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*Published in:*  
International Maritime Health

*DOI:*  
[10.5603/IMH.2016.0006](https://doi.org/10.5603/IMH.2016.0006)

*Publication date:*  
2016

*Document version*  
Publisher's PDF, also known as Version of record

*Document license*  
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*Citation for pulished version (APA):*  
Westlund, K., Attvall, S., Nilsson, R., & Jensen, O. C. (2016). Telemedical Maritime Assistance Service (TMAS) to Swedish merchant and passengers ships 1997-2012. *International Maritime Health*, 67(1), 24-30.  
<https://doi.org/10.5603/IMH.2016.0006>

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# Telemedical Maritime Assistance Service (TMAS) to Swedish merchant and passenger ships 1997–2012

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## ABSTRACT

**Background:** Telemedical Maritime Assistance Service (TMAS) for seafarers and traveling passengers is important and can be crucial for the optimal medical treatment on board ships. The aim of this study was to analyse and to compare the data from consultations and evacuations from merchant ships and passenger ferries for possible improvements.

**Materials and methods:** Data for seafarers from 1997, 2002 and 2007 and for passengers on Swedish ferries for the years 2007, 2009, 2011 and 2012 from the Swedish Radio Medical were studied. Symptoms and diseases were classified according to the International Classification for Primary Care (ICPC-2). The distribution of symptoms, accidents and diseases, treatments/actions taken, evacuations and the communication forms were analysed.

**Results:** One thousand ninety-five contacts for seafarers from merchant ships and 651 passenger patients from Swedish ferries were analysed. While the evacuations for the seafarers gradually decreased over the years from 18% in 1997 to 14% in 2007, still 39.5% of the passenger patient contacts were evacuated mainly by helicopters and 70 patients were picked up by an ambulance on the quay. Accidents were 20% for seafarers and 25% for passengers of the contacts. Evacuations for passengers were mainly in the diagnostic groups: unspecific (A), digestive (D), cardiology (K), musculoskeletal (L) and neurology (N). The use of VHF, radio communications and fax machines have been greatly reduced while the use of e-mail and satellite phone increased.

**Conclusions:** No significant differences in reasons for contact or actions over the years have been identified. The evacuations of seafarers decreased over the years but was stable among the passenger patients (39%). The circumstances and reasons behind the evacuations should be analysed for prevention. Standard forms and digital images for documentation can facilitate knowledge exchange and further studies.

(Int Marit Health 2016; 67, 1: 24–30)

**Key words:** telemedical, Radio Medical, shipping, evacuation, seafarer, passenger, repatriation

## INTRODUCTION

During the past seven or eight decades, the Radio Medical (RM) centres in seafaring countries such as Italy, Spain, Germany, Singapore, Denmark, Norway and Sweden have delivered expert telemedical advice to ill and injured seafarers and passengers at sea on a 24-h basis all over the world. Radio Medical is currently designated in the international context increasingly as the Telemedical Maritime Assistance Service (TMAS), though we continue to use the

RM concept here. The RM centres operate as hospital-based radio medical advice centres for ships worldwide. In Sweden the RM was started in 1922 on the initiative of the Sahlgrenska University Hospital and the Maritime Administration to provide medical advice to the Swedish merchant fleet employees at sea.

The commander or his or her delegate, usually the 2<sup>nd</sup> officer, medical care is responsible board. For any illness or accident on board the ship's captain or the delegate takes



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contact with the Joint Rescue Coordination Centre (JRCC) in Gothenburg, regardless of the ship's position. Contact from the ship is carried by satellite phone, cell phone, fax, email, VHF or shortwave radio. The JRCC forwards immediately the case to the RM physicians in duty through a direct connection and RM doctors are available round the clock, all year.

From 2002 to 2012 there were a total of 5396 cases with one or more contacts to the Swedish RM. The average annual number of cases increased from 430 to 534 in the two time periods 2002–2006 and 2007–2012, respectively. The average annual proportion of passenger cases during the two time periods increased from 19% to 28%. Remarkably, the proportion of passenger cases during each year from 2007 to 2012 increased from 19% to 37%. A previous study on Swedish Telemedical Maritime Assistance Services from 1997–2009 on infectious conditions among seafarers showed that infectious conditions are a significant contributor to calls to the service [1]. No study of all diagnoses among passengers and seafarers has been conducted on Swedish TMAS. Even internationally there are very few studies of this type.

