular disease and have slightly worse endothelial function [5, 6]. Nutritional deficiencies are also common in some line of work [7]. People who work in some professions are more prone to oral illness due to lifestyle variables; one such line of work is fishing.

Fishing is a blue-collar job that entails a lot of physical labour. It encourages bad behaviours such as irregular eating patterns, stress, alcoholism, tobacco use, and other undesired habits. Unlike other professions in India, there haven't been much technological innovations to improve the fishermen's working conditions. They continue to fish using traditional techniques, which is hazardous in many ways [8]. The prevalence of injuries during work and musculoskeletal disorders are high among this group [9, 10].

India has a total of 7,500 km of coastline and 3,827 fishing villages. It is the world's third-largest producer of fish and ranks second in aquaculture. Fishing is a significant contributor to the nation's economy. The export earnings from this industry is ₹334.41 billion (US$ 4.5 bn) and it contributes 1.07% to the country's overall gross domestic product (GDP). It is a large-scale industry in India employing 14.5 million personnel [11].

Fishing is one of the primary occupations in Goa, which is a tourist state located on the south-west coast of India with a coastline of 104 km stretching along the Arabian sea. The state has two districts, South Goa being one of them. Marine fishing in Goa contributes 3% of the state GDP and 2% of the total marine fish production of the country [12]. Since the mid-16th century, the local people have been fishermen. They reside in small settlements close to the fish landing centres. They use tobacco products to avoid seasickness and stay observant at night while working at sea and have a tendency of drinking alcohol after a hard day's labour. Fishing provides livelihood to a large number of people in South Goa and plays a vital role in its socioeconomic development.

Despite being one of the major occupations in India, studies on this secluded population remains scanty. Therefore, purpose of the study is to assess and compare the prevalence of dental caries, oral hygiene status and treatment needs of fisherman and non-fisherman population in South Goa, India.

MATERIALS AND METHODS

STUDY SETTING

This study was descriptive, cross-sectional in nature that followed STROBE guidelines for reporting. It was conducted among fishermen and non-fishermen population in South Goa district in India from November 2019 to January 2020.

ETHICAL CONSIDERATIONS AND INFORMED CONSENT

The ethical clearance was granted by the Institutional Research and Ethics Committee (23/12/10/19) and the study followed the ethical standards outlined in the 1964 Declaration of Helsinki and its subsequent modifications. An official permission was obtained from the fisheries officer of Cutbona jetty in South Goa, India. The method of data collection, confidentiality of the data and purpose of the study was explained clearly to the study participants and a written informed consent was obtained.

TRAINING AND CALIBRATION

The examiners were standardised and calibrated to ensure consistent examination by a panel of experts prior to the start of the study to ensure uniform interpretations of the codes and criteria that were to be recorded. The number of examiners were two and the inter-examiner reliability for World Health Organization (WHO) Oral Health Assessment Form (1997) [13] and Oral Hygiene Index Simplified (OHI-S) [14] was assessed using Kappa statistics and found to be 90% and 88%, respectively.

SELECTION CRITERIA

Participants aged 18 years and above were recruited and those who were not willing to participate and give consent for the study were excluded.

SAMPLE SIZE ESTIMATION AND SAMPLING TECHNIQUE

A pilot study was conducted among 50 participants to determine the feasibility of the study. The sample size was estimated to be 188 in each group with type I (α) error = 0.05 and Power (1-β) = 0.95 using G*Power statistical software (Ver. 3.1.9.4.), which was rounded off to 200 per group. Hence, this study consisted of a total sample size of 400. The participants were selected by multi-stage random sampling technique. There were 22 marine fish landing centres in South Goa which were divided into three zones: major, medium and minor. A fishing landing centre was selected from each zone to obtain the required sample size (Fig. 1).

DATA COLLECTION

A survey proforma designed with the help of WHO Oral Health Assessment Form (1997) [13] consisted of three sections: (1) Demographic data including name, age and occupation; (2) Method of tooth cleaning; (3) Clinical parameters assessed were the dentition status, OHI-S [14] and treatment needs. On predetermined dates the examiners visited the settlements around the fish landing centres of South-Goa where 200 fishermen and 200 non-fisher-

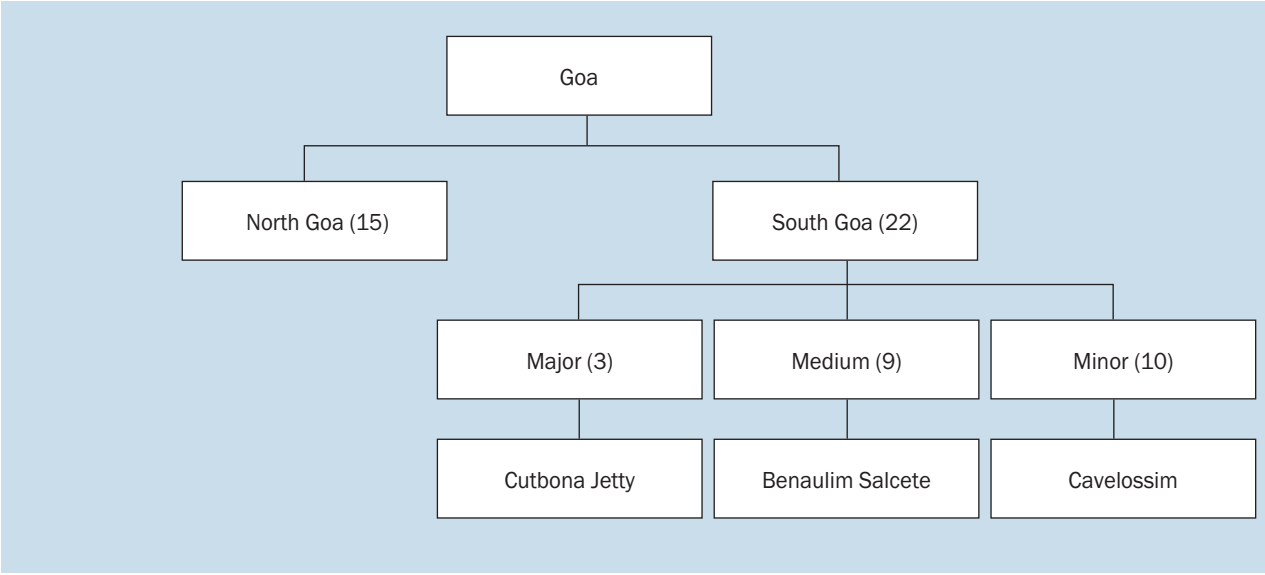


Figure 1. Multi-stage random sampling for the selection of study participants in South Goa

men belonging to six different age groups were examined. A type III examination was carried out by the examiners under natural light and the time taken for each subject was around 10 minutes.

STATISTICAL ANALYSIS

The recorded data were entered in Microsoft Excel 2019 and analysed using IBM-SPSS® Statistics-Version 21 (IBM, USA). Descriptive statistics were computed, which included percentages, means and standard deviations. The normality of the data distribution was determined using the Shapiro-Wilk test. Chi-square test was used to check for the association between the study variables among the participants. Mann-Whitney U test and Kruskal-Wallis test were performed to check for any significant differences in the study parameters. Multiple linear regression and binomial logistic regression analysis were also performed. For all the tests, confidence level and level of significance were set at 95% and 5%, respectively.

RESULTS

Among the 400 participants, 288 (72%) were found to be males and 112 (28%) were found to be females. The mean age of fishermen and non-fishermen were 28.55 ± 8.93 and 32.13 ± 15.60, respectively (Table 1). Occupation was significantly associated with caries prevalence ($p < 0.001$), OHI-S score ($p < 0.001$), oral hygiene aid ($p = 0.02$) and the treatment need ($p < 0.001$) when Chi-square test was used.

Among fishermen, 57% were not using a toothbrush and toothpaste as their oral hygiene aid, whereas in non-fishermen 97% used. Kruskal-Wallis test depicted that there was a statistically significant ($p < 0.001$) difference in the oral hygiene aids used among the participants (Table 2). The prevalence of dental caries among fishermen and non-fishermen were 82% and 54%, respectively (Fig. 2) and their mean Decayed, Missing and Filled Teeth (DMFT) index score was 4.10 ± 3.15 and 1.94 ± 1.46, respectively (Fig. 3). Mann-Whitney U test depicted that there was a statistically significant difference in caries prevalence ($p < 0.001$) and DMFT index score ($p = 0.002$) among the participants. In fishermen, extraction (42.2%) followed by pulp care (23.6%) was the highest treatment need whereas in non-fishermen it was one surface filling (50.6%) (Table 3). The mean OHI-S score of fishermen and non-fishermen was 2.11 ± 1.25 and 0.93 ± 0.79, respectively (Fig. 3). Among fishermen, 46% had poor OHI-S score; in contrast to that, 80% non-fishermen had a good score (Table 2). The difference between the OHI-S score was statistically significant

Table 1. Distribution of study population by age and occupation

Age [years]	Fishermen (n = 200)	Non-fishermen (n = 200)
20–29	132 (66%)	128 (64%)
30–39	38 (19%)	18 (9%)
40–49	26 (13%)	16 (8%)
50–59	0 (0%)	24 (12%)
60–69	4 (2%)	4 (2%)
70–79	0 (0%)	10 (5%)
Mean ± SD	28.55 ± 8.93	32.13 ± 15.60

All values are expressed as frequency with percentages (in parentheses); SD — standard deviation

Table 2. Oral hygiene status and aids used among fishermen and non-fishermen

Parameters	Fisherman (n = 200)	Non-fisherman (n = 200)	P
OHI-S score			< 0.001*
Good	46 (23%)	160 (80%)	
Fair	62 (31%)	34 (17%)	
Poor	92 (46%)	6 (3%)	
Oral hygiene aid			< 0.001*
Toothbrush and toothpaste	86 (43%)	194 (97%)	
Finger and toothpaste	64 (32%)	2 (1%)	
Finger and toothpowder/salt	28 (14%)	0 (0%)	
Chew sticks	22 (11%)	4 (2%)	

All values are expressed as frequency with percentages (in parentheses). The statistical test used: Kruskal-Wallis test; level of significance: *p ≤ 0.05 is considered statistically significant; OHI-S — Oral Hygiene Index-Simplified

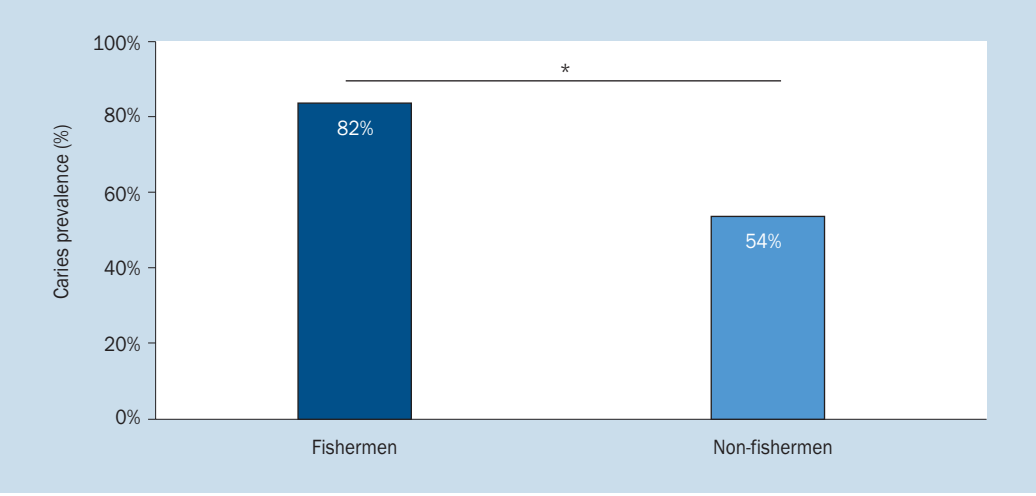


Figure 2. Comparison of caries prevalence (%) in fishermen and non-fisherman. Statistical test used: Mann-Whitney U test; *statistically significant, p ≤ 0.05

(p < 0.001) among the participants when Kruskal-Wallis test was used (Table 2).

ASSOCIATION BETWEEN CARIES PREVALENCE AND OHI-S SCORES WITH DEMOGRAPHIC VARIABLES AND ORAL HYGIENE AID

A significant relationship was seen using multivariate linear regression analysis between caries prevalence and OHI-S score with the model containing occupation (p < 0.001) and oral hygiene aid (p < 0.001), respectively. The dependence of caries prevalence and OHI-S score on the model containing occupation, oral hygiene aid and age were found to be 14% and 25.8%, respectively (Table 4).

When binomial logistic regression analysis was performed, it was found that fishermen had increased odds of 2.08 for acquiring dental caries when compared to non-fishermen (p = 0.008). Among fishermen, those who didn't use a toothbrush as their oral hygiene aid were 4.5 times more likely to acquire dental caries than those who used one (p < 0.001) (Table 5).

DISCUSSION

The workplace of an individual cultivates certain behaviours and habits that have some direct influence on their oral health [15]. Fishing community on a global scale endures the denial of health care reforms. Fishermen's monthly wages remain bare minimum compared to other occupations due to which they pay little to no attention to their oral treatment needs [16]. Fishing is primarily a male-dominated occupation. Majority of the participants in the current study (72%) were men in their late twenties. They need to remain fit and agile in order to maximise their working ef-

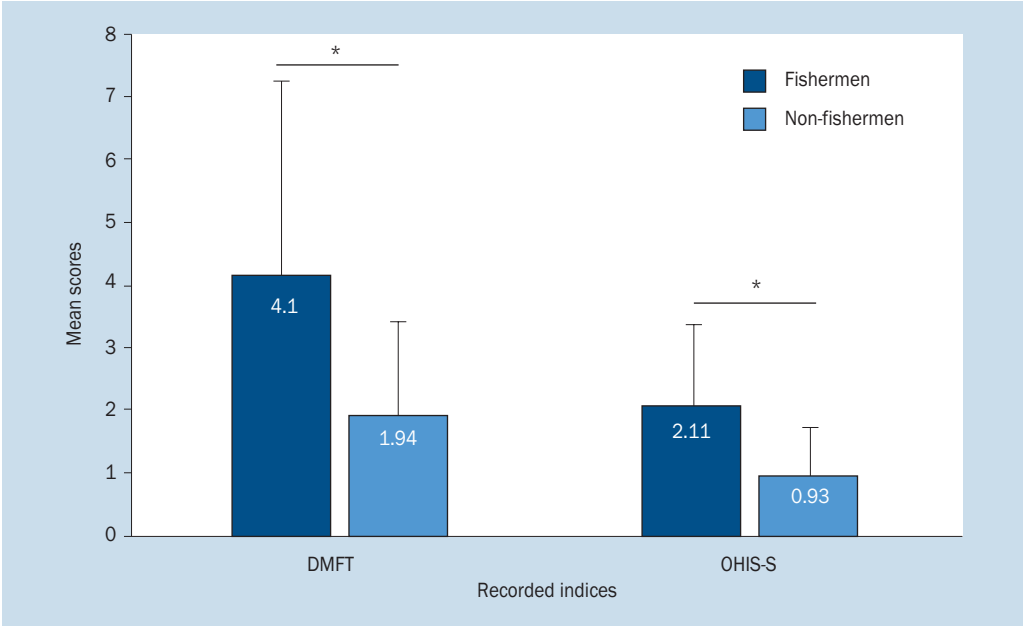


Figure 3. Comparison of Decayed, Missing and Filled Teeth (DMFT) and Oral Hygiene Index-Simplified (OHI-S) scores (mean ± standard deviation) of fishermen and non-fishermen. Statistical test used: Mann-Whitney U test; *statistically significant, p ≤ 0.05.

Table 3. Treatment needs of the population

Treatment needs	Fishermen	Non-fishermen	P
One surface filling	78 (11.5%)	182 (50.6%)	< 0.001*
Two or more surface filling	152 (22.4%)	92 (25.5%)	
Pulp care	160 (23.6%)	44 (12.2%)	
Extraction	286 (42.2%)	28 (7.8%)	
Crown	2 (0.3%)	14 (3.9%)	
Total	678 (100%)	360 (100%)	

All values are expressed as frequency with percentages (in parentheses). The statistical test used: Chi-square test; level of significance: *p ≤ 0.05 is considered statistically significant association

Table 4. Association between caries prevalence and Oral Hygiene Index-Simplified (OHI-S) with occupation, oral hygiene aid and age

Parameters	Coefficient r	SE	t	95% CI	P	Adjusted R^2
Dependent variable: caries prevalence						0.14
Constant	3.175	0.634	5.007	1.93 to 4.42	< 0.001*	
Occupation	–0.954	0.295	–3.239	–1.53 to –0.38	< 0.001*	
Oral hygiene aid	0.756	0.166	4.547	0.43 to 1.08	< 0.001*	
Age	–0.183	0.106	–1.728	–0.39 to 0.03	0.085	
Dependent variable: OHI-S score						0.26
Constant	2.648	0.256	10.354	2.15 to 3.15	< 0.001*	
Occupation	–1.018	0.119	–8.566	–1.25 to –0.79	< 0.001*	
Oral hygiene aid	0.211	0.067	3.143	0.08 to 0.34	< 0.001*	
Age	0.047	0.043	1.101	–0.04 to 0.13	0.272	

The statistical analysis used: multivariate linear regression; level of significance: *p ≤ 0.05 is considered statistically significant; CI — confidence interval; SE — standard error

Table 5. Association between caries prevalence with occupation and brushing habits

Parameters	Odds ratio	95% CI	P
Caries prevalence			0.008*
Non-fisherman	1 (Ref)	1.21–3.57	
Fisherman	2.08		
Caries prevalence of fisherman			< 0.001*
Brushing with toothbrush	1 (Ref)	2.03–9.98	
Brushing without toothbrush	4.50		

The statistical analysis used: binomial logistic regression; level of significance: *p ≤ 0.05 is considered statistically significant; CI — confidence interval

fectiveness; nevertheless, as they grow older, they become more susceptible to musculoskeletal complications [17]. In this study, fishing occupation was substantially associated with many oral health parameters that were recorded. This indicates that fishing occupation has a definite influence on the oral health of an individual. Therefore, occupational physicians should also give importance to oral health of fishermen, as poor oral health can decrease their working efficiency.

Fishermen spend more time at sea due to which their oral hygiene practices are not up to the required standards. In previous studies, less than 25% of this population used a toothbrush and toothpaste as their oral hygiene aid, the reasons stated being low economic status and inadequate education [15, 17–19]. In this study, a relatively higher use of toothbrush was seen in fishermen (43%) which is likely attributable to Goa's high literacy rate (88.70%) that ranks fourth in the country. This finding emphasizes the importance of education which has a direct influence on the oral hygiene practice of an individual [20]. It was found that fishermen who didn't use a toothbrush as their oral hygiene aid were 4.5 times more susceptible to dental caries. Hence, the mode of cleaning the teeth was an important factor. Strategies should be established by which public health specialists could provide oral health education on brushing habits and other oral hygiene practices through various means.

