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Outbreak of COVID-19 on an industrial ship

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ABSTRACT

Background: *People on ships are at high risk for outbreaks of infectious diseases including coronavirus disease 2019 (COVID-19). A rapid and well-coordinated response is important to curb transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). We studied an outbreak on an industrial ship to improve outbreak control for ships and coordination between participating harbour partners.*

Materials and methods: *Public Health Service (PHS) Rotterdam-Rijnmond performed an epidemiological investigation during the outbreak of COVID-19 among 77 seafarers on a ship in their port. The captain was interviewed about ship details and his experiences during the outbreak. The seafarers were asked to fill in questionnaires about symptoms suspicious of COVID-19 and date of symptom onset. Information about stakeholders involved in outbreak control was registered.*

Results: *The captain first contacted PHS about probable cases on March 31st 2020 via a physician ashore. One crewmember was hospitalised on April 8th and another died unexpectedly aboard on April 10th. Questionnaires distributed mid-April to the 75 remaining seafarers showed that 38 of 60 responders (63%) had had suspicious symptoms between February 15th and April 13th. None of them were tested but a total of 8 other crewmembers tested positive for COVID-19 after leaving the ship, including the hospitalised crewmember and the one who died aboard. On May 5th, the last case left isolation and the quarantine ended. Many different stakeholders were involved in the outbreak response and responsibilities were not always fully clear beforehand, causing coordination issues.*

Conclusions: *Testing crew with COVID-19 symptoms underpins control measures and clarifies communication between stakeholders. Building a-network beforehand to develop outbreak guidelines tailored to ships and local circumstances is essential to control future outbreaks on ships.*

(Int Marit Health 2021; 72, 2: 87–92)

Key words: COVID-19, SARS-CoV-2, coronavirus, outbreak, ship, harbour, public health service

INTRODUCTION

In December 2019, an outbreak of a novel coronavirus — severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first detected in Wuhan, China, rapidly spread throughout the world [1]. Since the beginning of the pandemic, several outbreaks on ships have been described worldwide [1–6]. Once SARS-CoV-2 is introduced, ships are at high risk for an outbreak due to crew working closely together in confined spaces [2, 7, 8]. Here we describe an outbreak among the crew of an industrial ship, from a public health point of view. We highlight the complexity of coordination of control measures and share lessons learned.

MATERIALS AND METHODS

A possible outbreak of coronavirus disease 2019 (COVID-19) in the port of Schiedam, the Netherlands, was reported on March 31st to the Public Health Service

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Table 1. Parties responding during an outbreak of coronavirus disease 2019 (COVID-19) on a ship in a Dutch port, with description of their roles

Captain	Responsible for crew on board the ship.
Ship´s port agent	Facilitate logistics and communication between the captain and PHS in different harbours.
Shipping company	Owns the ship, communicates with captain arranging logistics and financial issues.
Public Health Services (PHS)	Responsible for outbreak control in the region. The PHS gives advice about response measures and informs the safety region, press and National Institute for RIVM.
Regional Harbour Coordination Centre (HCC)	Informs the harbour master, press, and facilitates contact between the PHS, the captain and the shipping agent.
National Institute for Public Health and the Environment (RIVM)	National focal point for European Union member states considering cross border travel of COVID-19 cases.
Regional Safety Force (RSF)	Regional government body informing and coordinating actions between the police, the ambulances, the fire department and PHS.

(PHS). The outbreak location was a 600-foot (183 m) ship under Bahamian flag, designed to lay pipes at the seabed.

The ship had been in Pointe Noire, Congo-Brazzaville, for 9 weeks before departing with 134 crew on board on December 26th, 2019. Eight crewmembers debarked in African ports before the ship arrived in the port of Schiedam, a city next to Rotterdam, on January 23rd, 2020, where another 49 members debarked. Two service engineers boarded on several occasions up to March 4th for maintenance work. An Italian food company, with staff directly transporting the food supplies from Italy to the Netherlands, delivered to the ship on March 21st.

The remaining 77-man mainly Filipino and Malaysian crew included a Filipino physician and a Dutch captain, who boarded March 31st.

When the new captain boarded and noticed that several crewmembers were ill, he isolated all crew with respiratory symptoms. He notified a port physician, who alerted the PHS about a possible COVID-19 outbreak on the ship. The PHS informed the Harbour Coordination Centre in Rotterdam (HCC) and gave basic advice on outbreak control to the captain such as isolation, social distancing and detailed hygiene practices, according to Dutch national guidelines.

When on April 8th one crewmember had to be hospitalised, the captain contacted the HCC about that and an increasing number of cases. The HCC informed the PHS and then PHS started an outbreak investigation. At this time the outbreak had also received a lot of local media attention.

The PHS kept a record of communication with different stakeholders in the harbour (i.e. HCC, shipping agent, captain, ship company, sea pilots, hospital staff, laboratory staff, medical doctor working on the ship, medical doctor working in the harbour, national focal point (National Institute for Public Health and the Environment [RIVM]) and the Regional Safety Force (RSF), which is responsible for responding to different types of crises (Table 1).

The PHS sent two different questionnaires to the captain on April 13th, 2020. The first questionnaire was addressed only to the captain and concerned general information about the ship, the ship's travel log, and outbreak control measures that had been implemented. The captain printed and distributed the second questionnaire to each crewmember, requesting case related information (date of onset of symptoms, complaints, contacts with other crew, activities and preventive measures taken).

Cases were classified as probable when they had at least one of the following symptoms: fever, coughing, loss of taste or smell, headache, vomiting, nausea, sore throat, muscle or joint pain, or tiredness.

RESULTS

CONFIRMED CASES

Due to scarce testing materials at the time, no crewmembers were tested on board. On April 8th, 1 case was hospitalised with severe shortness of breath, and on April 9th he was confirmed SARS-CoV-2 positive by a polymerase chain reaction (PCR) test. One crewmember-died unexpectedly on April 10th. SARS-CoV-2 was confirmed post-mortem by PCR ashore. After April 6th another 6 crewmembers who had left the ship without symptoms were confirmed PCR-positive after repatriation.

SELF-REPORTED CASES

Sixty out of 75 non-tested crewmembers still aboard filled in a questionnaire, and 38 (63%) reported COVID-19 related symptoms (Fig. 1). Symptoms of the first probable case started on February 15th,

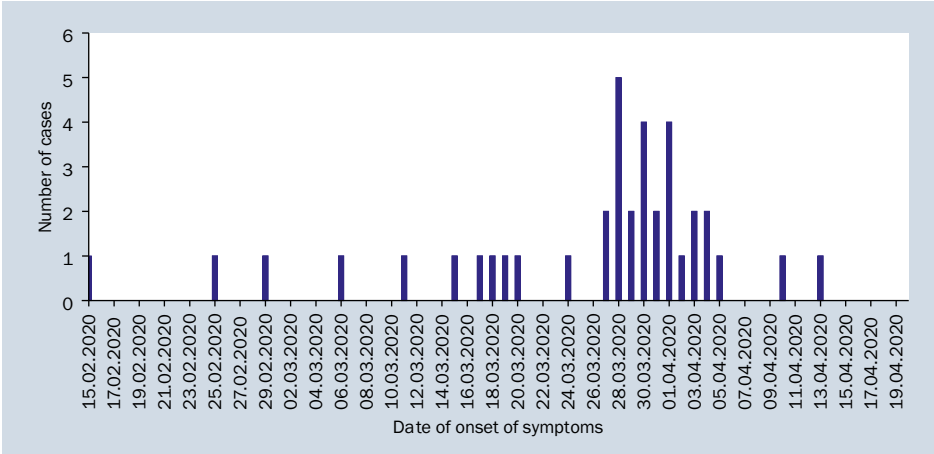

Figure 1. Coronavirus disease 2019 (COVID-19) outbreak on a Bahamian-registered ship in a Dutch port: Timeline for onset of symptoms reported by 38 of 60 seafarers who responded to a questionnaire distributed mid-April 2020 to 75 non-tested crewmembers still aboard

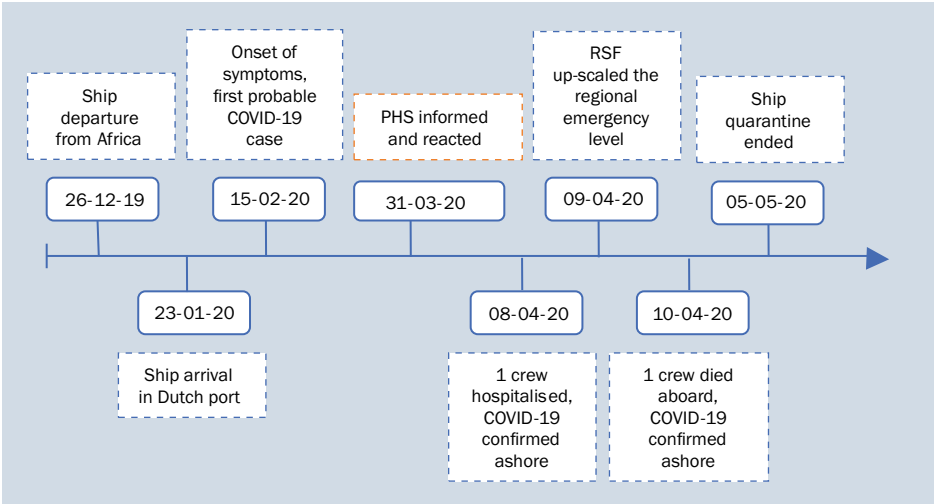

Figure 2. Timeline for key events regarding a coronavirus disease 2019 (COVID-19) outbreak on a Bahamian-registered ship that arrived in a Dutch port with 77 seafarers. A questionnaire about COVID-19 symptoms and date of onset was distributed mid-April 2020 to 75 non-tested crewmembers still aboard. Of 60 responders, 38 reported one or more COVID-19-related symptoms; PHS — Public Health Services; RSF — Regional Safety Force

2020. The number of cases rose until March 27th, peaking on March 28th. The last case reported first symptoms on April 13th. On May 5th, the final case left isolation and ship quarantine ended. Figure 2 shows some key events of the outbreak along a timeline.

PATIENT DETAILS

Based on the questionnaire data, the 38 ill crewmembers were between 25 and 60 years of age (median 32) and all were male. The median duration of symptoms was 7 days. Most frequent symptoms were mild cold symptoms (n = 24), muscle pain (n = 22), headache (n = 21), loss of smell or taste (n = 14) or cough (n = 12). Fever was mentioned 3 times (Fig. 1).

CONTROL MEASURES ON THE SHIP

On March 31st, a Dutch captain arrived on board after 14 days of quarantine at home. Before his arrival, some crewmembers had had mild respiratory complaints, but at first these complaints were assigned to the temperature change from Africa to the Netherlands.

On March 31th, however, the new captain announced some general restrictions to the crew. They were not allowed to disembark for even short trips ashore. The ship's doctor was involved in treatment and isolation of potential COVID-19 cases. Seventeen symptomatic crewmembers were promptly isolated. Later that day, a port physician, notified by the captain, discussed the sick seafarers with the PHS. The PHS agreed with the implemented control

measures and gave some additional advice based on Dutch COVID-19 guidelines. These measures were social distancing (based on the 5 feet distance principle) and cabin-isolation for symptomatic individuals until at least 24 hours after clinical recovery. The captain actively communicated the measures to the crew. In addition, the company that supplied medical services to the ship went beyond PHS recommendations and advised that symptomatic crewmembers should be kept in isolation for 14 days. Following PHS advice, every crew member was assigned a separate cabin. The HCC ordered the captain to suspend ship operations.

The ship's doctor had enough personal protective equipment (PPE) to protect himself during patient visits. Isolated crew was allowed to walk 1 hour per day on deck while using PPE. The doctor checked their temperature daily and supplied them with medication when needed. The non-isolated crew on board the ship continued to do necessary maintenance work, and therefore could not be quarantined at all times in their cabins. PPE (gloves, masks) were then used. To minimise the risk of infecting co-workers, small fixed crew groups worked in shifts. The PHS advised that the ship and crew should remain in port until quarantine of the last crewmember had ended to avoid them becoming (seriously) ill at sea.

Starting March 31st, kitchen staff wore masks and latex gloves. The number of crew allowed to eat in the galley at the same time was reduced in order to facilitate social distancing. Common areas such as the gymnasium were temporarily closed. Extra cleaning staff was hired to clean the common areas and cabins. The captain had daily contact with the medical service of the shipping company about the on-board health situation and measures taken. After the outbreak, the company required all new crew to quarantine themselves for 14 days before embarkment, followed by a pre-boarding PCR-test to minimise the risk of further SARS-CoV-2 transmission.

STAKEHOLDERS INVOLVED

During the outbreak response, many different parties were involved (Table 1). Here we present a brief summary to illustrate the complexity of the network of stakeholders involved in the management of an outbreak on a single ship.

The captain was responsible for the crew on board. The ship was owned by a company, which communicated with the captain and dealt with logistic and financial issues. The company also discussed quarantine measures with the captain. They were sometimes more stringent than those advised by the PHS. Shipping companies usually use port agencies to facilitate logistics and communication with the captain and PHS in the various harbours. The ship was docked at a terminal owned by the ship company. Staff members working in the terminal were involved in logistics around the moored ship. The crew included a medical doctor. A general physician (port doctor) visited the ship at the request of the captain to assist in diagnosis and care when COVID-19 was suspected.

The PHS was responsible for outbreak control in the region, including in the harbour. PHS-staff advised the regional HCC and the captain about response measures. The PHS informed the mayor of the city, who is responsible for the safety of the citizens and is head of the RSF, which includes the police, the fire department, ambulances and the PHS.

The HCC informed the harbour master about the outbreak. The HCC was in contact with sea pilots when the ship had to relocate to another part of the harbour.

When a crewmember had to be hospitalised, an ambulance, the police and the hospital, including the laboratory, were involved in patient transport and care. Due to the hospitalisation of the crewmember, the RSF increased the alarm phase temporarily on April 8th, to coordinate the response of public services such as ambulances, police, the fire department and PHS in the direct surrounding of the ship. This generated media attention. The PHS and HCC worked together to ensure that the press was properly informed, and the alarm phase was quickly decreased.

COVID-19 is considered a disease of (inter-)national concern and therefore guidance is directed from the national government. The PHS updated the RIVM about the outbreak. The PHS requested the laboratory of the hospital to perform sequence analysis of the PCR-positive specimens. RIVM, the national focal point for the World Health Organization and the European Centre for Disease Prevention and Control, was informed by another European Union (EU) member state about a crewmember who tested positive after returning home.

DISCUSSION

COORDINATION OF OUTBREAK MEASURES

The main purposes to take measures during an outbreak are to limit the transmission on the ship and to protect the population on land. It is very hard to prevent transmission between crew members while aboard a ship, but we drew some lessons from this outbreak which could improve speed of diagnostic and medical process, and communication with the different stakeholders in the future.

To start, early detection and disembarkation of positive cases, or complete crew change, have been suggested to stop further transmission [7]. It is advisable to have a detailed plan ready for both the PCR-negative and PCR-positive tested crew and to inform the total crew about this plan. The PHS had to arrange practical issues in collaboration with the other stakeholders, without a clear guideline that is specific to the regional circumstances and typical ship and crew issues. For example: evacuation of high-risk contacts has challenging issues such as visa-issues, arrangement

of a suitable quarantine location, and rules for crossing borders. It is also unclear who is responsible for costs [8]. It is helpful to describe beforehand who is responsible when an outbreak on a ship occurs for which actions, including measures taken on board, measures taken on shore, and communication.

We learned that an outbreak on a ship is challenging, and can draw media attention, especially when the regional alarm phase is increased, followed by visible police and ambulance response near the ship. We therefore advise public health services to clarify for themselves the roles and responsibilities of all main parties involved, so a more detailed response plan is ready when necessary. As illustrated, there are many organizations involved during an outbreak on a ship. We learned that it is necessary to align the PHS outbreak management policy with the shipping company and the ship's port agent, as the captain receives instructions from both. The policy and status of the outbreak must be explained and regularly updated to all parties involved, including harbour staff, such as police and sea pilots, since we experienced unrest among them. Clear communication is eminent. To accommodate outbreak management in the future, we strongly advise building an active network between all relevant parties in the harbour, for example by organizing simulated outbreaks.

In order to protect staff against infection and to be time efficient, the PHS did not visit and inspect the ship. All communication with stakeholders was done via telephone and email. Other subsequent outbreaks have taught us that a site visit generates a more detailed understanding of the situation, enables the inspection of hygienic standards and ventilation options, and improves trust in the advice given to the crew.

In the harbour area of Rotterdam, a location is reserved for quarantined ships. Appropriate isolation and hygiene measures on board are necessary to reduce the risk of transmission on the ship. Unfortunately, it is not always feasible to isolate or quarantine people on board. Ideally the ship company organises a quarantine location, such as a hotel, arranges logistics of crew, and pays for the costs. On a public health level, it seems wise to prepare for quarantines of larger numbers of crew or passengers of cruise ships. Therefore, it is relevant to have a location on shore dedicated for isolation or quarantine purposes.

DIAGNOSTIC TESTING

Some crew members, both symptomatic and asymptomatic, indicated that they wanted to be tested for COVID-19. But following national guidance at March 31st, laboratory confirmation of mildly sick cases was not recommended by the national guidelines at the time. The crew was not considered to be a vulnerable population at risk for severe infections, there was a national shortage of testing materials, and the PHS did not question COVID-19 as a most likely source of the outbreak: a positive diagnosis would not change the preventive measures advised. However, laboratory testing was initiated 8 times by other, non-PHS, health professionals. Their reasons to test were not public health related, but part of prevention policy in a hospital setting, to confirm individual diagnosis, or to allow travel. Considering the multiple partners involved in ship logistics, early confirmation of COVID-19 could have been helpful for a clearer communication. Especially for repatriating crew, a negative PCR-result can be relevant to allow flying or crossing borders. Additional testing can also be helpful to monitor the transmission of the virus on board.

SIGNALLING OUTBREAKS

The PHS did not receive a Maritime Declaration of Health (a requirement for captains in order to inform the HCC about sick crew), before entering the port, as the ship had already entered the harbour before the first case was noticed. It should be made clear to captains how, when and where to notify suspected cases and how to test them, once a ship has moored.

The PHS did not immediately inform the RIVM about the outbreak, as it did not expect crew to disembark and travel back home to other countries. Consequently, the notification of a case by another EU-member state to the RIVM was a surprise. In light of this experience, it is advisable to inform the national focal point when COVID-19 cases are detected on ships with an international crew.

The PHS did not notify the outbreak in the 'EU Shipsan Information System' (SIS; http://www.shipsan.eu/), as the ship was not travelling to other harbours or countries during the outbreak. Nevertheless, it is worth discussing when to declare an outbreak on a ship to be over and worth registering.

CONCLUSIONS

Testing of crew with respiratory symptoms during an outbreak in general and during a COVID-19 pandemic specifically, is advisable as it promotes acceptance of the control measures and clarifies communication between different stakeholders. During outbreaks, it is relevant to include both the captain and the shipping company in the communication. Considering the many parties involved, it is worthwhile to invest in network building beforehand, to develop outbreak guidelines tailored to ship-related issues and the regional circumstances, and to do exercises to test practical issues.

ETHICAL CLEARANCE

Outbreak investigations of notifiable diseases such as COVID-19 are the legal tasks of Public Health Services as described under the Public Health Act, and do not require separate medical ethical clearance.

DATA SHARING

All relevant data for this short report are within the paper. The authors support the policy of making relevant anonymised patient level data available on reasonable request. Requests should be directed to: eb.fanoy@rotterdam.nl.

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Estimation of local incidence of jellyfish envenomation in developed marine coastal areas and large populated island on the western coast of Peninsular Malaysia using case surveillance of government health facilities in Manjung, Perak and Langkawi Island

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ABSTRACT

Background: *Jellyfish stings are one of the commonest causes of marine animal related injuries in human. Despite mostly being harmless, box jellyfish species can cause major stings with fatalities or systemic envenoming symptoms. There are 15–20 species identified to be life-threatening. There are few reported cases that suggest the presence of deadly box jellyfish in the Malaysian coast. However, numbers of stings around Malaysia are still under reported.*

Materials and methods: *This observational study was conducted in Manjung, Perak and Langkawi Island to look at the pattern and incidence of jellyfish stings which occur within 1 year.*

Results: *There were 45 sting incidents reported with the highest number of cases occurred in December and February. Cases mainly involved young adults aged 10 to 29 years old. The most common clinical symptom that presented was sudden and persistent pain. Vinegar was applied as first aid in 53.3% of reported stings. All patients were treated symptomatically and discharged well. Stings occurred at mean sea surface temperature of 29.38°C and the wind speed of 7.6 knots. All cases were mild and did not require antivenom.*

Conclusions: *The study showed that the occurrence of jellyfish stings are affected by weather conditions. Jellyfish stings occur seasonally, thus making it predictable and easily preventable with public awareness, early first aid application and use of jellyfish nets.*

(Int Marit Health 2021; 72, 2: 93–98)

Key words: clinical toxinology, emergency, first-aid, jellyfish stings

INTRODUCTION

About 150 million marine envenomations occur annually with jellyfish as the commonest stings. Very few require medical attention other than basic first aid. However, there are identified fatal jellyfish which are medically significant to humans. These jellyfish are from the cubozoan class, the box jellyfish [1–3]. Box jellyfish are further divided into two subgroups, the Chirodropids and Carybdeid. The management of jellyfish envenomation must be initiated early and the primary management should be directed at alleviating

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the local effects of toxins, prevention of further discharge of toxins and systemic reaction control [4]. The most important steps after envenomation is basic life support with the aim of maintaining good respiration and normal blood circulation, and appropriate first aid management to prevent continuous release of toxins and alleviate pain [4]. Toxins are varied among jellyfish stings; thus different remedies are necessary to control the effects of envenomation. In addition to initial first aid management, patients may require adequate intravenous analgesia, particularly opioids, to relieve pain. Box jellyfish antivenom is indicated once the patient develops systemic envenomation such as life-threatening cardiac or respiratory depression, cardiac arrhythmias, unconsciousness or for patients who suffer from severe persistent pain despite first aid management and parenteral narcotics [5, 6]. There are a few reported cases suggestive of fatal or near fatal cases of box jellyfish envenomation in Malaysia [1, 7–9]. A study conducted along the Malacca strait in 2010 reported the presence of deadly box jellyfish *Chiropsoidis buitendijki* and *Carybdeid morbakka* in Penang and Manjung. The *Carybdeid morbakka* are similar to one that was found in Hawaii which causes Irukandji syndrome. Even though a few studies and cases prove the existence of deadly jellyfish in Malaysian coast, the data is still limited and studies are still lacking. Thus, the prediction of jellyfish blooms around the Malaysian coast and the management of the stung are poorly understood.

Therefore, this study was conducted to determine the frequency of jellyfish stings, the clinical spectrum of jellyfish toxin, common medical practice in managing the victims, and to determine any correlation between the incidence of jellyfish stings with weather and sea changes.

MATERIALS AND METHODS

This was a prospective observational study of jellyfish stings in Manjung, Perak and Langkawi Island from 1 October 2017 to 31 November 2018. A standard data collection sheet was used for patients presenting to selected hospitals and health clinics. The variables of the study included demographics, weather and sea details, clinical presentation of jellyfish envenomation, nature of suspected sting, treatment details including first aid and medication given were recorded.

Patients with jellyfish envenomation detected by the primary care provider in charge of the clinic or hospital were enrolled in the study. The data collection sheets were filled during the visit. The weather and sea details data were provided by the Malaysia Meteorology Department.

RESULTS AND DISCUSSION

A total of 45 patients presented to the primary care centres for jellyfish stings were analysed. There were 9 cases in Manjung, Perak and 36 cases in Langkawi, Kedah (Figs, 1, 2).

