COMPARATIVE ANALYSIS OF MEDICAL ASSISTANCE TO SEAFARERS IN THE WORLD AND THE REPUBLIC OF CROATIA

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ABSTRACT

Maritime affiliation is considered as a dangerous occupation. Sailing ships increases the chance of serious injury or loss of health. Medical assistance on board is available by doctors only on large passenger ships (transatlantic and cruise ships) and with the exception of special purpose ships (research, off-shore vessels designed for divers). On other merchant ships medical job is partially performed by the officer in charge of medical care on board. If the provision of medical care involves more complex procedures or if there is doubt as to proper treatment, the vessel may request radio advice – *Radiomedico*. The same is available in all parts of the world, direct radio-telephone contact with a doctor from the hospital. In Croatian territorial waters requests for medical advice can be sent via coastal radio stations. Geomorphology of the Adriatic Sea provides for a quick air intervention and transport of seafarer to the nearest hospital on the mainland. In this paper the authors analyse the system of medical assistance at sea and contribute to improving the same through the reorganisation of the existing system. Introducing more efficient medical assistance is of crucial importance in the summer months when the Croatian Adriatic Sea is overcrowded with boats for nautical tourism.

Keywords: safety, Radiomedico, first aid, medical care

1 INTRODUCTION

Maritime professions are considered dangerous. Sailing on board ships increases the chance of physical injury and loss of health. Seafarers have a one in 11 chance of being injured on their tour of duty – much higher than other occupations. This can be due to:

- Exposure to physical and psychological strain
- Spending periods of time in countries with low quality healthcare
- Exposure to epidemic diseases, dangers posed by ship and port environments
- Contact with individuals of questionable health conditions
- Exposure to sudden climate changes
- Exposure to devices with sudden electromagnetic, vibration and sound radiation
- Delays in medical assistance, etc.

Throughout the history, ships of various European navies often boarded physicians as crew members. However, physicians were rarely found on board merchant navy ships and this trend still persists. Today medical doctors form part of the crew only on large passenger ships (transatlantic and cruise ships).

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) requires that all maritime officers get a certificate in *First Aid* and, according to the same Convention; officer must obtain a certificate in *Medical Care on Board Ships*. The company designates the officer in charge of the ship's pharmacy and healthcare of

the crew on board in line with its company policy. In practice, the level of knowledge acquired through seafarer training (Table 1) is often inadequate for any more complicated interventions or first aid treatment.

Table 1: Medical training for seafarers

Certificate of Qualification	STCW number	Hours
Qualified to provide medical care on board ship	D20 - STCW VI/4	45
Certificate on qualification to provide medical first aid	D19 - STCW VI/4	21

Therefore, medicine-related tasks on board usually involve only the issuing of medication from the ship pharmacy, first aid for lighter injuries, escort to a GP surgery on the mainland during stay in ports, and taking care of ship pharmacy and ship hospital inventory.

If provision of medical aid at sea would mean more complex interventions or in case of doubts as to the treatment applied on board, the vessel can ask for medical assistance via *Radiomedico*. This service is available world-wide by direct radio-telephone contact with a hospital doctor. The service is provided by more than 300 coastal radio stations around the globe (Table 2).

Table 2: Organisation of the RADIOMEDICO service in the world per year

Year of establishment of main radio medical centres in the world	Country	Centre	Location
1922	Sweden	Swedish International Radio Medical Centre	Göteborg
1928	Japan	Seamen Relief Association	
1930	The Netherlands	Radio Medical Service of the Koninklijke Nederlandse Redding Maatschaschappij (KNRM)	Formerly Scheveningen, Now Ijmuiden
1931	Germany	Medico-Cuxhaven	Cuxhaven
1935	Italy	Centro Internazionale Radio Medico (CIRM)	Rome
1938	Ex Yugoslavia		
1964	Spain	Centro Radio Médico Español	Madrid
1983	France	Centre de Consultations Medicales Maritimes (CCMM)	Toulouse
1985	Greece		Athens
1992	Denmark		

Source: Francesco Amenta; Telemedical Assistance Systems: History and Evolution of Rules