Liquor taxes are low in Goa, which may lead to increased alcohol consumption among fishermen [21]. This behaviour encourages smoking and inappropriate eating habits, which when combined with poor oral hygiene practices contribute to dental caries and other oral health problems. In this study, the impact of factors such as occupation, oral hygiene aid used and age on caries prevalence was estimated to be 14%. The current study also revealed that fishermen were two times more prone to dental caries than non-fishermen and the prevalence of dental caries among fishermen (82%) was high. These findings were found to be in accordance with Asawa et al. [15] in Kutch, Rajmohan [22] in Chennai and Bhat [23] in Uttara Kannada however it contradicts that of Saravanan et al. [24] in Tamil Nadu.

Majority of the economically disadvantaged in Goa prefer the sole state-run government dental college. Some of the participants in this study complained about having to travel a certain distance for their dental treatment and were unaware of primary health centres that offered low-cost dental care. In the current study, the DMFT index score obtained in both the groups were comparable to studies by Saravanan et al. in Tamil Nadu [24] and in Kerala [17] and Bhatt in Mangaluru city [25] but lower than M. Bhat's study in Uttara Kannada [23]. Previous studies reported that the number of restored teeth among this population were low [23, 25], implying a lack of awareness or access to proper oral health care. Extraction (42.2%) followed by pulp care (23.6%) was the most common treatment which was needed in fishermen. This indicates that caries had progressed to the point where conservative and preventive dental treatments were no longer effective and they were not provided to them at the appropriate time. This was in accordance with M. Bhat's study in Uttara Kannada [23].

In the present study, a low number of fishermen (31%) had good oral hygiene status compared to non-fishermen (80%); the reason could be fishermen used inappropriate oral hygiene aids. Occupation, oral hygiene aid, and age influenced the OHI-S score by 25.8% in this study. The mean OHI-S score of fishermen in the current study was consistent with findings from Sanadhya et al. [26] in Kutch, but lower than Lodagala et al. [27] in Andhra Pradesh.

Fishermen play an essential role in "Blue Economy" put forward by the World Bank for sustainable use of ocean resources [28]. To accomplish these sustainable development goals, the World Dental Federation believes that oral health should be integrated into general healthcare systems, particularly in developing nations [16]. International Labour Organization mandates oral health assessment be included in a seafarer's medical examination and performed at least once every 2 years [29]. Health care administrators in India should consider a similar routine medical and oral

examination for the fishermen, as they are prone to not only dental caries but also other oral mucosal lesions [19]. Teledentistry assisted by community health workers may be a viable option for fishermen with inaccessible dental care. It has the potential to decrease treatment cost and can be integrated with electronic health records which is easily available to any dental care professionals [30].

LIMITATIONS OF THE STUDY

The limitation of this study being, the very cross-sectional nature of it because of which the temporal relationship between the lifestyle factors and oral health status could not be established. A longitudinal study of the same target group is needed to identify the risk factors that contribute to the development of oral disease.

CONCLUSIONS

Oral health among fishermen in South Goa was poor as they had high caries prevalence, poor oral hygiene status and used inappropriate oral hygiene aids. They required extensive dental treatments in comparison with non-fishermen. Effective oral health education and caries preventive programs are needed among the fishermen population.

Conflict of interest: None declared

REFERENCES

1. Sischo L, Broder HL. Oral health-related quality of life: what, why, how, and future implications. J Dent Res. 2011; 90(11): 1264–1270, doi: 10.1177/0022034511399918, indexed in Pubmed: 21422477.
2. Singh M, Ingle NA, Kaur N, et al. Dental caries status and oral hygiene practices of lock factory workers in Aligarh City. J Int Oral Health. 2015; 7(6): 57–60, indexed in Pubmed: 4479775.
3. Schmidt J, Vogel M, Poulain T, et al. Association of oral health conditions in adolescents with social factors and obesity. Int J Environ Res Public Health. 2022; 19(5), doi: 10.3390/ijerph19052905, indexed in Pubmed: 35270598.
4. Żywień U, Barczyk-Pawelec K, Sipko T. Associated risk factors with low back pain in white-collar workers-a cross-sectional study. J Clin Med. 2022; 11(5), doi: 10.3390/jcm11051275, indexed in Pubmed: 35268366.
5. Sagaro GG, Battineni G, Di Canio M, et al. A descriptive epidemiological study of cardiovascular diseases among seafarers. Int Marit Health. 2021; 72(4): 252–258, doi: 10.5603/IMH.2021.0049, indexed in Pubmed: 35146743.
6. Charles LE, Fekedulegn D, Landsbergis P, et al. Associations of work hours, job strain, and occupation with endothelial function: the Multi-Ethnic Study of Atherosclerosis (MESA). J Occup Environ Med. 2014; 56(11): 1153–1160, doi: 10.1097/JOM.0000000000000311, indexed in Pubmed: 25376409.
7. Park HY, Lim YH, Park JB, et al. Environmental and Occupation Factors Associated with Vitamin D Deficiency in Korean Adults: The Korea National Health and Nutrition Examination Survey (KNHANES) 2010-2014. Int J Environ Res Public Health. 2020; 17(24), doi: 10.3390/ijerph17249166, indexed in Pubmed: 33302471.
8. Alayyannur PA, Arini SY. The relationship between work environment and occupational accidents among fishermen in Indonesian coastal areas. Int Marit Health. 2021; 72(3): 195–198, doi: 10.5603/IMH.2021.0037, indexed in Pubmed: 34604989.
9. Barrow A, Kongira A, Nget M, et al. Epidemiology of occupational hazards and injuries among fishermen at Tanji fishing site in The Gambia: an analytical cross-sectional study design. Environ Health Insights. 2022; 16: 11786302221088699, doi: 10.1177/11786302221088699, indexed in Pubmed: 35340563.
10. Müller JD, da Silva EM, Franco Rego R. Prevalence of Musculoskeletal Disorders and Self-Reported Pain in Artisanal Fishermen from a Traditional Community in Todos-os-Santos Bay, Bahia, Brazil. Int J Environ Res Public Health. 2022; 19(2), doi: 10.3390/ijerph19020908, indexed in Pubmed: 35055729.
11. Shrivastava A. Decoding India's National Fisheries Policy[degreesofchange.in]. September 20, 2020. https://www.degreesofchange.in/articles/decoding-indias-national-fisheries-policy-2020 (Accessed January 26 2022).
12. GB S, Mujawar S. Fisheries sector of Goa: present status, challenges and opportunities. National Seminar on "Life & Life Processes: Interdisciplinary Approach for Sustainable Development. 2021: 3.
13. World Health Organization. Oral health surveys: basic methods. World Health Organization; 1997 [who.int]. https://apps.who.int/iris/handle/10665/41905 (Accessed June 13 2022).
14. Greene JC, Vermillion JR. The simplified oral hygiene index. J Am Dent Assoc. 1964; 68: 7–13, doi: 10.14219/jada.archive.1964.0034, indexed in Pubmed: 14076341.
15. Asawa K, Pujara P, Tak M, et al. Oral health status of fishermen and non-fishermen community of Kutch district, Gujarat, India: a comparative study. Int Marit Health. 2014; 65(1): 1–6, doi: 10.5603/MH.2014.0001, indexed in Pubmed: 24677119.
16. Singh MK, Abdulrahman SA, Rashid A. Assessment of oral health status and associated lifestyle factors among Malaysian Fishermen in Teluk Bahang, Penang: An analytical cross-sectional study. Indian J Dent Res. 2018; 29(3): 378–390, doi: 10.4103/ijdr.IJDR_545_17, indexed in Pubmed: 29900926.
17. Saravanan N, Kunjappan, Reddy C, Veeresh D. A Study to assess the Oral Health Status and Treatment needs of Fishermen Population in Coastal Region of Kerala. 2012: 407.
18. Aapaliya P, Shinde K, Deswal AK, et al. Assessment of oral health among seafarers in Mundra Port, Kutch, Gujarat: a cross-sectional study. Int Marit Health. 2015; 66(1): 11–17, doi: 10.5603/IMH.2015.0004, indexed in Pubmed: 25792160.
19. Chandroth SV, Venugopal HK, Puthenveetil S, et al. Prevalence of oral mucosal lesions among fishermen of Kutch coast, Gujarat, India. Int Marit Health. 2014; 65(4): 192–198, doi: 10.5603/IMH.2014.0037, indexed in Pubmed: 25522702.
20. Tsakos G, Sheiham A, Iliffe S, et al. The impact of educational level on oral health-related quality of life in older people in London. Eur J Oral Sci. 2009; 117(3): 286–292, doi: 10.1111/j.1600-0722.2009.00619.x, indexed in Pubmed: 19583757.
21. Anzil K, Mathews J, Sai AG, et al. Prevalence of Deleterious Oral Habits and Oral Mucosal Lesions among Fishermen Population of Mahe, South India. J Contemp Dent Pract. 2016; 17(9): 745–749, doi: 10.5005/jp-journals-10024-1923, indexed in Pubmed: 27733718.
22. Rajmohan M. An Assessment of Oral Health status and treatment needs of 12 and 15 Years Old School going Children of Fishermen Community residing at East Coast Road, Chennai, Tamilnadu. Ragas Dental College and Hospital, Chennai; 2013.

23. Bhat M. Oral health status and treatment needs of a rural Indian fishing community. West Indian Med J. 2008; 57(4): 414–417, indexed in Pubmed: 19566027.
24. Saravanan N, Reddy CV, Veeresh DJA. study to assess the oral health status and treatment needs of fishermen population in coastal region of Tamil Nadu. Public health. 2011; 2011(18).
25. Bhatt S, Rajesh G, Rao A, et al. Factors influencing Oral Health and Utilization of Oral Health Care in an Indian Fishing Community, Mangaluru City, India. World Journal of Dentistry. 2017; 8(4): 321–326, doi: 10.5005/jp-journals-10015-1458.
26. Sanadhya YK, Thakkar JP, Divakar DD, et al. Effectiveness of oral health education on knowledge, attitude, practices and oral hygiene status among 12-15-year-old schoolchildren of fishermen of Kutch district, Gujarat, India. Int Marit Health. 2014; 65(3): 99–105, doi: 10.5603/IMH.2014.0022, indexed in Pubmed: 25471157.
27. Lodagala A, Pachava S, Talluri D, et al. Association between tobacco usage and dental caries among 35–44-year-old fishermen of North Coastal Region of South Indian State, Andhra Pradesh. J Indian Association of Public Health Dentistry. 2018; 16(4): 308–312.
28. Roy A, Blue Economy in the Indian Ocean: Governance perspectives for sustainable development in the region. Observer research foundation. 2019; Occasional paper No. 181.
29. Guidelines on the medical examination of seafarers; [ilo.org]. 2013. https://www.ilo.org/wcmsp5/groups/public/—ed_dialogue/—sector/documents/normativeinstrument/wcms_174794.pdf (Accessed 24 May 2022).
30. Mahdi SS, Sibilio F, Amenta F. Dental hygiene habits and oral health status of seafarers. Int Marit Health. 2016; 67(1): 9–13, doi: 10.5603/IMH.2016.0003, indexed in Pubmed: 27029923.

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2022; 73, 3: 133–142
10.5603/IMH.2022.0026
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Impact of COVID-19 anxiety on work stress in seafarers: the mediating role of COVID-19 burnout and intention to quit

Ahmet Tuncay Erdem[1], Hasan Tutar[2]

[1]Bolu Abant Izzet Baysal University, Turkey
[2]Bolu Abant Izzet Baysal University, Affiliated University, Istanbul Commerce University, Turkey

ABSTRACT

Background: *The frequent encounters of seafarers with people from different countries compared to other occupations increase their risk of contracting different variants of coronavirus disease 2019 (COVID-19). This risk may cause additional anxiety for them. The main purpose of this research is to determine the mediating role of COVID-19 burnout and intention to quit in the impact of seafarers' anxiety about contracting COVID-19 on work stress.*

Materials and methods: *The research is a quantitative correlational research design cross-sectional study. We determined the research data according to the random sampling technique. Participants consist of 390 maritime business employees operating in Istanbul and Izmir. We determined the participants based on voluntary participation. We collected the data with the help of the Coronavirus Anxiety Scale, COVID-19 Burnout Scale, Intention to Quit Scale, and Work Stress Perception Scale.*

Results: *The study found that seafarers' anxiety about contracting the novel coronavirus positively influences their perception of job stress and that COVID-19 burnout and intention to quit strongly mediate this interaction. We also determined that seafarers had a high level of COVID-19 anxiety, leading to a higher perception of COVID-19 burnout.*

Conclusions: *These findings mean that although personal factors are important, negative psychological perceptions feed off each other and cause another psychological perception. The research results need to be strengthened by psychological factors such as job satisfaction, organizational trust and organizational support, and their psychological resilience should be increased so that seafarers do not show COVID-19 anxiety due to job stress and intention to quit.*

(Int Marit Health 2022; 73, 3: 133–142)

Key words: seafarers, novel coronavirus, COVID-19 burnout, intention to quit, work stress

INTRODUCTION

Many seafarers stay on ships for long periods; the crew needs to be changed regularly to avoid excessive fatigue. This translates into a monthly rotation of up to 100,000 seafarers [1]. United Nations Conference on Trade and Development (UNCTAD) expects international maritime trade to grow at an annual average of 3.5% in 2019–2024 [2]. Considering sectoral trends and fleet growth rates, more employment is required to feed the growing fleet in shipping. This situation increases the importance of human resources in maritime transport. Conditions such as working in a humid environment, risk of suffocation, and heavy workload expose workers in the maritime sector to mental, psychological and physical health risks than other occupational groups. All

Assoc. Prof. Ahmet Tuncay Erdem, Bolu Abant İzzet Baysal University, Faculty of Communication, Gölköy Campuss Bolu, Turkey, tel/fax: 00905448459110, e-mail: ahmeterdem@ibu.edu.tr

Received: 28.02.2022 Accepted: 5.07.2022

these severe and risky conditions raise the issue of sustainability in human resources in shipping [3–5]. In addition to prioritizing sustainability in recruitment, placement, and development processes, sustainable human resources management also prioritizes protecting the employed and the employees' psychological health [5–8]. Here, psychological health means complete well-being, psychologically free from all kinds of stress, tension, and burnout.

The number of deaths due to the COVID-19 epidemic has exceeded 18 million. According to worldometers.info data, which immediately follows the subject, the number of people who lost their lives due to COVID-19 is 5,893,061, the number of those who recovered is 346,813,010, and the number of cases is 422,230,030 (February 20, 2022). These numbers increase people's anxiety depending on personal factors such as awareness level and psychological resilience. The continuity of the said anxiety causes work stress in employees, and a new form of burnout called COVID-19 burnout occurs with COVID-19 [5, 6, 9]. Combining all these negativities is an everyday situation that will strengthen the employee's intention to quit. Long journeys, demanding work conditions, a humid environment, sleep disruption, sound vibration, fatigue, and pirate threats contribute to increased work stress [4, 10, 11]. The maritime profession, which contains many difficulties, can cause anxiety, burnout, and work stress. Trait anxiety is one of the most important threats of burnout, and burnout is one of the most important threats to professional continuity [5, 12]. Anxiety, job stress, and burnout may cause employees' interest and motivation to lose their job regardless of their type. A lack of job satisfaction and dissatisfaction may increase their intention to quit.

This study aimed to determine the mediating effect of COVID-19 burnout and intention to quit in the relationship between COVID-19 anxiety and work stress in maritime workers. While doing this, we based the independent variable of the research, "COVID-19 anxiety", on the State and Trait Anxiety Theory developed by Spielberger and Rickman [13]. State anxiety provides strong theoretical support to the research because it reflects the event-specific anxiety frequently experienced during the COVID-19 process, and trait anxiety reflects the anxiety state of the person for the future due to the long duration of the epidemic. We based work stress, the dependent variable of the research, on the work stress model developed by Katz and Kahn. The model is very explanatory for this research, as it explains job stress by considering the working conditions of the employee in the work environment and possible risks [14, 15]. We based the theoretical basis of COVID-19 burnout, one of the study's mediating variables, on the "Burnout Theory" developed by Maslach [16], which claims that the person's emotional energy decreases as the will to cope with life events weakens. We based the intention to quit, another mediator variable of the research, on the "Planned Behaviour Theory" developed by Ajzen [17]. The theory of planned behaviour provides a strong theoretical basis for this research, as it is a theory that explains the relationships in attitude-behaviour research.

CONCEPTUAL FRAMEWORK

NEW TYPE OF CORONAVIRUS ANXIETY

Anxiety causes feelings such as restlessness, anxiety, and fear to become stronger in an individual. Anxiety can be examined in cognitive, behavioural, and affective frameworks [18–20]. As in all attitudes and behaviours, anxiety can be handled in three dimensions: cognitive (do not worry, thinking about irrelevant things, etc.), affective (being nervous, bodily reactions, etc.), and behavioural (insufficient working skills, procrastination, avoidance, etc.) [20, 21]. Anxiety is an indication that an individual is healthy at a certain level and is a guarantee of staying healthy, especially during pandemic days. However, excessive anxiety is a state of being unhealthy and excessive anxiety causes exhaustion in the individual [5–7, 22]. The coronavirus caused the deaths of about 6 million people worldwide, and these deaths increased daily, causing a new form of anxiety called the "new type of coronavirus anxiety". Seafarers who have close contact with those who have contracted the new type of coronavirus and the news about the emergence of different variants in different parts of the world negatively affect seafarers who have close contact with people due to their duties [18, 20].

Decreased social relations to protect themselves from the epidemic may cause psychological problems such as depression, fear of death, anxiety about not getting enough health care, sleep problems, and anxiety. The high level of anxiety may cause the illness to be perceived more negatively and, therefore, its effect on the individual to be more negative [5, 6, 7, 9]. Measures taken due to the COVID-19 outbreak may cause seafarers to increase their state anxiety levels [5, 23]. When people are faced with a dangerous and undesirable situation, their state anxiety levels increase, and the severity of the risk perception affects the level of anxiety. When the stress is intense, an increase in the level of state anxiety is observed, and how these psychological processes are perceived causes another psychological state to emerge, such as burnout and work stress [19, 22, 24, 25]. People who work under the pressure of constant stress lose their job satisfaction and desire to succeed, and their intention to quit becomes stronger.

WORK STRESS

According to Selye [26], stress is a non-specific response produced by various harmful factors. The inability of the individual to meet work demands due to the im-

balance in the perception of the "person-environment" causes stress [24, 27]. On the other hand, job stress is the emotional reaction to disruptive environmental conditions where the employee's abilities cannot meet the job's requirements. Work stress occurs due to working and interacting with the environment. Job stress brings additional attention and work effort and thus strains [28, 29]. Job stress brings organizational problems such as job dissatisfaction, stronger intentions to leave, absenteeism, increased workforce turnover rate, poor performance, and error rates when organizational conflicts increase and disruptions occur in jobs [29–31]. Studies have shown that stressful conditions include arriving late and leaving work early, taking long breaks, poor concentration, and an inability to make decisions. The increase in the frequency of accidents in the workplace, organizational conflict, being less creative and innovative, early fatigue, and decreased communication are other negative effects of stress on employees [29, 30].

