

**DEVELOPING A MODEL OF AN INTERNATIONAL MEDICAL E-RECORD SYSTEM
WITH A FOCUS ON SEAFARERS**

Olaf Chresten Jensen¹, Despina Andrioti²

1. Occupational Health Doctor, Senior researcher, Centre of Maritime Health and Society, Institute of Public Health, School of Health Sciences, University of Southern Denmark. Niels Bohrsvej 9, 6700 Esbjerg, Denmark
2. Health Economist, Senior researcher, Centre of Maritime Health and Society, Institute of Public Health, School of Health Sciences, University of Southern Denmark. Niels Bohrsvej 9, 6700 Esbjerg, Denmark

ABSTRACT

The validity of work fitness certificates has long been discussed among the seafaring nations and the scientific community. Worldwide, each year more than 2 million seafarers and other seagoing personnel visit different doctors, for health examinations. Due to the working conditions the seafarers often have to use different clinics for their health examinations (HE). Furthermore, fit-for-work exams may take place anywhere across the globe. Their medical history is kept in the clinics without possibility to communicate the data due to lack of coherence among medical practices. E-health solutions in combination with mobile health equipments can help a lot to cost containment in the shipping sector and contribute to effectiveness and efficiency of health services by responding to clients/patients needs. The aim is to develop a framework for digitalized health care records with some specific requirements. Data should be useful for the seafarers' to follow their risk indicators in the biannual health examinations, for all clinics and on board. Further, data export facilities are needed for the personal diagnostic trend analysis of the risk indicators for the personal prevention and for epidemiological research and prevention in the seafaring population. Finally the personal data should be exportable to the seafarers' own Smartphone.

Keywords: Digitalized health care records, e Health, mobile health, m health, quality standards, prevention, epidemiological analyses

INTRODUCTION

Shipping is essential to the functioning of the global economy. Global economy highly depends on the international trade and the need to move goods from production to consumption sites. Raw materials and finished goods have been the main cargoes in international trade. In later decades, trade in intermediate goods for further processing has grown steeply and in parallel with

the so-called fragmentation of production processes. Fragmentation implies splitting the production process on several geographical locations so that each component is produced where the production costs are most favorable. Trade in these components constitutes an important part of sea borne trade and the world sea borne trade rises with economic growth (Oxford Economics 2017).

Maritime navigation represents a potentially dangerous occupation compared to several other ashore activities. Risky situations for the health of sea farer so passengers may occur during navigation. Merchant ships in general do not employ doctors or expert paramedic personnel on board and may be at sea for days or weeks before they can reach a port. Geographic distance separating sailors from access to health care and logistic or organizational problems potentially occurring during medical evacuation missions (MEDEVAC) may aggravate health risks of sea farers (Roberts et al. 2014)

Estimates amount the average total number of seafarers to about 1.5 million. All seafarers undergo health examinations every other year as a prerequisite for employment on board. In addition they can consult different doctors worldwide for issues of health concerns (Westlund et al. 2016). Furthermore, in case of illness on board the seafarer shall first contact the designated caretakers on board, who attend mandatory training courses and are able to provide medical first aid functions. These caretakers may seek medical assistance from the Tele Medical Services (TMAS), which operate in several states across the globe. The Maritime Labour Convention 2006 (MLC 2006) regulates health protection of sea farers ensuring their prompt access to medical care on board ship and ashore.

It is not unusual the seafarers due to the working and travelling conditions use different clinics for their health examinations (HE). Furthermore, fit-for-work exams may be taken place anywhere across the globe (Andriotti and Jensen 2017). Their medical history is kept in the clinics without possibility to communicate the data due to lack of coherence among medical practices. Most of the times, early onset of a disease is unknown to the next clinic, with a minimized possibility for early diagnosis and prevention (Baygi et al. 2016). Seafarers may also do "doctor shopping" in case of non-approval "fit-for-work" in one clinic. The size of the problem is unknown, but harmonization of practices across the globe is of paramount importance.

Furthermore, in Europe, the policy on patient-centred care is in place for some years now. It requires a different approach in doctor-patient relation and build upon the principle that the patients are equipped to make informed decisions about their health. Despite the existence of an integrated health communication system in Europe for the shore based populations, the health services provided to sea farers are still fragmented with lack in continuity of care. Effective care

should be organized in an integrated way and this applies particularly to the sea going employees (Jensen et al.2010).

Sea farers are a population group hard to reach, far from hospitals and with a great range of health needs duet other specific working environment and long working hours. Health communication systems should give attention to the needs of marginalized groups. Research findings showed that the ir perceived health is very poor with limited access to health information. Online resources associated with maritime health are fragmented and with poor understand ability for a diverse audience with different educational background and cultures (Guitton 2015).Moreover, in a recent research by the International Transport Federation, seagoing employees pointed out the need for getting accurate and current information about health issues (Chowdhury et al. 2016). The global dimension of shipping calls for global approaches in the area of seafarers' health and wellbeing.

