VIA MEDICA

REVIEW ARTICLE

Int Marit Health
2009; 60, 1–2: 36–39
www.intmarhealth.pl

ISSN 1641–9251

Maritime telemedicine — where to go and what to do

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INTRODUCTION

Telemedicine in a maritime environment differs from telemedicine onshore in several aspects. This fact necessitates the need for an independent development of maritime telemedicine. Some of the aspects of such development are discussed in this article, dealing with the basis, the need, the possibilities, and the principles for a suitable Telemedical Maritime Assistance Service (TMAS).

SHIPPING KEY FACTS

The sea covers 361 million square kilometres of the world's surface. Fifty thousand merchant ships are engaged in international trade, transporting every kind of cargo. One hundred and fifty shipping nations are involved, and over one million seafarers of virtually every nationality are employed in the industry [1].

LIMITATIONS FOR MEDICAL CARE ON BOARD

Huge distances and long periods of time out of reach of SAR helicopters and without possibilities for MEDEVAC characterize the working situation. When someone falls ill under these conditions, colleagues with little or no medical experience and a minimum of education and training [2] have to deal with illnesses or injuries for days and weeks. Professional medical assistance may be limited to radio medical advice from ashore. The equipment and medicines available on board are rather limited as compared to onshore facilities.

INTERNATIONAL FRAMEWORK FOR TMAS

The most important international regulating framework for TMAS is the ILO Convention (No. 164) concerning Health Protection and Medical Care for Seafarers of 1987, pursuing the Medical Advice at Sea Recommendation R 106 from 1958, and soon to be replaced by the Maritime Labour Convention 2006 (MLC). The Safety of Life at Sea Convention does not deal directly with TMAS, but says something about radio communications and the Global Maritime Distress and Safety System. The WHO has recommended a list of ship medicines, and the EU regulates some of the services in the EEC Directive 92/29. The qualifications of the seafarers are regulated in the STCW Convention. Handbooks in first aid and medical care are published from many nations, with the International Medical Guide for Ships (IMGS) as the most important one, published by the WHO.

The MLC sharpens the requirements as compared to the ILO Convention 164, in saying that the service shall be "as comparable as possible to that which is generally available to workers ashore" [3], exemplifying this by mentioning adequacy of protection of seafarers' health and medical care whilst working on board.

Telemedical Maritime Assistance Service shall be available at any hour of the day or night, free of charge, with an optimum use of facilities available. All ships shall carry a list of radio stations and coast earth stations through which medical advice can be obtained. All ships shall carry a medical guide, as well as the international code of signals. All doctors providing medical advice shall receive appropriate training and be aware of shipboard conditions.

EDUCATION AND TRAINING IN MEDICAL CARE ON BOARD

The beneficial outcome for a sick or injured seafarer on board depends on a series of conditions. It is not obvious which link in this chain should be pointed out as the weakest. It might be more fruitful to discuss where the biggest potential for improvement lies, and hence, where our efforts should be concentrated to improve the service. Table 1 shows some of the most important factors that determine the outcome of medical care on board. Some of them

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Table 1. The chain is no stronger than its weakest link

The SHIP	CREW	TMAS service	Trading area
Ship hospital	Fitness standards	Availability	Risks
Medicine chest	Education	Equipment	Distances
Communication equipment	Training-skills	Doctors	Medevac possibilities
	Experience	Experience	Harbours
			JRCCs

can be influenced more easily than others can. Education and training of seafarers is a field where improvements could be achieved. The IMGS and several other handbooks for seafarers are designed like textbooks and teaching aids more than practical manuals for the handling of situations (illnesses and injuries) on board.

CLASSIFICATION OF DISEASES

The International Classification of Diseases (ICD) in its current tenth version is a tool based on a patient's history, an examination by professionals, usually in a hospital, and laboratory findings. Often it is not possible to meet ICD-10 criteria in a maritime setting.

There are no professionals taking the history or examining the patient and usually there are no additional laboratory results.

The International Classification of Primary Care (ICPC) in its current second version is a tool based on the patient's history, and an examination by professionals in primary care, with few or no laboratory results. The ICPC-2 is designed to describe conditions that have certain aspects in common, without verifying the condition at the level of the ICD-10.

THE ACTUAL TMAS WORK

The reports from different TMASs throughout the world show the same pattern. Illness is more usual than injuries. Minor cases occur more often than major cases. Statistics are sparse, possibly due to small TMAS units with a poorly developed cooperation network. The pre-sea and periodic medical examination contributes to the selection of seafarers, and is a helpful tool to avoid individuals with a high risk of causing medical emergencies being employed on board.

TELEMEDICINE ON SHORE AND AT SEA

One of the most important differences between onshore and at-sea telemedicine is that the communication onshore takes place between health professionals, while at sea the communication is between lay seafarers and health professionals. Onshore there is a short delay until a sufficient level of medical assistance can be achieved, while this is not easily achieved at sea, where professional medical assistance may be delayed by days or even weeks.