The risk of infectious disease, time pressure, heavy workload, task complexity, monotonous work, and various obstacles are important work stressors. Role ambiguity and role conflict are role-related stress factors. Role ambiguity, burden, and confusion are stressors [15, 29, 31, 32]. Role load occurs when an employee simultaneously tries to meet the demands of more than one role. Role ambiguity occurs when job expectations are incompatible or conflict with the role definition and it is not always easy to understand what the job entails. In addition, the incompatibility of the employee's role with his or her abilities is also an important stress factor. Inability to adapt to workplace norms and culture, incompatibility between the characters of the manager, colleagues, and subordinates, and interpersonal conflict in the workplace are relationship-oriented social stressors in organizations. The effect of stress factors on the person determines the extent of his/her burnout perception. In particular, long-term and excessive stress is one of the important causes of burnout [29, 31, 33, 34]. Psychosomatic disorders caused by anxiety, worry, and excessive stress can increase the employee's perception of burnout and intention to quit the job. Based on this conceptual and theoretical framework, the following H1 hypothesis has been developed.

H1. COVID-19 anxiety positively affects work stress.

COVID-19 BURNOUT

Burnout is generally examined in three dimensions in the literature: emotional exhaustion, depersonalisation, and low sense of personal accomplishment. Emotional exhaustion expresses weariness, loss of energy, loss of power, exhaustion and exhaustion [35, 36]. Depersonalisation is manifested by negative attitudes towards other people, irritability, withdrawal, and loss of idealism [37–39]. Depersonalisation causes the individual to have negative feelings towards the people he or she works with and act indifferent towards them. A low sense of personal achievement towards work decreases the individual's sense of achievement and desire to work due to negative experiences. Symptoms such as decreased productivity, loss of talent, poor morale, and inability to cope with stressors are signs of a decreased sense of personal accomplishment [36, 38]. These three dimensions can come together in a certain process and cause the individual's perception of burnout stronger. Studies on COVID-19 burnout have found a positive relationship between stress and burnout [39, 40].

This new form of burnout, called COVID-19 burnout, has a different structure from the general burnout perception of the pandemic [39, 41, 42]. COVID-19 burnout affects workers, especially in unfavourable working conditions and at risk of death. Maritime workers have a relatively higher perception of burnout associated with loss of emotional, cognitive, and physical energy due to difficult working conditions [44]. Situations such as excessive workload, risk of being infected, fear of infecting their relatives, and witnessing deaths can cause seafarers to be under extreme stress. Research on the relationship between burnout, anxiety, and stress reveals that people experience high levels of burnout during the COVID-19 pandemic. Factors that increase people's resilience, such as organizational trust and organizational support, play an important role in reducing work stress and the perception of burnout during the pandemic process [9, 39, 40, 44]. Due to the protracted nature of the virus, the fact that people are suffering greatly from burnout related to COVID-19 can strengthen their intention to quit. The following hypotheses have been developed based on this conceptual and theoretical framework.

H2. COVID-19 anxiety positively affects COVID-19 burnout.
H3. COVID-19 burnout positively affects work stress.

INTENTION TO QUIT

Intention to quit is the desire of employees to leave their jobs due to dissatisfaction with their current job conditions [45–47]. The intention to quit is not the employee's intention to quit the job but the intention and desire to leave the job. Situations such as being laid off or retiring differ from the intention to leave. In order to talk about leaving the job, the employee must have a desire to leave voluntarily due to situations such as burnout, job stress, organizational insecurity, or excessive anxiety [47, 48]. As a result of the employees' evaluation of the future situation of the organization and their position in this situation, the intention to quit the job develops. In addition, various

studies have shown that the age factor is a factor that increases the intention to quit [49–51]. In addition, working time and personal habits can also affect quitting. An employee who intends to leave will underperform in his or her job and work at a low-performance level. An employee's emotional state accompanies the perception of burnout, such as indifference towards his or her job, insensitivity to colleagues, and low achievement [39, 45]. The intention to quit causes a high turnover rate.

Resignation occurs when the employee changes a unit, department, or position. When voluntary leaving work, motivational factors come to the fore [52–54]. The intention to quit the job arises from the individual's desire to go beyond the social system to which they belong of their free will. Intention to quit is strengthened when employees have low job satisfaction, stress, and burnout perceptions [52, 55]. Intention to quit the job occurs when the employees are not satisfied with the working conditions, which means the loss of qualified labour for the organizations. The high turnover rate brings high costs to the organizations [52, 56]. Loss of organizational memory, deterioration of business planning, loss of a skilled and educated workforce, negative impact on the competitive advantage against competitors, loss of time with recruits, recruitment costs, sadness, stress, conflict with recruits, and disagreements are negative organizational consequences of intention to quit [47, 52]. These results show that negative perceptions affect other psychological moods without ignoring individual differences. The following hypotheses have been developed based on the conceptual and theoretical framework.

H4. The intention to quit positively affects job stress.
H5. COVID-19 anxiety positively affects the intention to quit.
H6. Intention to quit and COVID-19 burnout plays a mediating role in the effect of COVID-19 anxiety on work stress.

MATERIALS AND METHODS

PURPOSE OF RESEARCH

The main purpose of this research is to determine whether the intention to quit and COVID-19 burnout function as mediating variables in the effect of COVID-19 anxiety on employees' job stress in maritime enterprises. The necessity of evaluating the research variables together, as explained above, is that there is a gap in the literature in this field, and the topic needs to be up-to-date, original, and functional. We think that the research can contribute to the literature in this respect.

PARTICIPANTS AND SAMPLING

We collected research data from the employees of maritime companies operating in the maritime sector in Istanbul and Izmir (Turkey). The sample determined according to the random sampling method in the research includes 390 employees. We chose many individuals or units to represent a part (sample) of the population with the random sampling method, as it allows individuals to be randomly determined from the population with a technique where everyone has an equal chance of being selected in this technique [57].

DATA COLLECTION INSTRUMENTS

In the study, we used three different scales to collect data. The first is the COVID-19 Anxiety Scale consisting of 5 items developed by Lee (2020) [58]. With this scale, we collected data on COVID-19 anxiety. Another scale is the 10-item COVID-19 Burnout Scale developed by Yıldırım and Solmaz (2020) [9]. With this scale, we collected data on COVID-19 burnout. We collected data on the participants' desire to quit their job with the 4-item Intention to Leave Scale developed by Hom et al. (1984) [59]. We collected data on job stress with the 14-item Job Stress Scale developed by Demiral et al. (2007) [60].

MODEL OF MEASUREMENT AND HYPOTHESES

In the hypothetical research model, we hypothesized that intention to quit and COVID-19 burnout would mediate the effect of COVID-19 anxiety on job stress. In the model, we constructed COVID-19 anxiety as the independent variable, the intention to quit work as the dependent variable, and work stress and COVID-19 burnout as mediator variables (Fig. 1).

VALIDITY AND RELIABILITY OF RESEARCH

Within the scope of the research, the reliability values of the scales; COVID-19 anxiety scale were determined as $\alpha = 0.906$, COVID-19 burnout $\alpha = 0.956$, intention to quit work $\alpha = 0.789$, and job stress scale $\alpha = 0.948$. In order to determine the reliability and validity of the scale expressions in the research model, we performed confirmatory factor analysis on the measurement model (Fig. 2). According to the confirmatory factor analysis result, the fit indices χ^2/DF, GFI, NFI, CFI, TLI and RMSEA values, good fit indices and validity values are shown in Table 1 [61–64].

It is seen that the χ^2 value is significant according to the four-factor model in Table 1 ($p < 0.01$). In addition, since the χ^2/DF value (2,141) is below 5, the model provides the criterion of fit in terms of validity. The data are concordant in terms of GFI = 0.894, CFI = 0.945, NFI = 0.902, TLI = 0.940, and RMSEA = 0.054 (Table 1). As a result of confirmatory factor analysis, we applied the "Chi-Square Difference Test" to determine whether there is a significant difference in terms of the fit between the four-factor model (COVID-19 anxiety, COVID-19 burnout, intention to quit, and job stress) and the single-factor model. We found that the difference between the χ^2 values of the test was

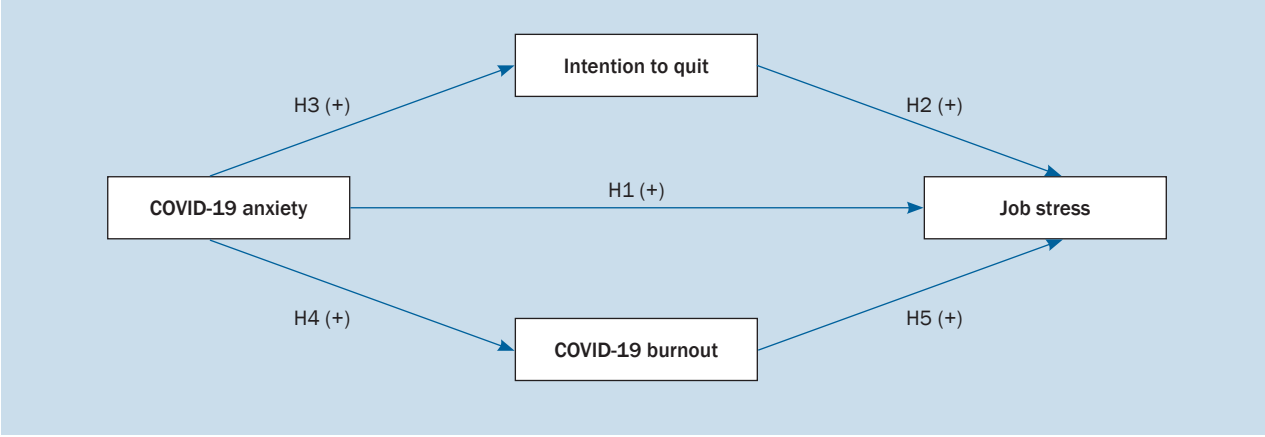


Figure 1. Research model

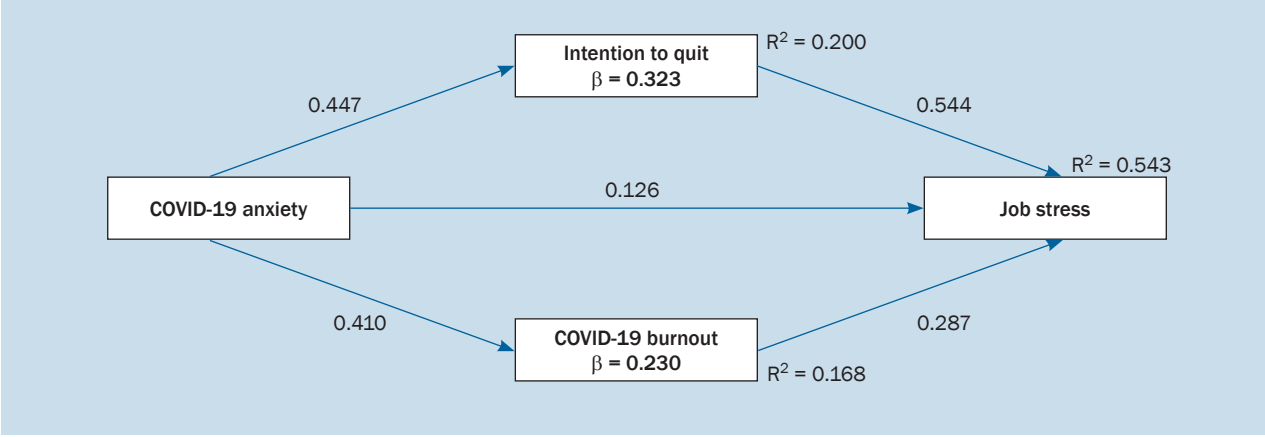


Figure 2. Structural equation model results

Table 1. Model-data fit values (resources: [61–64])

Data-model fit indices	Acceptable indices	Single factor model indices
Chi-Square (χ^2) = 1036,41		Chi-Square (χ^2) = 4263,45
DF (Degree of Freedom) = 484, p < 0.01		DF = 495
GFI (Goodness of Fit) = 0.894	GFI > 0.90	GFI = 0.410
NFI (Normal Fit Index) = 0.902	NFI > 0.90	NFI = 0.596
CFI (Comparative Fit Index) = 0.945	CFI > 0.90	CFI = 0.624
TLI (Tucker-Lewis Index) = 0.940	TLI > 0.90	TLI = 0.599
RMSEA (Root Mean Square Error of Approximation) = 0.054	RMSEA < 0.08	RMSEA = 0.140
χ^2/DF = 2.141	χ^2/DF < 5	χ^2/DF = 8.613

significant (Table 1). This finding determined no common method deviation in the data [64]. According to this finding, the data from the four-factor model is compatible [65, 66]. The findings also show that the model provides divergent and convergent discriminant validity (Table 2).

For the data obtained in the scales, we specified convergent validity according to the average explained variance (AVE) values [67]. The fact that the AVE values of the research model are higher than 0.5 indicates that the relevant items are valid in terms of implicit variables. As seen in Table 2, AVE values higher than 0.5 indicate that convergent validity is provided [65, 66]. In order to determine the discriminant validity, the correlation value between the scales must be less than 0.80, which indicates that

Table 2. Average, standard deviation (SD), reliability and correlation values of the variables

Variables	Mean	SD	CR	AVE	MSV	MaxR (H)	1	2	3	4
COVID-19 anxiety	3.64	0.935	0.899	0.640	0.256	0.905	–			
COVID-19 burnout	3.80	0.988	0.957	0.689	0.349	0.959	0.410**	–		
Intention to quit	3.79	0.833	0.799	0.504	0.216	0.824	0.447**	0.455**		
Job stress	3.85	0.820	0.950	0.578	0.281	0.956	0.468**	0.563**	0.702**	–

*Significant at 0.05 level (bi-directional); **Significant at 0.01 level (bi-directional); AVE — average explained variance; CR — composite reliability; MaxR (H) — maximal reliability; MSV — maximum shared variance

Table 3. Direct effects

Variables	β	t	SE	P
COVID-19 anxiety – Job stress	0.126	3.056	0.035	0.002
Intention to quit – Job stress	0.544	4.190	0.036	***
COVID-19 anxiety – Intention to quit	0.447	9.847	0.040	***
COVID-19 anxiety – COVID-19 burnout	0.410	8.870	0.049	***
COVID-19 burnout – Job stress	0.287	7.645	0.030	***

SE — standard error; *0.05; **0.01; ***significant at the 0.001 level (bi-directional)

divergent discriminant validity is provided [67]. Divergent discriminant validity is provided if the correlation values are lower than 0.80 and the significant relationship.

The standardized factor loads of the scale expressions used to collect data ranged from 0.51 to 0.86. The standardized factor loads of the study are greater than 0.5. In addition, the fact that the parametric test t values, which are among these factor values, vary between 8,307 and 13,714 shows that the research model is compatible. Table 2 shows a positive correlation between COVID-19 anxiety and COVID-19 burnout based on Pearson correlation analysis ($r = 0.410$, $p = 0.001$). We determined a positive correlation between COVID-19 anxiety and intention to quit ($r = 0.447$, $p < 0.001$). We discovered a link between COVID-19 anxiety and work stress ($r = 0.468$, $p = 0.001$). There is a positive correlation between COVID-19 burnout and intention to quit ($r = 0.455$, $p < 0.001$). There is a positive relationship between COVID-19 burnout and work stress ($r = 0.563$, $p < 0.001$). There is a link between the intention to quit and job stress ($r = 0.702$, $p = 0.001$). Correlation values show that there is a significant relationship between the variables.

RESULTS

DEMOGRAPHIC FINDINGS

According to the participants' demographic information, such as gender, education level, age, and seniority, 13% were female, and 87% were male. According to their marital status, 37% of the participants were single, and 63% were married. 30% of the participants were in the 36–45 age range. When the distribution by education level is examined, 35.6% of the participants are primary school graduates, 38.3% are undergraduates, 18.5% are graduates, and 7.6% are doctoral graduates.

TESTING RESEARCH HYPOTHESES

Table 3 shows the results of the structural equation model applied to the research data to test the research hypotheses.

Table 3, shows that COVID-19 anxiety has a positive and significant effect on work stress ($\beta = 0.126$, $t = 3.056$, $p = 0.002 < 0.01$). This means that the H1 hypothesis is confirmed. We found that COVID-19 anxiety positively and significantly affects COVID-19 burnout ($\beta = 0.410$, $t = 8.870$, $p < 0.001$). This result means that the H2 hypothesis is confirmed. We found a positive and significant effect of COVID-19 burnout on work stress ($\beta = 0.287$, $t = 7.645$, $p < 0.001$).

According to this determination, it is understood that the H3 hypothesis of the research is supported. According to the analysis results, the intention to quit positively and significantly affects job stress ($\beta = 0.544$, $t = 14.190$, $p < 0.001$). We also determined the positive and significant effect of COVID-19 anxiety on the intention to quit ($\beta = 0.447$, $t = 9.847$, $p < 0.001$). These results mean that the H4 and H5 hypotheses of the study were confirmed.

In this analysis, the parameters to be considered in order to determine the mediation effect are direct effect ($\beta = 0.126$) and total ($\beta = 0.487$) values. When the intermediary variables, intention to quit and COVID-19 burnout,

Table 4. Structural equation model significance (Bootstrap) values

	β	LLCI	ULCI
Direct effect			
Intention to quit – Job stress	0.544	–	–
COVID-19 anxiety – COVID-19 burnout	0.410	–	–
COVID-19 anxiety – Intention to quit	0.447	–	–
COVID-19 burnout – Job stress	0.287	–	–
COVID-19 anxiety – Job stress	0.126	–	–
Indirect effect			
COVID-19 anxiety – Intention to quit – COVID-19 burnout – Job stress	0.361	0.246	0.473
Total effect			
COVID-19 anxiety – Job stress	0.487	–	–

LLCI — lower limit confidence interval; ULCI — upper limit confidence interval

are included in the model, they increase the effect of the independent variable on the dependent variable (Table 4).

According to the findings, when the intention to quit work and COVID-19 burnout are included in the model, there is a significant increase in the total effect of COVID-19 anxiety on work stress. We performed the significance analysis using the Bootstrap method at a confidence level of 95%. According to Table 4, intention to quit and COVID-19 burnout mediate in the same model with the lowest 24.6% (lower limit of confidence interval: 0.246) and the highest 47.3% (upper limit of confidence interval: 0.473). The positive values indicate that the mediating effect of the assumed model is significant. It causes a positive increase in the 95% confidence interval (CI) for the mediating effect of intention to quit and COVID-19 burnout and a 36% (0.361) increase in the impact of COVID-19 anxiety on job stress (β = 0.361; 95% CI [0.246 and 0.473]; R2 = 0.543). According to this finding, the H6 hypothesis states that intention to quit and COVID-19 burnout function as a tool in the effect of COVID-19 anxiety on work stress were accepted.