Figure 1. Pangkor Island with the number of stings occurring mainly on the west coast of the island along the beaches of Tortoise Bay and Pasir Bogak

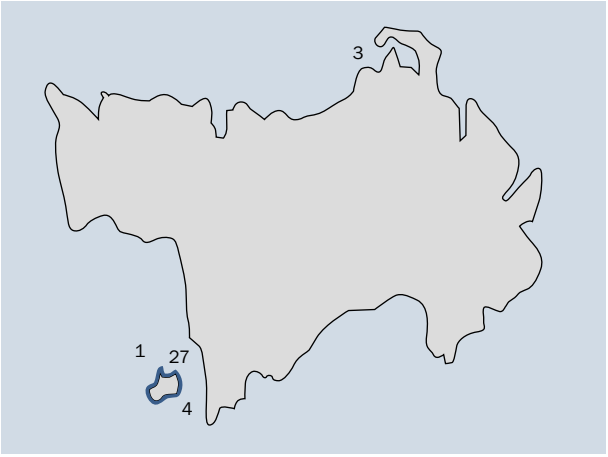

Figure 2. Langkawi Island with the number of stings occurring mainly along the southwestern beaches of Pantai Cenang. A few incidents documented at Tanjung Rhu beach in the north includes sting injuries from the harmful multi-tentacled Chironex species with one death incident. The incident location of one case was not documented

This study showed a seasonal pattern of jellyfish sting incidence that was higher in November, December and February (Fig. 3). There were no reported stings in July. This similar incidence was demonstrated in the first study done in Langkawi Island in 2012, where stings were higher throughout October to December [10]. This may be due to the surge of tourists to the Island as the local school holidays

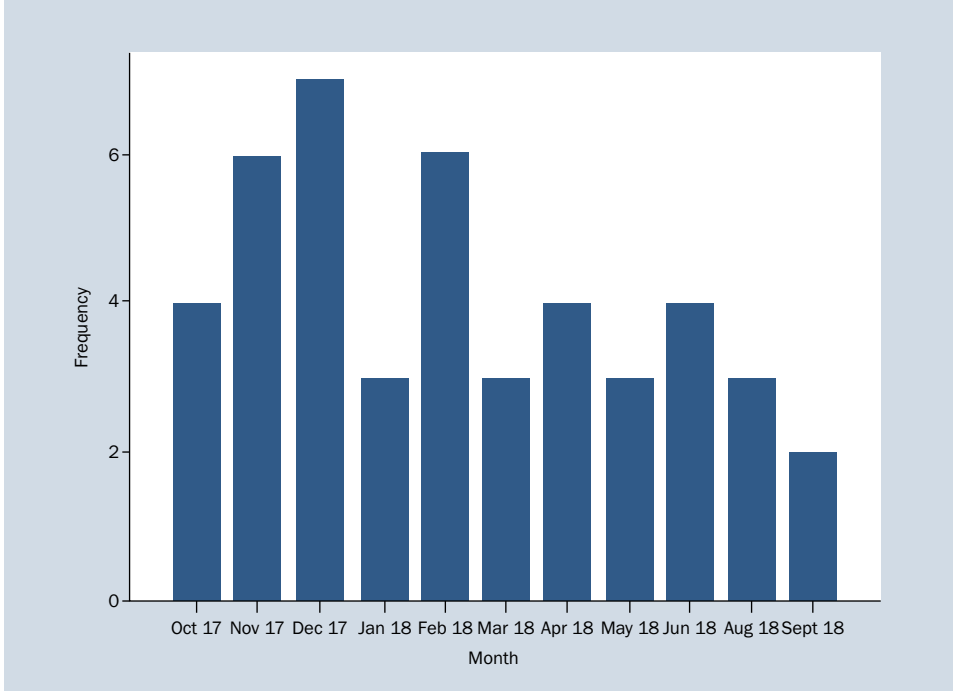

Figure 3. Number of patients treated for jellyfish sting according to months

fell within these months. In addition, sunny weather with lower average rainfall from November to February increased the risk of higher contact with jellyfish.

The highest jellyfish sting incidence happened in between 5 pm to 7 pm when most sea activities were held (Fig. 4). Activities associated with the risk of stings were swimming, and entering and standing in the water (Table 1). This shows that jellyfish stings were likely to occur at the seashore rather than within deep sea. This was due to jellyfish behaviour as they tend to drift along the current, becoming alienated onshore and along the coast [2].

Following jellyfish contact, most patients developed persistent pain over the sting area, generalised rashes, back pain, restlessness, headache, and profuse sweating (Table 2). These symptoms suggested the possibility of an Irukandji-like syndrome, a manifestation of venom-induced catecholamine storm. Intense pain may develop immediately, followed by systemic envenomation and associated symptoms. The clinical symptoms are usually delayed after 30 to 40 minutes and are diagnosed clinically. The classical clinical presentation is delayed onset of severe back and limb pain, sweating, hypertension, and in severe cases, evidence of cardiac dysfunction [6]. Two possible Irukandji syndromes have been reported in Langkawi in 2010 involving tourists who were stung by jellyfish that had developed severe chest pain, generalised muscle pain, intense local pain and nausea. They were treated with analgesia, with resolution of symptoms a few days later [9].

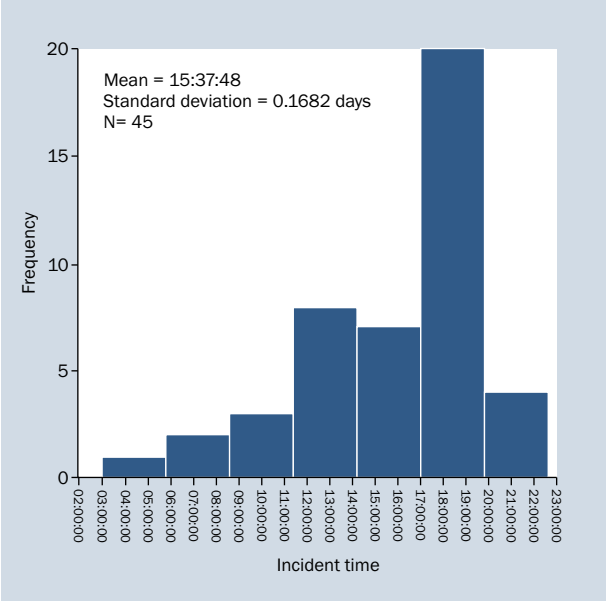

Figure 4. The incident time of jellyfish stings

Following contact with jellyfish, half of the patients had applied vinegar as first aid while 40% did not apply anything before arrival to the primary care centre. First aid is important to prevent new discharging nematocytes which may expose patients to further envenomation. Studies on vinegar to large box jellyfish showed deactivation of all undischarged venom-containing nematocysts. Be-

Table 1. Demographic characteristic of patients presenting with jellyfish stings

Characteristic	Number	Per cent	Mean	Standard deviation
Age [years]			23.44	14.3
0–9	8	17.8		
10–19	12	26.7		
20–29	12	26.7		
30–39	6	13.3		
40–49	5	11.1		
50–59	1	2.2		
60–69	1	2.2		
Gender				
Male	30	66.7		
Female	15	33.3		
Nationality				
Malaysian	30	66.7		
Non-Malaysian	15	33.3		
Activity during sting				
Entering the water	7	15.6		
Standing in the water	13	28.9		
Swimming	18	40.0		
Fishing in the shore	3	6.7		
Boating	4	8.9		

Table 2. Clinical presentation and treatment following jellyfish sting

Variable	Number	Per cent	Mean	Standard deviation
Clinical presentation				
Immediate pain	40	88.9		
Cardiorespiratory arrest	–	–		
Cardiac arrhythmias	–	–		
Loss of conscious	–	–		
Headache	3	6.7		
Back pain	5	11.1		
Generalised rashes	6	13.3		
Restlessness	4	8.9		
Profuse sweating	3	6.7		
Body surface area [%]			1.3	0.82
Body region sting by jellyfish				
Upper limb	21	42		
Lower limb	21	42		
Abdomen	1	2		
Head and neck	2	4		
Vital signs during presentation to primary care				
Blood pressure [mmHg]			122.34	17.6
Pulse rate [bpm]			94.18	16.7
Saturation [%]			98.53	0.26
Temperature [°C]			36.9	1.14
Pain score			5.31	2.11
Glasgow Coma Score (GCS)			15	0.00
First aid applied				
Vinegar	24	53.3		
None	18	40		
Sea water	1	2.2		
Others	2	4.4		
Medication				
Steroid	38	84.4		
Anti-histamine	28	62.2		
Opioids	22	48.9		
Nonsteroidal anti-inflammatory drugs (NSAIDS)	14	31.1		

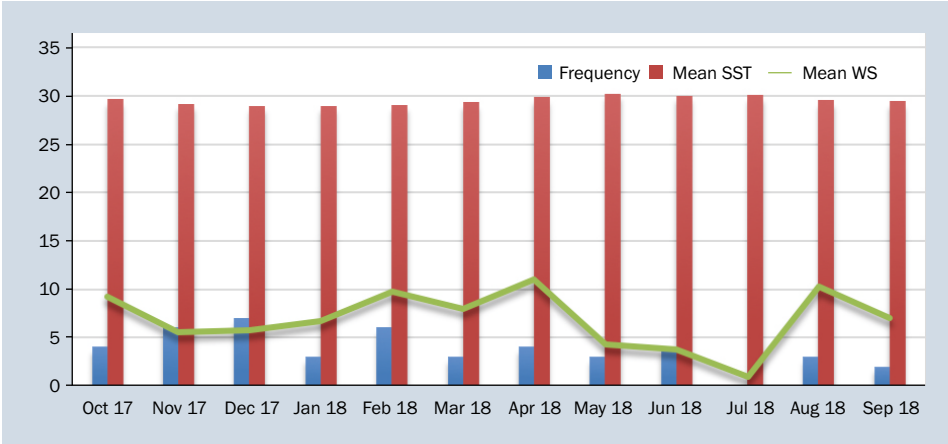

Figure 5. The association between frequency of incident, mean sea surface temperature (SST) and mean wind speed (WS) throughout the study period

Table 3. Weather details during jellyfish sting incident

Variable	Number	Per cent	Mean	Standard deviation
Weather:				
Clear	42	93.3		
Rainy	3	6.7		
Sea surface temperature [°C]			29.38	0.58
Wind speed [knot]			7.6	4.6
Tidal wave:				
High tide	23	51.1		
Low tide	22	48.9		

sides that, it has been shown to be effective in at least 5 species of carybdeid [11]. A box jellyfish sting victim had survived a severe envenomation despite a delay of 10 to 15 minutes of applying vinegar as first aid [12]. This shows vinegar is the best primary first aid of both carybdeid and chirodropid stings. Consequently, it is important for local authorities to provide vinegar at the seaside as it can prevent patients from developing severe envenomation while awaiting for emergency care services. Other first aid which can be used in the absence of vinegar is sea water. Fresh water application can cause discharge of the venom by changes in osmotic gradient causing severe envenomation and death.

Most patients were treated with steroids and anti-histamines. The analgesic of choice were opioids, compared to non-steroidal anti-inflammatory drugs. Most patients were treated with intravenous tramadol and fentanyl. Patients had immediate pain with a mean pain score of 5.31. Thus, opioid analgesic is appropriate in treating jellyfish stings. Other recommended agents which were used as analgesia were Magnesium sulphate, which serves as a peripheral inhibitor of catecholamine release and effect. It is usually given as a bolus, followed by infusion until the pain is controlled [6].

Weather had an influence on the rate of sting incidence (Fig. 5). Almost all stings occurred during clear weather with a mean sea surface temperature (SST) of 29.38°C and wind speed of 7.6 knots (Table 3). A study in Darwin showed a strong positive correlation between *Chironex fleckeri* stings and raised SST. Number of stings were higher when the SST was more than 30°C. Other studies showed similar results to this, with both *Chironex fleckeri and* Irukandji stings occurring at a mean temperature of 31.2°C [13]. With a higher mean SST in Manjung of 31.7°C, this predisposes to larger jellyfish blooms in this area [14]. Comparing *Chironex fleckeri and* Irukandji stings, both were prone to happen on 0-kot days. However, *Chironex fleckeri* stings happened more often during light wind while Irukandji stings occurred during moderate to strong wind [13].

All patients were treated symptomatically and were able to be discharged home. None required an antivenom due to the sting. Despite this, a few deaths related to jellyfish stings have been reported. The most recent was in Tanjung Rhu, Langkawi on 27th June 2018, when a Swedish tourist was

stung to death by a jellyfish. A similar incident occurred in February 2010 when a Swedish tourist was reported dead by jellyfish sting. Pulau Pangkor, Manjung had also reported a death of a 26-year-old Brunei tourist after contact with a jellyfish in 2000 [15]. This shows that even though all patients had presented to hospital with mild envenomation, deadly box jellyfish are still a threat in Malaysian waters. Box jellyfish antivenom are readily available in Malaysia. However, the antivenom is very limited and stored in hospital around Sabah. There is currently 5 in Queen Elizabeth Hospital, 3 vials in Kudat, Tawau, Lahat Datu, Semporna and Hospital Duchess of Kent Sandakan.

LIMITATION AND FUTURE DIRECTION

There were a few limitations of this study. This study is limited to patients who seek medical attention in these primary government health facilities. Sting victims may have seek treatment at private clinics, other health facilities or did not seek any treatment. The actual number of sting cases from these locations is likely to be significantly underestimated. The species of jellyfish which were responsible for the stings were unable to be identified as patients presented without any available samples for identification. Jellyfish species around Langkawi are still unknown as there is no study on jellyfish identification in Langkawi waters. A proper study should be conducted to determine the species of jellyfish as there were a few reported deaths in Langkawi attributed to jellyfish stings.

There were a total of 24 missing files that were identified. This shows poor documentation and case neglect by the healthcare providers. Remote Envenomation Consultation Services Malaysia provided a solution to this by collecting the data through electronic consultation.

CONCLUSIONS

This study identifies that patterns of jellyfish stings occur seasonally during clear weather, low average of rain falls and high sea surface temperature. The spectrum of presentation identified was similar to Irukandji syndrome. Envenomation was mild, not requiring antivenom and admission. We suggest the improvement of public awareness by placement of warning signs on beaches, pamphlets and jellyfish netting by local authorities and hotel management especially during higher seasons of jellyfish stings. Vinegar should be made available at local beaches to reduce the severity of jellyfish envenomation. Studies are very limited in this field despite several cases of life-threatening stings reported. More related studies are required for better understanding of the various harmful jellyfishes and to improve the clinical management of jellyfish envenomation.

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Rescue medical activities among sea migrants and refugees in the Mediterranean region: lessons to be learned from the 2014–2020 period

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ABSTRACT

Background: *Since 2014, the number of migrants and refugees crossing the Mediterranean towards Europe has risen significantly due to various reasons. Both state agencies and non-governmental organizations (NGOs) have launched rescue missions in the Central Mediterranean in accordance with international legal obligations for search and rescue (SAR) operations for those under distress at sea. Our aim is to summarise the specific qualifications needed for maritime SAR in the Mediterranean both in terms of the population at risk, the equipment and the medical support required, especially during the coronavirus disease 2019 (COVID-19) pandemic and the operational legal framework.*

Materials and methods: *This article aims to summarise the key points of SAR efforts from a medical perspective as depicted in the relevant literature during a specific timeline period (2014–2020) in a specific part of the Mediterranean Sea (Central Mediterranean route). Only papers published in English and whose full text was available were included in this study. The inclusion criteria were: a) articles referring to sea rescue operations between 2014 and 2020, b) research that focused on medical preparedness and assistance during rescue operations in the Central Mediterranean route, c) studies concerning demographic and clinical features of the rescue population, d) guidelines on the rule of conduct of persons and states participating in rescue activities. The exclusion criteria were: a) studies describing SAR operations in different regions of the world and b) studies focusing on routes, demographics and medical support of migrants/refugees on land.*

Results: *Three major themes were identified: a) characteristics of the population in distress at sea: country of origin, age groups, presence of communicable and non-communicable diseases were identified in the relevant literature. Our research shows that dermatological and respiratory issues were the major concerns among sea migrants, coming from different countries of both Africa and Asia, being relatively young and mostly males; b) medical preparedness and equipment needed for rescue: according to current guidelines, revised during the COVID-19 pandemic, infrastructure needed during SAR operations includes both equipment for resuscitation, personal protective equipment, deck adjustments, medical personnel trained to function in an austere setting and able to handle vulnerable patient groups such as children and pregnant women; c) medico-legal implications of SAR operations: knowledge of the legal framework encompassing SAR operations seems necessary, as European Union and state led initiatives seem to withdraw from proactive SAR, while criminalising NGO led rescue efforts. Operating with the imperative to save lives seems to be the only way of respecting international law and human values, thus, a summary of what the law dictates was made in an effort to keep medical workers participating in such operations updated.*

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Conclusions: *Investigation aims to shed light on the special clinical features of sea migrants, the skills, equipment and organizational structure needed by medical workers participating in SAR operations as well as the legal framework under which they will be asked to operate. Special consideration will be given to the difficulties that emerged due to the COVD-19 pandemic.*

(Int Marit Health 2021; 72, 2: 99–109)

Key words: sea migrants, search and rescue (SAR), Mediterranean route, initial assessment, COVID-19

INTRODUCTION

Migrants and refugees travelling by sea are not a phenomenon of the last decade; however, ongoing conflicts and war on several regions of the planet, including Northern Africa and Middle East, has provoked an unprecedented larger influx of people through different Mediterranean routes (West, Central and East Mediterranean route) between 2014 and 2020. Search and rescue (SAR) activities, established by European countries since the 70s, largely depend on national coast guard and rescue coordination centres (RCCs), European Union's border security agencies (FRONTEX), and vessels involving humanitarian agencies. Medical assistance provided during any SAR operation, no matter the agencies involved, requires previous knowledge of the demographic and clinical features of sea migrants, basic understanding of the medicolegal aspect of any rescue occurring at maritime environment, as well as skills on handling emergency medical situations up until delivery to a land-bound emergency service.

STEPS TOWARDS RESCUE

Usually as soon as a distress call gets intercepted, the RCC in charge of the relevant SAR zone is contacted. Even if the wrong RCC gets contacted, it remains the RCC's responsibility to transfer the case to the centre responsible for the region [1]. Afterwards the centre and the Government to which the region belongs falls under the obligation to coordinate the whole rescue effort either by sending state vessels, or any vessel they judge as capable of performing the operation at the time and to arrange for a safe disembarkation of those rescued (Fig. 1) [1–3].

The above description of current rescue efforts in the central Mediterranean migrational route, along with the fundamental legal obligations of those participating during such rescue operations and the organizational patterns implemented throughout an operation, seem to constitute a prerequisite knowledge for all the medical personnel involved, no matter the agency they choose to be employed by.

The aim of our study is to analyse the conditions upon which SAR operations were performed upon a specific timeline. Both the characteristics of the population at risk, the equipment, the medical qualifications and the legal restrictions concerning such operations will be mentioned. Special consideration will be given on the risks and difficulties that emerged due to the coronavirus disease 2019 (COVID-19) pandemic.

METHODOLOGY

The search was conducted through electronic databases including PUBMED and ScienceDirect. We used a series of logic combinations and research terms related to the topic including: "sea rescue", "SAR", "refugee rescue", "Mediterranean", "medical assistance". Only papers published in English and whose full text was available were included in this study. The inclusion criteria were: a) articles referring to sea rescue operations between 2014 and 2020, b) research that focused on medical preparedness and assistance during rescue operations in the Central Mediterranean route, c) studies concerning demographic and clinical features of the rescue population, d) guidelines on the rule of conduct of persons and states participating in rescue activities. The exclusion criteria were: a) studies describing SAR operations in different regions of the world, b) studies focusing on routes, demographics and medical support of migrants/refugees on land.

DISCUSSION

AN OVERVIEW OF THE SITUATION

Three different sea routes exist for migration in the Mediterranean: an Eastern one extending between Turkey and Greece, a Western one from North-West Africa up to Spain and a Central between North Africa, Malta and Italy. The Central route is the one receiving the largest influx of migration reaching 181,436 migrants during 2016, the highest number ever recorded in the region [4]. The majority of arrivals, during our focus period, have shifted from people originating from Syria and Eritrea [5] before 2016 to people arriving from Sub-Saharan Africa and Maghreb countries as approaching 2020. While the majority, throughout our timeline, consists of adult males, a large number of minors frequently unaccompanied is being observed both during 2014 with 12,000 unaccompanied minors arriving via the

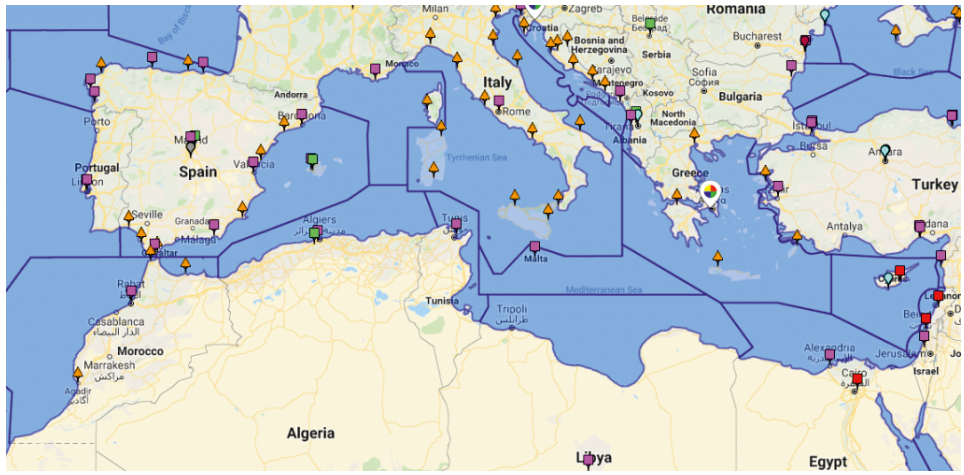

Figure 1. Map showing the Mediterranean search and rescue zones. Credit: Worldwide Search and Rescue contacts, managed by the Canadian Coastguard (Available from: https://www.infomigrants.net/en/post/18037/can-the-law-of-the-sea-regulate-the-stormy-standoffs-between-private-rescue-ships-and-eu-governments)

Table 1. Mediterranean Sea arrivals of migrants (by UNCHR) and dead and missing persons (by the Missing Migrants Project of International Organization for Migration) between 2014 and 2020, data available from: https://data2.unhcr.org/en/situations/mediterranean and https://missingmigrants.iom.int/region/mediterranean?migrant_route%5B%5D=1376

Year	Arrivals total	Dead and missing total	Arrivals (central route)	Dead and missing (central route)
2014	225,445	3,320	170,100	3,165
2015	1,032,408	4,054	153,842	3,149
2016	373,652	5,143	181,436	4,581
2017	185,139	3,139	119,369	2,873
2018	141,472	2,299	23,370	1,314
2019	123,663	1,885	11,471	1,262
2020	87,412	1,417	34,133	983

Central Mediterranean route and during 2020 with a total of 36,414 migrants arriving to Italy and Malta, 18% of which were children. The pattern of attempted sea crossings appears to be seasonal, with greater numbers observed during the summer months. At Table 1 we can see the trends of sea arrivals between 2014 and 2020, in the Mediterranean as a whole and specifically through the Central route, with data acquired from United Nations High Commissioner for Refugees (UNHCR) and the recorded deaths by the Missing Migrants Project of the International Organization for Migration (IOM) (Table 1).

As for 2021, while writing the present paper, IOM's Missing Migrants Projects recorded at least 237 deaths between January and March 2021.

It is worth mentioning that the vast majority of arrivals and unfortunately deaths, throughout the timeline that we investigate (2014–2020), are being observed mainly on the Central Mediterranean route. Data from the IOM (Table 2 [6]), clearly show higher death rates in the Central Mediterranean region, from the beginning of the investigated migration wave (2015) up until recently (2019). On Figure 2, we have an optical analogue of the surge of deaths and disappearances observed on the above mentioned region, leaving no doubt of the importance that the Central Mediterranean Sea holds when discussing search and rescue efforts.

One also has to underline the fact that, after the implementation of the European Union (EU)-Turkey cooperation in the field of migration during the spring of 2016, a great shift was observed from the East Mediterranean Sea route, between Greece and Turkey in the Aegean Sea, towards the Central route between Italy, Malta and Libya [7]. Such a gradual shift is clearly depicted on the following map by FRONTEX, regarding border crossings during 2020 (Fig. 3). While the Eastern route shows a 74% decrease in crossings, the Central route suffers a 137% increase, partly attributed to the EU-Turkey deal in 2016.