The lack of sufficient bandwidth at sea makes data transfer difficult between ships and onshore facilities.

COMMERCIALISM VERSUS PROFESSIONALISM

The commercial urge to sell and to convince ship owners and masters about the feasibility of installing advanced equipment may sometimes result in non-beneficial effects. Study-designs, which include installation of equipment for testing purposes and asking the crew about the feeling of safety before and after the installation, may give false results and in some cases may be suspected of being camouflaged marketing.

The professional attitude is to base the development on the need to have and the need to help. This implies the distribution of useful equipment only, and the conduction of studies aimed at the evaluation of benefits and cost-benefits of new equipment. The result will be safety based on reality rather than feelings.

TWO CONTROVERSIAL EXAMPLES

ECG

ECG is an important tool in shore-based health care, mainly in hospitals, but also in primary health care. It is not difficult to convince lay people that such an instrument would increase the safety on board by improving processes of medical diagnosis and treatment. However, a normal ECG does not prove a normal heart in a patient with acute chest pain. In the early stages of myocardial infarction (MI), decisions must be based on the patient's history and the results of a clinical examination. In as many as 85–90 % of patients with suspected myocardial infarction, the absence of significant ST elevation on arrival in hospital necessitates cardiac marker measuring in blood samples during the first 24 hours to diagnose the condition [4]. In another study, the ECG taken on admission to the emergency room was shown to detect only 65% of patients with subsequently verified myocardial infarction [5]. It is demonstrated that

typical ECG-changes that show few false positive findings are true positive in fewer than 50% of patients on admittance to hospital, who later demonstrated to have MI [6, 7]. Other studies have shown that the ECG may be normal in as many as 80% of MI cases after four hours, and in as many as 50% after 24 hours.

Some ship-owners have equipped their ships with ECGs in order to rule out MI in seafarers with chest pain without abnormal ECGs, relying on medical advice from doctors who are not very experienced in primary care in remote areas or in a maritime setting, or doctors who are not very experienced in interpreting ECGs. The result can be that a person suffering from MI will be kept on board without treatment, without getting proper treatment on shore.

Thrombolysis is not yet an alternative at sea, and it is difficult to see how it could be used in the future without having access to medical professionals and an intensive care unit on board. It is also difficult to see how the existing requirements of a 12-lead diagnostic ECG could be satisfactorily met at sea.

The benefits of an ECG on board must be balanced to the difficulties in constructing ECG equipment which is technically suitable for sea conditions, the training of personnel to ensure correct ECG registrations, and the process of calibration and technical maintenance of the equipment.

REAL TIME MOTION PICTURES

The use of real time motion pictures in onshore telemedicine is well established as a useful tool. On the sea, the lack of sufficient bandwidth has thus far restricted the use of such technology.

Still pictures have been used for a long time, and are regarded as a valuable tool in injuries and dermatological conditions. There are some situations where real time motion pictures would probably add valuable information to the assessment of the situation, but the benefits have not been demonstrated in studies so far. It could be useful in guiding the seafarer in certain procedures, e.g. in the replacement of a joint dislocation.

DISCUSSION

The limitations in medical care on board are obvious. Experiences from medical care services onshore should not be transferred directly to the maritime environment without a thorough review.

The aims of the TMAS, as described in the MLC 2006, are rather challenging, and will probably be difficult to reach in the near future. This should encourage us to strive for a better service.

The weakest link in the chain is probably the seafarers' educational and training level in medical care. This could be improved, but will need an international consensus to ensure defined minimum requirements on a higher level. The STCW revision is such a process. Medical handbooks for seafarers must be designed more like manuals for the handling of situations on board, rather than textbooks suited for teaching purposes.

The small TMAS units and the sparse statistics from this field clearly demonstrate the need for the development of a stronger network and a closer cooperation between them.

The process of achieving common TMAS procedures must include a description of today's service and agreement on the wanted service. We need to develop standards and generic protocols. We also need to enhance the competence of the existing TMAS units and assist more nations to start up centres. We must share information and harmonize policies, activities, systems, education, and research as cornerstones of our collaboration.

Neither ICD-10 nor ICPC-2 is well suited for TMAS disease classification. None of them complies with a situation in which lay people can register the patient's history and carry out the practical medical examination, even if guided from a doctor onshore.

The development of a special diagnostic tool for the maritime setting might be better, but could compromise comparisons with other services, like hospitals and primary care.

It is of utmost importance that development in the TMAS field is driven by professionalism, not by commercialism. The "nice to have" principle and studies that are camouflaged marketing are not what we need.

CONCLUSIONS

The conditions for medical care are quite different at sea as compared to medical care onshore, and will be so in the future. This makes the transfer value of onshore experiences to the maritime environment low.

A cooperation network is important to harmonize and coordinate development of the TMAS services.

Cost benefit analysis should be carried out prior to installation of sophisticated equipment on board.

The weakest chain in medical service on board is the education and training level of seafarers in medical care. Suitable manuals have to be developed as supplements to the textbooks on the market.

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