DISCUSSION

In this study, we aimed to examine the "mediator" role of intention to quit and COVID-19 burnout in the effect of COVID-19 anxiety on work stress in a sample of maritime businesses. Research findings have determined that the high-risk working environment, uncertainty, and unfavourable hygiene conditions during the pandemic strengthen seafarers' perceptions of anxiety, work stress, and burnout. We discovered that all these negative perceptions strengthen the intention of maritime business employees to leave their jobs. We have determined that COVID-19 anxiety increases work stress, and COVID-19 burnout and the intention to quit work are mediators in this interaction process. Research findings show that COVID-19 anxiety, work stress, and COVID-19 burnout reinforce perceptions and the intention to quit. These findings indicate that the pandemic's unfavourable psychological climate in maritime businesses leads to negative perceptions of interrelated variables such as COVID-19 anxiety, COVID-19 burnout, job stress, and intention to quit.

The perception of burnout from COVID-19 differs from the general burnout perception and the pandemic in terms of its cause and results [9]. COVID-19 burnout occurs not for many reasons but due to the pandemic, and when combined with anxiety and stress, Seafarers encountering people from different parts of the world at risk of carrying different virus variants may cause their anxiety levels and perceptions of burnout to be relatively high [43, 68]. In addition to the risk of disease transmission, people's anxiety about losing their jobs during the pandemic strengthens their perception of burnout. It significantly increases their depression, anxiety, and stress levels [9]. In the literature, it is stated that negative emotions such as helplessness, insecurity, fear and anxiety due to COVID-19 may cause death anxiety to increase the stress level in individuals, and this may lead to burnout in individuals [69–71]. Studies show that high levels of anxiety in employees cause job stress to be perceived more negatively [5, 6, 7, 22, 29]. In addition, studies have determined that factors that increase the psychological resilience of individuals, such as organizational trust and organizational support, play an important role in reducing work stress and burnout perception during the pandemic process [9, 40].

LIMITATIONS OF THE STUDY

This research is limited to examining whether there are mediator effects of intention to quit and COVID-19 burn-

out on the effect of COVID-19 anxiety on job stress. This quantitative research is limited to seafarers working in Istanbul Marine Enterprises. The research can be repeated in different samples with other organizational behaviour variables. In addition, the research can also examine whether it functions as a regulatory variable in the relationship established with COVID-19 burnout and intention to quit. In order to better understand the research subject, it can be repeated with different samples using qualitative and mixed research methods.

CONCLUSIONS

The psychological climate is important for seafarers to work with high performance and strong motivation. It is seen that there is a consensus in the literature that the variables are negative organizational behaviours in studies on subjects such as anxiety, work stress, and burnout. On the other hand, it is known that these negative situations strengthen the intention to quit the job. A study on the subject determined that the COVID-19 epidemic increased employees' anxiety, work stress, and depression [72]. In their research on teachers, Klassen and Chiu [73] determined that leaving their job strengthens their job stress. Deniz Günaydın [74] determined that individuals' fears of COVID-19 cause them to stay away from the organization, and this anxiety strengthens their intention to quit their jobs. Kokubun et al. [75], in a study conducted at a Japanese company in China, determined that employees' fears and concerns about COVID-19 increased their intention to quit, and Japanese employees were more likely to quit their jobs because of this fear and anxiety. Sunjaya et al. [76], in their study in Indonesia, determined that healthcare workers who have direct contact and responsibility for treating COVID-19 patients have a higher risk of experiencing depressive symptoms, anxiety, and burnout. Luceño-Moreno et al. [77]. In their study in the health sector in Spain, determined that the COVID-19 pandemic increased the perceptions of anxiety, stress, and burnout and strengthened their intention to quit. In their research, Dima et al. [78] determined that the pandemic caused work stress and burnout. Yıldırım and Solmaz [9] determined that individuals' COVID-19 burnout strengthens stress in their research in Turkey. All these findings show that the results of our research are in line with the literature.

Conflict of interest: None declared

REFERENCES

1. https://www.ilo.org/ankara/areas-of-work/covid-19/WCMS_743420/lang–tr/index.htm (Access date 01.12. 2022).
2. https://unctad.org/ (Access date 01.12. 2022).
3. Bates R. Improving human resources for health planning in developing economies. Human Resource Development International. 2013; 17(1): 88–97, doi: 10.1080/13678868.2013.857509.
4. Oldenburg M, Baur X, Schlaich C. Occupational risks and challenges of seafaring. J Occup Health. 2010; 52(5): 249–256, doi: 10.1539/joh.k10004, indexed in Pubmed: 20661002.
5. Torales J, O'Higgins M, Castaldelli-Maia JM, et al. The outbreak of COVID-19 coronavirus and its impact on global mental health. Int J Soc Psychiatry. 2020; 66(4): 317–320, doi: 10.1177/0020764020915212, indexed in Pubmed: 32233719.
6. Taylor S. The psychology of pandemics: Preparing for the next global outbreak of infectious disease. Cambridge Scholars Publishing. 2019. https://www.cambridgescholars.com/download/ sample/65716.
7. Liu N, Zhang F, Wei C, et al. Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: Gender differences matter. Psychiatry Res. 2020; 287: 112921, doi: 10.1016/j.psychres.2020.112921, indexed in Pubmed: 32240896.
8. Esen D. Sürdürülebilir İnsan Kaynakları Yönetimine Genel Bir Bakış. Journal of Current Researches on Business and Economics. 2018; 8(1): 85–104.
9. Yıldırım M, Solmaz F. COVID-19 burnout, COVID-19 stress and resilience: Initial psychometric properties of COVID-19 Burnout Scale. Death Stud. 2022; 46(3): 524–532, doi: 10.1080/07481187.2020.1818885, indexed in Pubmed: 32915702.
10. Kum S, Boşnak T. A qualitative study on nutrition of turkish seafarers. J ETA Maritime Science. 2016; 4(2): 135–147, doi: 10.5505/jems.2016.20591.
11. Slišković A, Penezić Z. Descriptive study of job satisfaction and job dissatisfaction in a sample of Croatian seafarers. Int Marit Health. 2015; 66(2): 97–105, doi: 10.5603/IMH.2015.0023, indexed in Pubmed: 26119680.
12. Weinborn R, Bruna B, Calventus J, et al. Burnout syndrome prevalence in veterinarians working in Chile. Austral J Vet Sci. 2019; 51(2): 91–99, doi: 10.4067/s0719-81322019000200091.
13. Spielberger CD, Rickman RL. Assessment of state and trait anxiety. Anxiety: psychobiological and clinical perspective. Hemisphere Publishing Corporation, London 1990.
14. Bliese P, Jex S, Halverson R. Integrating multilevel analyses and occupational stress theory: historical and current perspectives on stress and health. Research in Occupational Stress and Well Being. 2002: 217–259, doi: 10.1016/s1479-3555(02)02006-1.
15. Jex SM, Britt TW. Organizational Psychology: A Scientist Practitioner Approach. 2nd Edition. John Wiley& Sons, New Jersey 2008: 2008.
16. Maslach C. Burnout: The Cost of Caring. ISHK, Cambridge 2003.
17. Ajzen I. The theory of planned behavior. Organizational Behavior and Human Decision Processes. 1991; 50(2): 179–211, doi: 10.1016/0749-5978(91)90020-t.
18. Han HR. Measuring anxiety in children: a methodological review of the literature. Asian Nursing Research. 2009; 3(2): 49–62, doi: 10.1016/s1976-1317(09)60016-5.
19. Spielberger C, Reheiser E. Assessment of emotions: anxiety, anger, depression, and curiosity. Applied Psychology: Health and Well-Being. 2009; 1(3): 271–302, doi: 10.1111/j.1758-0854.2009.01017.x.
20. Elliott CH, Smith LL. Overcoming anxiety for dummies. Indiana: Wiley Publishing, Indianapolis 2010.
21. Zeidner M, Matthews G. Evaluation anxiety. In Elliot AJ, Dweck CS (Eds) Handbook of Competence and Motivation. Guildford Press, London 2005.
22. Zhao A, Guo Y, Dynia J. Foreign language reading anxiety: Chinese as a foreign language in the United States. Modern Language J. 2013; 97(3): 764–778, doi: 10.1111/j.1540-4781.2013.12032.x.
23. Dikmen AU, Kına M, Özkan S, et al. COVID-19 epidemiyolojisi: pandemiden ne öğrendik. J Biotech Strategic Health Res. 2020, doi: 10.34084/bshr.715153.

24. Yan H, Xie S. How does auditors' work stress affect audit quality? Empirical evidence from the Chinese stock market. China J Acc Res. 2016; 9(4): 305–319, doi: 10.1016/j.cjar.2016.09.001.
25. Çırakoğlu OC. Domuz Gribi (H1N1) salgınıyla ilişkili algıların, kaygı ve kaçınma düzeyi değişkenleri bağlamında incelenmesi. Türk Psikol Dergisi. 2011; 26(67): 9–64.
26. Selye H. Stress in health and disease. Butterworth-Heinemann: 2013.
27. Holmlund-Rytkönen M, Strandvik T. Stress in business relationships. J Business Industrial Marketing. 2005; 20(1): 12–22, doi: 10.1108/08858620510576757.
28. Chen J, Silverthorne C. The impact of *locus* of control on job stress, job performance and job satisfaction in Taiwan. Leadership Organization Development J. 2008; 29(7): 572–582, doi: 10.1108/01437730810906326.
29. Choudhury K. Managing Workplace Stress: Cognitive Behavioral Way. Springer, Kolkata, India 2013.
30. Cranwell-Ward J, Abbey A. Organizational Stress. Palgrave Macmillan, New York, NY 2005.
31. Sutherland VJ, Cooper CL. Strategic Stress Management: an Organisational Approach. Macmillan, Basingstoke 2000.
32. O'driscoll MP, Brough P. Work Organisation and Health, Occupational Health Psychology, Ed. Stavroula Leka, Jonathan Houdmont. Wiley-Blackwell., United Kingdom 2010: 57–86.
33. Landy FJ, Conte JM. Work in the 21st Century – an Introduction to Industrial and Organizational Psychology. John Wiley & Sons, Baskı, Hoboken, NJ 2013.
34. Quick JC, Henderson DF. Occupational Stress: Preventing Suffering, Enhancing Wellbeing. Int J Environ Res Public Health. 2016; 13(5): 459, doi: 10.3390/ijerph13050459, indexed in Pubmed: 27136575.
35. Arslan G, Yıldırım M. Okulda Mutluluğun Ölçülmesi ve Desteklenmesi. In: Arslan G, Yıldırım M (Eds), Okulda Pozitif Psikoloji: Kuramdan Uygulamaya (pp. 5-15). 2021 Pegem Akademi. https://doi.org/10.14527/9786257676977.
36. Maslach C, Schaufeli WB, Leiter MP. Job burnout. Annu Rev Psychol. 2001; 52: 397–422, doi: 10.1146/annurev.psych.52.1.397, indexed in Pubmed: 11148311.
37. Maslach C, Goldberg J. Prevention of burnout: New perspectives. Applied and Preventive Psychology. 1998; 7(1): 63–74, doi: 10.1016/s0962-1849(98)80022-x.
38. Fabio P, Stefania S, Elisabetta T, et al. Public health and burnout: a survey on lifestyle changes among workers in the healthcare sector. Acta Biomed. 2019; 90(1): 24–30.
39. Sung CW, Chen CH, Fan CY, et al. Burnout in medical staffs during a coronavirus disease (COVID-19) pandemic. SSRN Electronic J. 2020, doi: 10.2139/ssrn.3594567.
40. Morgantini LA, Naha U, Wang H, et al. Factors contributing to healthcare professional burnout during the COVID-19 pandemic: a rapid turnaround global survey. MedRxiv. 2020, doi: 10.1101/2020.05.17.20101915, indexed in Pubmed: 32511501.
41. Griffith AK. Parental burnout and child maltreatment during the COVID-19 pandemic. J Fam Violence. 2022; 37(5): 725–731, doi: 10.1007/s10896-020-00172-2, indexed in Pubmed: 32836736.
42. Yildirim M. Mediating role of resilience in the relationships between fear of happiness and affect balance, satisfaction with life, and flourishing. Eur J Psychol. 2019; 15(2): 183–198, doi: 10.5964/ejop.v15i2.1640, indexed in Pubmed: 33574950.
43. Holland JM, Neimeyer RA. Reducing the risk of burnout in end-of-life care settings: the role of daily spiritual experiences and training. Palliat Support Care. 2005; 3(3): 173–181, doi: 10.1017/s1478951505050297, indexed in Pubmed: 16594456.
44. Costa BRC, Pinto I. Cristina Jornalo Freire. Stress, Burnout and Coping in Health Professionals: A Literature Review. J Psychology Brain Studies. 2017: 1–8.
45. Fong YL, Mahfar M. Relationship between occupational stress and turnover intention among employees in a furniture manufacturing company in Selangor. Jurnal Teknologi. 2013; 64(1), doi: 10.11113/jt.v64.1673.
46. Yıldırım MH, Erul EE, Kelebek P. Tükenmişlik ile İşten Ayrılma Niyeti Arasındaki İlişki Banka Çalışanları Üzerine Bir Araştırma. Organizasyon ve Yönetim Bilimleri Dergisi. 2014; 6(1): 34–44.
47. Polat M, Meydan HC. Örgütsel özdeşleşmenin sinizm ve işten ayrılma niyeti ile ilişkisi üzerine bir araştırma. KHO Savunma Bilimleri Enstitüsü Dergisi. 2010; 9(1): 145–172.
48. Yousaf A, Sanders K, Abbas Q. Organizational/occupational commitment and organizational/occupational turnover intentions. Personnel Review. 2015; 44(4): 470–491, doi: 10.1108/pr-12-2012-0203.
49. Lewis G. Turnover and the quiet crisis in the federal civil service. Public Administration Review. 1991; 51(2): 145, doi: 10.2307/977108.
50. Schaufeli W, Bakker A. Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. J Organizational Behavior. 2004; 25(3): 293–315, doi: 10.1002/job.248.
51. Khanin D. How to reduce turnover intentions in the family business: Managing centripetal and centrifugal forces. Business Horizons. 2013; 56(1): 63–73, doi: 10.1016/j.bushor.2012.09.005.
52. Bibby CL, Should I. Stay or leave? Perceptions of age discrimination, organizational justice and employee attitudes on intentions to leave. J Applied Management Entrepreneurship. 2008; 13(2): 63–86.
53. Özyer K, Azizoğlu O. Demografik Değişkenlerin Kişilerin Etik Tutumları Üzerindeki Etkileri, Ekonomik ve Sosyal Araştırmalar Dergisi. Cilt:6, Yıl:6, Sayı:2, 6. 2010: 59–84.
54. Çetin A, Güleç R, Kayasandık A. Etik iklim algısının çalışanların işten ayrılma niyetine etkisi: tükenmişliğin aracı değişken rolü. EJOVOC Electronic Journal of Vocational Colleges. 2015; 5(2): 18, doi: 10.17339/ejovoc.18657.
55. Cho S, Johanson M, Guchait P. Employees intent to leave: A comparison of determinants of intent to leave versus intent to stay. Int J Hospitality Management. 2009; 28(3): 374–381, doi: 10.1016/j.ijhm.2008.10.007.
56. Özcan DE, Vardarlier P, Karabay EM, et al. Liderliğin örgütsel vatandaşlık davranışı ve işten ayrılma niyeti üzerindeki etkisinde güvenin rolü. Öneri. 2012; 10(37): 1–13.
57. Tutar H, Erdem AT. Örnekleriyle bilimsel araştırma yöntemleri ve-SPSS uygulamaları. Seçkin Yayıncılık, Ankara 2020.
58. Lee SA. Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety. Death Stud. 2020; 44(7): 393–401, doi: 10.1080/07481187.2020.1748481, indexed in Pubmed: 32299304.
59. Hom P, Griffeth R, Sellaro C. The validity of mobley's (1977) model of employee turnover. Organizational Behavior and Human Performance. 1984; 34(2): 141–174, doi: 10.1016/0030-5073(84)90001-1.
60. Demiral Y, Ünal B, Kılıç B, et al. İş stresi ölçeğinin İzmir Konak Belediyesi'nde çalışan erkek işçilerde geçerlik ve güvenilirliğinin incelenmesi. Toplum Hekimliği Bülteni, 26(1. 2007; 26(1): 11–18.
61. Schumacker RE, ve Lomax RG. A Beginner's Guide to. Structural Equation Modeling. 3rd Ed. Taylor & Francis Group, New York 2010.
62. Wang J, ve Wang X. Structural equation modeling: Applications using Mplus. John Wiley & Sons. 2019.
63. Munro BH. Statistical methods for health care research. Vol. 1. Williams & Wilkins, Lippincott 2005.

64. Fornell C, Larcker D. Evaluating structural equation models with unobservable variables and measurement error. J Marketing Res. 1981; 18(1): 39, doi: 10.2307/3151312.
65. MacKenzie S, Podsakoff P. Common method bias in marketing: causes, mechanisms, and procedural remedies. J Retailing. 2012; 88(4): 542–555, doi: 10.1016/j.jretai.2012.08.001.
66. Tutar H, Erdem AT. Examining the mediating role of organizational loneliness in the effect of organizational silence on the intention to quit. Upravlenets. 2021; 12(2): 102–118, doi: 10.29141/2218-5003-2021-12-2-8.
67. Kline RB. Principles and practice of structural equation modeling. Guilford Publications 2015.
68. Orgilés M, Morales A, Delvecchio E, et al. Immediate psychological effects of the COVID-19 quarantine in youth from Italy and Spain . Front Psychol. 2020; 11: 579038, doi: 10.3389/fpsyg.2020.579038, indexed in Pubmed: 33240167.
69. Dağlı DA, Büyükbayram A, Arabacı IB. COVID-19 tanısı alan hasta ve ailesine psikososyal yaklaşım. İzmir Katip Çelebi Üniversitesi Sağlık Bilimleri Fakültesi Dergisi, 5(2); 2020: 191–195.
70. Çelik MY. Üniversite Sınavına Hazırlanan Gençlerin Covid-19 Korkusunun Öğrencilerin Tükenmişlik ve Anksiyetelerine Etkisi. Van Sag Bil Derg. 2021; 14(1): 19–28, doi: 10.52976/vansaglik.760062.
71. Rahman S. Tıp fakültesi öğrencilerinin COVID-19 fobi durumlarının değerlendirilmesi. Fırat Üniversitesi Sağlık Bilimleri Tıp Dergisi. 2021; 35(1): 68–73.
72. Elbay RY, Kurtulmuş A, Arpacıoğlu S, et al. Depression, anxiety, stress levels of physicians and associated factors in Covid-19 pandemics. Psychiatry Res. 2020; 290: 113130, doi: 10.1016/j.psychres.2020.113130, indexed in Pubmed: 32497969.
73. Klassen R, Chiu M. The occupational commitment and intention to quit of practicing and pre-service teachers: Influence of self-efficacy, job stress, and teaching context. Contemporary Educational Psychology. 2011; 36(2): 114–129, doi: 10.1016/j.cedpsych.2011.01.002.
74. Deniz Günaydin H. Impacts of personality on job performance through COVID-19 fear and intention to quit. Psychol Rep. 2021; 124(6): 2739–2760, doi: 10.1177/00332941211040433, indexed in Pubmed: 34396815.
75. Kokubun K, Ino Y, Ishimura K. Social and psychological resources moderate the relation between anxiety, fatigue, compliance and turnover intention during the COVID-19 pandemic. International Journal of Workplace Health Management. 2022; 15(3): 262–286, doi: 10.1108/ijwhm-07-2021-0142.
76. Sunjaya DK, Herawati DM, Siregar AYM. Depressive, anxiety, and burnout symptoms on health care personnel at a month after COVID-19 outbreak in Indonesia. BMC Public Health. 2021; 21(1): 227, doi: 10.1186/s12889-021-10299-6, indexed in Pubmed: 33509159.
77. Luceño-Moreno L, Talavera-Velasco B, García-Albuerne Y, et al. Symptoms of posttraumatic stress, anxiety, depression, levels of resilience and burnout in Spanish health personnel during the COVID-19 pandemic. Int J Environ Res Public Health. 2020; 17(15), doi: 10.3390/ijerph17155514, indexed in Pubmed: 32751624.
78. Dima G, Schmitz LM, Şimon MC. Job stress and burnout among social workers in the VUCA world of COVID-19 pandemic. Sustainability. 2021; 13(13): 7109, doi: 10.3390/su13137109.