This is an extension by use of the same study material as used by Westlund in 2011. The study objective is to improve the quality of the TMAS with the following aims: 1) To establish an international comparable set of data from the RM contacts for passenger patients and seafarer patients; 2) To describe the change over time of the symptoms, diagnoses, treatments and type of evacuations for passengers and seafarers; and 3) How does the use of the technical equipment change over time.

## MATERIALS AND METHODS

The study was in two parts. Part-1 included patient cases among the crew of seafarers on board all types of Swedish and foreign ships. Logs from the JRCC and RM physician documentation, 376, 312 and 407 cases from the years 1997, 2002 and 2007, in all 1095 contacts were studied. The passenger contacts were excluded as the study population was defined to be only the employees at sea.

Part-2 included solely patient cases among the passengers on Swedish ferries for 2007, 2009, 2011 and 2012 in all 651 journal entries. For both part studies, each case has been studied and contact cause, symptoms and diseases were classified according to the International Classification for Primary Care (ICPC-2) codes which covers all the 17 symptom/diagnosis groups. In addition to the above issues, we also collected data about the extent to which the stated age, gender, job board, nationality and reduced work in the written documentation. The distribution of contacts due to accidents and diseases was calculated and the proportion of accidents in the diagnostic groups described. The actions and treatments, including the evacuations were analysed.

Further the proportion and type of consultations with other specialists and the type of communication, telephone, e-mail etc. analysed. The data was compiled without using information on personal names or personal identification. The ethical rules for database research in Sweden were complied. Besides the evacuation cases picked up by a helicopter, some patients stayed on board until the next port but paramedics have met at the dock with an ambulance and they were included as evacuations.

## RESULTS

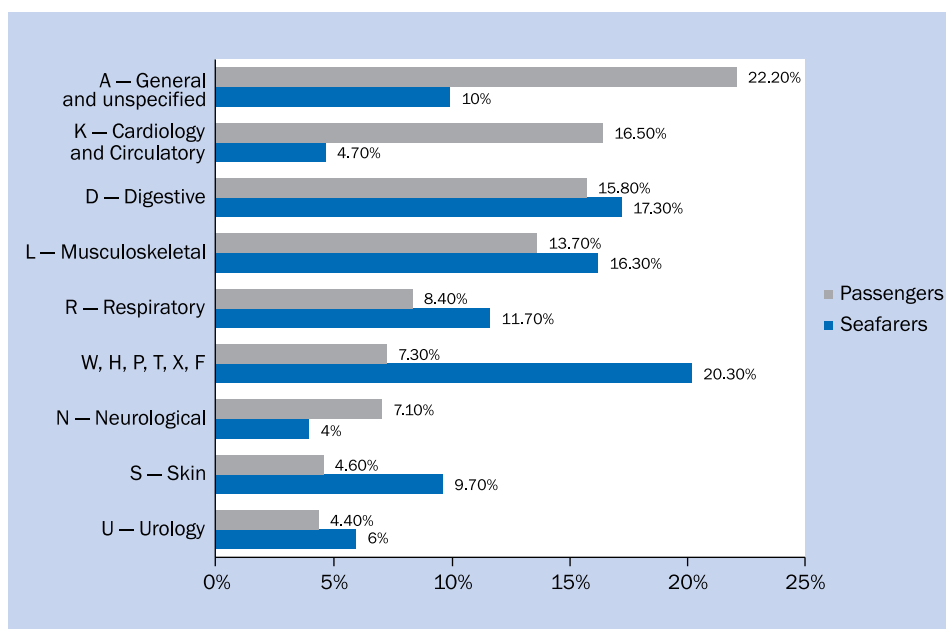
Figure 1 shows the main diagnostic groups among the 651 seafarers and 1095 passengers. The patients among the seafarers were mainly in Group D, symptoms from the gastrointestinal tract (17.3%), Group L, musculoskeletal problems (16.3%), and Group R, the respiratory system (11.7%), Group F, eyes (10%), Group S, skin (9.7%), and Group A, general and unspecified symptoms (10%). Percentage of infection-related cases that required treatment with antibiotics during 1997, 2002 and 2007 was about 35% and the tooth-related cases was 3% in 1997 and 2002 but increased to 7% in 2007. In 1997 and 1999, there were 3 and 2 deaths respectively among the seafarers (these are included in Group A, general).