Modern satellite communication (INMARSAT - *International Maritime Satellite Organization*) has made this service available from 70 °N to 70°S latitude. Medical advice is provided for free and it is organized and coordinated in accordance with international conventions. Officers must be trained for emergency interventions such as cardiopulmonary resuscitation (CPR) and must know how to ask for physician's advice via *Radiomedico.*

Seeking medical advice by radio (*Radiomedico*) is the logical choice of any officer in charge of medical care on board ship in cases when the diagnosis is ambiguous or when the general condition of the patient/injured is such that the level of medical aid on board would be inadequate considering the needs of the patient. However, to perform as instructed by the doctor an officer needs to be able to perform some basic steps which he should have been trained to do at the above course.

2 CONDITIONS OF USE

It is often believed among seafarers that radio medical advice and medical training for seafarers cannot meet the patient's needs when it comes to more complex treatments or interventions.

Medical advice provided over telecommunication devices can be of questionable quality if there are no medical records to consult or no eye contact with the patient. For a quality piece of advice, an estimate of the patient's general condition needs to be given by a physician who is experienced enough in diagnostics. In the case of *Radiomedico* advice, the doctor establishes a diagnosis based on information provided by the officer in charge.

Such a diagnosis can be questionable due to:

- Insufficient doctor-officer communication
- Lack of patient physical inspection by the doctor
- Insufficient patient-doctor communication
- Symptoms go unnoticed due to officer inexperience/insufficient knowledge
- Bad telecommunication connection quality.

Insufficient communication between the mainland doctor and the officer seeking medical advice can be due to:

- The language barrier
- Insufficient doctor experience
- Insufficient officer experience in transmitting important information.

English is the official language in maritime affairs. The STCW prescribes knowledge of English for use on board ships. However, the use of English varies from ship to ship since the speaker's mother tongue and accent can interfere and cause serious misunderstandings of particular words.

Lack of doctor experience is an important factor in diagnostics and counselling. The management of the authorised care institution on the mainland should have an experienced doctor available for *Radiomedico* service provision. Doctors should preferably be experienced in treatments on board ships; physicians who have sailing experience know best what level of knowledge and experience officers in charge of medical care on board ships have, as well as the conditions in which treatment on board ships is provided.

Most officers have no experience in providing treatment. Experience is also lacking when it comes to establishing a diagnosis. Officer medical knowledge is based on the hours of Medicine for Seafarers attended in maritime secondary schools, colleges and in courses providing first aid and medical care on board training for certificates. A digitalized image transmitted from a device on board helps with and affects diagnostics and treatment (Figure 1). Devices of this type, however, are not mandatory for all ships.

Similar clinical pictures of different diseases (so-called differential diagnosis) and limitations of radio-medical systems lead to wrong diagnoses and unnecessary evacuations of sick seafarers. To perform such evacuations, ships often have to turn to the closest port and bear the expenses arising therefrom.

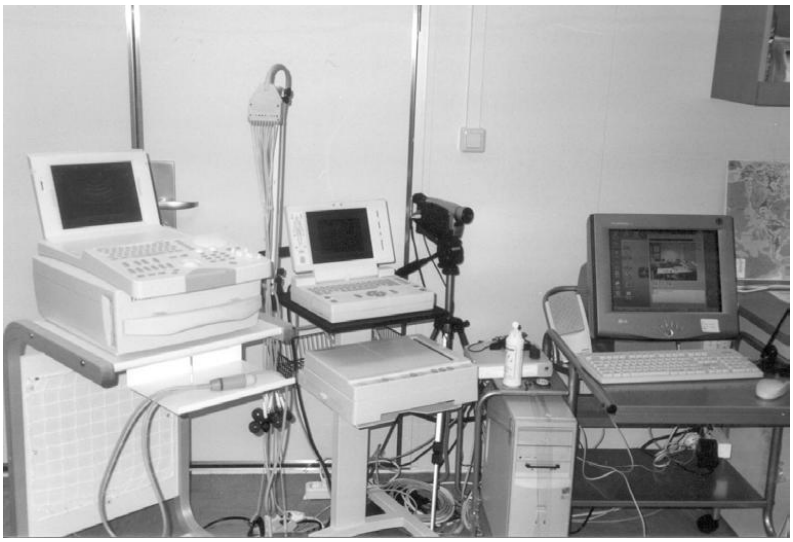

Figure 1: Workstation for telemedicine on board ships
Source: A. Barbagelata, F. Bagnoli, A. Gemelli, Telemedicine by Satellite. Experiences on Cruise Ships in the Mediterranean Sea, The Medical Journal of the International Radio Medical Centre, Proceedings of C.I.R.M./I.M.H.A. Workshop on Telemedicine for Improving Medical Assistance for Seafarers, Rome, Italy, 2002