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2022; 73, 3: 143–149
10.5603/IMH.2022.0027
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Quality of life among seafarers aboard the government passenger ships at Kochi Port

Ann John Mampilli, Mackwin Kenwood D'mello

K S Hegde Medical Academy, Deralakatte Nithyanandanagar, Mangaluru, India

ABSTRACT

Background: *Quality of shipboard life plays a significant role, as for a seafarer the ship is both his workplace and home for extended periods. Physical, psychological, social and environmental factors have a substantial impact on the seafarers' quality of life and work. The aim of the study was to analyse the domains determining the factors associated with the seafarers' quality of life at Kochi Port, India.*

Materials and methods: *This was a cross-sectional study in which 302 Indian seafarers took part in the research and was conducted in January–February, 2020. WHOQOL-BREF scale was used to explore the four domains of quality of life, and the participants had to rate their perceived satisfaction in each of the domains. The trained researcher conducted a face-to-face interview session using a structured questionnaire. Bivariate and multivariate analysis was used to determine associations and predictors for quality of life, respectively.*

Results: *The majority (80%) of the seafarers were married and were from a rural area (74%). The mean score (standard deviation) was highest for the psychological domain 70.9 (10.5), followed by environmental domain 69.9 (13.2), social relations domain 68.5 (16.9) and physical domain 61.2 (12.8), respectively. A significant association was found between age and the psychological domain ($p < 0.05$). At the same time, the area of residence had a significant association with physical and psychological domains whereas marital status with physical, psychological and environmental domains ($p < 0.05$). Daily working hours had a significant association with psychological domains and work experience with the physical and psychological domains ($p < 0.05$).*

Conclusions: *The findings of this study are an indication for the health policy makers to focus on interventions for improving the quality of life among the seafarers and would also help in enhancing healthy work environments for them.*

(Int Marit Health 2022; 73, 3: 143–149)

Key words: seafarer, quality of life, ship, mariner

INTRODUCTION

Quality of life is a broad concept that involves an individual's perception on their physical, psychological, social and environmental systems within their cultural values and beliefs. It also encompasses their goals, expectations, standards and concerns with respect to these systems [1].

On a global level, it was found that long-term separation from families, loneliness and social isolation are the most critical occupational stressors. Heavy workload, long strenuous working hours and conflicts around work-roles also topped this list [2]. It was also found that the maritime population was prone to greater injuries and accidents, psychosocial hazards and poor quality of sleep [3].

Other dimensions of industry's peculiarity are stress and fatigue, which are induced by a high workload, extensive paperwork and reduced crew levels [4]. Among Danish sea-

Dr. Ann John Mampilli, Master of Public Health, K S Hegde Medical Academy, Deralakatte Nithyanandanagar, Mangaluru, India, tel: +919482311849, e-mail: captmampilli.aj@gmail.com

Received: 14.08.2022 Accepted: 29.08.2022

farers, 209 out of the 1993 accidents caused permanent disability for more than 5% and 27 fatalities. Age, resting period during the voyage period, type of ship, and nature of work were found as the most significant risk factors for accidents [5]. In Great Britain, it was found that the fatal accidents that occurred among the seafarers were 27.8 times more than in the public workforce during the same period [6]. On a global level, when it comes to how the quality of life varies with age, it has been noted that around 23.2% of young seamen of age 20–24 years rated their quality of life as 'excellent' while the same percentage seafarers between 25 and 34 years rated it as 'very good' [7].

Since minimal research has been conducted on the quality of life among seafarers, and as the topic is significant, this study was conducted on Indian seafarers to determine their quality of life aboard passenger ships. Besides, the goal was to explore the four domains determining the quality of life in the WHOQOL-BREF questionnaire.

MATERIALS AND METHODS

This is a cross-sectional study conducted among the seafarers of Indian Government passenger ships (Lakshadweep Development Corporation Limited) at Kochi Port in January–February 2020. The Census (complete enumeration) method was the sampling method adopted. To avoid inter-person variability, a single trained investigator collected data using a structured interview method. The seafarers in these passenger ships who had completed at least 6 months of sailing off shore were included for this study. Government passenger ships are owned by the government and are used to transport people from one port to another for basic necessities. They are all India-registered and act as both cruise and general transport ships. The non-response rate of the survey was 7%.

In the described study, the following method was applied.

World Health Organization Quality of Life Questionnaire – Brief Version (WHOQOL-BREF) was the instrument that was included for this study. WHOQOL-BREF contained 26 questions distributed across the four (physical, psychological, social relation and environmental) domains of quality of life and followed a self-rating scale. The questionnaire had the socio-demographic component with seven questions regarding age, marital status, and area of residence (classified as urban and rural), the rank of employment (officers and auxiliary staff), work experience and daily working hours. The trained researcher conducted a structured interview schedule among seafarers aboard.

The four domains of the WHOQOL-BREF are described as follows.

The ability to work, energy and fatigue, drug dependence and its treatment, daily activities, mobility, pain and discomfort, and sleep duration were the physical components (D1) of the scale. Negative and positive feelings, self-esteem, spirituality, religion, way of thinking, memory, concentration and appearance were the components of the psychological scale (D2). Social support, sexual activity, personal relationships and environment made up the social scale (D3). The environmental scale (D4) comprised physical and psychological safety, healthcare (availability and quality), freedom, financial resources, home environment, learning new skills, physical environment, transport and recreation.

Two experts in the desirable field validated the questionnaire, and Cronbach's alpha was found to be 0.89. A pilot study was conducted among 20 seafarers in a similar study setting, and two questions were modified in the socio-demographic component accordingly. The institutional ethical clearance was obtained with the reference number and date being INST.EC/EC/113/2019-20 and 30.09.2019, respectively.

STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS) was used to analyse the variables of this study. The continuous variables were expressed in means and standard deviations and the categorical variables were expressed as proportions and frequencies. Student t-test was used to find the mean difference across the domain and p value less than 0.05 was considered to be significant. Multiple linear regression models were used to identify the predictors of quality of life.

RESULTS

SAMPLE CHARACTERISTICS

The study involved 302 seafarers employed in the government of India passenger ships (Lakshadweep Development Corporation Limited) who had the onboard experience of a minimum of 6 months. The study group consisted of only men aged 21 to 64 years. The mean age was found to be 38.2 ± 10.6 years. Majority of the seafarers were married (80.1%) and were from a rural area (74%). The officer's ranks were mainly from urban areas whereas most of the auxiliary staff were from the rural area. Majority of the seafarers in the study were deck crew (76%). The mean length of service at sea was 12.5 ± 9.6 years and most (74.8%) of the seafarers worked for more than 12 hours a day (Table 1).

Figure 1 shows the mean scores were highest for the psychological domain (70.9 ± 10.5), followed by the environmental domain (69.9 ± 13.23), social relations (68.4 ± 16.9) and physical domain (61.2 ± 12.8), respectively.

The analysis in Table 2 shows that age groups above 35 and below 35 is significantly associated ($p < 0.05$) with the psychological domain of quality of life and area of residence, urban and rural was significantly associated ($p < 0.001$) with the physical and psychological domain. The

Table 1. Socio-demographic and occupational characteristic of the respondents

Characteristics	Frequency	Per cent
Age groups		
< 35	133	44.0
> 35	169	56.0
Marital status		
Single	60	19.9
Married	242	80.1
Area of residence		
Rural	223	74.0
Urban	79	26.0
Rank of employment		
Officers	100	33.1
Auxiliary staff	202	66.9
Work experience [years]		
< 15	208	68.9
> 15	94	38.1
Number of daily working hours		
< 12	226	74.8
> 12	76	25.2

marital status of the respondents (married and single) was significantly associated ($p < 0.05$) with physical, psychological and environmental domains while it did not affect social relationships of the seafarers. The years of work experience both above and below 15 years was significantly associated ($p < 0.05$) with physical, psychological and social relations. Daily hours of working, above and below 12 hours had a significant association ($p < 0.05$) with the psychological domain of quality of life. A significant relationship was found between the rank of employment and the physical domain of quality of life.

Table 3 shows the results of multivariate analysis across four domains. Area of residence was a predictor variable for both physical as well as psychological domain. Seafarers from rural areas tend to have a poorer physical quality of life and better psychological quality of life than their urban counterparts.

DISCUSSION

The study shows that age is significantly associated with the psychological domain of quality of life. The aging of seafarers is particularly essential when it comes to the shipping industry [8]. The results of an international study conducted among seafarers in 2012 suggested that the increased mental strain among senior engine-room officers could be attributed to the rapid organizational and technological development in the shipping industry [9]. Findings from a Lithuanian study have established age differences in the physical and psychological health related quality of life [10]. The results of an international study of seafarers showed that as age increased the self-rated quality of life tend to decrease [5].

Work experience is also an important variable. In this study, there was a significant association between work experience and physical and psychological domain of quality of life. In a study conducted in Sweden (2006) it was found that although seafarers' health declines with age, the effects of work related stress were less as seafarers gained more experience throughout the years [11]. The results obtained by a study conducted in Poland focusing on the

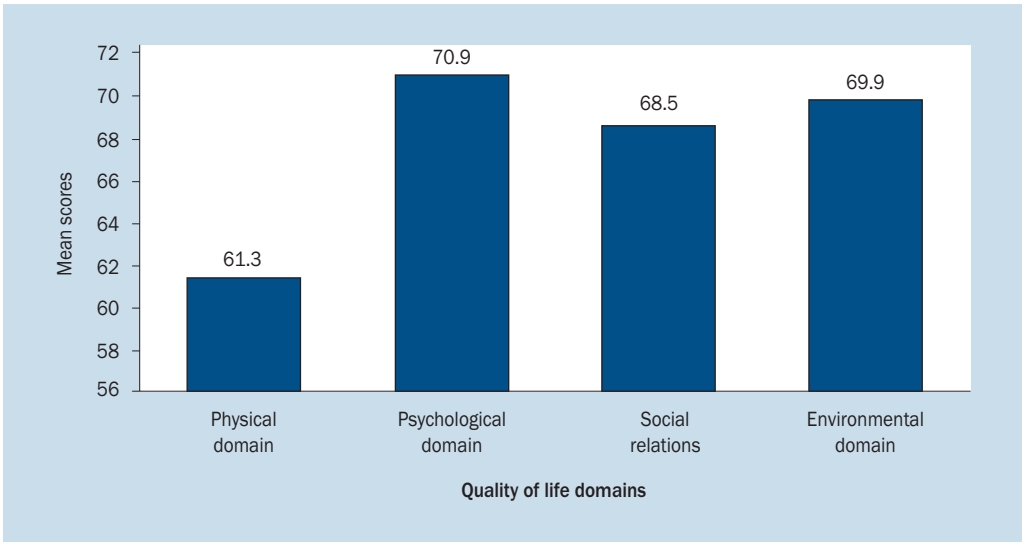


Figure 1. Mean scores of quality of life domains among the study population

Table 2. Association of quality of life domains with various social demographic factors

Characteristic	Physical domain	Psychological domain	Social relations domain	Environmental domain
Age group				
< 35	59.6 ± 11.0	74.1 ± 7.0	70.3 ± 17.0	71.3 ± 11.7
> 35	59.8 ± 11.4	71.2 ± 10.1	70.3 ± 16.2	71.4 ± 12.8
P-value	0.911	0.036	0.986	0.980
Area of residence				
Rural	59.2 ± 12.6	72.6 ± 9.7	68.7 ± 17.6	70.4 ± 13.4
Urban	67.2 ± 11.7	66.1 ± 11.3	67.8 ± 14.9	68.5 ± 12.6
P-value	0.000	0.000	0.694	0.277
Marital status				
Single	58.2 ± 10.0	74.1 ± 8.3	69.6 ± 17.6	73.2 ± 10.8
Married	62.0 ± 13.3	70.1 ± 10.8	68.2 ± 16.7	69.1 ± 13.6
P-value	0.039	0.009	0.561	0.030
Work experience [years]				
< 15.0	59.9 ± 11.8	71.8 ± 9.5	69.6 ± 16.7	70.6 ± 13.0
> 15.0	64.5 ± 14.5	69.0 ± 12.2	66.0 ± 17.0	68.4 ± 13.5
P value	0.004	0.035	0.085	0.183
Daily working hours				
< 12	60.7 ± 12.7	72.0 ± 10.2	68.1 ± 16.8	70.4 ± 13.2
> 12	63.1 ± 13.3	67.7 ± 10.7	69.6 ± 17.2	68.4 ± 13.1
P-value	0.160	0.002	0.489	0.275
Rank of employment				
Officers	63.7 ± 11.5	69.5 ± 11.6	67.7 ± 16.5	70.0 ± 13.7
Auxiliary staff	60.1 ± 13.3	71.6 ± 9.8	68.8 ± 17.1	69.8 ± 13.0
P-value	0.026	0.105	0.592	0.878

Table 3. Factors associated with domains of quality of life in multivariate analysis

Variable	B	Standard error	t	Sig.	95% confidence interval	
					Lower bound	Upper bound
PHYSICAL DOMAIN						
Marital status						
Single	–0.22	2.05	–0.10	0.91	–4.26	3.81
Married	Ref	Ref	Ref	Ref	Ref	Ref
Area of residence						
Rural	–6.46	1.74	–3.71	0.000	–9.89	–3.04
Urban	Ref	Ref	Ref	Ref	Ref	Ref
Work experience						
< 15 years	–0.86	2.32	–0.37	0.71	–5.44	3.71
> 15 years	Ref	Ref	Ref	Ref	Ref	Ref

→

Table 3. (cont.) Factors associated with domains of quality of life in multivariate analysis

Variable	B	Standard error	t	Sig.	95% confidence interval	
					Lower bound	Upper bound
Daily working hours						
< 12 hours	0.14	1.71	0.08	0.93	–3.22	3.50
> 12 hours	Ref	Ref	Ref	Ref	Ref	Ref
PSYCHOLOGICAL DOMAIN						
Marital status						
Single	0.84	1.67	0.50	0.61	–2.45	4.13
Married	Ref	Ref	Ref	Ref	Ref	Ref
Area of residence						
Rural	4.54	1.41	3.20	0.002	1.74	7.33
Urban	Ref	Ref	Ref	Ref	Ref	Ref
Work experience						
< 15 years	–1.65	1.89	–0.87	0.383	–5.39	2.07
> 15 years	Ref	Ref	Ref	Ref	Ref	Ref
Daily working hours						
< 12 hours	2.34	1.39	1.68	0.093	–0.39	5.09
> 12 hours	Ref	Ref	Ref	Ref	Ref	Ref
Age	–0.17	0.09	–1.88	0.060	–0.35	0.008
SOCIAL RELATIONS DOMAIN						
Marital status						
Single	–0.96	2.84	–0.33	0.735	–6.55	4.62
Married	Ref	Ref	Ref	Ref	Ref	Ref
Area of residence						
Rural	0.03	2.40	0.01	0.988	–4.70	4.77
Urban	Ref	Ref	Ref	Ref	Ref	Ref
Work experience						
< 15 years	0.81	3.22	0.25	0.801	–6.93	2.37
> 15 years	Ref	Ref	Ref	Ref	Ref	Ref
ENVIRONMENTAL DOMAIN						
Marital status						
Single	3.11	2.20	1.41	.160	-1.23	7.45
Married	Ref	Ref	Ref	Ref	Ref	Ref
Area of residence						
Rural	0.51	1.87	0.27	0.785	–3.17	4.19
Urban	Ref	Ref	Ref	Ref	Ref	Ref
Work experience						
< 15 years	0.09	2.50	0.03	0.969	–4.82	5.02
> 15 years	Ref	Ref	Ref	Ref	Ref	Ref
Daily working hours						
< 12 hours	1.14	1.83	0.62	0.535	–2.47	4.76
> 12 hours	Ref	Ref	Ref	Ref	Ref	Ref

Table 4. Mean scores of quality of life among different seafarers based on nationality

Nationality	Physical domain	Psychological domain	Social domain	Environmental domain
Indian seafarers	61.3	70.9	68.5	69.9
Polish seafarers	58.52	62.48	65.08	62.04
Chinese seafarers	67.8	64.3	63.8	52.5
Turkish seafarers	63.96	63.08	62	56.68

occupational stressors of seafaring (2006) showed that trainees on ships, compared to the officers perceived the job as highly stressful [12].

In the present study, the officers and non-officers almost gave similar satisfaction rates for the quality of life in each of the four domains. The results of the survey of Lithuanian seafarers showed that the health-related quality of life was best among the commanding officers thus establishing differences by profession. The physical dimension of quality of life was found to be poorest among engineer ship service members, while psychological quality of life was found worst among the auxiliary staff [10]. A study conducted among Polish seafarers (2013) showed differences in some aspects of psychological well-being between seafarers of different categories. These results combined prove the importance of the ranks and nature of work on board as they involve coping with various stressors [13]. The results of another international study (2009) also showed that a significant stressor for superiors on board resulted from the low satisfaction at work of the auxiliary staff. Long strenuous working hours of the auxiliary staff contributed to their higher stress levels than the engine room personnel [14].

Regarding marital status, there was a significant association between that and the physical, psychological and environment domains. It was found that among the younger seafarers with children, separation from home and family was a major stressor [2]. It was also shown that between stress and anxiety, and also between stress and a sense of purpose in life marital satisfaction played a significant role in their association [15, 16]. Hence the ability to cope with stress and anxiety at sea increased with respect to marital satisfaction. Daily working hours were found to be significantly associated with the psychological domain of quality of life. Oldenburg et al. (2009) [2] found that longer working hours was a significant occupational stressor affecting the quality of life.