Table 2. Death rates in the three Mediterranean routes, 2015–2019 (according to the International Organization for Migration and the International Organization for Migration's Global Migration Data Analysis Centre), data available from: https://publications.iom.int/system/files/pdf/mortality-rates.pdf

Year	Western Mediterranean	Central Mediterranean	Eastern Mediterranean	Total (all three routes)
2015	0.62%	1.98%	0.08%	0.36%
2016	0.87%	2.27%	0.21%	1.20%
2017	0.77%	1.98%	0.12%	1.41%
2018	1.23%	2.88%	0.29%	1.34%
2019	1.67%	4.78%	0.05%	0.99%

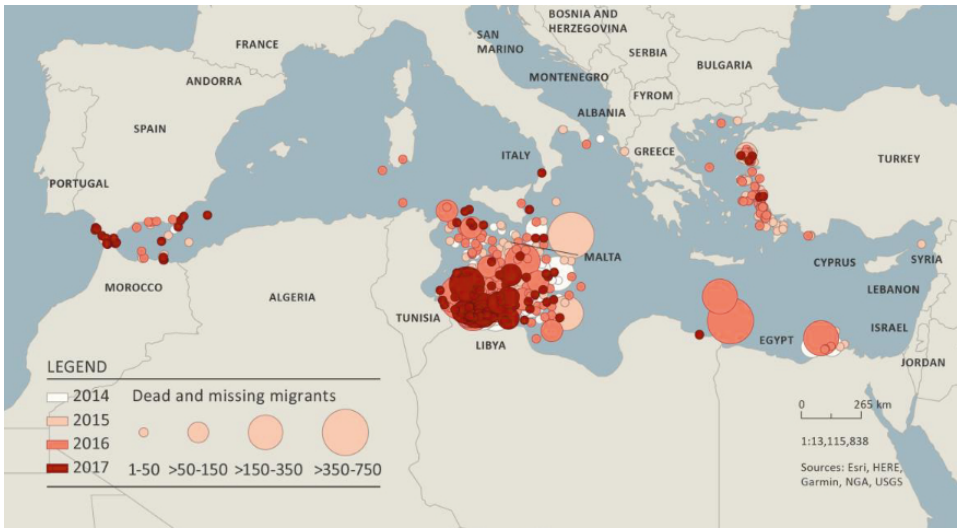

Figure 2. Migrant fatalities and disappearances recorded in the Mediterranean, 2017 (In: The Central Mediterranean route: Migrant Fatalities January 2014–July 2017, IOM's Global Migration Data Analysis Centre/UK Aid, Berlin 2017)

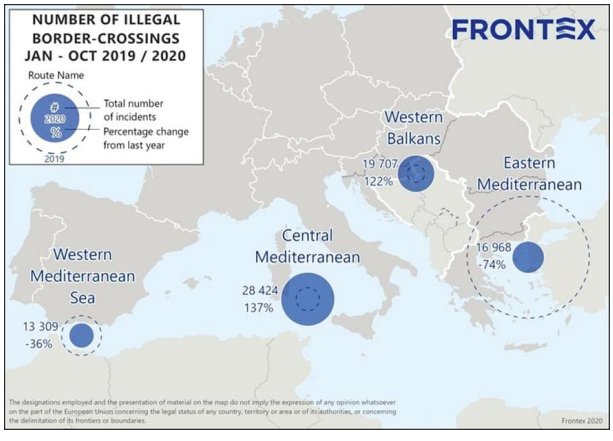

Figure 3. European Union Border Crossings between January and December 2020 (Map by Courtesy of FRONTEX, the European Border and Coast Guard Agency. Available from: https://frontex.europa.eu/media-centre/news/news-release/irregular-migration-into-eu-last-year-lowest-since-2013-due-to-covid-19-j34zp2)

A. THE PATIENT POPULATION IN DISTRESS AT SEA

A study performed by Kulla et al. [8] presents data collected during 2015 by an EU-led military operation (EUNAVFORD MED, Operation SOPHIA). The study's population involved mostly adult males, with the second largest group being children. Only a small percentage required treatment, with 3% needing transportation to an emergency field hospital [8]. Similar findings are presented by Escobio et al. [9] during 2016 in an operation organized by SOS Mediterranée and Médecins du Monde (MdM) on the boat Aquarius, although a higher percentage of unaccompanied male minors mainly from Sub-Saharan Africa were encountered [9]. Trovato et al. [10] performing their study at a disembarkation point in Sicily during 2014 note the existence of two different population groups in terms of demographic and clinical conditions: one with migrants from Near East with larger percentages of vulnerable groups (children, women, elderly, disabled), major chronic

conditions and health-seeking behavioural patterns and one with mostly young male Africans with high numbers of unaccompanied minors [10]. However all three studies share common ground on the conditions affecting the population at risk during SAR operations. Physical exhaustion, malnutrition and lack of fluids along with dermatological (chemical burns, scabies), respiratory (infection), gastrointestinal (pain, diarrhoea) conditions and trauma (accidental and intentional) constituted the main entities the medical personnel had to confront [8–10]. Suffering from traumatic events, including witnessing people drowning and being exposed to violence contributed to a heavy psychological burden in such populations resulting some times in medically unexplained physical symptoms [9]. The concern for communicable diseases seems to be impractical both due to their low prevalence in the provenance of the refugees, the lack of vectors to transmit tropical diseases during the trip and the fact that a previous long journey through the Sahara surpasses the incubation period of several viral or bacterial infections [2, 10]. More specific fourth study gathering information from children arriving in Spain through the West Mediterranean route ends up in similar findings regarding the medical conditions observed in such population [11].

Another Spanish study on immigrants arriving by sea at southern Spain, during 2016, notices a higher prevalence of health issues on immigrants from Sub-Saharan Africa as compared to the ones from Maghreb countries, mainly attributed to the higher duration of their travel and thereby prolonged exposure of themselves to harsh conditions [12]. Cañardo et al. [13], operating with the non-governmental organization (NGO) Open Arms, agree on the fact that the majority of the population up until 2018 originated from Sub-Saharan countries and that their health status appeared to be directly linked to the poor and precarious living conditions in transit [13]. Again skin, respiratory and gastrointestinal tract appeared to be the organs mostly affected. Something not quite noted on previous studies is the fact that they recorded a very low percentage of non-communicable diseases, either due to the younger mean age of those travelling or due to the realisation that such a long and dangerous journey can be undertaken from the more robust part of the migrant community. Their assumption does not agree with a study by Shortall et al. [14] performed on migrants arriving in Greece, where it is explained that mass displacement results in prioritising basic needs, thus leaving chronic non-communicable diseases undertreated and therefore with higher severity scores and complication rates [14]. Open Arms's study highlights also the vulnerability among the woman population traveling, with a 12% among them being pregnant but with unfortunately no proper antenatal care.

Angeletti et al. [15] appears to be the most thorough, in terms of analysing communicable diseases among such populations. Specific interview for tuberculosis, Mantoux skin test, X-ray and blood screening were some of the tests carried out on a land bound reception centre in Italy. Again from their study one can easily deduct the low prevalence of transmissible disease but the extreme deterioration on the nutritional and vitamin status of the migrant population. For one thing we can be sure, the majority of the migrants leave their country of origin in overall good health, so it is the journey and the precarious living conditions during it that cause a significant burden both physically and psychologically (Table 3) [15].

B. ORGANIZING MEDICAL SUPPORT — MEDICAL EQUIPMENT AND PREPAREDNESS

Bearing in mind the above analysis regarding the consistency of the population in distress at sea, several papers offer insight on how a medical team needs to be organized on board as well as how to perform correctly a SAR operation through medical perspective. Vessel adjustments and proper crew formation seems to be of crucial importance [2, 8, 9, 16]. According to Dittman et al. [2] the flight deck of a rescue boat needs to be divided to three areas, one for those rescued, one for those requiring medical attention and one with toilets and washing facilities. Rescuing from the water was performed through two life rafts after the proper implementation of personal protective equipment (PPE) by the rescuers. The occurrence of vermin along with the possibility of infectious diseases, mostly due to overcrowding and poor hygiene conditions seems to be avoided by the use of protective measures and the disposal of contaminated clothing [2, 9, 10]. PPE with protective respiratory masks and googles is also recommended by Kulla et al. [8] as basic form of crew's protection during rescue missions along with the installation of double door systems between the ship's divided areas. Another instruction is the preparation of different areas of the ship for security check, medical triage, first assistance, emergency assistance, isolation, obstetric emergencies, outpatient consultation, and accommodation of vulnerable groups [17].

The majority of the studies agree on the presence of an emergency physician, a nurse and a midwife, along with a psychologist, a humanitarian officer and a cultural mediator as the minimum prerequisite for safe and successful SAR operations [2, 8, 9, 16, 17]. Doctors need to be trained on handling emergency situations up until disembarkation. Additional knowledge on emergency evacuation (MEDEVAC) either by boat or helicopter, and training in the use of radio-communication seems necessary as quite often medical consultations and arrangements for severe cases are performed through the radio with land-bound services [16, 18].

Table 3. Summary of search and rescue studies showing basic demographic and medical information regarding rescued migrants (on each category, data with the higher percentages will be presented)

Study author	Year	Origin of rescued migrants	Age group	Non communicable diseases	Communicable diseases
Trovato et al.	2014	Syria 37% Gambia 10% Eritrea 10%	Adults 78% (81% males)	Respiratory 21% Dermatological 20% Trauma 12% Presence of chronic disease 11%	No clinical suspicion of tuberculosis 99%
Kulla et al.	2016	Not mentioned	Adults 88.5% (77.1% males)	Dermatological 55.4% Cardiovascular 22.1% Trauma 7.6%	Gastrointestinal infection 1.1%
Escobio et al.	2016	Gambia 27.8% Nigeria 24.1% Senegal 11.8%	Male minors 43.6%	Accidental trauma 24.1% (52.9% chemical burn due to benzene) Medically unexplained physical symptoms 14.2% Intentional trauma 6.6% (50% contusions)	Gastrointestinal problems 6.6%
Ponce-Blandón et al.	2016	Sub-Saharan Africa 53.1% Maghreb 46.2%	18–40 years 70.5% 91.2% males	Dermatological 24.7% Gynaecological 21.1% Headache 15.6%	Respiratory tract 6.4% Gastrointestinal 5.5%
Shortall et al.	2015	Syria 46.2% Afghanistan 29% Iraq 12.3%	Not clarified	40% non-communicable disease	Mostly respiratory infections and diarrhoea
Cañardo et al.	2016–2018	Sub-Saharan Africa 74.3% Asia 14.7% Northern Africa 11.1%	Mean age rescues 19.9 years 15.1% women (11% of them pregnant)	Hypothermia 5.8% Acute injury 3%	Infectious diseases 42% (the majority scabies 8.2%)
Angeletti et al.	2018	Eritrea ~100%	92% males Median age 24 years	Malnutrition Vitamin D deficiency	15.8% with suspected transmissible disease--only 10% among them with tuberculosis or pneumonia

Initial assessment during SAR operations is being highlighted as completely different from the one performed in a hospital Accident and Emergency department (A&E). All the studies agree that the rescue crew is bound to face a huge workload under stressful and harsh conditions. Limited amount of time can be allowed per rescued person both due to confined space and continuous influx [8]. The possibility of a backlog would jeopardize the whole rescue procedure, thus fast triage systems need to be implemented by experienced and trained personnel. Different triage systems were observed in the studies. Escobio et al. [9] preferred the South African Triage Scale (SATS) system, while Jachetti et al. [17] the Simple Triage and Rapid Treatment (START), the German SAR first responder course presents its own algorithm based on checking consciousness, respiration and pulse rate [16] and Kulla et al. [8] established also their own pattern of response. According to them, after registration and documentation, a series of technical examinations (core body temperature, pulse rate and peripheral oxygen saturation) preceded initial assessment which included the ability to walk, pattern of ventilation and pulse rate [8]. Cañardo et al. [13] also prioritized registration upon transferring migrants from the initial boat and they also utilise saturation and core temperature during medical assessment. The majority of the studies during initial medical assessment share the same purpose of allocating the injured and the supplies in an efficient way, allowing proper management of all those the crew's medical personnel can attend to, while organizing proper evacuation procedures in time for the severe cases (Table 4).

Having reviewed on the sections above the origin, the age groups and the medical conditions from which suffer the majority of those rescued, one can easily organize the infrastructure needed on board.

Customisation of a boat's areas simulating a hospital environment with basic emergency tools like an automated external defibrillator, equipment for airway

Table 4. Triage systems preferred by each study

Study author	Triage system preferred
Escobio et al.	South African Triage Scale (SATS) triage
Jachetti et al.	Simple Triage and Rapid Treatment (START) triage
Cañardo et al.	Documentation and registration first System based on ventilation, core temperature, oxygen saturation, skin integrity, pulse rate
Kulla et al.	Documentation and registration first System based on ventilation, core temperature, pulse rate, oxygen saturation, walking ability
Buschmann et al.	System based on consciousness, respiration and pulse rate Documentation later on

management (all sizes of endotracheal tubes and supraglottic devices, laryngoscopes), for oxygen delivery and for managing blood or fluid loss, is being described both by the German SAR programme and by Jachetti on board Prudence with the MsF team [16, 17]. The presence of old infected wounds, lacerations and even oropharyngeal abscesses that often need debriding, cleaning and stitching demonstrates the need for basic surgical instruments, antibiotics as well as disinfectants [8]. The German SAR educational programme lists several drugs needed on board [16]. Zamatto et al. [19] highlight also the increased presence of fuel burns on those rescued by sea. It consists of a chemical burn caused by the mixture of gasoline, leaked from a boat's container, and salt water. The combination results in third degree erosive burns that require special management in terms of everyday care, analgesia and antibiotic prophylaxis.

Provisions should be made for adequate food and water supplies both for the ship's crew and the population rescued, taking into account that:

— a large number of persons are usually rescued through each operation;
— people rescued have suffered travelling for a long time through land and sea without proper nourishment and hydration;
— delays can occur while arranging disembarkation with the RCCs involved [20].

Women and children on board call for special attention, therefore special management plans. A midwife with a set for delivery if deemed necessary, along with equipment dedicated to newborn care should be included on a well-coordinated SAR operation [17].

Traumatic events during the travel call for the presence of a psychologist so as to give the rescued a chance of handling his or her anxiety and mental burden besides common medications [9, 17]. A translator's presence, with more than one language translating capacity, would ease both the anxiety of the rescued and the workload of the rescuers (Tables 5, 6) [8, 9, 17].

Table 5. List of medical equipment and personnel needed on board search and rescue vessels

Automated external defibrillator
Airway management equipment (SADs, intubation kits, AMBU masks)
Oxygen delivery systems and ventilator
Fluid resuscitation systems
Kits for wound disinfection and debriding (sutures, antibiotics, gauzes etc.)
Essential drugs (for cardiovascular resuscitation, for analgesia, antibiotics etc.)
Equipment for emergency delivery during obstetric emergencies
Equipment for neonatal and paediatric support
Immobilisation and transport equipment
Personal protective equipment and disinfectants
Diagnostic methods: electrocardiogram, glucometer, ultrasound, urine test strips, rapid malaria tests
Large numbers of water and nutritional supplies
Thermal blankets
Personnel: midwife, translator; doctor trained in handling emergencies (both adult, paediatric and obstetric), trained in performing MEDEVAC

C. OPERATIONAL GUIDELINES FOR SAR DURING THE COVID-19 ERA

Understanding that the main priority for SAR organizations is firstly to protect the personnel involved during the rescue and secondly to provide adequate and high quality SAR and lifesaving services, has led to the adaptation of specific guidelines for SAR provision during the COVID-19 pandemic [21].

Such a challenging public health issue requires high levels of coordination among maritime service providers and port states to protect both seafarer's and general public's health [22]. Recommendations cover a wide range of activities, from personnel training on recognising suspected cases, donning and doffing PPE, disinfecting and disposing

Table 6. Recent examples of search and rescue vessels and their characteristics, data available from: http://searchandrescue.msf.org/, https://sea-watch.org/en/mission/sea-watch-4/, https://onboard.sosmediterranee.org/our-mission/

Vessel name	Year	Non-governmental organizations name	Vessel and crew size	Vessel capacity	Vessel medical equipment	Vessel additional rescue boats
Ocean Viking	2019	MsF, Sos Mediterrané	69 m long, 15.5 m long	Up to 200 survivors	Medical clinic with consultation, triage and recovery rooms	One davit-launched fast rescue craft Two davit-launched fast rescue boats One crane-launched fast rescue boat One inflatable rescue boat
Astral	2019	Proactiva Open Arms	30 m long	Unavailable	Unavailable	Unavailable
Sea Watch 3	2019–2020	Sea-Watch	55 m long	Unavailable	Unavailable	Unavailable
Sea Watch 4	2019–2020	Sea-Watch, MsF	60.8 m long, up to 26 crew members	300 survivors, 900 survivors during emergencies for a short time	Extra safe area for women and children with 24 beds	Unavailable

waste, to deck adaptations in order to allow isolation of possibly infected seafarers [21–24].

More specifically frequent and proper hand hygiene, distancing of at least 2 metres among crew members, disposable gloves, face touching avoidance during work, infection control coveralls and safety googles or face shields are measures and equipment considered absolutely necessary on board all rescue vessels [21, 22, 25]. Suspected cases on board should be isolated on a specially designated location, and a limited number of crew members — with fully donned PPE — should be responsible for handling them in an effort to minimise crew exposure. In terms of decontamination, all possibly soiled surfaces should be disinfected starting from cleaner areas towards dirtier ones, from higher ground towards lower surfaces [21, 22]. A routine of pre-cleaning followed by the application of high-grade disinfectants both at surfaces and objects is recommended [21]. Caution should be given towards waste as they are all considered infectious substances and should be packaged accordingly for disposal. The most common types of waste include face masks, gloves, infection coverage suits, food packaging and utensils. Everything that comes in contact with a potentially infected person will be considered a Category A infectious substance, thus requires specialized handling according to national guidelines [21].

As seafarers remain key workers required to travel across borders at all times, the need for presenting a proof of COVID-19 vaccination as a condition for entry in some countries, arose. Although World Heart Organization (WHO) recommended against such certificates for international travel, proof of vaccination has started to become a prerequisite. In March 2021, the International Maritime Organization (IMO) urged governments to consider seafarers part of the essential workforce that should be granted priority in COVID-19 national vaccination programmes [26], in compliance with the WHO SAGE Roadmap that mentions the need for prioritising vaccine use in the context of limited supply [27].

What appears to be worth analysing are the adaptations regarding resuscitation both in terms of providing cardiopulmonary resuscitation (CPR) and specifically ventilation to those unconscious. Mitigating infection risk during resuscitation requires rescuers to attempt an identification of suspected cases among those in risk of drowning. Everyone can agree that this is an unrealistic goal in the conditions described so far during SAR operations in the Mediterranean [24]. The International Maritime Rescue Federation (IMRF), the International Drowning Researcher's Alliance (IDRA), the International Life Saving Federation-Medical Committee (ILS-MC) and the International Chamber of Shipping as well as national Coast Guards like the Canadian Coast Guard, since April 2020, have attempted to provide providers of SAR with some advisory measures, specifically adapted to the COVID-19 context. It is discussed that a drowned person should be treated as potentially infectious if they appear to have COVID-related symptoms, or when close contacts also present with symptoms. Resuscitation cannot start unless adequate PPE is donned. It remains controversial whether or not to resuscitate if survival chances appear to be low or futile for persons with unknown COVID-19 status. IDRA suggests that prolonged submersion time, prolonged time before the start of resuscitation, and prolonged time to arrival of advanced care are all poor prognostic factors; however, there is no real cut-off point in time that rescuers can adhere to [24].

Table 7. Non-governmental organizations ships involved in search and rescue operations in the Mediterranean Sea between 2016 and June 2020

Operational (data until June 2020)	Legal proceedings against vessel/crew	At port due to COVID-19/maintenance	Not operational before 1/6/2020
Astral, Mare Jonio, Moonbird, Sea Watch 3	The Sea eye, Aquarius, Seefuchs, Golfo Azurro, Vos Hestia, Vos Prudence, Mare Liberum, Open Arms, Moonbird, Sea Watch 3, Mare Jonio, Josefa, Aita mari, Alan Kurdi, Iuventa, Lifeline, Eleonore	Ocean Viking, Open Arms, Sea Watch 4, Seabird, Josefa, Mare Liberum	The Sea eye, Aquarius, Seefuchs, Golfo Azurro, Vos Hestia, Vos Prudence, Phoenix, Minden, Sea Watch, Sea Watch 2, Bourbon Argos, Dignity 1, Aita Mari, Alan Kurdi, Iuventa, Eleonore, Lifeline

Once resuscitation has been decided upon, measures such as positioning the drowned downward from the rescuer and deploying rescuers belonging to lower risk groups in terms of age and comorbidities are some mitigation risk strategies. However it must be understood that the possibility to become infected (and spread the virus) will remain present [24]. As far as the CPR procedure is concerned, performing ventilations is the most difficult and controversial element among recommendations. The International Liaison Committee on Resuscitation (ILCOR) states that most unconscious persons are not to be ventilated, with the exception of children, as an effort to reduce exposure among laypersons. When proper PPE is available, when the likelihood of infection is low, when the drowned is a child or when a close contact of the person that is unconscious is present, trained and willing to provide ventilations, then ventilations are still considered the best practice. The practice of mouth-to-mouth/nose ventilations without any barrier device should be abandoned. Three techniques have been identified as the most adequate during the COVID-19 era:

— two rescuer bag-mask-ventilation with HEPA filter (BVM);
— mouth-to-mask ventilation with HEPA filter;
— passive oxygenation.

One can realise that many organizations and individuals will struggle to obtain the adequate types of PPE and other equipment recommended for resuscitating drowning persons during the COVID-19 pandemic. They may not have access to the training necessary to use this equipment safely and effectively. Suspended operations due to logistic difficulties caused by the coronavirus pandemic appears to be the norm among NGO SAR vessels [28]. State governments, like Italy and Malta, have introduced national and local restrictions, including: delayed port clearance, prevention of crew (or passengers where applicable) from embarking or disembarking, imposition of quarantine or refusal of port entry to ships [22]. However, one cannot forget that according to all the relevant international conventions, even during the ongoing COVID-19 outbreak, the effective protection of the health and safety of all seafarers must remain a priority. More specifically the International Labour Organization (ILO) Maritime Labour Convention highlights the need of port states to ensure the immediate medical care on land bound facilities to any seafarer on board ships in their territory, as treating infectious cases on board could endanger others [29].

D. MEDICO-LEGAL IMPLICATIONS OF SAR ACTIVITIES

European efforts in handling the Mediterranean migrational wave from 2014 up until nowadays include different operations and organizational patterns. From operation "Mare Nostrum" led by the Italian government during 2014, responsible for the rescue of nearly 150,000 migrant lives, EU progressively decided on aiming more at border control rather than proactive SAR operations by implementing operations "Triton" (during 2015) and "Sophia" (from 2015 until now, through different phases). Operating closer to Italian coast, these operations prioritise apprehending smugglers making secondary contributions to SAR resulting to an increased death rate in the region after their implementation [30]. The gradual withdrawal of EU-led operations, inaugurated the larger involvement of humanitarian NGOs in search and rescue operations from 2015 up until now (Table 7).

From the table above one can understand that the described shift from state-led operations towards NGO's involvement in SAR was accompanied by a significant increase in the criminalisation of humanitarian volunteers involved. Arguments regarding SAR operations as a "pull" factor for the increased influx of migrants through the Mediterranean and as a reason why smugglers use less sea-worthy means of travel, thus further endangering migrant lives, are being widely used by EU countries as an excuse to legally persecute those who have been aiding migrants in distress [30, 31]. Founding their legal basis on the 2002 EU Facilitation Directive and Framework, that fails to distinguish between smuggling and humanitarian assistance, EU countries utilise criminalisation as a mean to deter and shield their borders from irregular immigration [31].

Apart from the obvious unethical aspect of allowing people to drown in the name of their own security and as a way to deter others, it is international law along with United Nations legislation that highlights the obligation of states to

rescue, or facilitate the rescue of people in distress at sea [31]. As the right to life prevails upon national legislation, subsequently efforts to preserve it should not be able to be criminalised.

In terms of responding to the unfounded accusations against NGO-led SAR operations, a paper by Arsenijevic et al. [30] manages to refute them. They claim that such allegations fail to take into consideration the complexity of migration dynamics and drivers such as conflict, prosecution and poverty. Their statistics provide proof that NGO involvement after EU withdrawal from SAR resulted in the saving of 46,806 people in total, with a 59% improvement of maritime safety as depicted by the reduction of adverse sea outcomes [30]. In the meantime scaling back from SAR, since 2019, contributed to a higher mortality rate among those travelling and led to a preference of longer and riskier routes in the Mediterranean, fact that entails a safety decline.

WHAT IS DICTATED BY LAW?

Providing assistance to any person in distress at sea is a clear legal requirement under international maritime law [1, 20]. International conventions concerning sea rescue include:

- the 1982 United Nations Convention of the Law of the Sea (UNCLOS);
- the 1974 International Convention for the Safety of Life at Sea (SOLAS) by the IMO;
- the 1979 International Convention on Maritime Search and Rescue by the IMO.

According to UNCLOS and SOLAS it is a ship master's obligation to render assistance to all those in distress at sea without regard to their nationality, status or circumstances in which they are found, even if the distress situation was caused on purpose [2]. SAR convention obliges all coastal states to implement specific search and rescue zones (SAR zones), each with a maritime RCC in charge of accepting responsibility for all rescue efforts in their region. They are the ones that would organize and coordinate assisting ships up until disembarkation to a place of safety. IMO states that a place of safety is where rescue operations are terminated while a person's safety of life is no longer threatened and basic human needs are met, highlighting that it has to be a place with no immediate danger of prosecution, incarceration or torture [1, 3, 20, 32, 33]. International asylum and migration law also clearly states that state agencies (ex. coast-guard vessels) have direct obligation not to engage in or allow refoulement [1]. Although definition of distress remains vague, it is the rescue ship's captain who will make an assessment of the situation [33]. With the sea being a dangerous environment for people and the majority of the boats being overloaded and not seaworthy, nearly all cases are considered under distress even from the moment they launch [19, 33].