3 SERVICE USE IN CROATIA AND THE WORLD

Research conducted in Cuxhaven (Germany) city hospital on the provision of radio-medical advice for ships at sea shows that most crew members start giving treatment before calling *Radiomedico*. In 71.8% (544) of cases, the mainland physician did not want to take responsibility for further actions on the ship, undertaken before it reaches the next port of call. In 5.4% of cases (41 patients) the physician did not establish a diagnosis. In the remaining 717 patients, the officer in charge determined a diagnosis in 429 (59.8%) cases which the physician confirmed in 346 (80%) cases. Therapy on board was recommended in 51.2% of cases and in 18.7% of cases the ship was redirected to the nearest port. At the destination port, treatment was given in 20.6% of cases and emergency evacuation took place in 9.7% of all cases. Taking into account ship redirection and evacuation, it can be concluded that the ship owner was exposed to ship redirection expenses in 214 or 28.4% cases. On top of these are the costs to which they were exposed due to delayed arrival to destination. The majority of all calls were due to injuries and stomach pain. Data indicating the accuracy of diagnoses provided through radio-medical assistance are not available since the treatment of seafarers from the moment they arrived to hospital until they were released from hospital was not recorded.

Research conducted on Croatian registries of *Radiomedico* protocols at the University Hospital Centre in Rijeka (KBC Rijeka) show a very limited scope of the *Radiomedico* service, comparable to that of layman assistance.

A Japanese study into *Radiomedico* advice on ships indicated that in 10% of requests for assistance it was suggested to immediately turn to the next port of call. Reasons for which urgent hospital care was advised were presumed cerebral haemorrhage, acute appendicitis, stomach or duodenal ulcer with bleeding or perforation, bone fractures, different contagious diseases related to physical weakness, open wounds or acute heart attacks. These illnesses occurred in more than 60% of all cases. Main causes of death were cerebral haemorrhage, falls due to accidents, acute heart attacks and stomach or duodenal ulcers, which accounted for 70% of all deaths.

Research conducted in Great Britain show the same pattern. Their study was conducted in the period between 1976 and 1995 and involved 600 deaths on board ships, 427 (71%) of which were due to cardiovascular diseases. At the moment of death, 63% of those who died of cardiovascular disease were not at their workplace but in leisure or relaxation places. Some 40% were found dead in their cabins. Literature provides unambiguous evidence that despite the "healthy worker" image, seafarers are at higher risk of cardiovascular disease while at sea. Their death rate is characterised by the fact that they die while in their cabins, and due to inadequate medical resources on board ships and logistic issues in transportation to hospital. Over 40% of all deaths occur while the ship is ashore, which indicates significant delays in recognising emergency situations as well as delays in taking certain actions – be these alerting and contacting mainland services or actions that should be taken on board ships. Therefore, it is quite irrelevant whether ships are in a "small coastal" or unlimited (ocean) trade since in both cases the time for intervention is tight. This statement is also supported by data from the above study, according to which there was no statistically significant difference ($p<0.05$) in the distribution of deaths due to cardiovascular diseases between coastal (44%) and ocean navigation (56%). The difference was statistically significant in deaths due to gastrointestinal tract diseases (25% to 75%), which is expected since the "time-window for intervention" in these diseases is much larger and therefore there is time for intervention or evacuation.

On the territory of the Republic of Croatia, the request for medical advice can be sent via coastal radio stations. In case of emergencies, the message must contain the RADIOMEDICAL signal and the intermediary to which the request is being sent (e.g. RADIOMEDICAL SPLITRADIO). The message should contain a short description of the accident or the symptom. It can be written in open text or coded according to the International Code of Signals (ICS) in the medical part, and must be signed by the shipmaster. Such messages are free of charge.