The mean ratings for quality of life among the seafarers were highest for the psychological domain followed by environmental, social relations and physical domain. In China, from a study conducted on seafarers, it was found that the mean ratings for the domains were highest for the physical health followed by psychological, social relations and environment domains [7]. In a study conducted among the Turkish seafarers the mean scores of quality of life were such that the highest scores were for physical followed by psychological, social and environmental domains [17]. Many studies have found the mean ratings for social relations domain as the lowest, which is a cause of concern. This could be attributed to the fewer number of questions asked in the social domain. In another study conducted among Polish seafarers, it was found that the highest score for quality of life was obtained for the social relationships followed by psychological and environmental domains. The lowest scores were attributed to the physical domain [18]. Table 4 gives a concise view of these scores.

LIMITATIONS OF THE STUDY

Since the study was carried out in the presence of a supervising officer, participants may not have been able to openly discuss their satisfaction levels related to their work leading to self-reporting bias. The possibility of the incorrect response of the participant due to recall bias concerning the occurrence of occupational accidents would have occurred. The study could have included more predictor variables. All the seafarers were males, as no female seafarers were on board during the time of data collection. Hence the quality of life-based on gender could not be determined.

RECOMMENDATION

More researchers need to carry out studies on Indian seafarers to highlight their quality of life and issues surrounding that. Very few studies are conducted in India; in this regard, policy-makers need to formulate policy regarding working hours in the government passenger ships. Working hours need to be regulated, and over-time needs to be compensated accordingly. Policies should encourage the construction of living and office spaces with ergonomic considerations.

Posters listing the dos and don'ts to prevent occupational accidents and to enhance the quality of life on board should be displayed in the offices aboard the ships to increase the awareness. Weekly/monthly recreational activities should be conducted on board to reduce stress and encourage physical activity among the seafarers.

CONCLUSIONS

Although the government brings new schemes for the seafarers through welfare programmes, getting an optimal quality of life is inevitably challenging to most of the seafarers. Seafarers at higher positions are well received in society, and their status has a positive impact on the quality of life. Digital means of communication, which plays an essential role in the life of the people, has still a long way to help the seafarers maintain their social relations while working aboard the ships. Every domain of quality of life should be focused upon to increase the overall score of quality of life.

The study contributes new knowledge about quality of life of seafarers in different domains and socio-demographic characteristics. One finding was that Indian seafarers in government of India passenger ships experienced low quality of life in the domain of the social relation. The seafarers should be empowered to adjust their mentality to find joy and fulfilment in their careers and should be encouraged to build good-quality social relationships and thus improve their perception of the quality of life. Lastly, the findings of this study are an indication for the health policy makers to focus on interventions for improving the quality of life among the seafarers and also to help in enhancing healthy work environments for them.

Conflict of interest: None declared

REFERENCES

1. WHO | WHOQOL: Measuring Quality of Life [Internet]. WHO. https://www.who.int/healthinfo/survey/whoqol-qualityoflife/en/ (cited 2020 Jan 20).
2. Oldenburg M, Baur X, Schlaich C. Occupational risks and challenges of seafaring. J Occup Health. 2010; 52(5): 249–256, doi: 10.1539/joh.k10004, indexed in Pubmed: 20661002.
3. Abdalla S, Apramian SS, Cantley LF, Cullen MR. Occupation and Risk for Injuries [Internet]. The International Bank for Reconstruction and Development / The World Bank; 2017. https://www.ncbi.nlm.nih.gov/books/NBK525209/ (cited 2020 Mar 1).
4. Allen P, Wadsworth E, Smith A. Seafarers' fatigue: a review of the recent literature. Int Marit Health. 2008; 59(1-4): 81–92, indexed in Pubmed: 19227741.
5. Jensen HJ, Oldenburg M. Potentially traumatic experiences of seafarers. J Occup Med Toxicol. 2019; 14: 17, doi: 10.1186/s12995-019-0238-9, indexed in Pubmed: 31164911.
6. Roberts S. Hazardous occupations in Great Britain. Lancet. 2002; 360(9332): 543–544, doi: 10.1016/s0140-6736(02)09708-8.
7. Xiao J, Huang B, Shen H, et al. Association between social support and health-related quality of life among Chinese seafarers: A cross-sectional study. PLoS One. 2017; 12(11): e0187275, doi: 10.1371/journal.pone.0187275, indexed in Pubmed: 29176809.
8. Slišković A, Penezić Z. Descriptive study of job satisfaction and job dissatisfaction in a sample of Croatian seafarers. Int Marit Health. 2015; 66(2): 97–105, doi: 10.5603/IMH.2015.0023, indexed in Pubmed: 26119680.
9. Rydstedt LW, Lundh M. Work demands are related to mental health problems for older engine room officers. Int Marit Health. 2012; 63(4): 176–180, indexed in Pubmed: 24595972.
10. Sąlyga J, Kušleikaitė M. Factors influencing psychoemotional strain and fatigue, and relationship of these factors with health complaints at sea among Lithuanian seafarers. Medicina. 2012; 47(12): 99, doi: 10.3390/medicina47120099.
11. Jepsen JR, Zhao Z, van Leeuwen WMA. Seafarer fatigue: a review of risk factors, consequences for seafarers' health and safety and options for mitigation. Int Marit Health. 2015; 66(2): 106–117, doi: 10.5603/IMH.2015.0024, indexed in Pubmed: 26119681.
12. Lipowski M, Lipowska M, Peplińska A, et al. Personality determinants of health behaviours of merchant navy officers. Int Marit Health. 2014; 65(3): 158–165, doi: 10.5603/imh.2014.0030.
13. Carotenuto A, Fasanaro AM, Molino I, et al. The Psychological General Well-Being Index (PGWBI) for assessing stress of seafarers on board merchant ships. Int Marit Health. 2013; 64(4): 215–220, doi: 10.5603/imh.2013.0007, indexed in Pubmed: 24408143.
14. Oldenburg M, Herzog J, Harth V. Seafarer deaths at sea: a German mortality study. Occup Med (Lond). 2016; 66(2): 135–137, doi: 10.1093/occmed/kqv153, indexed in Pubmed: 26409049.
15. McVeigh J, MacLachlan M, Vallières F, et al. Identifying predictors of stress and job satisfaction in a sample of merchant seafarers using structural equation modeling. Front Psychol. 2019; 10: 70, doi: 10.3389/fpsyg.2019.00070, indexed in Pubmed: 30787888.
16. Employment of Indian seafarers grows by an unprecedented 35 percent this year. [Internet]. https://pib.gov.in/Pressreleaseshare.aspx?PRID=1564700 (cited 2020 Jan 20).
17. Demir İH, Oruç D, Bayram S. Determining the factors that affect self-reported quality of life among Turkish seafarers. Int Marit Health. 2021; 72(2): 129–137, doi: 10.5603/IMH.2021.0022, indexed in Pubmed: 34212353.
18. Jeżewska M, Leszczyńska I, Grubman-Nowak M. Personality and temperamental features vs. quality of life of Polish seafarers. Int Marit Health. 2013; 64(2): 101–105, indexed in Pubmed: 23788227.

VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2022; 73, 3: 150–161
10.5603/IMH.2022.0028
www.intmarhealth.pl

ISSN 1641-9251
eISSN 2081-3252

Impact of work exposure on cognitive performance in Faroese deep-sea fishers: a field study

Annbjørg Selma Abrahamsen[1, 2], Pál Weihe[1, 2], Wessel M.A. van Leeuwen[3], Fróði Debes[1]

[1]Department of Occupational Medicine and Public Health, The Faroese Hospital System, Tórshavn, Faroe Islands
[2]Faculty of Health Sciences, The Faroese University, Torshavn, Faroe Islands
[3]Department of Psychology, Stress Research Institute, Stockholm University, Stockholm, Sweden

ABSTRACT

Background: *This study examines the impact of work-related exposure on the cognitive performance of Faroese deep-sea fishers. Faroese fishing crews work long hours in demanding and noisy environments amidst highly uncertain and challenging weather conditions. These factors, together with compromised patterns of rest and sleep, are known to increase fatigue. Our aim was to study if changes could be measured in fishers' cognitive performance at the end of the trip when compared with the baseline measure at the beginning.*

Materials and methods: *Data was collected over 15 months (May 2017 to July 2018) from 157 fishers on 18 fishing trips which involved 202 investigative days on board. Questionnaires and six computerised cognitive tests: Simple Reaction Time, Numeric Working Memory, Corsi Blocks, Rapid Visual Information Processing, Digit Vigilance, and Card Sorting Test were used for data collection at the beginning and end of the trip. Differences between the outcomes on the two test points were analysed with one-way ANOVA comparing the performances at the beginning and end of the voyage, and two-way ANOVA to examine the interactive effect of chronotype and test occasions on the outcomes. Mixed models were used to test for the effects of predictor variables.*

Results: *Significant declines in cognitive performance were observed from the beginning to the end of the trip, with decreases in visuospatial memory and reaction times, and increases in cognitive lapses. Furthermore, slowing in response times was observed in the second half of the Digit Vigilance test when comparing the halves.*

Conclusions: *Declines in performance were observed from the start to the end of the trip. Furthermore, fishers performed significantly worse in the second half of some parted tests, and evening types seem less influenced by irregular work hours. These findings call for improving the safety of the vessels and their crew.*

(Int Marit Health 2022; 73, 3: 150–161)

Key words: fishers, fatigue, cognitive decline, Digit Vigilance, Simple Reaction Time, Visuospatial Memory, the Psychomotor Vigilance Tests

INTRODUCTION

The fishing industry in the Faroe Islands is the driving force of the economy, accounting for approximately 50% of its annual exports [1]. This vital enterprise, however, is heavily dependent on factors like vegetational growth and weather conditions for its sustainability. Its location in the North Atlantic Ocean continues to provide many challenges to the industry and its workers by way of inclement weather and rough seas.

Annbjørg Selma Abrahamsen, MSc, Department of Occupational Medicine and Public Health, Sigmundargøta 5, FO-100 Tórshavn, Faroe Islands, e-mail: annbjorg@health.fo

Received: 29.09.2022 Accepted: 30.09.2022

The cognitive and physical demands on the fishers of this island nation remain part and parcel of life as their job involves high levels of physical activity, repetitive movements, and manual material handling tasks. They need to be constantly alert to possible dangers, whether caused by weather, machinery or incidents that require prompt and appropriate responses. Furthermore, their workload and working hours are controlled by fishing seasons and the magnitude of the catch rather than the clock, often resulting in limited and fragmented sleep.

The International Maritime Organization (IMO) defines fatigue as: "a state of feeling tired, weary, or sleepy that may result from prolonged mental or physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep", its causes and consequences being widespread [2]. The most recognised causes of fatigue in fishers are poor quality of rest, excessive workloads, noise and fractious interpersonal relationships [3].

Life on board fishing vessels differs from other types of shift work. Fishers remain on board during free shifts, eating and sleeping under challenging conditions. Various factors influence sleep quality on board, e.g. noise, vibrations, cabin temperatures, alarms, sleeping facilities and time of day [4]. In addition, workplaces in motion result in higher energy use [5], and psychosocial stress factors such as insecure income and distance from family could increase fatigue. Fishing vessels are relatively small in comparison to merchant vessels, thereby increasing the impact of environmental factors [6].

Fishers have a higher accident rate than those who work on land and on merchant vessels [7, 8]. The accident ratio between land workers and fishers in the Faroe Islands is 1 to 4 [7], and fatigue has been found to be a contributory factor in 16% of critical vessel accidents in the maritime industry [9]. Several groundings and collisions are linked to fatigue [10], making it a significant contributor toward 33% of personal injuries/accidents in maritime operations [11]. In fact, long-term cognitive fatigue (14%) is said to be the largest single factor responsible for accidents [12].

Despite these disproportionately high accident rates within the fishing industry [7, 13], research offering direct objective measures of fatigue in fishers is limited. Thus, our primary aim was to study how fatigue influences fishers' cognitive functions; and specifically investigate whether changes in cognitive performance could be observed during the fishers' time at sea. As far as we know, ours is the first study to provide objective quantitative measures testing the effect of fatigue on cognitive function among fishers [14].

MATERIALS AND METHODS

PARTICIPANTS AND PROCEDURES

Data was collected by the first author on board four types of fishing vessels based on their different working patterns and the varying length of workdays. Common to all vessels was that they had only one crew with no regular periods of leave. Data was collected from 18 fishing trips over 15 months, resulting in 202 investigative days on board and 1,822 person-days. Most of the study happened in Faroese fishing waters, except for two trips in East Greenland and Icelandic territories, and lasted between 2 to 39 days, with a median of 9 days.

The study was conducted in compliance with the Declaration of Helsinki, and received prior approval from the Faroese Committee on Biomedical Research Ethics and the Faroese Data Inspection Agency J. no. 16/00230-13. All participants were requested to provide written consent before participation.

DATA COLLECTION

Data collection began at the beginning of the voyage when the fishers were expected to be most rested. They were assessed through questionnaires and a Computerised Mental Performance Assessment System (COMPASS software developed by Northumbria University in Newcastle).

QUESTIONNAIRES

Self-report questionnaires (paper and computer-based) were used to collect demographic data, physical and mental health information, and work history. The Karolinska Sleep Questionnaire (KSQ), with a 6-point Likert scale (1 = always, to 6 = never) [15] was used to measure sleep quality, the Multidimensional Fatigue Inventory (MFI-20), with 20 questions on a 5-point scale (1 = "yes, that is true" to 5 = "no, that is not true"), assessed fatigue levels in five dimensions [16], and the Cognitive Failure Questionnaire (CFQ), with a 5-point Likert scale (0–4) in three dimensions was used to measure fatigue and its effect on cognition [17].

MENTAL ASSESSMENTS ON COMPUTER ASSISTED TESTS

Fishers were given six computerised cognitive tests at the beginning and end of their trips. The testing was performed with COMPASS 5.0 which was installed on 10 computers. The tests were: Simple Reaction Time (SRT), assessing attention, Numeric Working Memory (NWM), assessing working memory, Corsi Blocks (CB), assessing visuospatial memory, Rapid Visual Information Processing (RVIP), assessing working memory and sustained attention, Digit Vigilance (DV), assessing attention and vigilance, and Card Sorting (CS), assessing higher cognitive functioning (Table 1).

Participants were provided with four pre-test sessions to familiarise themselves with the process and to flatten the learning curve. Test results gave objective measures

Table 1. Cognitive tasks completed at baseline, at beginning and end of the fishing voyage prior to resting

Task	Descriptor	Scoring	Domain
SRT	An upwards pointing arrow was displayed on the screen at irregular intervals. Participants had to respond as quickly as possible when they saw the arrow appear. 50 stimuli were presented. The task lasted 3 minutes.	RT [ms]	Attention
NWM	Six single target numbers were displayed on the screen, one at a time. Participants were required to memorise the numbers as they appeared. Once the target series was presented, numbers were displayed one at a time, and participants were required to indicate which number was presented previously or not. Three trials were completed.	Accuracy [%] and RT for the correct responses [ms]	Working memory
DV	A fixed number appeared on the right of the screen and a series of changing numbers appeared on the left of the screen. Participants were required to respond when the number on the left matched the number on the right. The task lasted 3 minutes.	Accuracy [%], RT for the correct responses [ms], and false alarms (numbers)	Attention and vigilance
RVIP	A continuous series of single digits was presented at the rate of 100 per minute. Participants were required to make a response when three consecutive odd or three consecutive even digits are displayed. The task took 3 minutes to complete.	Accuracy [%], RT for correct responses [ms], and false alarms (number)	Working memory and sustained attention
CB	Nine blue squares on a black background were displayed on the screen. Some blue squares changed to red and back to blue in sequence. Participants were required to remember the sequences. The task was repeated 5 times at each level of difficulty, with the sequence span increasing from 4 upwards until the participants could no longer correctly recall the sequences. Participants had to select the blocks in the same sequence in which they were presented.	Length of sequence remembered	Visuospatial memory
CS	Cards varying in type, colour, and number of figures on card were displayed on the screen. Participants had to match each card that appeared at the bottom of the screen to one of the four piles (numbered 1, 2, 3, 4) in the upper part of the screen. The cards were matched by selecting the pile to which they thought they belonged. Participants were not told how to match the cards but were told whether they were right or wrong each time. Participants were told that they would not be timed.	Once fishers successfully completed 10 consecutive correct sorts, the rule changed and they repeated the process until they successfully completed 6 sorts Scoring: Number of responses used to complete the test	Executive functioning and cognitive flexibility

SRT — Simple Reaction Time; NWM — Numeric Working Memory; DV — Digit Vigilance; RVIP — Rapid Visual Information Processing; CB — Corsi Blocks; CS — Card Sorting; RT — Reaction Time; ms — milliseconds

of the fishers' abilities on both occasions and made it possible to view changes in cognitive performance. Based on a test-retest design, results from the end of the trip were compared to those from the beginning. The baseline test was completed at the beginning of the trip (most often on the day following training), to allow for some rest after training. The completion of the test battery took from 19–24 minutes. The recommendation to use tests that gather as many stimuli in as short a time as possible (to avoid subjects turning passive) was followed [18, pp. 39–70]. At the end of the last shift, before resting, the fishers were re-tested with the same cognitive test battery. All tests and procedures performed at the beginning of the trip were repeated with the exception of the questionnaire being more focussed on the details of their current voyage.

For the SRT test, Reaction Time (RT's) < 150 milliseconds (ms) were registered as false starts, and RT's > 1000 ms were registered as major lapses. For the DV, RT's < 300 ms were registered as false starts, and RT's > 800 ms as no response.

STATISTICAL ANALYSES

All fishers were included in the analysis. ANOVA was used to test for group differences in the MFI-20, KSQ, and CFQ. The group differences of interest were "type of ship", "having a paid job at home", "chronotype", and "age". Since age is a continuous numeric variable, regression was used for the age variable.

This being a field trip, there were a few variables beyond our control such as test 'start and end time' and length of trip. Since we wanted to examine the exact change in performance between the two test points with ANOVA, which does not control for covariates, a linear mixed model was first defined using crew ID nested within vessel type as random intercepts to investigate whether the outcome variables (SRT and DV) were affected by the predictor variables. Additive predictor variables were: 1) Test-time: beginning/end of trip; 2) Chronotype: morning, neither morning or evening, or evening person; 3) Dummy variable: designating time of day using the following time points: 1 = 0000–0559,

2 = 0600–1159, 3 = 1200–1759, 4 = 1800–2359; 4) Age; 5) Occupational titles: captains, mates, engineers, cooks, deckhands and holdmen; 6) Length of trip in days; 7) Hours of work per day; 8) Hours of sleep in the preceding 24 hours of testing, and 9) Interaction between test time and chronotype. The variables that were found to significantly affect the test outcomes are listed in Tables 2 and 3. Thereafter, one-way ANOVA was used to examine changes in performance on the computerised cognitive tests conducted at the two test points divided into the five domains under investigation. The outcome matrices assessed in our analysis for the SRT and DV tests were: (1) mean RT in ms (= DVMean, and SRTMean, for mean on the DV and SRT tests respectively); (2) Optimal response times – approximately the fastest 10% of RT in ms (DVF10P and SRTF10P, respectively; (3) The approximately 10% slowest RT in ms (DVS10P and SRTS10P respectively); (4) The size of variation within the responses (DVSD and SRTSD, respectively), and for the SRT test (5) The number of major lapses – RT's exceeding 1000 ms (SRT > 1000 ms). Horne and Wilkinson (1985) [19] states that although training may reduce learning, on experimental testing it rarely wholly eliminates it. The authors were of the opinion that the results of the NWM and CS tests were influenced by skill acquisition; thus, only the main measures listed under "scoring" in Table 1 were used in these tests to minimise the risk of incorrect conclusions based on a potential learning effect [19, 20]. The accuracy per cent of the RVIP test was only 40%. It seems that the fishers found it too complicated, so the test was excluded. Since there is only one variable for the CB test, a paired t-test comparison was used to compare test results from the beginning and the end of the trip.