CONCLUSIONS

We conclude that during rescue medical activities in the Mediterranean specific qualification adapted to maritime search and rescue appears to contribute in better quality healthcare services. Previous understanding of the population at risk and the concomitant comorbidities, along with rescue ship adjustments with adequate equipment constitute an integral part of a physician's preparedness training. Health care providers should maintain a high level of emergency skills along with a situational awareness based on understanding the legal framework upon which they will operate. Coordination among state and military agencies and NGO vessels is proven to be frequently difficult due to different goal settings, resulting in miscommunication and additional stress for which all personnel involved needs to be prepared. We want to emphasize the fact that an ongoing human tragedy is being unfolded in the Mediterranean Sea, for which EU gradually chooses a "non-assistance" response. A higher level of proactive SAR operations with more rescue assets is in our view the only adequate response, secondary to ensuring safe routes to those fleeing war and poverty. Therefore health care workers choosing to participate in SAR missions should operate with the imperative to save lives as the only way to respect international legal obligations and human values.

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First envenomation report of the Cnidarian *Physalia physalis* in Indonesia

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ABSTRACT

Despite the high number of victims every year, Physalia physalis's *envenomations in Indonesia are scientifically unsounded. This annual event occurred mainly in Java's southern beaches and the Eastern Bali Islands, which are the most tourist destinations. The lack of scientific reports can lead to unaware and uneducated beachgoers resulting in a high number of victims, which in turn may ruin the economic sectors. Thus, this study aimed to report* P. physalis's *envenomation and its treatments in the southern beaches of the Special Region of Yogyakarta Province. It was based on the 15 beach lifeguards' and the primary health care units' reports in 2019–2020. The envenomation cases varied among beaches and years, whereas the highest number of cases were reported in the most popular beach (Parangtritis beach). The partial beach closing due to the pandemic COVID-19 caused the number of cases in 2020 was slightly lower than that in 2019. The envenomations' general symptoms were oedema and local pain that were treated with 5% food vinegar and hot water, if available. The severe cases (dyspnoea, nausea, vomiting, and cephalgia) were only reported twice in 2019. They were hospitalised in primary health care units; however, many people still practise the traditional non-scientific treatments, particularly in a chaotic situation.*

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Key words: *Physalia physalis*, envenomation, treatment, Indonesia

INTRODUCTION

Physalia physalis is a cosmopolitan organism found in many subtropical and tropical Atlantic, Pacific, and Indian Oceans, though it is originally tropical [1]. It has a float-filled gas (Pneumatophore) that navigates the drift direction with diameter varied (3–12 in) and a submersible tentacle that can reach up to 30 m [2]. The Pneumatophore is bluish, whereas all the submersible parts are turquoise blue. *P. physalis* belongs to class Hydrozoa of Phylum Cnidaria. It comprises polyps with a specialized function [3]; they are pneumatophore, dactylozooids (tentacles) to catch the prey, and produce nematocysts, gastrozooids for food digestion, and gonozooids for reproduction. The preys are mainly fish and fish larvae [4, 5]. The nematocyst produces a toxin that can paralyze fish [6]. Studies showed that the extract toxin of nematocyst in fish tissues caused nervous system respiratory centres, therefore caused general paralysis and death if the doses increased [7]. The envenomation to humans mostly occurs when the unaware or uninformed individuals contact this organism, especially children, due to their curiosities [8, 9]. The general symptoms when contact with human skin are the oedematous and skin inflammation [8, 10–12], followed by intense pain and burning sensation. More severe and fatal envenomations can cause vomiting, nausea, respiratory failure [13], and even death [14]. The envenomations cases of *P. physalis* were reported around the world, such as Brazil [8], Venezuela [11], Florida Atlantic coast [14], Chile [15], France [16], New Zealand [17], and Australia [18]. However, the reports from tropical Indo-Pacific remains limited. In Indonesia, the envenomation cases

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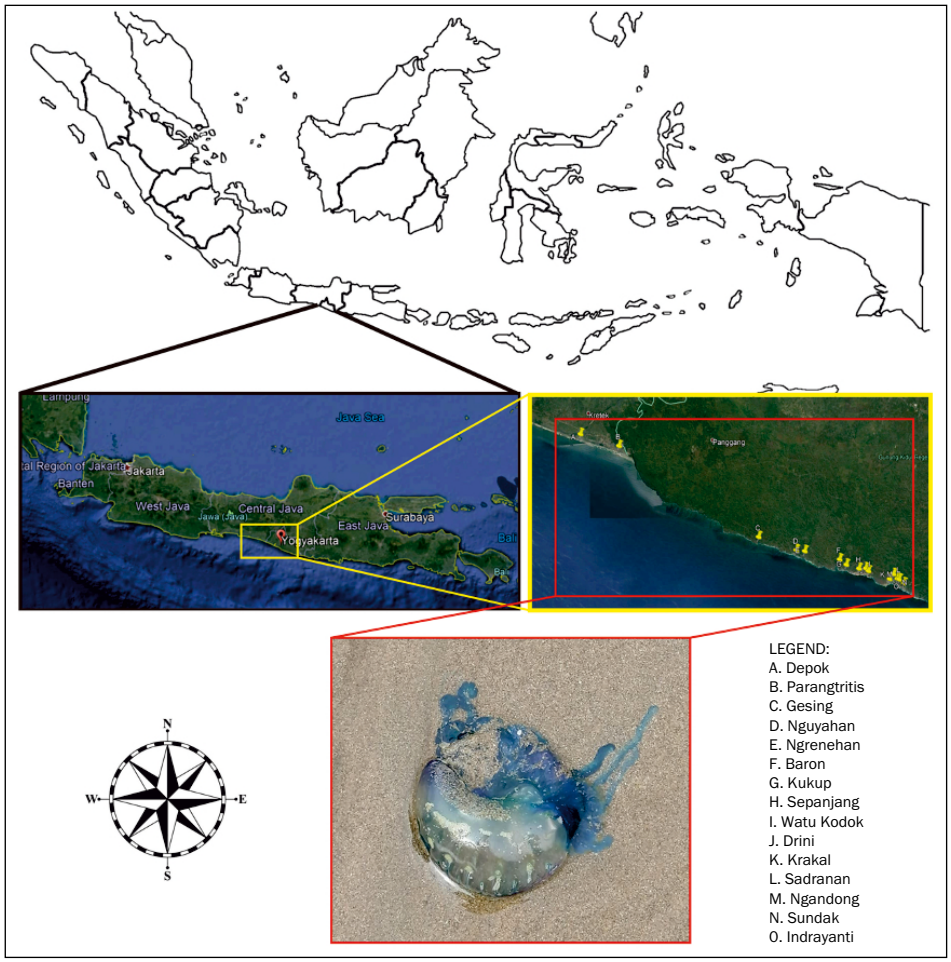

Figure 1. Relative location of Special Region of Yogyakarta Province, Indonesia, indicating the beaches where the *P. physalis*'s envenomation occurred (insert: a specimen captured on the beach)

have been published in local and national newspapers since 2005, with the highest numbers found on the southern coast of Java and eastern coast of Bali islands, the most popular tourist destinations in Indonesia. It is annual events that reach tens to hundreds of people per year. *P. physalis* is commonly found stranded on the beaches from June to August, although in some places it was reported to be present until September. The reported cases mainly come from the beach lifeguards and the primary health care unit near the beaches. Few beach lifeguards have trained to apply first aid to the victims, such as vinegar and hot water immersion. However, they often did not practiced first aid, mostly when the victim numbers were massive; therefore, they also used any traditional treatments to control the chaotic situation. Despite the lack of age reported, the high number of cases every year that is mostly young children indicates the lack of information and education to the beach lifeguards and beachgoers as well as the absence of official authority's concern. Thus, to increase public awareness, this study aimed to report the *P. physalis* envenomation and treatments in southern beaches of the Special Region of Yogyakarta Province based on the beach lifeguards and primary health care unit reports.

PARTICIPANTS

The participants in this research were mainly visitors to each beach that having stranded *P. physalis*.

MATERIALS AND METHODS

The local and national news have reported *P. physalis*'s envenomations in Indonesia since 2005; however, the detailed information has been recorded since 2019. The envenomation cases per day were derived from the reports of 15 beach lifeguards, whereas the clinical features and course data were obtained from the primary health care unit's reports near the beaches in the Special Region of Yogyakarta Province, Indonesia, in 2019–2020 (Fig. 1). The identification of *P. physalis* was based on peculiar physical characteristics specimen found on the beaches.

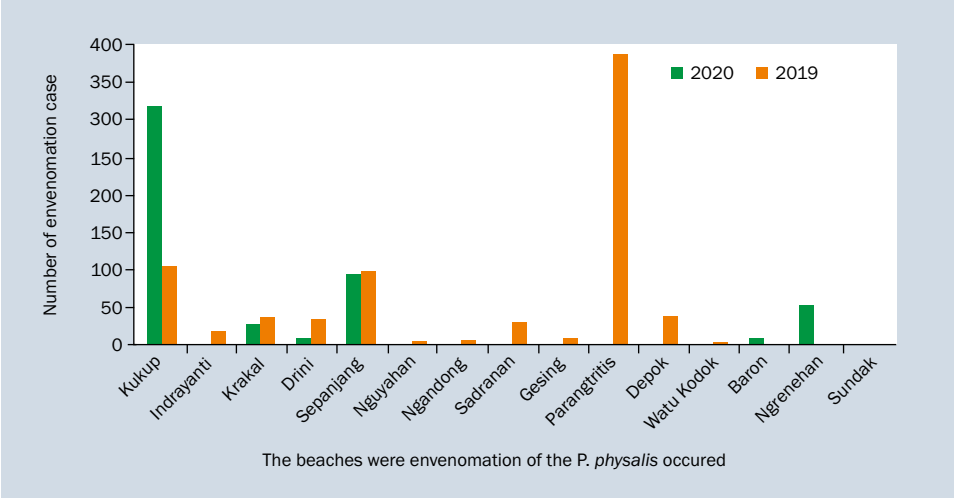

Figure 2. Number of the *P. physalis*'s envenomation cases among beaches and year

Table 1. Characteristics of *P. physalis*'s envenomations reported in the 15 beaches of Special Region of Yogyakarta Province, Indonesia in 2019–2020

***P. physalis*'s envenomations**	**Year**	
	2019	**2020**
Period of year	June–July	June–July
Patients (number)	773	514
Patients (sex-ratio: male/female)	Not available	1.44
Clinical feature	Dyspnoea, nausea, vomiting, pain, cephalgia, oedema: 2 (0.25%)	Pain, oedema: 514 (100%)
Medical management	Hospitalisation, local treatment	Hospitalisation, local treatment
Clinical course	Dermal mark, average local pain (score: 2–8)	Dermal mark, average local pain (score: 2–8)

This research is a retrospective case series and describes the experiences reported by the 15 beach lifeguards and the primary health care unit's near the beaches in the Special Region of Yogyakarta Province, Indonesia, in 2019–2020.

RESULTS

The number of envenomation cases varied among beaches and years (Fig. 2), whereas the highest number of cases were reported in Parangtritis beach (more than 350 cases), followed by Kukup beach. The total number of cases in 2020 was lower than that in 2019; however, the envenomation cases in 2020 reached 0.67 fold of 2019's cases only in 17 days (total cases in 2019 reported from 34 days) (Table 1). Despite the closed beaches due to pandemic in 2020, two beaches (Krakal and Sepanjang) showed no significant differences in the envenomation cases in 2019 and 2020.

The envenomation reports and treatments of the *P. physalis* are shown in Table 1. The sex ratio in 2020 indicated that the male patients were slightly predominant (1.44); unfortunately, there is no available data in 2019. The general clinical features were a combination of pain and oedema that were dominantly found in all envenomation cases in 2019 and 2020, with pain scores ranging from 2 to 8. Dyspnoea, nausea, vomiting, and cephalgia were rarely reported, in 2 cases only in 2019. The clinical course presented in this envenomation was a dermal mark (Fig. 3). Symptomatic treatment and topical first aid was conducted by spraying with 5% food vinegar and immersion with hot water, if available. This method was applied to over 90% of patients. The severe envenomation victims were treated in the primary health care units near the beaches. It was reported that up to 10% of the patients must have been hospitalised for 3 days to 1 week.

DISCUSSION

The low total number of envenomation cases in 2020 might be due to the pandemic of coronavirus disease 2019 (COVID-19), leading to partial beach closure announced by the local government of Special Region of

Figure 3. Clinical finding (dermal mark) related to *P. physalis's* envenomation. Photograph: Tri Maharani

Yogyakarta Province, particularly the most popular tourist destination beaches such as Parangtritis beach. Thus, tourists mainly visited the unpopular beaches other than the Parangtritis beach, such as Krakal and Sepanjang beaches, and having the annual stranded *P. physalis* at the same time. The hydro-oceanography of the southern seas of Java Island, which have high waves, makes them dangerous to swim. The envenomations mainly occurred when the beachgoers touched or took the stranded jellyfish while playing or walking on the beach (unrecorded data). These envenomation cases differ from those in other parts of the world where more than 50% are envenomated during bathing, diving, or swimming [8, 11, 19]. Moreover, despite the lack of age data, the beach lifeguards reported that the victims were mainly young children. They were attracted by distinctive colour and the bottle like-shape of the pneumatophore of the *P. physalis* that scattered abundantly on the beaches. The study showed that the dead *P. physalis'* nematocyst is still able to sting [20].

The first aid training to the jellyfish's envenomation has been conducted voluntarily by Toxinology Society of Indonesia (TSI) and Remote Envenomation Consultancy Services (RECS) Indonesia since 2013 to few beach lifeguards in the Special Region of Yogyakarta Province. Besides the training, socialisation was also carried out by put pamphlets in some areas. First aid treatment included the application of 5% food vinegar (affordable to get), hot water immersion, and modern dressing to the sting body parts, as recommended by the National Agency of Drug and Food Control (BPOM) [21]. Even though the effectiveness of the vinegar for *P. physalis's* envenomation remains debatable [10], the immersion of hot water was usually not practiced, particularly when the victims were massive. The application of vinegar is widely used in *P. physalis's* envenomation cases, such as in Brazil [8] and Venezuela [11]. The vast areas and a limited number of lifeguards on each beach relative to the high number of victims, predominantly young children, mostly made a chaotic situation. Therefore, the trained beach lifeguards also used traditional treatments such as tobacco, toothpaste, salt, ethyl chloride, and even urinated at the stung skin they believe are as effective as the first aid. Though those treatments are not scientifically proved [22].

The medical management of the envenomation of the *P. physalis* varied depending on the severity. According to the beach lifeguards' experiences, the local symptoms disappeared a few hours after treatment with the food vinegar. In severe cases with dyspnoea, nausea, vomiting, or cephalgia, the patients were treated with analgesic and antiemetic drugs. Due to dyspnoea, adequate airway and breathing management was needed to help the patient. The dermal mark due to *P. physalis's envenomation* had hyperaemia and moderate local pain. These signs and symptoms lasted 1 to 3 days. The envenomation symptoms in Indonesia were relatively milder than those in Brazil [8, 12], Venezuela [11], and France [19] that most frequently had local signs such as erythema, urticaria with linear plaques as well as a distinctive dermal scar. However, the general symptoms of *P. physalis's* envenomation in Indonesia were similar to those cases, without any fatal case. It was argued that adequate first aid and treatment and rehabilitation resulted in patients' recovery from *P. physalis's* envenomation. As human's curiosity and unawareness mainly contributed to *P. physalis*'s envenomation, thus proper education to the beachgoers is the most important way to minimise the number of victims. Furthermore, the trained beach lifeguards and well equipped first aid will reduce the severity of the envenomation. Ultimately, it is suggested that the responsible authorities and government close the beach during *P. physalis's* annual stranding season since this envenomation would adversely affect the community health and the economic sectors.

CONCLUSIONS

The highest number of envenomation cases generally occurred in the most popular beach. The local government's partial beach closing due to the COVID-19 pandemic caused the cases in 2020 was slightly lower than those in 2019. Few beach lifeguards had been trained to treat the envenomations' general symptoms with 5% food vinegar and hot water, if available. Oedema and local pain were mainly reported as the general symptoms, whereas the severe cases were dyspnoea, nausea, vomit, and cephalgia, which only reported 2 cases in 2019. They were treated

with analgesic and antiemetic drugs and hospitalised for dyspnoea in the primary health care units. The combination of accurate education to the beachgoers and the trained beach lifeguards will reduce the severity of the *P. physalis*'s envenomation.

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Medical assessment of fitness to dive. Part II

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ABSTRACT

Good physical and mental health is a prerequisite for anyone planning to scuba dive. A certificate of fitness to dive for those willing to enter a scuba diving course as well as for active divers, either amateur or occupational, can only be issued if there are no medical contraindications to dive. It is usually within the competence of a diving instructor, a manager of underwater work or a physician to assess a person's mental and physical health and grant them permission to stay under hyperbaric conditions. The legal requirements for issuing a certificate of fitness to dive are different for recreational and occupational divers. The part II of this article discusses the issues concerning medical assessment of fitness to dive for professionals, and divers in uniformed services. It also discusses contraindications to scuba diving and guidelines for medical assessment of fitness to dive in divers with a history of a diving-related condition.

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Key words: diving, health assessment, medical contraindications

MEDICAL ASSESSMENT OF FITNESS TO DIVE FOR OCCUPATIONAL DIVERS

Because of the difficult working conditions and exposure to increased hydrostatic pressure, a candidate for a professional diver has to be in perfect health, both physically and mentally. Occupational divers are required to undergo a regular health assessment to check their fitness to work underwater. Divers themselves should be interested in maintaining full physical fitness in order to be able to cope with the physical and emotional strain of their job and their work environment. Taking good care of their own physical and mental health will allow them to stay professionally active for a longer time, and will help reduce the negative health effects of the job.

In 2003, the European Diving Technology Committee (EDTC), in cooperation with experts, set new standards for medical assessment of occupational divers [1]. The EDTC guidelines include standard record forms for medical assessment of working divers; they discuss all diagnostic tests which must be performed, and list all contraindications to scuba diving, grouped by organs and systems. In compliance with the European Union legislation, the guidelines have been adopted in Poland and have been outlined in the Regulation of the Minister of Health of 2007 [2]. Under the Regulation, all candidates for divers are obliged to undergo a preliminary health assessment, while professional divers must undergo a periodic medical examination. Medical assessment of fitness to dive can be carried out at the University Center for Maritime and Tropical Medicine in Gdynia, regional healthcare providers run by the port authorities and other medical facilities designated for this purpose. Medical assessment of fitness to dive can be also carried out by physicians certified by the Polish Hyperbaric Medicine and Technology Society and the National Center for Hyperbaric Medicine.

After the initial medical check-up, candidates for commercial divers are issued a certificate of fitness (or lack of fitness) to work as a diver. Professionally active divers, on the other hand, receive a certificate confirming a lack of contraindications to work as a commercial diver or a certificate

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of temporary or permanent disability to work underwater. After a fitness to dive assessment is complete, occupational divers are issued with one of the following documents:

— a certificate confirming a lack of contraindications to continue work as a commercial diver;
— a certificate limiting the maximum diving depth to 18 m;
— a certificate of temporary disability to work as a commercial diver;
— a certificate of permanent disability to work as a commercial diver.

A preliminary health assessment for prospective divers includes: a general medical examination, ear, nose and throat examination including an audiometric and a balance test, a neurological examination, an eye test, as well as multiple diagnostic tests such as: a chest X-ray, electrocardiogram (ECG), a blood test, urinalysis, a test for syphilis. If there are no medical contraindications to work as a commercial diver, candidates are referred for pressure tolerance test in order to assess their response to changes in the atmospheric pressure of no less than 0.3 MPa (an equivalent of 30 m of water column). Routine medical re-assessment of commercial divers is performed every 12 months, if their maximum depth limit is 18 m, or every 6 months, if they their allowable depth limit is more than 18 m. A special diving health re-assessment is carried out after a break from diving lasting longer than 3 months, a diving-related illness or injury, or right before a dive session if a diver reports of any health problems. Although the risk of diving-related illnesses or injuries is similar for all types of scuba-diving (occupational, sports, recreational), it may differ depending on the technology and equipment used by individual divers. Proper training, practice and modern equipment reduce the risk of diving-related illnesses and injuries. The basic criteria for determining fitness to dive in commercial divers are as follows:

— the absence of medical contraindications to work as a commercial diver (i.e. having good swimming skills and communications skills, being responsible and mentally competent);
— the absence of illnesses or disorders which could potentially put a diver or any member of a dive team at risk (e.g. a history of syncope, disorientation, a tendency to panic);
— the absence of conditions which might result in deterioration of a person's health condition (i.e. conditions which increase the potential for a barotrauma);
— the absence of conditions which increase the risk of diving-related illnesses, e.g. patent foramen ovale (PFO), a history of a diving-related accident (since the risk of developing a decompression sickness [DCS] is low in divers with PFO, diagnostic tests for this condition are generally not recommended in recreational divers; however, because occupational and military divers may be exposed to a much higher decompression stress, candidates should, in our opinion, be tested for PFO).

The task of a dive doctor performing a diving health assessment is to disqualify each person who has medical contraindications to scuba diving, using their own experience and the recommended medical guidelines for assessing a person's fitness to dive. A preliminary health assessment for commercial divers must be very careful. Disqualification from scuba diving before the training starts will be less stressful for a candidate than disqualification shortly after the completion of training or at the beginning of a career. The primary purpose of each diving health assessment is to improve diving safety as much as it is possible. A thorough preliminary evaluation of candidates will reduce the risk of major injuries as well as the risk of death from pre-existing conditions which might occur during a dive session. Manifestation of an underlying condition under water is dangerous for a diver himself as well as for his buddy and other members of a dive team. The aim of periodic re-examination is not only to determine a person's fitness to continue work as a commercial diver but also to detect any conditions or abnormalities which might have resulted from exposure to hyperbaric conditions in order to minimize the negative health effects of scuba diving which may affect a diver later in his life. When a diver retires, his complete medical records might be used to determine the extent of work-related personal injury for the purposes of an insurance claim. A reliable medical assessment of fitness to dive requires close cooperation between a patient and a doctor, which is based on mutual trust. During an interview, a diver must provide the physician with accurate and complete information about their health condition and inform the physician of any illnesses or injuries which had occurred in between successive re-examinations that resulted in a temporary disability to scuba dive. The fitness to dive examination and assessment form should be completed in the presence of a patient. A physician must make sure the patient fully understands the questions concerning their past and present medical history. An interview is an excellent opportunity to observe patient's behavior and assess their mental condition and communication skills. Before a dive doctor issues a certificate of medical fitness to dive, he or she will have to analyze the results of the diagnostic tests and get acquainted with the opinion of other specialists. The medical examination form must be signed by both the doctor conducting the examination and the diver. The medical records should be available for review by any other physician if necessary. If possible, it is highly recommended that all subsequent fitness to dive re-examinations should be carried out by the same physician. This way, it will be easier to identify even the slightest changes to a diver's health.

A certificate of fitness to dive should include the following information: the type of scuba diving a person is cleared to engage in, the maximum depth limit and the term of its validity. If an individual is declared 'unfit to dive' or 'fit to dive with restrictions', the reasons for such a decision must be clarified to the diver. If a diver is not cleared to scuba dive, he should have the right to appeal against the decision to a superior institution.

European Diving Technology Committee recommends to distinguish between: a preliminary diving health assessment of candidates for occupational divers (during which a maximum depth limit is established), periodical medical assessment and special medical re-assessment to resume diving after a diving-related illness or injury, including DCS. According to the EDTC guidelines, a periodical health re-assessment does not require such comprehensive tests and procedures as the initial examination. However, it is recommended that a diver is interviewed by a dive physician on a yearly basis. If the information obtained during the interview suggests any abnormalities, a diver should be referred for diagnostic tests. EDTC recommends that an in-depth health re-assessment is to be performed every 5 years. Divers who have suffered a diving-related condition or injury or those who have recently had a surgical procedure will require a special medical re-assessment including the analysis of the existing health problem and its consequences for continuation of occupational diving. This type of examination needs understanding and knowledge of the job as well as its physical demands and hazards in order to be able identify potential restrictions [3].

MEDICAL ASSESSMENT OF FITNESS TO DIVE FOR UNIFORMED SERVICES

In Poland, the most stringent regulations concerning medical assessment of fitness to dive apply to the military personnel. This can be explained by the fact that soldiers must at all times be ready to work under extremely dangerous conditions, often in operational settings, and might be involved in exceptionally challenging missions and tasks, such as offshore rescue operations (including submarine rescue operations), planting explosives, sabotage or subversion missions. To accomplish such difficult tasks, military divers may be required to dive using highly specialized equipment, e.g. a semi-closed or closed circuit breathing apparatus as well as an oxygen or mixed breathing apparatus [3].