The International Radio-Medical Centre in Rome (CIRM) organises radio medical assistance for vessels at sea. This includes medical advice and transport of sick and injured persons to hospital. Any seafarer at sea can use such assistance, regardless of their nationality or flag under which they are sailing. Calls for assistance are sent via CIRM code describing the type of assistance required, diagnosis and general patient condition, etc.

Patient transportation services are provided by the ship seeking assistance, which will have to turn from its route. The vessel seeking medical assistance will be sent helicopters or vessels of the Croatian Coastal Guard, depending on the distance, urgency and weather conditions. In case of unfavourable weather conditions for helicopters or boats of the Croatian Coastal Guard, one of the tugboats of the *Brodospas* company can be used (Figure 2).

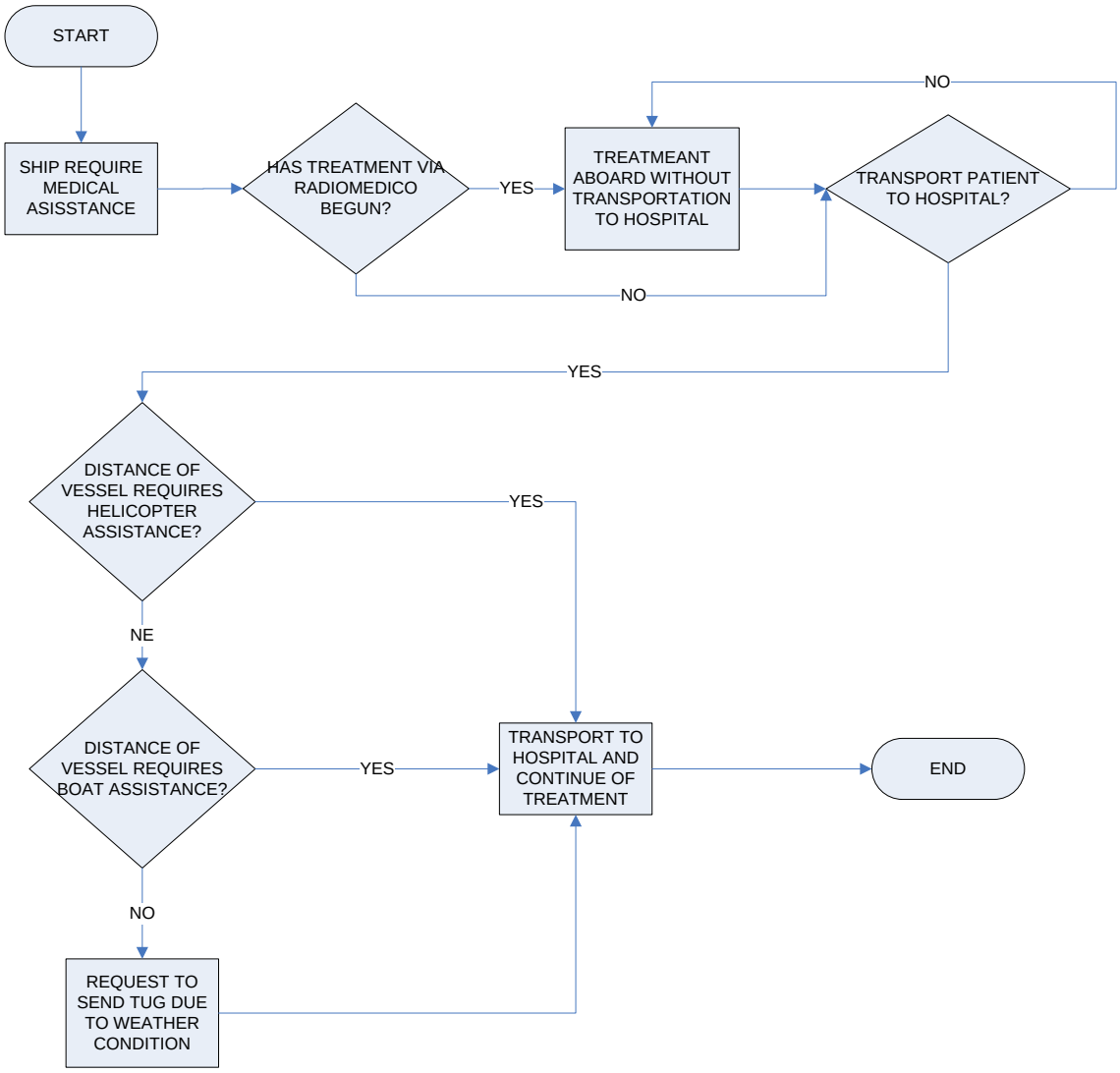

Figure 2: Decision making process for patient treatment on board ship

Recent technological developments enabling image transfers between remote locations facilitate avoidance of the above described issues currently encountered in the Radiomedical system. To facilitate overcoming such problems and improve the standards and availability of healthcare at sea, the European Commission has financed the *Network of integrated vertical medical services* – NIVEMES project through its *Telematics Applications* health programme. This project developed the technology to connect ships and remote communities with medical expertise centres which had previously been unavailable to them. The chances of proper patient treatment can be drastically improved by the in time medical data – such as ECG, blood pressure datas and patient digital images (in emergencies or routine check-ups) – are transferred. This form of remote diagnostics between remote areas is called *TelePresence*.

In all research studies looking into seafarer death rates, there are a large proportion of those whose death was caused by a disease; however, deaths due to cardiovascular and cerebrovascular diseases make the largest group by far. Such studies also deal with accidents on ships and without exception show that the circumstances under which accidents and acute conditions take place limit the chances for successful rescue. For emergency medical services (EMS) on the mainland, the "golden standard" is 15 minutes following the call (incident), which is the time within which the EMS team should reach the patient with all necessary equipment. This standard is not randomly chosen; it was determined through precise and

comprehensive analyses conducted by experts for emergency medicine. It stands true for most western countries, including Croatia.

In emergency situations, the following three elements need to be taken into account:

- Time
- Training of people providing assistance and