For passengers the most common contact causes are in the following diagnostic groups: A: general and non-specific symptoms (22.2%), K: symptoms of cardiovascular system (16.5%), D: symptoms from the gastrointestinal tract (15.8%) and Group L, musculoskeletal symptoms (13.7%). It has not been able to see any gender difference in the number of cases or over time.

Table 1 shows the specific subgroups of symptoms for the passengers. The most important symptoms among the passengers were: allergy, stomach pain, pain related to the heart, sprains or dislocations of the legs, fractures, commotio cerebri, alcohol/drug related symptoms, asthma, shortness of breath, insect pricks, contusion of the skin, cystitis and kidney stones. Seven deaths occurred, of which the cardiopulmonary resuscitation started on three occasions prior to contact with the RM-physician established. On one occasion a lifeless person was found in a cabin. In one case the passenger initially complained of "pain in the heart". One death was probably due to a stroke and a blow to the head during a fall after the stroke. The percentage of evacuations were 39.5%, including the 59 patients picked up by an ambulance on the kay.

## ACCIDENTS

The proportions of accidents were on average 20% for seafarers and 25% for passengers. The distribution of accidents over the years in the diagnostic groups is shown in Figure 2. For the seafarers the proportions of accidents



**Figure 1.** Distribution of the International Classification for Primary Care (ICPC-2) diagnostics for contacts to with the Swedish Radio Medical for 651 ferry passengers 2007–2012 and 1095 seafarers 1997, 2002 and 2007 (mean percentages for the years); W – Pregnancy; H – Ears; P – Psychological; T – Endocrine/metabolic/nutritional; X – Female gen; F – Eyes. For seafarers: F Eyes and H Ears are 10.0% and 4.7% for seafarers and both are 0% for passengers

were highest for Group F – the eyes (52%), Group L – musculoskeletal (40%) and Group S – skin and Group N – neurological were equal (38%) and Group A – general and specific 20% accidents in the years.

For the passengers the highest proportions of accidents were mainly in Group S – skin (77%), Group L – musculoskeletal (75%), Group N – neurological (42%), Group A – general and unspecified (16%), Group D – digestive (6%).

## MEASURES AND EVACUATIONS

Approximately 70% of seafarers patients were fully treated on board, 15% evacuated, 6% recommended a doctor ashore and the remaining 10% were treated on board but recommended follow up on shore (Table 2). The group “medicine given, other treatment, surveillance” means medical prescriptions, advice about wound-bandage, diet regulation etc., checks of heart rate, blood pressure, temperature and/or continuous monitoring of the patient.

While the actions and treatments do not differ between the studied years, the evacuations decreased to 18%, 16% and 14%, respectively for the years 1997, 2002 and 2007. The evacuations included cases where the patient stayed on board until the next port with paramedics waiting at the dock with an ambulance.

For the passengers, approximately 40% of all patients were fully treated on board, 39% evacuated, 18% recommended a doctor ashore and for 9% absence of reliable data. Evacuations are distributed in all the diagnostic

groups: K – cardiology (58%), N – neurological (44%), U – urology (27%), A – general (26%), M – musculoskeletal (25%), D – digestive (21%) and lacerations in the S – skin (16%) (Table 1).

The types of evacuation, either by helicopter or vessel are shown in Table 3. Nearly half of the evacuations among the passengers were by helicopter and 27% remained on board until the next port to be picked up by an ambulance with paramedics. Like for the seafarers one cannot deduce any trends of change in the period.

## CONSULTATIONS WITH OTHER SPECIALISTS

For patients among the seafarers, the number of consultations with other specialists did not change over the years but the distribution between the different specialties differ over the years. For example, infectious disease specialists were consulted nine times in 2007 but only one time in 1997 and 2002.

For the passengers the consultations with other specialists occurs in about 11% of cases. Surgery and orthopaedics are the most common specialties. One cannot deduce any definite trends to change in the period.