The latest provisions regulating medical assessment of fitness to dive in military personnel were specified in the Regulation of the Minister of National Defense of 2015 [4], the provisions form the basis for qualifying or disqualifying prospective and active divers from occupational diving. According to the eligibility criteria, the age of a candidate should range from 18 to 30 years. In compliance with the provisions, a candidate for a military diver must be in perfect health and should demonstrate a high level of physical fitness. In order to determine his health status and fitness level, a prospective diver is referred for an initial assessment of fitness to dive by a board of specialists. The preliminary evaluation of candidates includes a series of diagnostic tests (e.g. ECG, echocardiogram, radiography of the chest, paranasal sinuses and the epiphysis of the long bones, blood test, urinalysis) as well as multiple consultations with specialists: a psychologist, a neurologist (electroencephalography [EEG] test), an ophthalmologist (fundus examination), otolaryngologist (audiometric test), internal medicine specialist (a spirometry test), a surgeon, a dermatologist and a dentist. During the initial assessment of candidates, particular attention is paid to their body build. In doubtful cases, exercise ECG and spirometry test results are used to determine the physical fitness of candidates. Excessive body weight (obesity), underweight and asthenic body build are considered absolute contraindications to occupational scuba diving in the Polish Armed Forces. ECG and echocardiography (ECHO) tests are performed to exclude those candidates who suffer from a heart condition. During contrast ECHO a candidate for a diver performs the Valsalva maneuver. The ECHO test performed in this way makes it possible to detect the PFO in the interatrial septum. If such a condition is diagnosed, a candidate is declared unfit to become a military diver because of a high risk of developing a severe decompression sickness. Radiography of the chest and paranasal sinuses is performed in order to disqualify any candidates with respiratory system pathologies. Radiography of the long bones epiphysis is performed during the first 3 years of service, before a diver leaves the service as well as after each diving related accident. The aim of the preliminary radiography is to disqualify any candidates with aseptic osteonecrosis, while the tests which are performed after accidents or when a person leaves the service are aimed at identifying any possible long-term health effects associated with scuba diving or the extent of work-related personal injury. Because of the nature of the underwater environment, it is essential that military divers have excellent eyesight and good color vision. Also, they should present with no dental problems or conditions. The proportion of the missing teeth cannot exceed 45%; however, none of the front teeth can be missing, otherwise a candidate will not be able to hold the scuba mouthpiece. Also, a prospective military diver cannot have any chronic, allergic or purulent dermatoses. The assessment of the mental state of a prospective diver is a key element of the initial evaluation of fitness to dive. Psychological consultation is aimed to assess the emotional state of a person and their tolerance to stress. Psychological assessment of military divers is performed before they start service, shortly before they leave

the service as well as after each diving-related accident. All types of neuroses or phobias (e.g. claustrophobia) are considered an absolute contraindication to scuba diving in the military. However, the final decision whether or not a person may be medically cleared to become a military diver is taken after the analysis of the hyperbaric chamber test results. The hyperbaric pressure tolerance test and oxygen tolerance test are performed to determine a person's sensitivity to the effects of hyperbaric oxygen. A routine reassessment of military divers' fitness to dive is normally carried out every 12 months. A number of diagnostic procedures, including radiography of the long bones, EEG test, fundus examination and audiometric test are performed as part of the initial assessment of candidates. The same tests are routinely performed in all active military divers during periodic medical re-assessments at least every 3 years; the tests are performed in order to identify any negative health effects associated with scuba diving.

The following medical conditions disqualify a person from becoming a military diver or continuing service as a military diver: chronic infections of the upper respiratory tract, especially chronic or recurrent paranasal sinusitis, perforation of the tympanic membrane, chronic otitis media, a past history of the inner or middle ear surgery, inability to equalize middle ear pressure, chronic pulmonary illnesses, cardiac diseases, arterial hypertension, peptic ulcer, hernias (until surgically managed), epilepsy, a history of severe head trauma or craniocerebral surgery, disorders of the central nervous system, severe hearing or vision loss, obesity, diabetes, mental disorders, urinary tract abnormalities, alcohol or substance abuse.

A large number of tasks and missions which were previously carried out by military divers or members of the national scuba diving clubs have been taken over by the Polish National Police and the State Fire Service. The regulations on medical assessment of fitness to dive in police officers and firefighters have been specified in the Regulation of the Minister of Health of 2007 [2] and the Regulation of the Minister of Internal Affairs and Administration of 2014 [5]. Under these Regulations, candidates for divers recruited from among the ranks of the Polish Police or the State Fire Service must show perfect physical and mental health and a good level of fitness, as is the case with military divers. The tasks executed by members of the two services are usually carried out under difficult conditions and in dangerous waters. The task of a physician responsible for certification of medical fitness to dive is to determine each candidate's fitness to dive and disqualify all candidates with any underlying health conditions on the basis of the applicable guidelines as well as their own experience. The initial medical assessment of fitness to dive is extremely important and has to be very careful. The purpose of routine fitness to dive examinations, on the other hand, is not only to declare a person fit or unfit to dive, but also to identify any illnesses or conditions which might have resulted from exposure to hyperbaric conditions and which may potentially have a negative effect on a diver's health later in his life. After conducting all the recommended tests and procedures a medical board declares whether a given candidate is fit to become a diver. Prospective divers are selected on a voluntary basis. All amateur or professional divers should hold a current medical certificate confirming their fitness to dive and stating the date of their last fitness to dive assessment. In order to become a good diver, a candidate must enjoy the activity, feel safe underwater and be confident with the equipment he is using [3].

FITNESS HEALTH ASSESSMENT AFTER DIVING-RELATED ILLNESSES

Whether it will be possible to return to diving after having had a diving-related accident or a diving illness will much depend on the nature of the incident or the condition itself and the risk of deterioration or recurrence of symptoms. The criteria for medical assessment of fitness to dive in individuals with a history of a diving related-illness vary depending on the institution or types of services which employ the diver, in other words, they will be different for the military and for commercial companies. Each time a diver has suffered a diving-related injury or illness, they will be obliged to undergo a careful medical examination. The purpose of such an examination will be to assess a diver's general health condition and the extent of the injuries. Such an examination will also be necessary if an injured diver claims for compensation or a disability benefit. Before declaring a person fit to dive, a physician needs to consider whether this person will continue to dive occupationally (either for a commercial company or as a member of the uniformed services) or only for recreational purposes [3].

DECOMPRESSION SICKNESS

When a diver exhibits signs of a DCS, the role of a physician is to determine whether the condition has resulted from inadequate decompression or if it has been the result of individual risk factors which could increase the chance of DCS occurrence. The primary cause of a decompression sickness is shortening the decompression time. However, in some cases the disease may occur even if a diver has followed the recommended decompression procedures and adhered to the diving tables limits; in such cases, the decompression sickness is usually associated with cerebral or cutaneous manifestations. The incidence of DCS in divers is relatively low, ranging from 0.01% to 0.095% depending on the diving environment and the type of diving activity. A study involving a relatively small group of divers with

a known PFO has shown that the incidence of decompression sickness in such individuals ranges from 0.5% to 1.8% [6, 7]. During a longitudinal study of a group of recreational divers who had received recompression treatment for decompression sickness, study subjects received a variety of psychometric tests as well as the electronystagmography test (electronystagmography is a diagnostic test which records nystagmus in response to stimuli and helps diagnose the causes of vertigo). A total of 50% of the study group showed abnormal tests results after 1 week of completing the treatment, after 3 weeks of the treatment only 10% of the patients had abnormal tests results, which indicates that the neurological signs and symptoms of decompression illness persist for a minimum of 1 month. Therefore, divers are not recommended to return to scuba diving for at least 4 weeks after hyperbaric treatment [1, 8–11].

A mild form of a decompression sickness is relatively easy to manage. Some specialists even believe that if recompression treatment is effective and all signs and symptoms subside, a person can safely return to scuba diving after a minimum of 24 hours of the treatment. A lot of researchers, however, consider such an approach too risky. In compliance with the United States (US) Navy recommendations, a person who has suffered a mild form of a decompression sickness and met the criteria for recompression treatment specified in the US Navy Treatment Table 5, can safely return to diving after a week of hyperbaric treatment, provided that all signs and symptoms have subsided. Divers who meet the criteria listed in the US Navy Treatment Table 6 may be allowed to return to scuba diving after a week of successful hyperbaric treatment, whereas those with a severe form of a decompression sickness manifesting with neurological, pulmonary or circulatory signs and symptoms who have been treated in compliance with the criteria defined in the US Navy Treatment Tables 4 or 7, can only be allowed to return to scuba diving after they have had a medical assessment of fitness to dive by a specialist physician and no earlier than 3 months after completing recompression treatment. Individuals who have experienced a severe form of a decompression illness with residual neurological symptoms should not be allowed to return to occupational diving at all. A medical assessment of fitness to dive in individuals with a history of a decompression illness should include a complete neurological and psychological examination as well as a computed tomography or magnetic resonance imaging scan of the brain and the spinal cord as well as the evoked potential test [8, 9].

It is not uncommon that commercial or military divers conceal or dissimulate their symptoms for fear of losing their job. It is, therefore, important that a physician makes them realize that diving with any residual neurological symptoms increases the potential risk for further brain damage, which may eventually lead to a permanent neurological dysfunction. According to the general recommendations, divers may be medically cleared to return to diving 1–4 weeks after successful hyperbaric treatment. Not all diving specialists, however, agree with the proposed guidelines. The reason for this is the fact that the results of imaging tests performed in patients with a history of a severe form of a decompression illness have shown that the central nervous system damage was far more extensive than the presence (or absence) of residual symptoms. Some diving specialists believe that every single episode of a decompression illness manifesting with neurological symptoms should be considered an absolute contraindication to commercial or professional diving. In our opinion divers with a patent foramen ovale, atrial septal defect or intracardiac or intrapulmonary shunts should not be cleared to return to commercial scuba diving after they have experienced an episode of a decompression illness. In some cases, one might consider limiting professional activity to more conservative diving in order to reduce the risk of venous gas bubbles forming and passing through the PFO to the left part of the circulatory system. This can be achieved by: shortening the dive time to the limits of a no-D dive, limiting the diving depth to less than 15 m, performing only one dive per day, using nitrox, deliberately extending the safety stop or the duration of shallow decompression stops, avoiding any exercise or any unnecessary effort for at least 3 hours after diving. Percutaneous PFO closure may also be considered; performing the procedure eliminates the risk of DCS [12]. As for recreational divers, only those with the atrial septal defect and a history of a severe decompression illness manifesting with neurological symptoms should not be permitted to resume scuba diving. Divers with osteonecrosis revealed by a routine X-ray examination can be medically cleared to return to commercial or professional scuba diving [8–10].

PULMONARY BAROTRAUMA AND ARTERIAL GAS EMBOLISM

Medical assessment of fitness to dive in individuals who have suffered arterial gas embolism (AGE) resulting from a pulmonary barotrauma (PB) or those who have experienced a PB with or without accompanying neurological symptoms is a more complicated issue. Experts disagree as to whether such patients may be medically cleared to safely return to scuba diving. It is generally accepted that individuals who have had any of these conditions may be more prone to the recurrence of symptoms because once a lesion has occurred, lungs become more susceptible to injury. For this reason, before a patient with a history of AGE or PB might be declared fit to return to scuba diving, he will need to undergo a series of specialist pulmonary tests. When consulting a diver who has suffered a PB it is

important to establish whether the condition has been the result of a diver's mistake or whether it might have been caused by some underlying conditions or the presence of pathological lesions within the lungs which increase the potential for pulmonary parenchymal damage. If a diver has not had a quick and uncontrolled ascent and has not reported a respiratory arrest during a dive, the reasons for air-trapping must be looked for elsewhere. The common causes of a diving-related barotrauma might include: a recent respiratory infection, air bubbles trapped at lung apices or interstitial scarring. Because minor lesions may not be visible on a standard chest X-ray, in some cases it might be necessary to perform more accurate diagnostic tests (e.g. computed tomography scan). If the test reveals any abnormalities in the lungs, a patient cannot be medically cleared to return to scuba diving. In rare cases, divers who have received treatment for AGE may develop neurological residuals (although the symptoms are generally more common in patients with a PB). In such cases, divers with a history of AGE will have to undergo the same tests and procedures as those who have had a decompression illness. It will be necessary to perform tests to detect a patent foramen ovale or intracardiac or intrapulmonary shunting. According to the United Kingdom Diving Medical Advisory Committee, any person with symptoms of AGE (with or without the signs of pulmonary damage) as well as any person with signs of a lung injury should be declared as permanently unfit to scuba diving. In exceptional cases, and only if a patient shows a complete recovery from a PB or AGE, divers may be medically cleared to return to scuba diving after a minimum of 3 months [8–10, 13].

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Quest for life satisfaction in the sea of loneliness

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ABSTRACT

Background: *The aim of this study was to investigate whether workplace loneliness is related to life satisfaction of seafarers on board deep-sea going cargo ships and to determine whether there exist differences in experienced workplace loneliness and life satisfaction between officers and ratings.*

Materials and methods: *A cross-sectional research design was used to assess the variables in a sample of 521 seafarers sailing on foreign going vessels.*

Results: *The findings showed that workplace loneliness was an important dimension for determining life satisfaction. As for the differences in the experienced loneliness, the findings show that there is a difference between officers and ratings. The findings support the theory of need for belongingness, which emphasizes the importance of interpersonal relations at work in understanding the well-being among workers.*

Conclusions: *This study is of practical significance to ship owners and ship managers, where they can use the findings to implement interventions for improving the individual's life satisfaction.*

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Key words: workplace loneliness, life satisfaction, rank, seafarers

INTRODUCTION

Life satisfaction is a desirable goal for humans and a happy life has been viewed as a basic human drive [1]. Life satisfaction measures an individual's overall assessment of the life circumstances [2]. Literature has long established the positive correlations with social relationships and support [3], success at the workplace due to its association with better job performance, career satisfaction, organizational commitment, decreased turnover intentions [4] and physical health [5] whereas negative evaluation of life satisfaction is associated with depression and unhappiness [6]. Constructs of happiness, subjective well-being and, life satisfaction are important for society [7]. Reviews of studies on life satisfaction suggest that, it is associated to personality [8] and demographics [9], there is limited focus of research on the work domain [4] especially for emotions like workplace loneliness which has been addressed empirically in a limited way [10].

Essentially, workplace loneliness is a workplace-specific emotion that exists with certain characteristics of the working environment [11]. It is defined as the emotional anxiety caused by the perceived absence of quality workplace interpersonal relationships [12]. Being a negative emotion, the studies have largely explored its dissenting outcomes for organizational identification, commitment and well-being [13], job performance, organizational citizenship behaviour [14], creativity and life satisfaction [15].

The impact of workplace loneliness is attenuated for challenging remote workplaces due to the difficult climatic conditions and limited access to facilities [16]. Working in the shadows, outside of the system and out of mind, seafarers work in conditions characterised by stressful factors like increase in workload due to downsizing, constant call of ports [17], living in limited space, rare shore leaves, volatile climatic conditions, sleep deprivation [18] and frequently changing multi ethic crews [19].

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Socially a seafarer lives two contradictory lives consisting of his workplace at sea and the other dealing with his personal life related to the families back home. This causes a discrepancy between their personal relationships and their social environment [20] leading to heightened feelings of loneliness. The likelihood of such feelings increases due to prolonged absence from home or the loss of a significant other [21]. Additionally, the crew members come from different cultures, rigidly hierarchical ranks and with different linguistic skills. Therefore, seafarers are innately socially dissociated while executing their duties on board [22]. A number of marine accidents have been a result of the social isolation as experienced by the seafarers on board [23]. These conditions affect employees physically and mentally [24]. A study by International Maritime Organization (IMO) revealed the critical role of human error in the accidents on board cargo ships to the extent of 80% being caused by human factor [25] and that is why this study becomes important as the conditions in which seafarers work may impact them adversely.

Given that human spend as much or more of their lives at work and the critical impact of workplace loneliness on work outcomes, this study aims to investigate the effect of workplace loneliness and recreation support on life satisfaction of sailors who work in an isolated and confined environment.

MATERIALS AND METHODS

LITERATURE REVIEW

The purpose of this section is to provide a comprehensive literature review of life satisfaction and workplace loneliness for suggesting relevant hypothesis, establishing a suitable conceptual framework and identifying appropriate measurements for the study.

LIFE SATISFACTION

Traditionally, there have been two theoretical approaches to the concept of life satisfaction, i.e., the 'bottom-up' approach and the 'top-down' approach. These approaches differ in terms of the causal assumptions of the factors affecting life satisfaction. The 'top-down' approach asserts that life satisfaction can be explained based on the stable characteristics such as personality [8] and, the 'bottom-up' perspective assumes that a person's overall life satisfaction depends on his or her satisfaction in multiple domains in life such as family, finance, friendship, work, leisure, health and the like [26]. Life satisfaction is not an average of the satisfaction experienced in the different life domains owing to the fact that humans have a tendency to weigh the different life domains differently [4]. In effect, both the dispositional and situational factors interact and impact life satisfaction [27]. It would be interesting to investigate life satisfaction as an outcome variable in the domain of management field for enhancing people's lives [4] and therefore the impact of situational variables on life satisfaction is being investigated in the present study. Another important question that needs to be addressed is the identification of the factors that have an ability to influence life satisfaction. Both dispositional variables (e.g., personality) and situational experiences have been shown to predict life satisfaction.

WORKPLACE LONELINESS

Loneliness is defined as a psychological state that is a result of qualitative or quantitative deficiencies in a person's social relationships [20]. Literature suggests that loneliness can be broadly understood on two distinct dimensions i.e., social loneliness/social companionship and emotional loneliness/emotional deprivation. While social loneliness deals with the absence of satisfactory social relationships or the quantity of the relations; emotional loneliness or deprivation deals with the quality of the employees' relations [28].

The antecedents for loneliness include dispositional factors like personality, shyness, social competence [29], and organisational factors like group coherence, span of control, intense workload, and organizational climate [30]. Research reveals that optimistic feelings correspond to positive outcomes like job performance [31], job satisfaction [32], well-being [3] and life satisfaction [15] whereas negative feelings like loneliness result in mental alterations, abnormal behaviour impacting one's reasoning, and decision-making ability [33] Such undesirable feelings may affect employee commitment, intention to leave [4], employee well-being [11], performance and work alienation [34] to mention a few. These get further compounded for specialised and high-risk occupations like seafaring where inappropriate decisions may lead to situations of life and death.

Furthermore, literature also suggests that loneliness is an occupational hazard for senior-ranked members of an organization [35]. This is often seen as the consequence of maintaining power distance from those lower in the hierarchy of the organization. Since the organization structure is like a pyramid, suggesting the number of employees reduce as the individual moves up the ranks, the scope for meaningful relationships diminishes [36]. Conversely, there are studies that suggest people at the bottom of the organizational hierarchy are more prone to experiencing feelings of loneliness [37]. In the current research, the possibility of difference in the experienced loneliness among the ranks is also explored.

WORKPLACE LONELINESS AND LIFE SATISFACTION

Experiencing an encouraging workplace environment seemed to correspond positively with life satisfaction, as

individuals have a ubiquitous need to form enduring and mutually nurturing relationships [38]. Workplace factors including interpersonal relationships among the members significantly promote or spill-over to an individual's well-being [39].

Issues related with social relationships in the workplace have been recognised to be key contributors in the stress process and to the outcomes of job and life satisfaction. However, the majority of the studies in the literature have examined the role of social relationships as effects of personal relations like having close friends and being married [40] and a small number of studies have explored the correlation between work-based relationships and life satisfaction. Moreover, this restricted number of studies reveal the possibility that relationships at work may be significant for life satisfaction [41].

The results of this work shall help understand the identifiable gaps in the literature and provide insights into the relationship between dimensions of workplace loneliness, i.e., social loneliness and emotional deprivation, and the identified domains of life satisfaction namely, physical well-being, financial wellbeing, emotional well-being and subjective well-being. Furthermore, presently there has been special attention to the role of personal factors as compared to the environmental factors for studying workplace loneliness [4]. Conventionally it has been observed that measures of loneliness correlated negatively with self-reported life satisfaction in elderly research participants [42]. However, similar research has yet to be conducted with different samples belonging to different work groups. Additionally, there are not many empirical studies on workplace loneliness and there is lack of research on the effect of loneliness in the workplace on outcome variables, as most studies have discussed only correlation between the two [43]. The study becomes important due to the sample of seafarers as there have been limited studies on the impact of workplace loneliness on life satisfaction in specialised and remote workplaces like seafaring. To further this line of inquiry, it is anticipated that the quality of workplace relationships may commonly influence the individual's feelings about life. Given the admission that work is inherently a fundamental constituent of life, it is reasonable to expect an association between feeling lonely at work and feeling dissatisfied with life [44]. Therefore, the purpose of this paper is to examine the relationship between perceived feelings of loneliness at work that includes the ability to blend into the workplace and "be present, work and function" and life satisfaction. Therefore, it is expected that:

— H1: Workplace loneliness has a significant negative impact on life satisfaction;
— H2: Rank of the seafarer influences their experienced workplace loneliness.

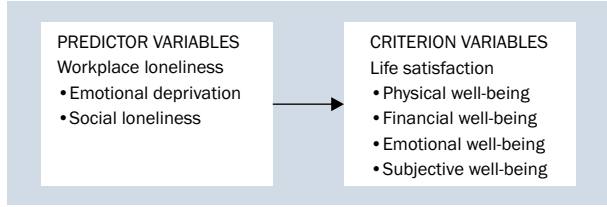

Figure 1. Conceptual model

On the basis of the literature review and the hypothesis formulated, Figure 1 shows the proposed conceptual model for the variables under study.

RESEARCH DESIGN

Participants

This research work included Indian seafarers and uses randomisation methods. Instrument was administered via mixed mode i.e., google forms and paper based. The survey was sent to 1077 participants and 588 responses were received, leading to a response rate of 54.11%. The control variables for the study included industry experience of minimum 3 years; sailing experience of minimum 2 years and annual sailing of minimum 6 months in any financial year (April – May). After excluding unfinished responses to the questionnaire, the final research sample included 521 Indian seafarers from different levels of competency; 43.5% deck officers, 33.6% engine officers, 23.3% ratings. Participants had mostly 3–10 years (61.6%) of experience. Our sample consisted of 100% male seafarers and 243 of them were single while 273 of them were married and 5 were divorced. They were working on different types of ship such as tankers (46.4%), dry bulk carriers (25.9%), containers (11.9%) and others (6.2%). The seniority and the corresponding ratios were as follows: 3–10 years — 61.6% (n = 321), 10–15 years — 15% (n = 78) and above 15 years — 23.4% (n = 122). The total sailing experience was 2–5 years — 51.4% (n = 268), 5–10 years — 23.8% (n = 124) and above 10 years — 24.8% (n = 129).

Instrumentation

The instruments captured the data by the use of 5-point Likert scales i.e., the loneliness at work scale (LAWS) [27] and the original life satisfaction scale [43]. LAWS has two dimensions i.e., emotional deprivation and social loneliness and life satisfaction scale consists of physical well-being, financial well-being, emotional well-being and subjective well-being, the scales were modified to suit the context of the present study. Appropriateness of data set is analysed in order to identify psychometric qualities of scales for this sample. In this reference, missing values and outliers are defined and multicollinearity, singularity and normality tests

Table 1. Descriptive statistics for loneliness at work scale (LAWS) and life satisfaction scale

Variables	Items	Scale	Cronbach's α	Skewness	Kurtosis	Common method variance
LAWS	16	1–5	0.894	0.139	0.375	30.073
Life satisfaction scale	18	1–5	0.906	–0.437	0.644	

Table 2. Results of exploratory factor analysis

Variables	No. of items dropped	No. of items retained	Factors extracted	Explained variance (%)	Cumulative explained variance (%)
Workplace loneliness	3	13	1 (ED)	32.130	32.130
			2 (SC)	24.901	57.031
Life satisfaction	1	17	1 (PW)	25.488	25.488
			2 (FW)	15.217	40.705
			3 (EW)	12.958	53.664
			4 (SW)	9.657	63.320

ED — emotional deprivation; SC — social companionship; PW — physical well-being; FW — financial well-being; EW — emotional well-being; SW — subjective well-being

are conducted. A visual inspection of histograms, normal q-q plots and box plots shows that all scales are approximately normally distributed and Shapiro-Wilk's test p values are more than 0.05 as presented in Table 1. All scales have adequate internal consistency coefficients ($\alpha > 0.80$) and are hence considered reliable. Since the single factor accounts for 30.073% of variance it is taken as evidence that common method bias is not an issue [44].

STATISTICAL ANALYSIS

SPSS software 20.0 was used for the evaluation of data and capturing the means and standard deviations (SD) of the variables under study. Correlation and regression analyses were conducted to test the hypotheses for workplace loneliness and life satisfaction. One-way ANOVA was conducted to understand the relation between rank and loneliness. All procedures were performed in compliance with relevant laws and institutional guidelines and that the appropriate institutional committee(s) have approved them. There was no funding received from external agencies for this study. The descriptive statistics are mentioned in Table 1.

RESULTS

EXPLORATORY FACTOR ANALYSIS

Exploratory factor analysis was performed by principal component analysis and all items were found to be higher than 0.40 ($r > 0.30$), indicating all items took place in the factor analysis. Because some items were below 0.40 or had cross loadings with more than one factor, factor analysis was performed by removing the items one at a time until the ideal solution was achieved. In the workplace loneliness scale three items were dropped. The two factors which evolved were named as emotional deprivation and social loneliness with KMO = 0.900 and significance value (p = 0.00).