- Equipment used.

Even in cases when the problem is noticed on time, crew medical training is not such that they could recognize the severity of the condition; even if the right decision is taken, there is a time delay in alerting services on the mainland and evacuation i.e. arrival of assistance from the mainland (Figure 3).

Figure 3: Evacuation of injured from ship
Source: Bas Rikken Telemedical advice at sea. Do we need more gadgets?

Another problem lies in the character of the disease. It has been undisputedly proven that even optimally performed cardiopulmonary resuscitation has no effect on the final result of resuscitation if there is no access to early defibrillation and early advanced life support. If it were supposed that the crew were also trained in resuscitation, that they were alerted on time, and even that there is a physician on board the ship, if defibrillation and advanced life support with all required equipment and medicine are not applied immediately, the chances of survival are minimal. The "smaller" distance factor in "small coastal navigation" only blurs the problem – if one were to calculate the amount of time needed for a ship to reach a port where an ER vehicle is awaiting or suppose how long it would take a team to get there by helicopter, one would see that it would be technically impossible within 15 minutes' time. Such analyses have been made for the Adriatic Sea and indicate that time in some zones is measured in hours. Even if helicopter teams with all necessary equipment were on stand-by, it would take them more than 15 minutes to intervene. For this reason, the fact that navigation along the Adriatic is closer to the mainland has no impact on the outcome of such incidents

aboard ships and it does not change the fact that a large number of deaths on board are the direct consequence of the lack of availability of medical resources.

Seafarers on board ships in "small coastal navigation" have minimal chances of surviving such an incident.

4 CONCLUSION

Urgent and life-threatening situations on board ships with no physicians still remain a problem. Prescribed training for all seafarers and crew members represents an attempt to train seafarers to adequately provide first aid which would prevent cerebral death in seafarers (in cases of cardiac arrest) and enable successful continuation of resuscitation once the health workers arrived. One of the possible solutions in case of acute cardiac arrest is use of "smart" mobile defibrillators that "recognize" whether the heart is pumping and defibrillate in case of arrest. In other situations, especially those when ships are sailing far away from harbours, the outcome depends on the skills of officers in charge and possibilities of applying medical advice obtained via telecommunication devices.

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