## COMMUNICATION

The use of Telex was gradually faded out and was not in use at all in 2007. The use of VHF, radio communications and fax machines have been greatly reduced while the use of e-mail and satellite phone has increased. The practice of

**Table 1.** International Classification for Primary Care (ICPC-2) diagnoses and evacuations for ferry passenger patients to the Swedish Radio Medical 2007–2012 (n = 651)

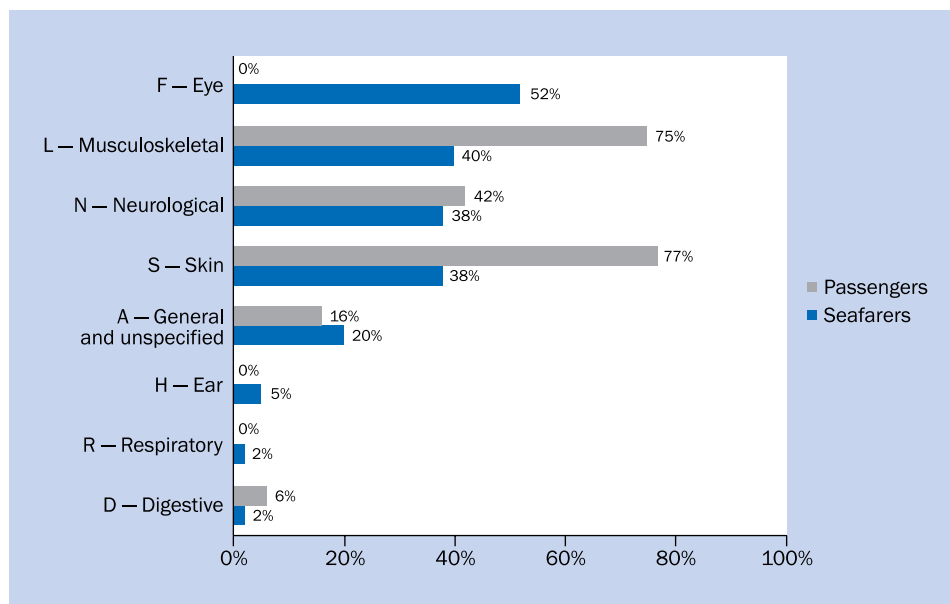
ICPC-2 Diagnostics	Most frequent symptoms/diagnoses	Contacts		Evacuations		
		n	(a)	n	(b)	(c)
A – General (n = 150)	Allergy	32	21%	2	6%	
	Fainting	20	13%	7	35%	
	Unconscious	20	13%	20	100%	26%
	Pain in the chest	20	13%	8	40%	
	Death	7	5%	2	29%	
D – Digestive (n = 107)	Stomach pain	36	34%	18	50%	
	Epigastric pain	8	7%	0	0%	21%
	Nausea	14	13%	3	21%	
	Gallbladder/stone	7	7%	2	29%	
K – Cardiology (n = 112)	Pain related to the heart	35	31%	27	77%	
	Cordial infarct	9	8%	9	100%	
	Atrial flutter	13	12%	7	54%	58%
	Stroke	16	14%	13	81%	
	Pression/feeling uncomfortable	11	10%	9	82%	
L – Musculoskeletal (n = 93)	Sprains/dislocations	13	14%	8	62%	
	Fractures, tibia/fibula/femur	11	12%	9	82%	
	Fractures, radius/ulna	13	14%	4	31%	25%
	Fractures, other	7	8%	0	0%	
	Pain unspecified	5	5%	2	40%	
N – Neurological (n = 48)	Commotio cerebral obs.pro.	19	40%	13	68%	
	Convulsions	10	21%	7	70%	44%
	Epilepsy	3	6%	1	33%	
R – Respiratory (n = 57)	Asthma	15	26%	1	5%	
	Shortness of breath	17	30%	5	29%	11%
	Nose bleeding	7	12%	0	0%	
S – Skin (n = 31)	Insect bite/prick	7	23%	1	14%	
	Laceration	5	16%	4	80%	16%
	Contusion	7	23%	0	0%	
U – Urology (n = 30)	Cystitis	10	33%	3	30%	27%
	Renal stone	10	33%	5	50%	
H, P, T, X, F, W (d) (n = 49)	Fear/depression	7	14%	1	14%	
	Alcohol/drugs	9	18%	4	44%	16%
	Diabetes	8	16%	1	12%	
	Bleeding in pregnancy	3	6%	2	67%	
% evacuations among all patients (257/651)						39%