According to the "new effort" effect (change from one test to another), even severely sleep-deprived subjects may perform normally for a short time by increasing compensatory effort [21, p. 150]. Given the relatively short sub-tests, the participants could benefit from the shifts between tests. Therefore, the raw data from the SRT and DV tests were divided into halves, comparing the first half to the second half of the corresponding test to check for decline when the test became one of endurance (SRTBh and SRTEh, and DVBh and DVEh, respectively). The tests appeared in the following sequence: 1 = SRT, 2 = NWM, 3 = CB, 4 = RVIP, 5 = DV, and 6 = CS. The tests took approximately 3 minutes each to complete. Lastly, a two-way ANOVA test was run between the SRTMean and DVMean outcome variables to test for the effect of time of test in interaction with chronotype. The mixed model and the two-way analysis were run in R, and one-way ANOVA and t-test analyses were made in SPSS software 28 (IBM Corp., Armonk, NY, USA).

RESULTS

Of the 176 fishers working on ships, 157 participated in the study of which 156 (99.4%) were men. Five did not complete the questionnaire at the beginning. Details regarding participants from the four vessel groups are presented in Table 2.

From the analysis between the MFI-20, the CFQ and the KSQ with subscales (Table 2) and the group variables: "type of ship", "having a paid job at home", "chronotype", "job on board" and age, the following differences were found: Those who had a paid job at home scored higher on general fatigue F(1, 125) 6.44, p = 0.012, and a positive association was found between general fatigue and age (r = 0.22, n = 148, p = 0.01). Age also had a positive relationship with CFQ-distractibility (r = 0.035, n = 119, p = 0.041) and the KSQ-Sleep apnoea index (r = 0.07, n = 144, p = 0.002). For more details on means and standard deviation (SD) divided by vessel type see Table 2.

From the linear mixed models that were conducted between the SRT and DV outcome variables (to examine effects of the predictor variables), the ANOVA tests made on the models revealed that test time and age were the variables with the highest influence on the outcome, with only the outcome of the DVEhSD being affected by job type and length of the trip as additional variables (Tables 3 and 4).

A paired t-test revealed that the fishers remembered significantly longer sequences of 4.80 (1.67) on the CB test at the beginning when compared to the end of the trip 4.44 (1.96), t (152) = 2.780, p = 0.006 (Fig. 1).

No change was observed between the start and end tests from the assessment on DV tests. When comparing the halves, however, a few significant changes emerged. The results revealed an increase in DVhMean and in the DVhF10P in the second half of the test conducted at the beginning and end of the trip and the DVEhS10P in the end test (Table 5).

When comparing the SRT test results from two time points, only RT > 1000 ms showed a change, with more major lapses at the end of the trip.

Comparing the mean RTs of the first half of the test to the second half conducted at the beginning of the trip, the size of the SD and the SRT > 1000 ms differed between the halves. The fishers' had higher variation and fewer lapses in the second half of the test. From the end test, only SRT > 1000 ms differed between the two halves, and similar to the start test, fewer lapses were detected in the second half of the test. The results from the SRT variables are illustrated in Table 6.

From the two-way ANOVA tests (viewing the relationship between the outcome variables of SRTMean and DVMean and the interaction between test time and chronotype, respectively), it is clear that chronotype influences test outcomes (Fig. 2). Of the six analyses run on the "mean variables", an interaction effect of test-time and chronotype was observed on the DVMean variable (p = 0.007), with the difference being between the

Table 2. Demographic characteristics of the fishers, presented both per vessel group and all together

Baseline characteristics	Longliner fresh fish	Longliner freezer	Netting vessel	Trawler boat	Overall
Number of participants:	90	14	34	19	157
Captain	7	1	4	5	17
Officer	9	1	3	5	18
Engineman	8	1	4	4	17
Cook	7	1	4	2	14
Deckhand	49	8	19	3	79
Holdman	7	2			9
Number of trips in vessel groups	8	1	4	5	18
Number of active ships in fleet	9	4	5	7	25
Median trip length [days]	14.0 (3.2)	39 (0)	3.4 (2.3)	6.0 (2.6)	8.5 (8.6)
Total days of data collection in each vessel group	114	39	22	27	202
Mean workdays a year	199	189	187	204	196
Minimum days	15	39	50	100	15
Maximum days	320	340	300	340	340
Work experience as a fisher [years]	25.1 (14.1)	17.7 (18.2)	17.6 (16.2)	27.8 (15.2)	19.5 (16.3)
Nationality:					
Faroese	84	14	34	19	151
Danish	4				
Other non-Nordic	2				
Civil status:					
Married/co-habiting	30	7	20	12	69
In relationship	16	2	4		22
Single/widowed, divorced	42	5	11	7	65
Not answered	2				2
Education:					
No vocational education	43	10	13	11	77
Education specific to job	17	4	11	3	34
3–4 year practical or theoretical education			2		2
+4 years education	3		2		5
Other					1
Education not stated	25		6	5	36
Age [years]	42.3 (16.7)	36.3 (15.4)	41.8 (15.4)	46.33 (15.2)	42.1 (16.1)
BMI	26.3 (5.6)	27.9 (6.1)	25.7 (4.8)	29.0 (4.4)	26.7 (5.3)
Diurnal preference (1, extreme morning to 5, extreme evening)	3.3 (1.3)	3.3 (1.3)	3.1 (1.4)	2.4 (1.3)	3.2 (1.4)
Self-reported sleep need [min]	445.7 (82.5)	436.2 (84.5)	462.0 (76.2)	476.1 (153.3)	452.9 (93.6)
KSQ Overall	81.78 (12.56)	80.93 (11.70)	77.4 (18.34)	84.61 (10.01)	81.29 (13.63)
Sleep quality index	16.67 (4.53)	16.00 (5.19)	17.93 (3.12)	18.58 (3.61)	17.1 (4.28)
Non-restorative sleep index	12.48 (3.05)	12.36 (3.18)	10.97 (3.78)	12.32 (2.43)	12.14 (3.09)
Sleep apnoea index	15.18 (3.46)	14.29 (4.73)	13.57 (4.25)	15.42 (1.87)	14.81 (3.63)

→

Table 2 (cont.). Demographic characteristics of the fishers, presented both per vessel group and all together

Baseline characteristics	Longliner fresh fish	Longliner freezer	Netting vessel	Trawler boat	Overall
Sleepiness and fatigue index	22.54 (4.37)	23.93 (3.71)	22.62 (3.91)	22.58 (4.15)	22.69 (4.17)
MFI:					
General fatigue	12.1 (2.4)	13.0 (2.2)	11.8 (2.3)	11.2 (2.1)	12 (2.3)
Physical fatigue	9.9 (2.0)	9.4 (2.7)	9.1 (1.9)	8.7 (2.1)	9.5 (2.1)
Mental fatigue	9.4 (2.1)	8.6 (2.1)	9.4 (1.9)	8.8 (2.6)	9.2 (2.1)
Reduced activity	9.4 (3.2)	8.2 (2.7)	8.9 (3.3)	10.4 (3.1)	9.2 (3.1)
Reduced motivation	8.1 (2.7)	6.6 (2.3)	7.6 (2.5)	6.8 (2.1)	7.7 (2.6)
CFQ:					
Forgetfulness	13.8 (4.7)	12.3 (4.2)	12.8 (4.4)	12.7 (3.9)	13.2 (4.5)
Distractibility	12.9 (4.2)	12.2 (4.2)	12.7 (4.4)	11.8 (4.8)	12.6 (4.4)
False triggering	9.8 (4.1)	7.6 (4.7)	8.8 (4.1)	9.2 (4.1)	9.2 (4.2)
CFQ — overall	37.5 (12.6)	34.5 (13.7)	35.6 (11.9)	34.4 (13.7)	36.3 (12.5)

Means and standard deviations presented in parentheses, per vessel group and all together; BMI — body mass index; KSQ — Karolinska Sleep Questionnaire; MFI — Multidimensional Fatigue Inventory; CFQ — Cognitive Failure Questionnaire

Table 3. Depicts the significant effects of independent variables (fixed effects) on the models with the repeated Simple Reaction Time dependent variables

Dependent variable (repeated)	Independent variables (fixed effects)	Df	F	P-value
SRTMean	Vessel Age	(F=1, 134.93) (F=1, 135.7)	5.96 18.36	0.02 < 0.001
SRT F10P	Vessel Age	(F16, 247.0) (F1, 247.0)	2.24 16.01	0.005 < 0.001
SRTSD	Age	(F1, 136.0)	9.87	0.002
SRT Lapses > 1000 ms	Age Test time	(F1, 136.0) (F1, 137.0)	11.35 7.12	< 0.001 0.009
SRTBhMean	Age	(F1, 133.0)	29.22	< 0.001
SRTBhF10P	Age Test time	(F1, 132.0) (F1, 133.0)	26.55 5.42	< 0.001 0.02
SRTBhS10P	Age Test time	(F1, 132.8) (F1, 132.34)	16.96 11.59	< 0.001 < 0.001
SRTBhSD	Age Test time	(F1, 133.0) (F1, 134.0)	11.18 19.14	0.001 < 0.001
SRTBhRT > 1000 ms	Age Test time	(F1, 136.0) (F1, 137.0)	10.33 16.74	0.002 < 0.001
SRTEhMean	Age	(F1, 133.0)	8.42	0.004
SRTEhS10P	Vessel Test time	(F16, 121.0) (F1, 137.0)	1.85 8.40	0.03 0.004
SRTEhF10P	Age Test time	(F1, 132.0) (F1, 133.0)	14.83 10.66	< 0.001 0.001
SRTEhSD	Age Test time	(F1, 133.0) (F1, 134.0)	4.67 7.46	0.03 0.007
SRTEhRT > 1000 ms	Age Test time	(F1, 134.93) (F1, 135.7)	5.96 18.36	0.02 < 0.001

Non-significant models: Model 3, SRTS10P; Df — degree of freedom

Table 4. Depicts the significant effects of independent variables (fixed effects) on the models with the repeated Digit Vigilance dependent variables

Dependent variable (repeated)	Independent variables (fixed effects)	Df	F	P-value
DVMeanR[T]1	Age	(F1, 124.54) (F2, 125.84)	15.20 6.96	< 0.001 < 0.001
DVF10PRT[2]	Age	(F1, 128.33)	29.23	< 0.001
DVS10PRT[3]	Age	(F1, 138.59)	11.70	< 0.001
DVBhF10PRT[7]	Age Test time	(F1, 132.45) (F1, 131.61)	30.97 12.74	< 0.001 < 0.001
DVEhMean[10]	Age Test time	(F1, 132.00) (F1, 133.00)	27.39 65.75	< 0.001 < 0.001
DVEhF10P[11]	Age Test time	(F1, 132.00) (F1, 133.00)	46.46 44.64	< 0.001 < 0.001
DVEhS10P[12]	Age Test time	(F1, 132.00) (F1, 133.00)	8.82 14.10	0.004 < 0.001
DVEhSD[13]	Job types Trip length days Chronotype Test time	(F5, 117.02) (F1, 224.70) (F2, 116.58) (F1, 195.69)	3.13 5.69 4.29 8.82	0.011 0.018 0.016 0.003

Models: 4 DVSDRT, 5 DVBhMeanRT, 8 DVBhS10PRT and 9 DVBhSD are non-significant. Model number is specified by superscript numbers; Df — degree of freedom

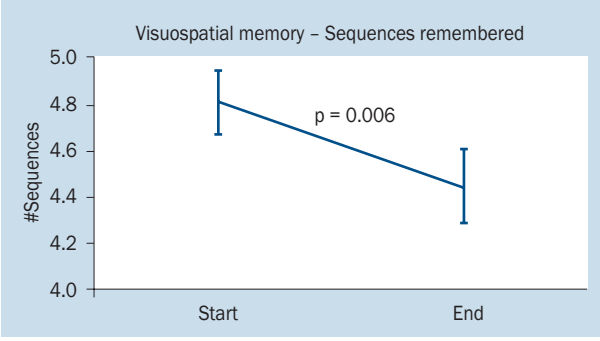


Figure 1. Paired t-test between the Corsi Blocks (CB) test conducted at the Start and End of the trip; Start — CB test at beginning of trip, End — CB test at end of trip

morning and evening types on the tests conducted at the end of the trip (p = 0.004). An effect of test time on the DVBhMean variable (p = 0.01), with the RT being slower at the end of the trip (p = 0.014) was also observed. Furthermore, both test time and chronotype as independent variables affected the DVEhMEAN variable, both at a level of p < 0.001. The fishers' performance was slower on the end test (p < 0.001), and the difference between chronotypes was found to be between morning and evening types (p < 0.001), neither morning or evening types, and evening types (p = 0.02). The effect on the SRTMean is not as strong, with the only group differences being observed between the chronotypes and SRTMean where the morning types' RT was significantly slower (p = 0.01). See Table 7 for the means and SD of the fishers.

Lastly, no differences emerged between the two test points on the NWM when comparing the accuracy of the responses in percent and RT of correct responses (RT in ms), or for the CS test. This is not surprising since the effect of

Table 5. Means, standard deviations and one-way analysis of variance of the Digit Vigilance (DV) Test, comparing reaction time at the beginning and end of the trip and comparing both halves of the tests conducted at the beginning and end of trip

DV measure	1st half	2nd half	F ratio	P
DVBhMean	498.41 (48.79)	511.87 (47.90)	5.065	0.025
DVBhF10P	411.25 (42.02)	422.13 (39.91)	5.118	0.024
DVEhMean	497.08 (50.32)	517.51 (50.30)	12.219	< 0.001
DVEhF10P	411.74 (43.04)	427.52 (45.27)	9.274	0.003
DVEhS10P	617.01 (66.86)	637.99 (63.01)	8.021	0.005

Standard deviations are presented in parentheses.

Table 6. Means, standard deviations and one-way analysis of variance of the Simple Reaction Time (SRT) Test, comparing reaction time at the beginning and end of the trip and comparing both halves of the tests conducted at the beginning and end of trip

SRT measure	Start/1st half	End/2nd half	F ratio	P
SRT lapses > 1000 ms	0.87 (1.43)	1.44 (2.58)	5.812	0.16
SRTBhSD	99.05 (63.08)	520.08 (168.54)	6.024	0.15
SRTBh lapses > 1000 ms	0.6 (1.04)	0.27 (0.71)	10.495	0.001
SRTEh lapses > 1000 ms	1.01 (1.87)	0.47 (1.08)	9.489	0.002

Standard deviations are presented in parentheses.

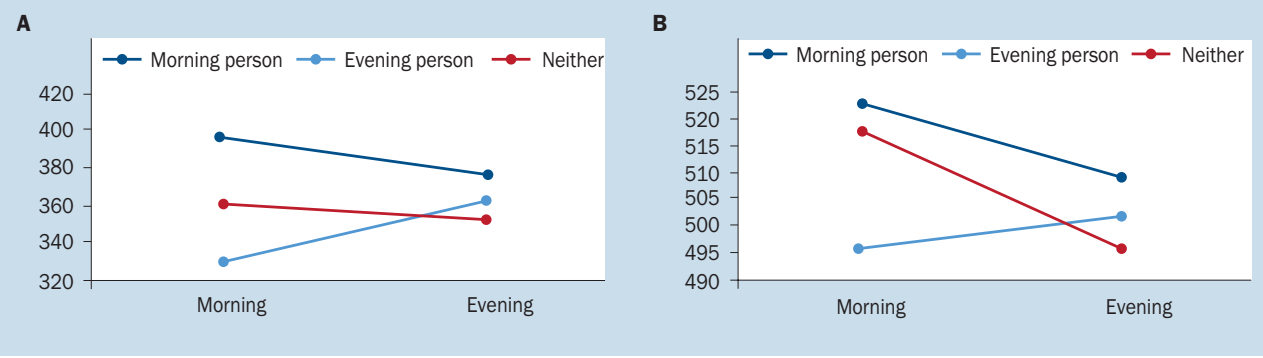


Figure 2. Chronotype and effect on performance on the Simple Reaction Time (SRT) and the Digit Vigilance (DV) interaction between the reaction time on the SRT (**A**) and DV (**B**) variables by test time (morning and evening) and chronotype

fatigue on performance has shown to vary between tests, with the highest impact observed from simple tests such as the SRT and the DV [22].

DISCUSSION

Despite major improvements in safety through education, training and technological advancement, human physiology and psychology are variables that have remained unchanged, and are the main challenges regarding irregular working hours [23, 24].

Unsurprisingly, fishers who also had paid jobs on land scored higher on general fatigue. Furthermore, age showed a positive relationship to general fatigue, distractibility on the CFQ, as well as sleep apnoea on the KSQ. The effect

Table 7. Means and standard deviations of the Simple Reaction Time (SRT) and the Digit Vigilance (DV) tests, full scale, comparing both halves of the start and end tests, respectively

Condition	DVMean	DVBhMean	DVEhMean	SRTMean	SRTBhMean	SRTEhMean
T1	502.2 (45.4)	498.4 (48.9)	496.84 (50)	357.9 (79.9)	362.4 (95.7)	367.8 (149.1)
T1:M	502.9 (43.7)	501.0 (46.7)	517.0 (54.2)	378.8 (85.3)	386.4 (96.8)	388.9 (95.4)
T1:N	492.3 (51.2)	489.4 (55.5)	506.0 (44.8)	354.4 (64.3)	347.2 (61.8)	354.8 (83.3)
T1:E	506.7 (42.5)	504.4 (48.1)	483.1 (43.6)	349.5 (82.9)	356.5 (107.3)	362.1 (199.4)
T2	505.7 (47.8)	512.1 (47.8)	518.2 (50.5)	360.8 (82.4)	356.2 (76.5)	364.1 (97.3)
T2:M	524.6 (46.0)	527.7 (46.3)	538.9 (48.7)	387.5 (90.3)	373.4 (81.2)	382.9 (95.0)
T2:N	517.2 (47.7)	512.0 (56.2)	526.5 (53.6)	356.3 (81.3)	367.3 (80.2)	352.6 (88.5)
T2:E	491.3 (49.4)	503.8 (43.8)	503.9 (45.3)	348.7 (78.0)	345.9 (73.9)	361.9 (107.2)
M	513.8 (47.4)	513.3 (48.8)	527.9 (52.4)	381.8 (87.8)	378.8 (89.4)	384.7 (94.9)
N	504.0 (50.6)	500.2 (56.4)	515.8 (49.8)	355.3 (72.2)	356.9 (71.2)	353.8 (84.9)
E	499.3 (42.5)	504.1 (45.9)	493.2 (45.3)	349.1 (78.0)	351.3 (92.4)	362.0 (160.8)

Standard deviations are presented in parentheses; T1 — time 1 (start of trip); T1:M — time 1, morning type; T1:N — Time 1, neither morning type or evening type; T1:E — Time 1, evening type; T2 — Time 2 (end of trip); T2:M — Time 2 — morning, T2:N — Time 2 — neither morning or evening type; T2:E — Time 2 — evening type

of age on the test results was also confirmed by the mixed model where it (together with test time — start/end of trip) had the most consistent effect on outcome variables.