In the original life satisfaction scale, there were seven domains identified. It was observed that there were high correlations among the satisfaction domains. This indicates that these aspects of life were referring to a similar life functioning area. Hence, factor analysis helped in data reduction and identification of the life domains. This technique helped keep maximum information as it is and avoided the problem of duplication of information. Four main domains of life satisfaction KMO = 0.890 and significance value (p = 0.00) identified on the basis of the factor analysis are: 1) Physical well-being: Satisfaction with current health; 2) Financial well-being: Satisfaction with the present economic condition; 3) Emotional well-being: Satisfaction with social life, leisure time, family time and work based relations; and 4) Subjective well-being: Global life satisfaction which measures the judgmental component of subjective well-being. This accords flexibility to the subjects to integrate and weigh the life domains as per what they feel is important. The factor loadings of the same have been presented in Table 2.

CORRELATION AND REGRESSION

Pearson correlation coefficients were computed to determine the significant relationships between dimensions of workplace loneliness and life satisfaction (Table 3). All variables under study correlated with each other and as contemplated there was a statistically significant negative correlation between dimensions of workplace loneliness and life satisfaction ($p < 0.001$ for a two-tailed test), based

Table 3. Intercorrelations of the study variables

	Mean	SD	1	2	3	4	5	6
1. WL–ED	2.08	0.716	1					
2. WL–SL	2.20	0.672	0.658*	1				
3. LS–PW	4.13	0.662	–0.407*	–0.364*	1			
4. LS–FW	3.40	0.811	–0.294*	–0.371*	0.363*	1		
5. LS–EW	3.85	0.665	–0.463*	–0.518*	0.537*	0.575*	1	
6. LS–SW	3.45	0.720	–0.425*	–0.506*	0.522*	0.617*	0.837*	1

*Correlations are significant at the 0.01 level (2-tailed); SD — standard deviation; WL — workplace loneliness; ED — emotional deprivation; SL — social loneliness; LS — life satisfaction; PW — physical well-being; FW — financial wellbeing; EW — emotional well-being; SW — subjective well-being

Table 4. Regression analysis results of dimensions of workplace loneliness and dimensions of life satisfaction

Variables	Dependent variable — Life satisfaction							
	PW		FW		EW		SW	
WL–SL	–0.161*	F = 57.559	–0.413*	F = 42.886	–0.442*	F = 108.028	–0.463*	F = 96.240
WL–ED	–0.272*	R^2 = 0.179 DW = 1.886	–0.114	R^2 = 0.139 DW = 1.770	–0.247*	R^2 = 0.292 DW = 1.757	–0.183*	R^2 = 0.268 DW = 1.619
Workplace loneliness	β = –0.547*; F = 730.077; R^2 = 0.584; DW = 1.714							

Table columns contain standardized β coefficients; *p < 0.01; DW — Durbin Watson value; WL — workplace loneliness; ED — emotional deprivation; SL — social loneliness; PW — physical well-being; FW — financial wellbeing; EW — emotional well-being; SW — subjective well-being

Table 5. One way ANOVA between rank of the seafarer and workplace loneliness

	Sum of squares	Df	Mean square	F	Significance
Between groups	1284.488	3	428.163	5.633	0.001
Within groups	39300.134	517	76.016		
Total	40584.622	520			

on 521 complete observations ranging from –0.294 to –0.518. The intercorrelations showed significant negative associations between all indicators of workplace loneliness and life satisfaction. Social loneliness had a strong negative correlation with emotional well-being (r = –0.518; p < 0.01) and subjective well-being (r = –0.506; p < 0.01).

Pearson correlation results were significant; therefore, directions of correlation between the variables were investigated with the help of linear regression analysis. Loneliness at the workplace has two dimensions as an independent variable and life satisfaction has three dimensions. For all variables F and adjusted R^2 values are presented in Table 4. Since the Durbin-Watson scores are close to 2 there is no autocorrelation between the variables.

Social loneliness was negatively significant with all indicators of life satisfaction. Physical well-being (β = –0.161, p = 0.00), financial well-being (β = –0.413, p = 0.00), emotional well-being (β = –0.442, p = 0.00) and subjective well-being (β = –0.463, p = 0.00). Emotional deprivation was found to be significantly predictive of physical well-being (β = –0.272, p = 0.00), emotional well-being (β = –0.247, p = 0.00) and subjective well-being (β = –0.183, p = 0.00). However, emotional deprivation was negative but not significant with financial well-being (β = –0.114, p = 0.00). The two dimensions of workplace loneliness had combined predictor effects of 54.7% on life satisfaction (F = 730.077; p < 0.01). Therefore, the hypothesis H1: Workplace loneliness has a significant negative impact on life satisfaction is accepted.

ONE-WAY ANOVA FOR RELATIONSHIP BETWEEN RANK AND LONELINESS

In order to find the relationship between the rank held by the seafarer and their loneliness, a one-way ANOVA was conducted (Table 5). The participants were divided into four groups based upon their ranks (group 1: deck officer; group 2: deck rating; group 3: engine officer, and group 4: engine rating). An analysis of variance showed that there was a statistically significant impact of rank on loneliness

at the $p < 0.05$ level for all the four conditions [$F(3,517) = 5.633$, $p = 0.001$]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for group 1 ($M = 59.81$, $SD = 9.19$, 95% CI = 58.56, 61.02) and group 3 ($M = 58.44$, $SD = 8.02$, 95% CI = 58.44, 60.83) was significantly different from group 2 ($M = 56.32$, $SD = 9.04$, 95% CI = 54.32, 58.32) and group 4 ($M = 55.50$, $SD = 8.14$, 95% CI = 52.89, 58.10). Therefore, the results suggest that there is a difference in the experienced workplace loneliness amongst the ratings and officers.

There was a statistically significant difference in the experienced workplace loneliness among the officers and ratings. On the basis of the above findings the hypothesis H2 i.e., the rank of the seafarer influences their experienced workplace loneliness is accepted.

DISCUSSION

The objective of the present research work was to explore the relationship between experienced workplace loneliness and the life satisfaction of seafarers. In brief, the findings show that workplace loneliness and its indicators i.e., social loneliness and emotional deprivation are important correlates of life satisfaction and its indicators in the maritime industry. As for the rank differences, the findings differ for officers and ratings with respect to perceived workplace loneliness. The results of the study are consistent with the previous studies i.e., when feelings of loneliness increase, life satisfaction decreases. The feeling of loneliness, when considered in the organization context, leads to negative emotions and stress which affects the performance levels of the employees adversely. In this study which examined the effects of workplace loneliness on life satisfaction of sailors, the impact is further compounded due to the nature of the profession which is very different from the conventional workplaces. This aspect of the research tries to address the literature gap where the available literature has emphasized the importance of individual factors rather than organizational factors in the evaluation of life satisfaction which is the basis the ongoing dispute of the bottom-up and top-down approach of life satisfaction.

Among the dimensions of life satisfaction, financial well-being was negatively correlated with workplace loneliness dimensions and was not significant with emotional deprivation. This may be explained by the fact that the shipping sector pays the seafarers decently and if a person was working onshore with the same qualifications and technical expertise, he wouldn't have the same earning capacity in the present context for the study. Earning power is one of the major factors which draw seafarers to the shipping sector in addition to the opportunity to explore new places. This finds support in the compensation effect of life satisfaction where dissatisfaction in one domain is compensated for satisfying experiences in other domains [45]. Physical well-being indicator of life satisfaction also correlated weakly with workplace loneliness indicating that the regular mandatory pre-joining medicals for seafarers were helping in keeping a check on the seafarer health resulting in fewer medical conditions. Emotional well-being and subjective well-being had a moderate relation with workplace loneliness as humans as social animals have the need to be accepted by peers and family members. Lack of these meaningful relations leads to a host of emotional issues and affects the individuals' organizational performance [3].

Interestingly it was found that the feelings of loneliness were more pronounced for the officers as compared to the ratings. The officers found it easier to connect when they were sailing at lower ranks; however, as they moved up the ranks, they felt the need to maintain distance from the crew in order to get the work done as they felt it would be easier to get the work done if the rank differentials were prominent. This was also supported by literature as many studies highlight that power creates social distance [46]. However, there are contrasting studies that state that rank can be negatively related to loneliness. As such, during the contractual period, the seafarers' social interactions are limited to a small circle of colleagues and the socialization process includes the formation of temporary bonds among seafarers that are interrupted when they sign-off and new bonds are formed with new on joiners, as is the culture of the seafaring profession [47].

The strength of this study includes a relatively large sample with an acceptable response rate by using recognised and validated instruments. Therefore, the inferences may be generalisable to the larger population, inclusive of research on the workplace environment and employee well-being and satisfaction in general. However, some caution needs to be exercised when interpreting the results from this study as: firstly, the data is based on self-reports and though the data was checked for common-method variance, the results still need to be generalised with caution. Secondly, one cannot draw conclusions about causal relationships as the data was cross-sectional and may be a longitudinal study is needed to attain more knowledge about the causality of the relationships existing between the variables. Furthermore, loneliness being a perception-based variable, it reflects the perceptions of the participants and they may be reluctant to express their emotions; therefore, results may not reflect objectivity.

There is a great deal of complexity created by the needs of the sailors, their families, the shore teams, the charterers, and the organizations. Sailors when they join ships suddenly find themselves in "relational deficit," if not social isolation, at a time when they need more than the usual support. Generally, organizations consider emotional or social issues

like loneliness as personal problems and not as having an impact on organizational operations. Conversely, studies about loneliness have supported direct effects of the same on outputs such as performance, motivation, etc. [3]. The importance of having positive social relations was also highlighted by Elton Mayo in his Hawthorne studies which laid the ground for the real source of employee motivation and team building [48]. Lonely people often expected less from their jobs and future careers [49]. Although the term loneliness is used very casually in daily life, the outcomes of loneliness can be far more reaching as seen in the literature review. Therefore, on the basis of the above findings it can be suggested that the organizations can be proactive in order to offset the loneliness feelings and help reduce the consequences of experienced loneliness. The reality necessitates that the top four ranks i.e., captain, chief officer, chief engineer, and second engineer help induce positive social relationships on board. Social activities like get-togethers, indoor game tournaments, and pieces of training related to interpersonal relations covering topics like conflict management, improving social abilities, etc. may be organized for improving social interactions among employees.

CONCLUSIONS

In conclusion, there are many demanding aspects of seafaring such as the inability of employees to leave the worksite, living in confined workplaces, working with multi-national crews with limited means of communication, extreme weather conditions, long periods away from home, and motion of the workplace. Some of these features can be controlled, modified and adjusted for yet others are a reflection of the nature of the industry. Hence, identification of the important work domain factors may help as a basis for introducing strategies and interventions which can help minimise the negative impact of these factors on the life satisfaction of a seafarer [50]. In the present study, it was evident that interpersonal relations on board are primarily very important in setting off the feelings of loneliness. Hence the findings support the theory of belongingness which focuses on the interpersonal relations among the members of the organization. The rank at which the seafarer sails also is crucial in understanding the loneliness the employee may experience.

Furthermore, while it is important to study loneliness in vulnerable groups, in this paper the group being sailors, it is equally important to examine loneliness across a wider range of the population to allow for valid conclusions and interventions. Another challenge for future studies may be to bring in the aspect of cultural differences to understand the relationship between workplace loneliness and life satisfaction. This study, in the future, maybe extended to include women seafarers where we anticipate that the results may help provide rich insights paving the path for gender comparative studies as currently, their numbers are small as compared to their male counterparts.

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Determining the factors that affect self-reported quality of life among Turkish seafarers

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ABSTRACT

Background: *The purpose of this study is to determine the quality of life (QOL) of Turkish seafarers and its relationship with the factors affecting it.*

Materials and methods: *A total of 103 Turkish seafarers completed an "Employee Assessment Form" and "WHOQOL-BREF" Scale.*

Results: *The majority of the seafarers who participated in the study were males (98%) of the age group 36–48 (44%). Among the seamen, 58% smoked and 42% used alcohol. The rate of exercising was 29% and the mean body mass index was 27.63 ± 3.78. Average scores of WHOQOL-BREF sub-dimension are 15.99 ± 1.83 for physical (PHY), 15.77 ± 2.26 for psychological (PSY), 15.50 ± 2.73 for social (SOC), 14.17 ± 2.25 for environmental domain (ENV), and finally 14.18 ± 2.13 for ENV-TR.*

Conclusions: *According to the results of this study, it is possible to argue that Turkish seafarers have a weak awareness towards improving their health and QOL in their working life and that they need assistance in improving their QOL, especially in psychological and social aspects.*

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Key words: health promotion, nursing, working characteristics, seafarers, Turkey, quality of life

INTRODUCTION

Ships and ports are the basic elements of maritime transport. Ships are industrial structures designed and produced to serve a particular purpose. In world maritime transport, about 1.5 million seafarers are employed and the international merchant fleet consist of about 55,000 merchant ships, 85% of which are oil tankers, bulk carriers and container ships [1]. Maritime activities in Turkey are mostly the transport of people, goods and vehicles, oil survey, container transport, fishing, coast guard and scientific research activities [2]. Turkey has the second rank in the world with 179,828 seafarers and 6.6% share [3, 4]. It is necessary for each ship to carry a specific number of seafarers with particular abilities according to its flag, class and size. A ship's complement mainly consists of two departments which are "Deck" and "Engine". According to Regulation on Seafarers and Marine Pilots (2018), seafarers consist of the captain, officers, mariners, and other people employed on the ship [4, 5].

Seafarers are qualified professionals and are at risk of serious injury and death. Forsell et al. (2017) [6] found risk of an accident in deck staff as 67%, among engine crew as 77%, and 64% for service personnel during last year of service. It is noted that the death rate of Danish seafarers and coastal pilots is 10 times higher than industrial workers. While the average risk of fatal accidents at sea was found to be 6.4/100 years, the average risk of accidents that lead to 5% or more permanent disabilities was 0.67/100 years [7]. According to data obtained from a study by an Italian marine telemedical centre which provide remote

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assistance for seafarers, 383 deaths were reported in a period of 25 (1.31%) years. The reasons of death in seafarers were reported as cardiovascular diseases, accidents, contagious diseases, psychoactive factors and respiratory diseases. Average age of death was found as 44.89 ± 10.53 [8]. In a follow-up study conducted on German seafarers, crude death rate was reported as 65 per 100,000 seafarer-years. The average age of death was 48.5 ± 12.7 and 57.8% of these included documented records of occupational accidents, suicides and ischaemic heart disease. The rate of fatal accidents proved higher among the staff working on deck and engine room compared to other crew members [9].

During their work on the ship, seafarers are exposed to chemical and physical substances that cause cancer. It was reported that cancer incidence in Finnish seafarers is not different compared to the general male population, however some types of cancers, such as non-melanoma skin cancer was seen 1.6 times, and mesothelioma as 2.9 times more [10].

Cardiovascular diseases are also another serious health problem for seafarers. It was stated that German seafarers have a 10-year coronary heart disease risk similar to the German reference population of the same age (56 against 57 for each 1000 subject); it was expressed that healthy worker effect might affect this prediction [11]. Scovill et al. (2012) [12] reported a high prevalence of obesity (61%), smoking (41%), high level of triglycerides (42%), low level of high density lipoprotein cholesterol (47%), hypertension (42%), high fasting blood sugar (22%) and displaying three or more characteristics of metabolic syndrome among United States (US) inland waterway merchant marine captains and pilots. Among the corps members on US Navy vessels, the prevalence of hyperlipidaemia was found as 21%, hypertension as 26%, smoking as 27% and obesity was reported to be 13% [13]. Among Danish male and female seafarers, the prevalence of metabolic syndrome was found as 26% and 11%, respectively. It was also reported that 31% had a habit of smoking and 19% declared high alcohol consumption [14]. In a study conducted on Danish seafarers, it was stated that 44% smoked, 25% were obese and 51% were diagnosed with metabolic syndrome disease [15]. The prevalence of metabolic syndrome among Iranian seafarers was found to be 15%, while common cardio-metabolic risk factors were identified as excessive weight (51%), abdominal obesity (39%) and smoking (28%) [16].

Moreover, musculoskeletal disorders are also common in seafarers due to long working hours, long shifts, poor living conditions, noise, and vibration effects. Among Danish fishermen, the prevalence of pain in all musculoskeletal system areas was found as more than 80%. More than one third (37%) reported back pain enduring for at least 30 days. Workload was identified as the only predictor about all pain zones, especially upper and lower extremity pain [17]. It was stated that the rate of hand and arm pain was 24% due to vibration caused by power tools. Exposure to vibration and noise, ringing in the ears and hearing disorders amount to 83% among the members of the engine department, 71% in service personnel and 70% in deck crew working for Swedish merchant fleet [6]. Besides, vibrations emanating from the ship were found to be the most frequent reason for sleep disorders for 63% of the engineering personnel aboard vessels in the Royal Norwegian Navy [18].

It was reported that seafarers except for the command staff had a much higher rate of skin diseases and the most common problems were found to be dermatitis and eczema. In the same study, it was found that the incidence of sexually transmitted diseases was significantly higher among Danish seafarers working aboard ships other than passenger liners and among this population especially HIV and hepatitis had increased for 5 years [19].

It was emphasized that seafarers had increased stress and psychological problems related to work. In a study, prevalence of depression among seafarers was found to be 5% [12]. Borch et al. (2012) [20] reported that 11% of deaths among Danish seafarers were suicides. The prevalence of stress/depression/anxiety in female seafarers was reported as 43%. In addition, 18% of female seafarers reported sexual harassment as another issue [16]. Carotenuto et al. (2013) [21] found that compared to deck crew, engine staff had more anxiety and fatigue and lower job satisfaction. It was observed that deck and engine officers had higher self-control levels than the engine crew.

As it is known, health problems do not only emerge from biomedical, social or psychological conditions, but more frequently from lifestyle and behaviour. Health-Related Quality of Life (HRQOL) is a multi-dimensional concept that includes physical, mental, emotional, and social functionality. HRQOL is the general well-being of individuals, measuring positive emotions and life satisfaction. Well-being is a relative condition where the individual maximises his/her physical, mental and social functions in the context of supportive environments to lead a full, satisfying and productive life [22]. A study called Healthy People 2020 performed by US Department of Health and Human Services emphasized the importance of quality of life (QOL) and well-being in the cycle of life [23]. The World Health Organization (WHO) emphasized the importance of individuals' psychosocial and economic productivity along with health and a better QOL [24]. An individual's QOL is directly affected by the occupations that shape both their economic and health life. Seafarers have different characteristics according to their gender, age, physical activity, body mass, nutrition, alcohol/tobacco consumption, and health issues [25]. While they have to cope with long working hours

and three-shift schedules, they work in poor conditions with high noise levels due to the operations in the engine department. Furthermore, strong and rapid changes in the natural environment at sea make it difficult to sustain homeostasis [26]. However, QOL in seafarers is a new topic which has not been studied sufficiently. Available sources on this topic show results of the World Health Organization Quality of Life Scale (WHOQOL-BREF) on seafarers from various countries. An empirical study on Lithuanian seafarers proved QOL to be at poor-moderate level [27]. In two studies conducted on Polish seafarers, QOL level proved to be high [28, 29]. In Turkey, however, there have been no studies focusing on QOL on seafarers. In Turkey, seafarer's healthcare services are conducted as travel health, health inspections and seafarer's health services, by Directorate General of Health Services for Borders and Coasts of Turkey, associated with the Ministry of Health [30]. However, medical examinations on seafarers are made up of limited examinations and superficial inspections.

In this respect, the purpose of this study is to determine the QOL of Turkish seafarers and its relationship with the factors affecting it. In this study, the QOL was studied especially by using WHOQOL-BREF. The study tried to answer the questions below:

— What is the QOL level in seafarers (using WHOQOL--BREF Scale)?
— Is there a relationship/difference between socio-demographic characteristics, working conditions and health characteristics of seafarers?

MATERIALS AND METHODS

SUBJECTS

Sample of the study is seafarers applying for certificate of competence exams in a port authority in Black Sea Region, under the supervision of the Ministry of Transport and Infrastructure. Without conducting sample selection, a total of 103 Turkish seafarers who accepted to participate in the study, 1.9% (n = 2) of whom are female and 98.1% (n = 101) of whom are male, constitute the sample. Out of 200 people who registered to the exam centre, 103 accepted to take part in the study. It is not possible to extrapolate on whether 50% of seafarers who did not take part in the study have similar characteristics with the sample group, as their demographic information (age, department, rang, gender etc.) was not collected. The study was approved by the Noninvasive Clinical Research Ethical Committee, Faculty of Medicine, Düzce University (03.09.2018, decree no: 2018/165). A written approval was obtained from the ministry before the study. The purpose of the study was explained to all participants, and their consent was obtained. The study was completed in accordance with the Helsinki Declaration.

STUDY DESIGN

The study was designed as descriptive, analytical, and cross-sectional in order to determine the factors affecting QOL among Turkish seafarers. Data was gathered from September–December 2018 through "Employee Assessment Form" and "WHOQOL-BREF Scale". It took about 15–20 minutes to fill in the forms for each applicant.

EMPLOYEE ASSESSMENT FORM

The form includes questions on gender, age, marital status, level of education, maritime transport type, ship's flag, ship's area of activity, seafarer's profession aboard, term of employment, employment type, work hours, history of work accidents, chronic diseases, tobacco and alcohol consumption, exercise habits, daily sleep time and body mass index (BMI).

WORLD HEALTH ORGANIZATION QUALITY OF LIFE SCALE SHORT FORM TURKISH VERSION (WHOQOL-BREF)

The scale was developed by the WHO. Validity and reliability tests were conducted by Eser et al. (1999) [31] WHOQOL-BREF Scale calculates four domain scores as physical (PHY), psychological (PSY), social (SOC) and environmental domain (ENV). Highest scores in each domain prove a better QOL. The first two questions of QOL scale are not summed with total but examined separately. While the original has 26 questions, Turkish version contains 27 questions. The 27th question in the Turkish version "How would you rate challenges (of peer pressure and control) you face from people close to you (spouse, colleagues, relatives)?" was added to ENV-TR score. The items are rated on a 5-point Likert scale; however, 3rd, 4th, 26th, 27th questions have reversed ratings as their answers include negative statements. The measure score is obtained by calculating the arithmetic average of related items; PHY (3, 4, 10, 15, 16, 17, 18), PSY (5, 6, 7, 11, 19, 26), SOC (20, 21, 22), ENV (8, 9, 12, 13, 14, 23, 24, 25), ENV-TR (8, 9, 12, 13, 14, 23, 24, 25, 27) and multiplying all four domain scores [32]. In this study, internal consistency of the scale with its sub-dimensions was found as 0.62 for PHY, 0.78 for PSY, 0.65 for SOC and 0.79 for ENV, also 0.77 for ENV-TR, which are all at an acceptable level.

STATISTICAL ANALYSIS

Data gathered as a result of the study was analysed using SPSS (Statistical package of social science) 21.0. While continuous variables were given as standard deviation of the mean, categorical variables were shown in numbers and percentage. Data normal distribution was assessed through Kolmogorov-Smirnov test. In the reliability test, the internal consistency (Cronbach alpha) of the sub-dimensions

Table 1. Sociodemographic, health and work environment characteristics of seafarers (n = 103)

Variables	Number or mean ± standard deviation	Per cent* or range
Sex:		
Female	2	1.9
Male	101	98.1
Age [years]:	39.29 ± 9.43	23–62
23–35	41	39.8
36–48	45	43.7
49 and over	17	16.5
Marital status:		
Married	70	68.0
Single	33	32.0
Children	64	62.1
Level of education:		
Primary–Secondary	18	17.5
High school	52	50.5
University degree	33	32.0
Having chronic diseases	12	11.7
Daily sleep time [h]	7.19 ± 1.21	4–10
Body mass index [kg/m^2]:	27.63 ± 3.78	18.50–39.18
Normal weight (18.5–24.99)	23	22.3
Overweight (25.00–29.99)	57	55.3
Obese (> 30.00)	23	22.3
Term of employment [month]	155.92 ± 111.49	2–468
Daily working hours [h]	14.89 ± 7.29	4–24
Employment type:		
Full time	32	31.1
Shift/watch	71	68.9
Maritime transport type:		
Bulk carrier	53	51.5
Multi-purpose	15	14.6
Tugboat	25	24.3
Other (fishing-passenger-yacht-pilot vessel)	10	9.7
Flag type:		
Turkey	79	76.7
Other	24	23.3
Area of activity:		
Transoceanic	36	35.0
Seas	14	13.6
Inland waters (straits and gulf)	53	51.5
Profession:		
Command staff	32	31.1
Engine staff	38	36.9
Deck officers	29	28.2
Stewards department	4	3.9
Having work accidents (in the last year)	16	15.5

*Line percentages are given

for WHOQOL-BREF Scale was calculated. In comparison of medians, Mann-Whitney U, Kruskal-Wallis H, Spearman's rho tests were used. Results were within reliability range of 95%, significance was at a level of $p < 0.05$.