(a) The subgroups are divided by the total in the main group, example. Allergy = 32/150 = 21%

(b) The subgroup evacuations are divided by the subgroup numbers, example: Allergy evacuations = 2/32 = 6%

(c) The sum of evacuations divided by the sum contact patients in the main group, example. Group A: 39/150 = 26%

(d) H = Ears, P = Psychological, T = Endocrine/metabolic/nutritional, X = Female gen, F = Eye, W = Pregnancy



**Figure 2.** The accidents parts of all contacts in each of the International Classification for Primary Care (ICPC-2) diagnostic groups for passenger and seafarer patients over all the years. The accident percentages for seafarers and passengers were zero for the other diagnostic groups: B – Blood, blood forming organs, lymph, spleen; K – Cardiology and circulatory; P – Psychological; T – Endocrine/metabolic/nutrition; U – Urology; W – Pregnancy; X – Female gen

**Table 2.** Advice and measures for seafarers and passengers contacts to the Swedish Radio Medical 1997–2012\*

	Seafarers			Passengers
	1997	2002	2007	2007–2012
Advice given only	10%	13%	10%	0%
Medicine given, other treatment, surveillance	69%	71%	66%	40%
Evacuation	18%	16%	14%	39%
Recommended contact medical clinic next harbour	6%	6%	6%	18%
Start treatment and medical clinic next harbour	13%	9%	15%	0%
Other advice i.e. dentist next harbour	2%	2%	5%	3%

\*Percentages are based on the total number of contacts to Radio Medical.

**Table 3.** Methods of evacuations for seafarer and passenger contacts in the study period 1997–2012

Type of evacuations	Seafarers								Passengers	
	1997		2002		2007		Total		2007–2012	
	%	n	%	n	%	n	%	n	%	n
Helicopter	30%	23	27%	15	34%	21	30%	59	49%	126
Other vessel	18%	14	16%	9	18%	11	17%	34	9%	24
Deviation	10%	8	7%	4	10%	6	9%	18	0%	0
No information	30%	23	30%	17	23%	14	28%	54	15%	37
Ambulance at the quay	12%	9	20%	11	16%	10	15%	30	27%	70
Total	100%	77	100%	56	100%	62	100%	195	100%	257

sending digital photos via email started after 2002 and was used in 11% of the 407 cases involving seafarers during 2007 and an increasing use of e-mail has been observed since then. For the seafarer patients, nearly 90% of the contacts are established with a telephone contact, about 10% is both email and telephone and 10% is only by e-mail. In some cases several contacts for the same patient have been used. For the 651 passenger patient contacts, e-mail was only used 4 times and then with digital images on a wound or rash as an attachment.

## DISCUSSION

The study included contacts to the TMAS for 1095 seafarers from merchant ships and 651 passenger patients from Swedish ferries. One of the strengths of the study is that all contacts are registered in a specific database, useful for detailed data analysis. Also the use of the international diagnostic classification gave a unique possibility to analyse the data in detail and compare the data for seafarers and passengers. In order to present the data more clearly in Table 1 only the main categories of the contact diagnoses are included. However, the omitted contacts are probably mainly minor problems and questions about medications and we suppose this will not bias the overall diagnostic distribution. For comparison only a few similar studies of the TMAS and/or RM were found. Data from the journals for 1 year from RM Denmark consultations with the medical officers on passenger ferries were analysed [2]. A high number of potential and life-threatening medical conditions such as angina pectoris were seen among the passengers, and nine of these patients were evacuated by helicopter. The paramedical assistance and the medicine chest contents were considered insufficient in several cases. A French study about cardiovascular diseases among seafarers on and electrocardiogram (ECG) teletransmission aboard ships found that calls regarding cardiovascular disease are infrequent but require an effective response [3]. Recording and transmitting an ECG to the TMAS is technically feasible and enables treatment to be started with specific drugs, mainly in the management of ST-segment elevation in myocardial infarction.