Cognitive testing of sleep-deprived people has demonstrated declined performance on psychomotor vigilance tests [23, 25, 26]. Our study confirms that a person's chronotype has an impact on the outcome of cognitive tests, depending on the time of day [27]. Furthermore, numerous studies have shown a relationship between long working days, insufficient sleep and decreased performance on such tests [28]. Even in cases of 4-hours on/8-hours off shifts, reduced alertness has been observed in the early mornings [29]. Our study also demonstrated significant reductions in visuospatial working memory at the end of the trip. Furthermore, reductions were observed between the 1st and 2nd half of the DV test (in mean RT and optimal response at the beginning of the trip), and in the mean RT and the fastest and slowest 10% of the reaction times in the end tests.

From the mixed model analysis, age and test time (beginning and end of trip) were the variables that most often influenced the results, and the vessel had an effect on the mean RT and the optimal response on the SRT test. As for the DVEhSD, the type of job, trip length and chronotype influenced the outcome together with test time. It was surprising that not more of the independent variables in the mixed model illustrated an effect on the outcome variable. However, although the test time is accounted for in the ANOVA, we must keep in mind (when interpreting outcome), that age and other significant effects in Tables 3 and 4 could have further influenced results.

The SRT test targeting attention (3-minute test), did not detect fatigue in the form of slowed RT but revealed cognitive decline by indicating significantly more major lapses (RT > 1000 ms) at the end of the test, possibly, due to lower sensitivity demonstrated in shorter tests [30]. These results are in accordance with the main measure of psychomotor vigilance tests and the most commonly used variable, which is not to assess the RT but to measure sustained attention and give numerical measures of sleepiness by counting the number of lapses in attention across tested occasions [27]. Furthermore, comparing the halves of the SRT tests, the SD increases in the second half of the test. This is in line with literature that supports a higher variance in fatigued individuals [31]. However, despite increased lapses from the beginning to the end of the trip, a decrease in lapses is seen in the second half of the tests, both at the beginning and at the end of the trip. One explanation might be due to it being the first test in the test battery. Possibly the fishers used a few test stimuli to get acquainted and ready for the test situation. Another explanation could be that compensatory alertness is mobilised in response to a state of mild fatigue that might result in an increased performance.

In a study testing sleep-deprived persons for 6 weeks on ten neuropsychological tests, only visuospatial memory and vigilance attention demonstrated significant cognitive decline. Our findings confirmed this by demonstrating a decline in visuospatial memory and RT at the end of the trip [32]. Overall, our study confirmed previous findings, with a slowing of RT and an increase in the number of lapses in the second half of the tests [23, 31].

Our study also challenges the assumption that fishers were rested on re-entry to vessels. The fishers usually got between 2 and 5 days off between each trip, and trawler crews even less. Assuming that more than half the fishers worked in shifts (splitting sleep into 1.5 to 4 periods per day), many may not have had time to adapt to natural sleeping rhythms on land, thus returning to the ship more fatigued, particularly if they wished to remain awake for family and social activities. It was also observed that many single young fishers desired to be socially active while on land. This alternate assumption is in line with the findings from an Icelandic study where fishers were most tired the first days at sea because they remained almost sleepless when home for just a few days [33, 34]. The current study assessed fishers on six tests of approximately three minutes each. Thus, the "new effort" effect could not be rejected. The "new effort" effect means that the fishers managed to mobilise much energy at the beginning, yet, when the test became one of endurance, fatigue manifested [21, p. 150].

The strength of this study is that it was conducted by the first author in the fishers' work environment during the entire voyage, reflecting work-life as it is, in contrast to laboratory studies. The use of objective measures to assess quantitative changes in the fishers' cognitive performance over two testings at the beginning and end of the trip is an additional strength since drowsy individuals have been found erroneous in evaluating their degree of fatigue-related cognitive impairment [23, 33]. By using this method, we can quantify the "after effect", with the difference reflecting how fatiguing the work has been. One likely explanation for not observing declines in more variables could be that the tests might have been too short and insensitive to measure the full extent of the fishers' fatigue. Short tests were chosen for this study to ensure economy of time and to prevent fatigue for participants. Basner et al. (2011) [30] suggest an increase in the sensitivity of 3-minute tests by reducing the threshold for lapses to 355 ms to get the same effect as in the standard 10-minutes the Psychomotor Vigilance Tests. However, we chose not to do this since the lowest DVMean RT was 394 ms and it would include about 50% of the SRTMean RT's. One could speculate that a higher threshold than 355 ms could serve a similar purpose in a future analysis.

Our findings indicate a chronically sleep-deprived group of workers. Chronic partial sleep deprivation can be defined as "subjects that are prevented from obtaining their usual amount of sleep within a 24-hour period" [35, p. 221]. This is also supported by actigraphy data from the same set of data published elsewhere, and the study shows that the mean sleep time for these fishers was less than 5 hours a day [36]. Being a field study, the researcher had limited opportunity to control the testing environment, e.g. time of testing and disturbance factors. Also, on the way out to sea, all fishers would usually be tested simultaneously, whereas at the end of the trip, only about half the fishers were tested at the same time, as the majority worked in shifts. However, it was obvious that some fishers were already fatigued at the beginning of the trip. The better performance in the first half of the test could, in addition to the test duration, demonstrate the "new effort" effect.

Results from the two-way ANOVA (showing the interaction-effect between test-time and chronotype, and the test time and chronotype as independent variables) confirm that it is a challenge to the human system when it comes to working irregular hours. Reduction in alertness can have widespread consequences for crew and vessel safety as it only takes a short moment of inattentiveness for an eventuality to occur, confirming other studies about how chronotype influences fishers' alertness and speed on tests [37, 38]. Thus, knowledge of the crews' chronotype is vitally important, especially when scheduling watches. Since there is increased risk of crew falling asleep during the early morning hours, extra manpower should be engaged on the bridge to increase safety. It is noteworthy that the evening types overall fared better on the tests and seemed less sensitive to long periods of work that are outside of standard daytime working hours.

Time spent on tasks has been shown to negatively affect performance as time increases [21]. The decrease in the second half could be a normal tiredness (time-on-test effect) affecting rested individuals, but we cannot rule out (especially in the DV starting around the 15th minute of testing) the presence of task-based fatigue. When this effect is detected, the individual tests are usually longer than the ones used in the current study [21, 23]. It is likely that the participants were more tired on the DV test than with the SRT test (1st in the test sequence). We doubt, however, that the extra 90 seconds of the DV test alone would be adequate explanation for all the change between the halves.

The results demonstrate that fishers' performance on the cognitive tests declined between the two testings, with more major lapses on the SRT at the end test and slower reaction times in the second half of the DV test conducted at the beginning and end of the trip; deterioration in the crews' visuospatial memory on the end test; as well as chronotype and the interaction between chronotype and the two test-points having an overall deteriorating effect on the outcomes.

CONCLUSIONS

The aim of this study was to examine the impact of fatigue on cognition amongst deep-sea fishers in North Atlantic waters. Despite the short duration of the various tests, the results demonstrate deterioration in attention, vigilance, and visuospatial memory in tests completed towards the end of the trip. Moreover, the finding that age and chronotype affected the results between the two testings (at start and end of trip) suggests that assigning shifts based on chronotype could be one way of reducing the risk of accidents. Furthermore, with the long working hours, being rested when returning to sea is imperative, as having a paid job on land might increase the risk of accidents due to increased general fatigue. Although the time of day the fishers performed the tests did not demonstrate a significant effect on any of the outcome variables, future studies should focus on further improving test times and test environments. Priority should be on fewer but longer tests to avoid the possibility of learning effects and the new effort effect. Although not possible with the current test battery, it will be beneficial for tests to appear in random sequence if more than one is to be conducted, to prevent the issue of sequential test effects.

The findings in this study demonstrate that fatigue is highly prevalent amongst this segment of workers, shedding light on its underlying reasons, as well as suggesting strategies that could be implemented to reduce the risk of potential accidents that could arise owing to this. More in-depth research in the field is imperative since lapses in attention and reduced response times in workers could result in more frequent and serious eventualities occurring on board vessels of this nature.

ACKNOWLEDGEMENTS

The authors would like to thank Rógvi Lydersen and Jonas Elias Larsen for their help with preparing graphs and tables, the deceased Jógvan á Høvdanum for involvement in data collection, Maria Skaalum Petersen and Turid Hammer for reading through the work and giving valuable advice, and Amaranie E. Goonetilleke for proofreading and editing. Furthermore, we want to thank Lis H. Magnussen and Jóhan Simonsen at the Faroese Fisheries Inspection (vorn. fo), for co-operation in getting in contact with the captains when ships arrived in harbour and made it possible to make arrangements for getting onboard the vessels. Lastly, we would like to show our gratitude to the fishers for participating in the study.

FINANCIAL SUPPORT AND SPONSORSHIP

This work was supported by the Faroese Research Council; the Fisheries Research Fund of the Faroe Islands; the Faroese Agricultural Foundation; the Faroese Union of Shipmasters and Navigators; The Faroese Marine Engineering Union; The Faroese fishermen Union; The Workers Union of *Kollafjørður*; and the Workers Union *Hæddin*.

Conflict of interest: None declared

REFERENCES

1. Faroese, Government. Hagstovan. https://hagstova.fo/fo/b%25C3%25BAskapur/uttanlandshandil/%25 C3%25BAtflutningur-av-v%25C3%25B8rum.
2. Jepsen JR, Zhao Z, van Leeuwen WMA. Seafarer fatigue: a review of risk factors, consequences for seafarers' health and safety and options for mitigation. Int Marit Health. 2015; 66(2): 106–117, doi: 10.5603/IMH.2015.0024, indexed in Pubmed: 26119681.
3. International Maritime Organisation. Fatigue factors in manning and safety. In: Fatigue Factors in Manning and Safety. Vol. A. 772; 1993: 7. https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.772(18).pdf.
4. Hansen JH, Holmen IM. Sleep disturbances among offshore fleet workers: a questionnaire-based survey. Int Marit Health. 2011; 62(2): 123–130, indexed in Pubmed: 21910116.
5. Breidahl T, Christensen M, Jepsen JR, et al. The influence of ship movements on the energy expenditure of fishermen. A study during a North Sea voyage in calm weather. Int Marit Health. 2013; 64(3): 114–120, indexed in Pubmed: 24072536.
6. Zhou Y, Daamen W, Vellinga T, et al. Impacts of wind and current on ship behavior in ports and waterways: A quantitative analysis based on AIS data. Ocean Eng. 2020; 213: 107774, doi: 10.1016/j.oceaneng.2020.107774.
7. Christiansen JM, Hovmand SR. Prevention of Accidents at Work in Nordic Fisheries – What Has Worked. 2017, doi: 10.6027/TN2017-509.
8. Roberts S, Williams J. Update of Mortality for Workers in the UK Merchant Shipping and Fishing Sectors. Vol 1976; 2005.
9. Raby M, Lee JD. Fatigue and Workload in the maritime industry. In: Stress, Workload, and Fatigue. In P.A. Ha. Mahwah. Lawrence Erlbaum Associates. New Jersey 2000: 566–578.
10. Strauch B. Investigating fatigue in marine accident investigations. Procedia Manufacturing. 2015; 3: 3115–3122, doi: 10.1016/j.promfg.2015.07.859.
11. Knauth P. Extended work periods. Ind Health. 2007; 45(1): 125–136, doi: 10.2486/indhealth.45.125, indexed in Pubmed: 17284884.
12. Wadsworth EJK, Allen PH, McNamara RL, et al. Fatigue and health in a seafaring population. Occup Med (Lond). 2008; 58(3): 198–204, doi: 10.1093/occmed/kqn008, indexed in Pubmed: 18310605.
13. Jensen OCC, Petursdottir G, Holmen IM, et al. A review of fatal accident incidence rate trends in fishing. Int Marit Health. 2014; 65(2): 47–52, doi: 10.5603/IMH.2014.0011, indexed in Pubmed: 25231324.
14. A Høvdanum AS, Jensen OC, Petursdóttir G, et al. A review of fatigue in fishermen: a complicated and underprioritised area of research. Int Marit Health. 2014; 65(3): 166–172, doi: 10.5603/IMH.2014.0031, indexed in Pubmed: 25471166.
15. Akerstedt T, Knutsson A, Westerholm P, et al. Sleep disturbances, work stress and work hours: a cross-sectional study. J Psychosom Res. 2002; 53(3): 741–748, doi: 10.1016/s0022-3999(02)003331, indexed in Pubmed: 12217447.
16. Smets EM, Garssen B, Bonke B, et al. The multidimensional fatigue inventory (MFI) psychometric qualities of an instrument to assess fatigue. J Psychosom Res. 1995; 39(3): 315–325, doi: 10.1016/0022-3999(94)00125-o, indexed in Pubmed: 7636775.
17. Broadbent DE, Cooper PF, FitzGerald P, et al. The cognitive failures questionnaire (CFQ) and its correlates. Br J Clin Psychol. 1982; 21(1): 1–16, doi: 10.1111/j.2044-8260.1982.tb01421.x, indexed in Pubmed: 7126941.
18. Dorrian J, NL R, Dinges D, Kushida CA. Psychomotor vigilance performance: Neurocognitive assay sensitive to sleeploss; pp. 39-70. In: Kushida CA, ed. Sleep Deprivation Clinical Issues, Pharmachology, and Sleep Loss Effects. Vol. 193. 1st ed. Marcel Dekker, New York 2005: 39–70.
19. Horne JA, Wilkinson S. Chronic sleep reduction: daytime vigilance performance and EEG measures of sleepiness, with particular reference to "practice" effects. Psychophysiology. 1985; 22(1): 69–78, doi: 10.1111/j.1469-8986.1985.tb01562.x, indexed in Pubmed: 3975321.
20. Tao M, Yang D, Liu W. Learning effect and its prediction for cognitive tests used in studies on indoor environmental quality. Energy Build. 2019; 197: 87–98, doi: 10.1016/j.enbuild.2019.05.044.
21. Lee M, Kleitman N. Studies on the physiology of sleep. II. Attempts to demonstrate functional changes in the nervous system during experimental insomnia. Am J Physiol-Legacy Content. 1923; 67(1): 141–152, doi: 10.1152/ajplegacy.1923.67.1.141.
22. Harrison Y, Horne JA. The impact of sleep deprivation on decision making: a review. J Exp Psychol Appl. 2000; 6(3): 236–249, doi: 10.1037//1076-898x.6.3.236, indexed in Pubmed: 11014055.
23. Van Dongen HPA, Maislin G, Mullington JM, et al. The cumulative cost of additional wakefulness: dose-response effects on neurobehavioral functions and sleep physiology from chronic sleep restriction and total sleep deprivation. Sleep. 2003; 26(2): 117–126, doi: 10.1093/sleep/26.2.117, indexed in Pubmed: 12683469.
24. Hansen JH. Shift work in the offshore vessel fleet: circadian rhythms and cognitive performance. Dr thesis. 2012;39. https://brage.bibsys.no/xmlui//handle/11250/244989.
25. Dinges DF, Pack F, Williams K, et al. Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4-5 hours per night. Sleep. 1997; 20(4): 267–277, indexed in Pubmed: 9231952.
26. Tilley AJ, Wilkinson RT. The effects of a restricted sleep regime on the composition of sleep and on performance. Psychophysiology. 1984; 21(4): 406–412, doi: 10.1111/j.1469-8986.1984.tb00217.x, indexed in Pubmed: 6463172.
27. Barnett M, Zhao Z, van Leeuwen WMA. Project MARTHA: The Final Report. 2017(January), doi: 10.13140/RG.2.2.30339.30249.
28. Basner M, Dinges DF. Maximizing sensitivity of the psychomotor vigilance test (PVT) to sleep loss. Sleep. 2011; 34(5): 581–591, doi: 10.1093/sleep/34.5.581, indexed in Pubmed: 21532951.
29. van Leeuwen WMA, Kircher A, Dahlgren A, et al. Sleep, sleepiness, and neurobehavioral performance while on watch in a simulated 4 hours on/8 hours off maritime watch system. Chronobiol Int. 2013; 30(9): 1108–1115, doi: 10.3109/07420528.2013.800874, indexed in Pubmed: 23879695.
30. Basner M, Mollicone D, Dinges D. Validity and sensitivity of a brief psychomotor vigilance test (PVT-B) to total and partial sleep deprivation. Acta Astronautica. 2011; 69(11-12): 949–959, doi: 10.1016/j.actaastro.2011.07.015.

31. Doran SM, Van Dongen HP, Dinges DF. Sustained attention performance during sleep deprivation: evidence of state instability. Arch Ital Biol. 2001; 139(3): 253–267, indexed in Pubmed: 11330205.
32. Smith MG, Wusk GC, Nasrini J, et al. Effects of six weeks of chronic sleep restriction with weekend recovery on cognitive performance and wellbeing in high-performing adults. Sleep. 2021; 44(8), doi: 10.1093/sleep/zsab051, indexed in Pubmed: 33630069.
33. Olafsdóttir L. The relationship between fishermen's health and sleeping habits. Work. 2004; 22(1): 57–61, indexed in Pubmed: 14757907.
34. Ólafsdóttir L. Áhrif hvíldar á heilsu og öryggi sjómanna Rannsókn gerð á íslenskum sjómönnum: Á vegum Samgönguráðuneytisins Maí 2004 Solarplexus ehf. 2004: 1–97.
35. Web W. Partial and Differential Sleep Deprivation. In: Kales A, Lippincott J, eds. Sleep, Physiology and Pathology: A Synopsium. JB Lippincott, Philadelphia 1969: 221–231.
36. Abrahamsen A, Weihe P, Fróði D, et al. Sleep, sleepiness, and fatigue on board Faroese fishing vessels. 2022(December 2021): 347–362.
37. Deutsch J. The effects of time of day on cognitive performance in adolescents. J Clin Sleep Med. 2011; 7(3): 3–7.
38. van Leeuwen WMA, Pekcan C, Barnett M, et al. Mathematical modelling of sleep and sleepiness under various watch keeping schedules in the maritime industry. Marine Policy. 2021; 130: 104277, doi: 10.1016/j.marpol.2020.104277.

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.