RESULTS

Considering the sample of seafarers, 98.1% were male, 43.7% were within the age range of 36–48 (average of age was 39.29 ± 9.43), 68% was married and 62.1% had children. The rate of chronic diseases was 11.7%. Of all the participants, 58.3% of them smoke, 41.7% drink alcohol. BMI average was 27.63 ± ± 3.80 kg/m^2. Flag type was Turkey for 76.7% of them and 51.5% work in inland waterways (In the straits and gulfs of the Marmara Sea). Regarding the professions aboard, 36.9% (n = 38) were engine department staff. The incidence rate of occupational accidents for seafarers in the last year was 15.5% (Table 1).

Table 2. WHOQOL-BREF subdimension average scores for seafarers (n = 103)

Domain	Mean ± standard deviation	Minimum	Maximum
Physical domain	15.99 ± 1.83	10.29	20.00
Psychological domain	15.77 ± 2.26	8.00	20.00
Social domain	15.50 ± 2.73	8.00	20.00
Environmental domain	14.17 ± 2.25	7.50	19.50
Environmental Turkish domain	14.18 ± 2.13	8.44	19.11

Table 3. Correlation of WHOQOL-BREF subdimension scores for seafarers (n = 103)

Variables*	Physical domain	Psychological domain	Social domain	Environmental domain	Environmental Turkish domain
Physical domain	1	0.559**	0.449**	0.445**	0.453**
Psychological domain		1	0.641**	0.534**	0.528**
Social domain			1	0.527**	0.512**
Environmental domain				1	0.966**
Environmental Turkish domain					1

*Spearman's rho correlations (r), **p < 0.001

In Table 2, WHOQOL-BREF sub dimension scores of seafarers are given. Average scores are 15.99 ± 1.83 for PHY, 15.77 ± 2.26 for PSY, 15.50 ± 2.73 for SOC, 14.17 ± ± 2.25 for ENV, and finally 14.18 ± 2.13 for ENV-TR.

The analysis of the interrelationships of WHOQOL-BREF sub-dimensions showed PHY and PSY (0.559) were at a moderate level, positively and significantly correlated. PSY and SOC (0.641), ENV (0.543) and ENV-TR (0.528) were at moderate level, positively and significantly correlated. SOC and ENV (0.527) and ENV-TR (0.512) were at moderate level (p = 0.000) (Table 3).

According to the comparisons made within the sample, in seafarers without children, PHY (–2.378; 0.017) and ENV (–2.265; 0.024) mean scores were significantly higher than in participants with children. According to BMI value, it was seen that ENV-TR (7.361; 0.025) mean score of overweight seafarers was higher than that of seafarers with normal weight. SOC mean score of seafarers working on bulk carriers was significantly different compared to seafarers working on tugboats (11.919; 0.008). For flag types other than Turkey, PHY (–2.705; 0.007), SOC (–2.089; 0.037) and ENV-TR (–2.189; 0.029) were significantly higher compared to Turkish flag. As the perception of participants towards QOL rose, WHOQOL-BREF all sub domain scores also increased (p < 0.05) (Table 4).

DISCUSSION

It is essential for a seafarer to be healthy physically and mentally to work at seas. Furthermore, it is necessary to maintain physical health during the period of medical certificate obtained every 2 years. Seafaring is not about a maritime adventure or exploration of the globe as it used to be, but a profession that requires modern technology and difficult conditions such as high working pace and being away from family for an extended period [33]. Working on a ship means a tough working period with many possible health risks. Moreover, health is a means of life for seafarers and there is a need for a health-based approach [26]. There is a need for the application of approaches where occupational health nurses play an active role in studies on improving marine crew health and QOL [34]. Ships are convenient places where health improvement programmes can be applied. Factors such as employees' involuntarily spending their shifts and leisure time on deck, the possibility to contact all other members of the crew at the same time, ability to provide support and interaction among peers, ease of receiving feedback on the effects of the programme and the ability to re-evaluate it make ships an ideal place to apply health improvement programmes successfully.

In this study, it can be concluded that Turkish seafarers are a young population at a productive age with family relations but with a medium level of education, according to their socio-demographic characteristics. While PHY and PSY are higher in women, SOC, ENV and ENV-TR domain scores are higher in men. PHY is higher for people aged 36–48, while PSY, SOC, ENV and ENV-TR scores are higher for people aged 49 and over. Similarly, in a study conducted on Lithuanian seafarers, PHY was found to be higher between

Table 4. Comparison of WHOQOL-BREF subdimension scores of seafarers with sociodemographic characteristics (n = 103)

Characteristics	Physical domain	Psychological domain	Social domain	Environmental domain	Environmental Turkish domain
Having children					
Yes	15.66 ± 1.95	15.64 ± 2.34	15.29 ± 2.84	13.77 ± 2.43	13.85 ± 2.33
No	16.53 ± 1.48	16.00 ± 2.12	15.83 ± 2.53	14.82 ± 1.76	14.74 ± 1.63
Test statistic*	–2.378	–0.390	–0.841	–2.265	–1.839
p	**0.017**	0.697	0.400	**0.024**	0.066
Daily sleep time					
Test statistic***	0.200	0.061	0.189	0.166	1.153
p	**0.043**	0.539	0.056	0.094	0.123
Body mass index class					
Normal weight (1)	16.17 ± 1.46	15.51 ± 2.29	15.42 ± 2.81	13.26 ± 2.24	13.26 ± 2.14
Overweight (2)	16.18 ± 1.48	16.09 ± 1.85	15.42 ± 2.81	14.65 ± 1.93	13.87 ± 2.75(1)
Obese (3)	15.33 ± 2.70	15.25 ± 2.99	15.65 ± 2.20	13.90 ± 2.75	13.99 ± 2.57
Test statistic**	1.569	1.238	0.263	5.727	7.361
p	0.456	0.538	0.877	0.057	**0.025**
Type of transport					
Bulk carrier (1)	16.26 ± 1.77	16.03 ± 2.46	16.05 ± 2.69(3)	14.58 ± 2.27	14.52 ± 2.13
Multi-purpose (2)	15.47 ± 2.32	15.51 ± 1.81	16.18 ± 1.88	13.97 ± 1.78	13.99 ± 1.68
Tugboat (3)	16.00 ± 1.48	15.84 ± 1.65	14.67 ± 2.37	13.88 ± 1.95	13.99 ± 1.99
Other (4)	15.31 ± 2.08	14.67 ± 2.90	13.60 ± 3.65	12.95 ± 3.12	13.20 ± 2.88
Test statistic**	4.623	4.857	11.919	4.300	6.659
p	0.202	0.183	**0.008**	0.231	0.447
Ship's flag					
Turkey	15.73 ± 1.82	15.66 ± 2.30	15.36 ± 2.66	13.96 ± 2.10	13.98 ± 1.961
Other	16.86 ± 1.61	16.14 ± 2.13	15.94 ± 2.95	14.85 ± 2.63	4.85 ± 2.52
Test statistic*	–2.705	–0.891	–1.296	–2.089	–2.189
p	**0.007**	0.373	0.195	**0.037**	**0.029**
Employment type					
Full-time	15.32 ± 1.91	15.13 ± 2.56	15.04 ± 3.46	13.47 ± 2.53	13.53 ± 2.31
Shift/watch	16.29 ± 1.73	16.07 ± 2.05	15.70 ± 2.32	14.48 ± 2.06	14.48 ± 1.98
Test statistic*	–2.244	–1.438	–0.576	–1.758	-2.235
p	**0.025**	0.150	0.565	0.079	**0.042**
Perception of quality of life					
A little bad (1)	11.89 ± 1.87 (2, 3, 4)	11.33 ± 3.50 (3, 4)	11.20 ± 3.35 (3, 4)	10.40 ± 2.46 (3, 4)	10.84 ± 2.05 (3, 4)
Neither good, nor bad (2)	15.76 ± 1.36 (3, 4)	15.50 ± 1.88 (3)	15.34 ± 2.64	13.66 ± 1.88 (3)	13.65 ± 1.76 (3)
Quite good (3)	17.06 ± 1.70 (4)	16.89 ± 1.35	16.35 ± 2.08	15.74 ± 1.58	15.79 ± 1.50
Very good (4)	17.71 ± 0.00	18.33 ± 2.91	17.67 ± 1.68	16.75 ± 2.10	16.56 ± 2.13
Test statistic**	31.210	21.670	13.767	34.921	38.239
p	**0.000**	**0.000**	**0.003**	**0.000**	**0.000**
Perception of satisfaction with health					
A little satisfied (1)	12.19 ± 1.83 (3, 4)	12.11 ± 3.56 (3, 4)	11.11 ± 3.34 (3, 4)	10.58 ± 3.18 (3, 4)	10.89 ± 2.68 (3, 4)
Not very satisfied (2)	15.37 ± 1.42 (3, 4)	15.14 ± 2.04 (4)	14.85 ± 2.36 (4)	13.22 ± 1.88 (3, 4)	13.31 ± 1.85 (3, 4)
Quite satisfied (3)	16.62 ± 1.43 (4)	16.16 ± 1.65 (4)	15.91 ± 2.41 (4)	14.88 ± 1.80 (4)	14.89 ± 1.75 (4)
Very satisfied (4)	17.23 ± 1.25	17.90 ± 1.27	17.85 ± 3.39	15.92 ± 1.17	15.62 ± 1.23
Test statistic**	34.960	25.369	26.021	30.494	27.239
p	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

*Mann-Whitney U (z);**Kruskall-Wallis H (χ^2 KW); ***Spearman's rho (r)

the ages of 20 and 24, and PSY proved to be better in seafarers aged 20–24 and 25–34 [35]. Another study on Lithuanian seafarers showed that while PHY, PSY, ENV and total QOL are the highest among seafarers aged 20–24, they are at the lowest among seafarers aged 55–64 [27]. QOL is higher in all subdimensions for both single seafarers and employees without children. Furthermore, there is a significant difference in ENV scores of seafarers without children. While PHY, ENV and ENV-TR scores are higher for people with a university degree, PSY and SOC scores are higher in seafarers with primary school education.

In this study, QOL scores among Turkish seafarers were 15.99 for PHY, 15.77 for PSY, 15.50 for SOC, 14.17 for ENV and 14.18 for ENV-TR. There were moderate significant positive correlations between PHY and PSY, SOC, ENV and ENV-TR domains; between PSY and SOC, ENV, ENV-TR; and between SOC and ENV, ENV-TR domains. In a study conducted on Polish seafarers, QOL level proved to be high and the scores were respectively, SOC (16.27), PSY (15.62), ENV (15.51) and PHY (14.63). The strongest correlation among QOL domains was noted between PHY and PSY, and it was stated that the level of SOC could be related to good personal relationships and social support [28]. Another study on Polish seafarers, QOL domain scores were found as SOC (16.48), ENC (15.64), PSY (15.17) and PHY (13.54) [29]. While both studies show PHY as the lowest, in this study PHY scored the highest. This may be due to the fact that Turkish seafarers are at a young age and have fewer health issues. On the other hand, while SOC level ranked the first in two studies, SOC ranked the third in this study. This indicates that the need for programmes towards improving their psychosocial health has increased due to the increase of fatigue, psychiatric diseases (depression, suicide) and other stress-related issues.

The seafarers' level of perception of their own QOL was found to be at a moderate (neither good, nor bad) level (65%). Being satisfied with one's own health was found mostly (46%) to be at a good level (very satisfied). Leszczynska et al. (2014) [35] noted that there was a strong significant correlation between the presence of health issues and dynamics of stress, and that there was a significant negative relationship between perceived level of health and again dynamics of stress. They also reported the perceived health median as 8 (between 0 and 10). In this respect, Turkish seafarers' high satisfaction of their own health and their low perception of their QOL do not match. The most important starting point of efforts to improve QOL is the elevation of health level. Their subjective perception of good health may have prevented them from efforts to improve their QOL. While PHY, PSY, ENV and ENV-TR levels are significantly different and high for people who perceive their QOL as "very good", SOC level is highly significantly different. Considering satisfaction of one's own health, QOL level is significantly different for people who answered "very satisfied", compared to others.

In this study, the rate of seafarers with at least one chronic disease was found to be 12%. The rate of Polish seafarers working on an oil rig was 62% [36]. The prevalence of having one or more chronic health issues is 42% among mariners in the US Navy [13]. Compared to this rate, Turkish seafarers have fewer chronic diseases. The level of QOL is better in all dimensions among people without chronic diseases compared to the people suffering from one.

The rate of smoking among seafarers is about 58%, alcohol use is 42%. The rates in this study, compared to other study results, were quite high [12, 14–16]. While PHY, SOC, ENV and ENV-TR scores are higher in non-smokers, PSY level is high for smokers. For alcohol users PHY, PSY, ENV and ENV-TR levels are high, but SOC level was found to be lower. Rate of doing exercise in Turkish seafarers is around 29%. While PHY, PSY and SOC levels are higher for seafarers doing exercise, ENV and ENV-TR domain scores of QOL are higher for people who do not exercise. In their study, Hjarnoe and Leppin (2013) [15] stated that there were no differences between physical activities of seafarers on land and aboard.

For the sleep time of seafarers, average daily sleep time was reported as 7 hours. The most important causes of sleep disorder on ships were noted as noise, vibration, caffeine or use of tobacco products [19]. There is a weak, positive, and significant correlation between sleep time and PHY level only.

Body mass index average of seafarers was found as 28. While the rate of overweight seafarers is 55%, the rate of obesity is 22%. In other studies, there were varying results [12, 13, 15, 16, 36]. ENV-TR score is significantly different between the overweight and normal weight seafarers. Romero-Paredes et al. (2016) [37] observed that 14% of seafarers who were suggested a more appropriate diet and physical exercise had decreased levels of BMI and cholesterol. This result is important in that it shows the effect of health improvement programmes focusing on diet and nutrition that is to be conducted on ships.

While PHY, PSY, ENV and ENV-TR levels were high for people working on bulk carriers, SOC levels of the people working on these ships were significantly higher than people working on tugboats. PSY and SOC levels were higher for people working on foreign ships compared to people on ships with Turkish flag; PHY, ENV and ENV-TR were significantly different. This result was interpreted in the manner that organizational support towards the health and well-being of employees working for maritime businesses belonging to ships with foreign flags were more effective.

Considering the area of activity of the ships, 52% work at inland waters and 35% work overseas. Especially for personnel working on overseas lines, the condition of being away from ports and working for longer hours gets more frequent. While it may be safe to assume that this situation might affect their health negatively, it did not make a significant difference on their QOL levels. However, while PHY levels were higher for people working overseas, PSY, SOC, ENV and ENV-TR levels were higher for people working at sea.

In this study, the employment type of 69% was shift/watch. Average work time was 13 years; daily working period was approximately 15 hours. When daily working

and sleeping periods of seafarers are considered, most of them did not have enough time for meals and leisure (about 2 hours in total). These reports from seafarers show that the conditions are not in accordance with the standards of training, certification and watchkeeping and are concerning. QOL levels of employees doing shift work were higher than full-time workers in all domains. Furthermore, the difference in PHY and ENV-TR domains was significant for shift workers. However, there was no significant correlation between QOL subdomain levels and working time or daily working hours. When the profession on the ship is considered, most participants were engine and command staff (37%, 31%, respectively), a smaller group worked in deck services department (28%) and the smallest section was found to be stewards department (assisted services). While a difference in health risks and characteristics for different department staff was expected, this situation made no difference on QOL in this study. However, while PHY, ENV-TR levels were high in command staff, PSY, SOC and ENV levels were better for people working in assisted services.

Rate of occupational accidents among seafarers was 16% in the last year. The accident rate among Turkish seafarers proved to be lower compared to the research of Forsell et al. [6]. Having experienced a work accident did not make a significant difference on any of QOL sub domains. However, while PSY, SOC, ENV and ENV-TR levels were high for people with an occupational accident history, PHY level was higher for people without it.

Seafaring is a risky occupation considering the health and welfare of seafarers. The results of this study confirm the need for health improvement interventions such as quitting smoking, healthy nutrition, and physical exercise programmes, which could bring about a better lifestyle. The challenge here is the necessity of taking particular seafaring conditions into consideration while applying these improvements.

CONCLUSIONS

In conclusion, it is possible to argue that Turkish seafarers have a weak awareness towards improving their health and QOL in their working life and that they need assistance in improving their QOL, especially in psychological and social aspects. Occupational health services for seafarers in Turkey are; (1) port health services where ship environment risks are observed and health trainings for personnel are conducted, (2) travel health services where immunisation services are performed, (3) health services which perform medical examinations needed to become a seafarers and continue working on the ship, and (4) 7/24 telehealth services for ships en route. Nurses are considered as a profession group within health officers on the ship and named “health personnel” in telehealth services. However, there are no details regarding the nature of nursing services.

In this respect, it is suggested that ship health models which also include occupational health nurses should be developed in order to improve work environment conditions of Turkish seafarers and their health and to conduct consultancy programmes and observations. When designing these models, medical and health care should be integrated to port health and telehealth services. Thus, it will be possible for seamen to receive not only medical care, but also health care involving QOL.

NOTE

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Seafarers' mental health in the COVID-19 era: lost at sea?

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ABSTRACT

Seafarers are exposed to several physical and psychosocial stressors. Recent studies highlighted specific disorders as fatigue, boredom and diseases as depression. Seafarers are also commonly exposed to post-traumatic stress disorder (piracy, accidents, threats). Coronavirus disease 2019 (COVID-19) impacts seafarers with an estimated 400,000 of whom are stranded on vessels around the world, with extended time on board, repatriation's difficulties and the financial concerns of the unexpectedly unemployed. International Maritime Organization has established the Seafarer Crisis Action Team to help them. In France, in last 10 months a dedicated call centre received 142 calls from 32 seafarers for psychological phone consultations mostly linked to this era. With the increase of duration of the COVID-19 crisis, psychological health care, repatriations and financial solutions are needed for seafarers.

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Key words: maritime medicine, psychological impact, seafarers, COVID-19

INTRODUCTION

In recent decades, studies increased knowledge on occupational physical and psychological stressors exposure in seafarers. Some, like fatigue, boredom and social isolation are linked to social and technology modifications. Global economic growth is coupled with shipping trade and maritime technology has to respond to globalisation signals. Globalisation encouraged transactions of goods and service "just in time" in smaller packets. Maritime transport, shipping but also fishing is now directly impacted by worldwide globalisation. The International Maritime Organization has recently circulated communications on the coronavirus disease 2019 (COVID-19) pandemic risk for maritime workers with impact on goods transport, limitation of international travel opportunities. Objectives of this paper are to describe seafarers' mental health and associated factors in a narrative review and in a second part to answer if in the COVID-19 era, additional damaging effects appeared.

SEAFARERS' MENTAL HEALTH AND ASSOCIATED FACTORS

Oldenburg et al. [1] recently published an article on stress and strain among seafarers considering their jobs on board. With a sample of 323 seafarers employed on 22 container ships, they conducted an interview-based study with a questionnaire addressing stressors among seafarers validated in a previous study [2]. Specific job-related factors such as sailing route, trip duration at sea, physical stressors (e.g. noise and seasickness) and psychosocial stressors (e.g. shift to new ship and social problems due to

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migration) were assessed. Nautical officers more frequently felt mentally stressed than the ratings, which the authors attributed to their higher maximum working hours and higher work-related demands. They also found that watchkeepers had significantly shorter sleeping periods than daytime workers (i.e. 5.5 h vs. 5.8 h) and significantly lower scores for effectiveness of sleep, the overall average of which was 69.6% (odds ratio [OR] 0.48; 95% confidence interval [CI] 0.26–0.88). In view of those findings, the authors proposed a possible relationship between chronic fatigue and human error during maritime disasters [1].

Fatigue is considered to be a major threat to maritime safety and mental health among seafarers, the youngest of whom have reported feeling overburdened by stress, especially due to fatigue and a lack of good social relationships and of control on board [3, 4]. On German-flagged merchant ships, individual stress levels were assessed in relation to 23 stress factors, most notably separation from family, pressure of time, long working hours, high temperatures in workplaces and lack of skills among subordinate crew members. By job type, officers complained more often than non-officers about high stress levels due to time constraints and administrative tasks [1]. In other work, a survey conducted in France with 74 seafarers employed on oceanographic vessels examined stress using the Karasek's demand–control model [5]. Among the respondents, 17% had low job-related decision-making latitude, which indicates a high risk of stress, and 33% showed mental stress on their overall health tests. A particular risk factor among officers was a backlog of administrative work while in port, which creates difficulty with organizing work efficiently [1].

Another aspect of occupational mental health among seafarers is boredom which occurs due to daily monotonousness combined with frustration [6]. That combination is common among seafarers, who generally experience the monotony of work on board at sea, particularly routine deck chores, time on watch and maintenance tasks. Such boredom at work is a source of stress and addiction, according to data in the literature, even if most studies on boredom among transport workers have been done in the air and road transport sectors [7–12]. In a recent exception, Jegaden et al. [13] interviewed 80 seafarers — 40 officers, 40 crew members — and 63 office staff with three validated questionnaires: Boredom Proneness Scale (BPS), the Hospital Anxiety Depression Scale and the Job Content Questionnaire (JCQ). Between the two groups of seafarers, significant differences emerged for boredom disposition score ($p = 0.02$) and external stimulation score ($p = 0.05$). The results on the JCQ significantly differed in average sense of job demand and job control, whereas no difference surfaced for social support [13]. Compared with the officers, the crew had significantly low sense of job demand and job control, which ranked them in the passive workers category (51%). By contrast, the percentage of active workers was significantly higher among officers (30% vs. 5.1%) [13]. Oldenburg and Jensen [14] found that insufficient opportunities for telecommunication were experienced as a work-related strain among seafarers assigned to worldwide destinations (OR 1.87, 95% CI 1.15–3.04) and crew members without children (OR 2.00, 95% CI 1.03–3.88). Moreover, in another interview-based study with 337 seafarers employed on Chinese-flagged ships, An et al. [15] found a significant, negative correlation between work performance and both work-family conflict ($p < 0.05$) and occupational stress ($p < 0.05$). In their logistic regression model, job satisfaction played a moderating role in the relationships between work-family conflict, job stress and work performance, and relationships between job stress, work-family conflict, work performance and satisfaction at work resembled ones in Siegrist's effort-reward imbalance model [15, 16].

At sea, less job demand can be expected to accompany a risk of boredom due to monotony and the repetitiveness of tasks. Many studies have confirmed the strong relationship between proneness to boredom and depression. Stress and strain among seafarers are related to greater job demands and management tasks during stays in port and during arrival and departure periods [17–19]. Iversen [20] found that from 1960 to 2009, 5.9% of all reported deaths were due to suicide and 13.1% to illness.

Seafarers are also commonly exposed to post-traumatic stress disorder (PTSD). In interviews with 323 seafarers on German ships addressing severe mental stress or potentially traumatic events on board, 35.9% of seafarers reported experiencing major maritime disasters, threats or accidents, including piracy on board (17.0%) and stowaways (39%). Added to that, 83.6% of seafarers who had experienced disasters and 76.4% who had experienced piracy reported often unintentionally thinking about the events or dreaming about them. Experiences involving the threat of stowaways had particularly affected non-European seafarers. According to interviews at 12 shipping companies conducted in 2020 a total of 14 deaths had occurred in the past 3 years in the companies: 3 due to heart attack, 3 due to cancer, 3 due to accidents, 2 due to suicides and 3 due to unknown causes [21].

Today, as the International Maritime Organization (IMO) has declared on its website, the COVID-19 pandemic has put seafarers around the world at risk of another set of precarious situations, which may in turn affect their mental health. Travel restrictions have meant that they cannot leave their ships, be repatriated home or even receive urgent medical assistance. Other seafarers have seen their contracts unilaterally terminated or been quarantined on board their vessels for more than 14 days, all without pay. Numerous seafarers,

their spouses and family members have contacted the IMO to share their concerns about a range of difficult situations caused by the COVID-19 pandemic. As some consolation, the theme for this year's World Mental Health Day is "Mental Health for All", which could be good news for seafarers, an oft-forgotten part of the workforce [22].

As COVID-19 continues to adversely impact seafarers, an estimated 400,000 of whom are stranded on vessels around the world, many working within the maritime industry have become increasingly concerned about the damaging effects of extended time on board, as well as complications with repatriation and the financial concerns of the unexpectedly unemployed. The well-being of seafarers during on-board COVID-19 outbreaks was evaluated with the General Health Questionnaire-12, where 60% of the sample had mean Likert-scores below 15 (i.e. "No problems"), whereas 40% had scores from 15 to 23 (i.e. initial problems). In response to other items, half of the seafarers did not feel safe performing their jobs and 60% did not think that every precaution had been taken to ensure their health at work due to the pandemic. Another 30% suffered from insomnia to the extent of becoming concerned, while 26% reported being unhappy and depressed during their latest tour of duty [23]. In response, a combination of person-focused and organization-focused prevention approaches has been advocated as the most promising for alleviating job stress in the workplace at sea (ISWAN) [24].