Deaths on board ships assisted by the Italian Centro Internazionale Radio Medico over 25 years [4]. The causes of 383 deaths on board in the 25 years (1986–2010) were reviewed. Cardiovascular and external causes such as accidents and violence, infectious and parasitic diseases, alcohol and drug addiction and respiratory diseases were the principal causes of deaths among seafarers. A Scottish study analysed 186 calls to the RM advice to fishing vessels for 12-month period from August 2005 [5]. During the study period 53% of the calls were trauma-related, while 47% were medical emergencies. Overall, 85% of calls from fishing vessels resulted in evacuation as the outcome.

In a Norwegian study of the maritime telemedicine and its potential for improvement [6] 24 people representing 13 different shipping companies and maritime public authorities were interviewed. The morbidity pattern reported differed between the groups very similar to our study: on cruise liners and ferries the major problems were due to coronary heart disease, while on merchant ships, navy vessels and in the fishing fleet the major problems were accidents. The different pattern of morbidity on person ferries and merchant ships is also in accordance with the findings of other investigators. Dahl [7] observed skin disorders and respiratory problems dominating the work of a cruise doctor. Whereas dermatological problems were common among the crew, passengers had a significantly higher frequency of cardiovascular diseases. These differences call for different technical equipment on board and on shore.

The proportion of accidents was 20% for seafarers and 25% for passengers and differed much in the different diagnostic groups (Fig. 2). While about half of the eye problems were due to accidents for seafarers it was zero for passengers. A United States study among seafarer patients found 30% cases due to accidents [8].

The proportion of evacuations was more than twice as frequent for passengers than for seafarers (39% vs. 14%). The difference is probably because the seafarers is a selected “healthy population” that must undergo a fitness examination prior to starting work on board a ship, and at regular intervals thereafter. It would therefore be reasonable to expect the seafarers to remain in good health whilst on board unless an incidental illness should occur, or they are injured. The higher proportion of evacuations among the passengers could also be explained by the older age structure of the passengers with no regular health examination and no selection out if they have chronic diseases like diabetes or cardiovascular diseases. In comparison only 5.7% of the passenger patients and none among the crew were evacuated in a Danish study for RM contacts to on Danish long-distance ferries (7 routes) [2]. The difference of the proportions of evacuations should be further investigated to evaluate the effect of the health outcomes.

While the proportions of evacuations for passengers kept the same level on 39.5% during the observed years, there is a reduced proportion of evacuations with 18%, 16% and 14%, respectively for the seafarers. The reason could be due to better pre-hospital training of the officers, better communication and better technical equipment on board the merchant ships. In any case it is relevant to study the causes and the circumstances for the evacuations in order to lower the proportion of evacuations. When we include the 70 patients that were picked up at the quay by ambulance, then the total evacuations will be 39.5%. This part of the patients is normally not included as evacuations, but they

are even as important when we want to estimate the total burden of diseased or injured passengers.

Today's available technology has revolutionised and simplified the possibility of good communication regardless of position and the biggest changes have occurred in the way of communication. The use of digital photos by e-mail has been used from about 2002 but not yet been included as routine in gathering information prior to contact with the RM doctors in 2007.

## CONCLUSIONS

The main change over the years was in the communication methods between the ship and the TMAS which is now mainly by satellite- and mobile telephone and e-mail. The most common diagnostics for passengers were in Group A of general and non-specific symptoms, Group K – cardiovascular problems, Group D – symptoms from the gastrointestinal tract and Group L – musculoskeletal problems. For seafarers the contacts were mainly in Group L, musculoskeletal problems, Group D, symptoms from the gastrointestinal tract, and Group R, the respiratory system, Group F, eyes and Group S, skin and many are due to accidents. The evacuations decreased from 18% to 14% for the crew while it was unchanged 39.5% for the passengers.

## RECOMMENDATIONS

The use of standard forms for documentation of RM cases can facilitate knowledge exchange and further studies. An increased use of digital images will probably improve

the accuracy of diagnosis, providing additional safety for the patient and one can expect an increased use in the future. There is a gap of research in TMAS especially on how to reduce the number of evacuations. In general there is a need for detailed data recording systems, possibly in an international collaboration. The databases should be used for research to elucidate risk factors for illness and injury, to inform preventive measures and to reduce seafarers' disability.

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