Without the possibility for crew changes employers have planned to extend crew contracts for one to several months. In some cases, due to COVID-related restrictions, seafarers' on-board access to medical staff has been denied by custom authorities. In February 2020, a platform for psychological phone consultations for seafarers at sea and ashore was created in France, one with assessing shock and/or acute stress as its major objective. The long-term goal to prevent PTSD among seafarers following potentially traumatic events. In early November, we performed 142 consultations with 32 seafarers from France, whose reasons for consultation were COVID-19's impact (n = 11 officers, n = 3 crew members) and PTSD (n = 10 officers, n = 4 crew members). We also phoned social relations of 3 seafarers, 2 retired seafarers, 2 foreign crew members and all crew members on the 3 ships about the impact of COVID-19 and on-board accidents. Interviews revealed the importance of the feeling of isolation among seafarers, both physical and societal, and the remoteness of healthcare services. During on-board missions, seafarers suggested that they had adopted strategic defences (e.g. dissociation and structural dissociation) and collective defence strategies in the crew. Many had been undermined by fatigue, contradictory or piecemeal information on landing possibilities, the overloading of their psychological capacities for adaptation and eventually exhaustion. The loss of those mental health resources can cause severe anxiety or suicidal crises with clinical signs of depersonalisation or paranoid disorder. At the same time, clinical signs are not comparable to usual psychiatric symptoms in acute paranoid disorder. In the case of seafarers, such conditions can be interpreted as prior dissociation with signs of a suicidal crisis — that is, an attempt to face an all-too-violent reality. Furthermore, the management and follow-up of on-board seafarers' health and well-being have specific impacts by encouraging a departure from isolation and the feeling of societal indifference, as well as an ability to re-associate their functional identities as seafarers with their personal identities. Seafarers who called the post-crisis health resource centre described symptoms of severe PTSD and the lack of all capacity to return to work on board. They recounted concrete experiences of potential death in isolated environments during the COVID-19 pandemic, when the crew did not get full compensation, and everyone was preoccupied with personal concerns and efforts to stay safe. Although the insurance system clearly needs to become more easily accessible to all seafarers, some other recommendations were made clear by the initial experiment. For one, seafarers' mental health requires care during on-board missions but also in port and between missions. For another, the societal relations of seafarers constitute a fundamental axis of health prevention, as the COVID-19 pandemic has highlighted. Thus, there is a need to focus not only on PTSD but also on all forms of psychological disorders.

The IMO has established the Seafarer Crisis Action Team (SCAT) to help to resolve individual cases, often by working alongside other organizations such as the International Labour Organization (ILO), the International Transport Workers' Federation (ITF) and the International Chamber of Shipping (ICS) [25]. Since the beginning of the COVID-19 pandemic, that dedicated team has worked around the clock to contact representatives from national governments, Non-Governmental Organizations (NGOs), trade unions and relevant associations and to orient seafarers towards the most suitable organizations and solutions. Seafarers and their relatives can contact the SCAT via email at info@imo.org.

CONCLUSIONS

To prevent mental health disorders among seafarers, all characteristics of organizations at sea, at port and in different types of vessels should be included in prevention programmes, and more research should be conducted on factors of boredom and stress among seafarers and fishermen. We fear long-term psychological and social effects on seafarers of COVID-19 pandemic. In first part, psychological disorders like depression, anxiety and increased rate of suicide will appeared. In a second part, with anxiety, social pressure from family and financial difficulties, we could

hypothesize that numerous seafarers refuse to go back on board vessels and leave the maritime transport. Increasing access and information on health and psychologist consultations in face to face or by videoconference is imperative. Capacities of crew changing, help from health services and foreign offices are also needed. Discussion between international organizations, shipping and workers institutions to build short-term and long-term prevention actions could surely be benefit for seafarers.

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LETTER TO THE EDITOR

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Seeking to address issues with COVID-19 vaccines in Japan and to resolve global problems with vaccination programmes

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Over a year has passed since coronavirus disease 2019 (COVID-19) first emerged and began to spread around the world, but there are still no signs of it being contained in Japan or elsewhere. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) variants have increasingly become a cause for concern.

In a study by the Ministry of Health, Labour and Welfare of Japan, about 15,000 residents of 5 Japanese prefectures underwent an antibody test for COVID-19 in December 2020 [1]. In each prefecture, 0.14–0.91% of residents tested positive for COVID-19 antibodies. Given the percentage of people with COVID-19 antibodies, containment via herd immunity cannot be expected [1]. The public needs to be accurately informed about COVID-19 vaccine [2]. Another issue to be addressed is the efficacy of each vaccine against the United Kingdom and South Africa variants of SARS-CoV-19 [3]. Additional information about these and other SARS-CoV-19 variants will probably be needed in the future.

Vaccination of the general population is proceeding as COVID-19 vaccines are being developed around the world. While developed countries have obtained sufficient vaccine supplies and have started or plan to start vaccination programmes, in many developing countries there is a shortage of both vaccine supplies and vaccination programmes according to the World Health Organization [4]. COVID-19 vaccination in both developed and developing countries may be the key to containing the disease, so it is crucial that developing countries obtain sufficient vaccine supplies and promote vaccination programmes if COVID-19 is to be contained worldwide. The collaboration between international organizations like the World Health Organization and various fields related to COVID-19 measures needs to be enhanced, and developing countries need substantial support in vaccinating their populations against COVID-19.

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Early detection of excessive stress in people due to the ongoing COVID-19 pandemic: studies including those using biological markers

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The coronavirus disease 2019 (COVID-19) epidemic continues to affect countries around the world. As of May 22, 2021, there were about 33 million people in the United States infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (the virus that causes COVID-19), about 26 million in India, about 16 million in Brazil, about 5.9 million in France, about 5.2 million in Turkey, about 4.9 million in Russia, and about 720,000 in Japan [1, 2]. SARS-CoV-2 variants are also prevalent now, and their spread will presumably lead to a great deal of stress. The ongoing effects of the COVID-19 pandemic on various aspects of people's lives will also presumably intensify stress. Excessive stress needs to be quickly detected and dealt with. Detection of stress is often difficult, so this report has been conducted from the perspective of ascertaining and dealing with stress.

Discussion of stress involves use of 1) a questionnaire like that used in a "stress check" system [3], 2) a questionnaire about everyday life, and 3) biological markers. Discussion using the approach in 1): examine stress factors at work, the mental and physical stress response, and support from others. Discussion using the approach in 2): look at sleep, eating a regular diet, addiction to smartphones and video games, an individual's physical and mental state, ties to friends and family (is the individual isolated?), school attendance, and whether the individual is receiving needed outpatient care and taking his/her medication. Discussion looking at 3): typically use cortisol and amylase [4, 5] as stress markers and chromogranin A as a mental stress marker.

This report has detected excessive stress early on using these three approaches. However, personnel in various areas such as members of the public, family members, members of the community, schools, the workplace, and medical personnel need to work together to deal with stress caused by the ongoing COVID-19 pandemic so that it does not result in mental or physical illness or lead to suicidal behaviour.

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Suez Canal blockage and its global impact on healthcare amidst the COVID-19 pandemic

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It is estimated that 90% of the world's trade, including hospital supplies and medicines, is transported by sea and man-made waterways, such as the 193-kilometre-long (120 miles) Suez Canal, which cuts through Egypt and connects Mediterranean Sea to the Red Sea. This artificial channel in Egypt has played an important role in economic growth since its completion in 1869, serving as an artery of world trade, including the healthcare industry, being a key transit point for ships moving goods from Asia, Middle East, and Europe [1, 2]. On an average day, the canal caters to nearly 50 vessels carrying essential commodities. It was responsible for the transit of over 19,000 ships in 2019 representing nearly a third of the world's container ship traffic, equating to nearly 1.25 billion metric tons of cargo, and accounting for about 12% to 13% of world trade per year [3].

However, on March 23, 2021, a 224,000-ton and 400-metre-long cargo ship Ever Given ran aground near the southern end of the Suez Canal due to low visibility and poor navigation amid 40-knot winds and a sandstorm [4], causing a blockage in the major waterway. Meanwhile, navigation through the Suez Canal was temporarily suspended and ships en-route the canal during this incident were escorted back to nearby anchorage areas [5]. This week-long incident resulted in a maritime traffic jam causing at least 422 cargo vessels carrying oil and consumer goods to be stranded, holding up an estimated $9.6 billion of trade daily. It has also forced multiple operators to reroute vessels around Africa's Cape of Good Hope travelling an extra 6,000 miles, and substantially extending navigation time to about 3 weeks [6–8]. Aside from the global trade, countless retailers also suffered losses due to the blockage as key shipments were delayed. The extent of economic loss due to the blockage is likely to be even higher when costs such as additional shipping operation charges, commodity prices and shipping delays are factored in [8].

Fortunately, the Suez Canal blockage was resolved on March 29, 2021. Tugboats were used to re-float the vessel, while dredges excavators have been removing sand and mud from around the port side [5]. However, its impact still constitutes a global concern. The obstruction of the canal has caused a global shortage of essential commodities, including medical and surgical supplies and medicines, which are essential during the coronavirus disease 2019 (COVID-19) pandemic. Several countries currently suffering from the global public health emergency were greatly affected due to the delay of shipment of hospital and pharmaceutical supplies caused by the Suez Canal blockage [9].

Given the crucial role of the shipping industry in the timely delivery of healthcare resources and the detrimental effect triggered by a single vessel, healthcare industry and stakeholders have found themselves to a precarious position [10]. On top of the financial losses, frontline workers have found themselves in short of personal protective equipment, non-COVID-19 wards have experienced even more difficulties in maintaining their functionality, and outpatient and informal/at-home care have been affected by shortages. In a word, healthcare delivery could have been

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compromised, if the blockage lasted longer [11]. Therefore, this incident has exposed the long-standing vulnerability of the medical product supply chain [12].

Aside from its current impact on medical and drug supplies, the delays can affect the COVID-19 vaccines logistics. International bodies, national governments, and companies might hesitate to entrust vaccines transportation to the shipping industry. Using airlines instead of vessels in such a short notice will put a — potentially unbearable — burden on aviation [13, 14]. The whole situation calls into question the goal to deliver the right care to the right person at the right time. Patients experience higher morbidity and mortality risk due to potentially substandard quality of care, reuse of medical products, and increased risk of substitute equipment-related error. These are systemic risks that we have to consider if we are looking into developing effective long-term solutions [15, 16].

The Suez Canal blockage crisis has highlighted the importance of shipping in the global economy and in the healthcare industry. This incident stressed the need to enhance the resilience of the supply chain, especially in case of disruption of just-in-time production during the COVID-19 pandemic. This issue poses several industries, including pharmaceutical and medical technology companies at risk. Consequently, these entities might abandon their plans to ship COVID-19 vaccines via cargo ships in fear of similar incidents in the future. This could backfire into more delay with the shipping of vaccines globally. As a result of this, the quality of medical supplies could be greatly affected, especially when it comes to COVID-19 vaccines which need consistent storage conditions. Hence, stakeholders should analyse this incident in greater detail and devise contingency plans in anticipation of similar incidents. Hampering global transactions and supplies comprises great risk and healthcare nowadays cannot afford such a risk.

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COVID-19 and alcohol consumption: were mariners forgotten?

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More than 1 year after, coronavirus disease 2019 (COVID-19) pandemic is still on with high impact on social relationship. Measures to protect against the virus limit capacities and modalities of time spending in family, with friends or in working groups. In April 2021, worldwide total deaths due to COVID-19 are more than 3 million. Maritime transport decreased of 4% in 2020. Seafarers are impacted on different ways: travel restrictions have meant that they cannot leave their ships, be repatriated home or even receive urgent medical assistance. Other seafarers have seen their contracts unilaterally terminated or been quarantined on board their vessels for more than 14 days, all without pay. What about health impact for seafarers?

We could answer by different ways. We only discuss alcohol consumption in this letter. Indeed, it is well known that alcohol consumption, addiction and mental health burden linked to it are real problems in this population [1]. Is the COVID-19 modifying it? It's impossible to answer when looking on data in recent literature.

However, it was demonstrated for other working groups. Some studies found a decrease in alcohol consumption as in China with restrictions on movement [2]. In other way, due to fewer situations of parties, teenagers and young adults limited their binge drinking habits [3]. Nevertheless, in most of studies, alcohol consumption increased during the COVID-19 pandemic, especially in United Kingdom, Australia or European Union. Reasons are numerous [4–6]. For some, they used alcohol as an anxiolytic and during the pandemic, information from media was a strong risk factor for anxiety. For others, restriction of movement highlighted some problems with their family, and they wanted to forget it. And finally, some people used alcohol to overcome boredom. The lack of sport and professional activity increased feelings of monotony and uselessness [6].

Linked to these elements, seafarers would probably have such social problems. During longer period ashore, they had to adapt to new conditions of life with higher social demand from their families. During embarkment, on the one hand work tasks could be an escape from new social balance, and on the other hand they were more anxious with news on the pandemic. Symptoms of anxiety could increase when seafarers stayed in port of high COVID-19 impacted countries or if some of their social relations lived in such countries.

For this population with higher prevalence of psychoactive substances consumption, conditions due to COVID-19 pandemic strengthened the need of prevention of alcohol consumption or other addiction. Risk assessment and preventive interventions for this population should be a relevant and important axis of public health.

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Accidental rectal injury during a boat trip in a child: a challenge for telemedicine

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We read the stimulating article recently published in your journal by Sagaro et al. [1] that reports the experience of telemedical assistance at sea of Centro Internazionale Radio Medico (CIRM) during coronavirus disease 2019 (COVID-19) pandemic. The Italian Telemedical Maritime Assistance Service (TMAS) represents the largest experience at sea in the world.

This system, actually used by cargo ships or cruise ships, could be helpful also in commoner situations, like ferries or private boats. The rationale is having first medical contact in difficult-to-manage situations, such as severe allergic crisis or trauma, equipping the boats with adequate devices.

Recently we treated the case of a 10-year-old girl affected by a perineal trauma after a fall on a wet surface with impaling on the rudder of a pleasure boat. The situation did not appear immediately critical and the crew decided to return to shore without haste.

About 8 hours after the trauma she referred to the Emergency Room with rectal bleeding and abdominal pain. She was haemodynamically stable, without visible wounds, perineal or vaginal lesions, and her urine was clear. The computed tomography showed the presence of intraperitoneal fluid and some hydro-aerated levels, with air close to the right anterolateral wall of the sigma-rectum passage. The walls of the rectum were thickened with gaseous areolas in the context. The sigmoidorectoscopy demonstrated a lesion of the rectum mucosa, suspected for perforation of the intraperitoneal rectum. At laparotomy faecal material was found in the rectovaginal space, spilling from a rectal wall lesion at the peritoneal reflection level. The perforation was repaired and a protective colostomy was done. The postoperative course was uneventful and the recanalisation was performed after 6 months. There were no long-term complications.

Penetrating anorectal injuries in children are rare and thus remain relatively under-reported in literature [2]. The commonest causes are falls on sharp objects, sexual abuse, gunshot wounds, traffic accidents, enemas, ingested foreign bodies and use of rectal thermometers.

According to Beiler et al. [3], severity of the wounds is difficult to estimate because too small lesions are not obvious or immediately visible: anyway, it's important, in terms of management and outcome, a main distinction between injuries of the intraperitoneal and extraperitoneal segments of the rectum, due to the different management [4].

Recent literature suggests individual management for anorectal lesions, in particular small and isolated anal lesions could be sutured without colostomy while more extensive injuries require faecal deviation. The prognosis of penetrating perineal lesions during childhood is good, even in cases of severe anorectal damage. Peritonism should be considered as an urgent indication for laparotomy or laparoscopy [5].

Herein could the presence of telemedicine on board be an added value? Would an early diagnostic suspicion change the outcome? A journey at sea could reserve pitfalls: inexperience, unusual accidents, absence of telephone network, and poor knowledge of on-board instrumentation. In our opinion, in this case, an early consultation in telemedicine would probably have reduced the access times to the first treatment. The future will lie in making systems such as TMAS increasingly usable.

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Remote diagnosis, monitoring and intervention for maritime industry workers: need and challenges

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The mariner industry plays a significant role in overall world trading. It seems to be almost impossible to do intercontinental trade, massive global transportation, import/export of goods and food items without having assistance from the shipping industry [1]. However, due to the tough and challenging working environment, it is very difficult to work in this industry. The person working in the maritime industry has to normally spend a couple of months and more on the ship. The hectic work pressure and isolation from the family may induce different human psychiatric conditions among the mariners. Therefore, for the healthy mental state of mariners, there is a dire need to monitor the psychological state of the mariners at a regular interval of time, so that, they can be given remote psychological intervention if required.

There is a tremendous need to design and implement a mental healthcare policy that focuses on providing psychological intervention, mobile and online mental health services for the shipping industry workers. However, one of the major challenges in designing such a monitoring system is the bandwidth and the availability of the internet connection.

The delay in this health policy can drastically exacerbate stress, anxiety, depression, and other psychological disorders [2]. Initially, to cope with this health problem, the distinct online resources (Zoom, WebEx, Skype, Join.me) need to be used to develop a virtual environment (School, College, Gym, Temple) for assisting the sharing among the congregation of people. Moreover, a comprehensive therapeutic technique (psychotherapy) should be used to understand and rectify the behaviours, thoughts, and emotions of mentally sick employees. The use of in-place cognitive and behavioural therapies may assist to transform the mental state and behaviour of the mariners. The psychological interventions strengthen their morale and could be effective in mitigating the psychological impacts induced due to momentous work and the isolation from family. The psychiatric therapies (cognitive and behavioural) will also improve the functioning of their immune systems. However, the implementation of an in-place comprehensive therapeutic technique seems to be very tough and challenging as far as the shipping industry is concerned. Therefore, there is a need for remote monitoring of the psychological health of mariners.

In the light of the above situation, the real necessity is a well-planned framework that works on following strategic policies:

- as people normally share their feelings and opinion over social networks; therefore, despite the official record, the use of sentiment analysis of Facebook, Twitter, and other social networking sites can also be useful to trace the individuals that are in serious psychiatric needs;
- additionally, the design of a stress symptom mapper app (Android and iOS) can be an added advantage;
- the early and timely mobile (remote) psychiatric intervention can even mitigate the risk and mortality rate of suicides;
- the use of m-health (mobile health) services such as calls (audio, video), apps (WhatsApp, Zoom, WeChat), messages (text, audio, picture, video) would be an important way to mental stepped care;
- different m-health services can be used to provide cognitive and behavioural therapies to stressed workers;
- additionally, there is a dire need to design and implement free web-based mental health services (like www.betterhelp.com, www.moodgym.com.au, www.beyondblue.org,.au etc.) for effective management of different psychiatric conditions such as stress, anxiety, depression, suicide, anger, and sleep disorders (Fig. 1).

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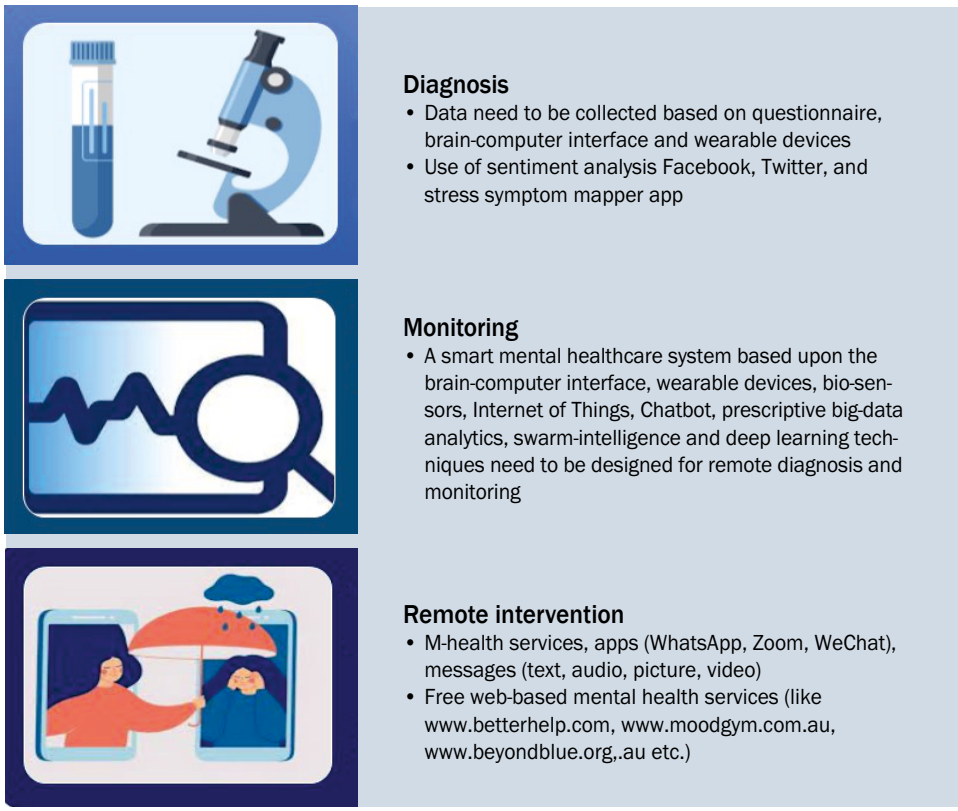

Figure 1. Proposed system

Above all, a smart mental healthcare system based upon the brain-computer interface, wearable devices, bio-sensors, Internet of Things, Chatbot, prescriptive big-data analytics, swarm-intelligence and deep learning techniques need to be designed for remote monitoring of the psychological condition of the mariners [3]. The system may be used to monitor the real-time psychological state of the victims so that remote (online or mobile) psychiatric assistance can be provided to them if needed. Moreover, an online hub of leading psychiatric and research institutes need to be deployed to provide regular and timely support to all afflicted individuals [4]. The challenges that need to be faced during the design and implementation of this system are:

— first of all, the reliability and the precision of the proposed system significantly depend upon the internet connection. However, the internet availability, bandwidth and the cost associated with it is the real challenge in the successful implementation of this model;
— furthermore, as the system attempts to locate a satellite, the unstable connections, lack of coverage, lapses in operation and slowdown are some of the common connectivity issues on the ship;
— additionally, for effective performance, the exploration and exploitation phases for swarm-intelligent computing techniques need to be carefully balanced;
— finally, to maintain the privacy and confidentially of the mariner's data, advanced security mechanism need to be employed.

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Issues in medical assessment of fitness to dive review

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Krzyżak and Korzeniewski [1] are commended for their effort in developing this review. While much of the content provides useful reference, some clarifications are warranted.

The primary concern regards overly broad statements regarding standards of practice. Most notably, it is not true that all recreational candidates are required to be medically evaluated prior to diving. The authors refer to the recreational diving medical screening system that is widely used internationally [2]. The participant questionnaire allows individuals to forego medical assessment if no issues are flagged. The product does not need to be "analysed by a diving instructor" beyond recognizing that "yes" has been entered against any of 10 questions. It is not expected that instructors are experts in diving medicine, nor that they will make medical decisions. The system depends upon honest and informed answers by participants, and unrecognised medical conditions might be missed, but widespread problems have not been identified.

The statement that insulin-dependent diabetes mellitus is an absolute contraindication to diving is similarly overstated. This position is held by some, but certainly not by all medical professionals. Guidelines for recreational diving with diabetes are well established [3, 4] and widely used internationally.

There are additional misconceptions that have crept into the paper. It is probably more myth than reality that "a vast majority of scuba divers were all young and physically fit." While the age of divers is increasing, this probably reflects a combination of long diving lifetimes and a drop in youth recruitment. There have long been participants with moderate, low, and sometimes very low physical fitness. This does not discount the importance of reasonable fitness, but it can help with perspective. The idea that divers should be able to work at an intensity of 13 metabolic equivalents (requiring an oxygen consumption rate of 45 mL O_2/kg body mass/minute) has often been stated, but it does not realistically reflect the minimum physical fitness level, and generally not even the mean fitness level, of recreational divers [5].

The comment that formal restrictions are more relaxed now and people fail to get training prior to participation is probably also not valid. Recognition of the need for "certification" is increasingly entrenched, and this obligation affects buying or renting diving equipment, buying breathing gas, and participating in almost any organised diving activity.

The statement that drysuit diving "protects the middle ear from flooding" is not accurate. Drysuits seal at the neck, and both wetsuits and drysuits rely on wet hoods that expose the outer ear to water to eliminate external ear squeeze issues. If the eardrum does rupture, water will enter the middle ear and transient caloric vertigo can be expected (with symptoms resolving fairly rapidly as the temperature difference within the two ears wanes). The comments on dental health are also somewhat unclear. Poor dentistry probably creates a greater risk for trapped gas and susceptibility to squeezes than the presence of caries, which by their nature are open to the environment. Finally, it is unclear that scuba diving enhances air swallowing under any normal conditions, making the comments associated with this surprising.

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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.

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