Nowadays high-speed internet-connection coupled with the growing development of ehealth and mobile health (mhealth) makes it easier and cost effective for monitoring citizens health, and especially remote population groups like seafarers.

Big data and cloud storage is a priority for European Union. The scientific community has been working together with the responsible stakeholders to resolve issues of privacy and security with regards to the health records (Ackerman 2013, Kher 2016).

Open source systems provide cost-effective and user-friendly alternatives for comprehensive continuity of care (Zaidan et al. 2015, Fordetal.2016). IT solutions such as the electronic cards (ehealth and mhealth) help to this direction.

Communications with in the maritime health system is fundamental. To help the system responsiveness there is a need for an integrated communication system that better respond to this population group specific need sand expectations. Maritime doctors play an important trolein health out comes of the sea going personnel. This includes communication with authorities and the respective maritime clinics across the globe, the follow- up practices of early diagnosis and prevention for chronic diseases(Blumenthal and Tavenner 2010).This could facilitate the issuance of fit-to work certificates. Medical doctors will have to complete and store seafarers' health records in the system for use by medical doctors in other countries (Kaelber and Pan 2008).Provision of good quality medical care requires knowledge of the basic health information and of the clinical history of apatient (Carter and Stannard 2014).

A digitalized health care records system for sea farers has so far been poorly developed, despite the need for optimizing health services offered and the continuity of care. Issues regarding the interoperability and sustainability of the digitalised system should be taken into consideration (Munoz et al. 2011, Barbarito et al 2012). Establishing a comprehensive integrated care for the seafarers, with personalized health information while keeping the privacy and confidentiality could be very efficient and cost-effective approach for other type of employment as well, such as mobile workers.

This study aims at create a framework for the exchange of digitalized health care records of seafarers for better clinical diagnosis, prognosis, prevention and research.

Methods

- a) A qualitative approach adopted for the study. A Delphi technic will be implemented to identify data demands for the digitalized health records. All relevant stakeholders will be invited to participate in the study including the International Maritime Health Association (IMHA), the European Community Ship owners' Association (ESCA), and the International Transport Workers Federation (ITF). The survey will take place electronically and the answers will be anonymised. Following the relevant Delphi methodology the team envisages 2 rounds of forecasts with one week time interval and expected duration one month in total. The facilitator after each round will analyze the results giving feedback to the participants. With the completion of the survey, the team in cooperation with the IMHA-research can assign health examinations to the demands as well as the variables to be included in the digitalized health records. This will include the demands for pre- employment examinations set by IMO/ILO guidelines and a minimum data set of indicators with regards to aspects of occupational health and wellbeing.

- b) Standards on health information, exposures at work, food, drinking, tobacco and living conditions will be developed by the International Maritime Health Association (IMHA-Research) based on international standards defined by the International Organisations including the International Labour Organization, the World Health Organization and the European Union. In addition these of the Occupational and Environmental Medical Associations will be taken into consideration.

- c) The team in cooperation with the University of Southern Denmark IT department will review existing open source systems so as to select the most suitable one to collect and store seafarers' health records. The team will take into consideration the relevant guidelines for personal data protection and use provided by the responsible authorities. Pilot testing of the system will follow to ensure the interoperability and sustainability. Pilot testing of the electronic system is planning to involve a small number of maritime doctors. The results of this will give the opportunity to make amendments and modifications to the system.

- d) The researchers envisage the creation of an electronic card for individual seafarers use containing their health records and their health examinations. The "card" which could have the form of a "credit card" is easy to transfer due to its small size. This card is based on seafarers' unique registration number. Their medical records are to be stored in this while at the same time a report to the maritime authority could be created and send with respective recommendations, fit for sailing or else with message to the seafarer.

- e) As further development the use of smart phones (mhealth) would be considered. The team in cooperation with IMHA will review and create health information, prevention practices and guidelines in relation to health and wellbeing according to their needs, taking into consideration issues of culture and background. Accurate information raises awareness and empowers seafarers to take care of their health.

More specifically the project is designed in 4 phases:

Phase1: Identification of the needs for stake holders

A literature review is designed to retrieve the relevant material on guidelines with regards to the range of pre-employment health examinations coupled with parameters on maritime occupational and environmental health. These will enrich the questions in the Delphi approach.

Phase 2: Development of software

Review and customise existing open source systems for selection and storage of seafarers' health records and their digitalization including health examinations for research and for use in the medical clinics.

Phase 3: Development of the needs for the data system

For the personal health, for work-place prevention and for research there is a need of a combination of several data functions: a) personal data available for the seafarers and their families, the ships captains etc., b) the complete clinical health records to be used in all medical clinics and hospitals including Magnetic Resonance Imaging (MRI), dental records and CTI scan c) work-related risk factors for seafarers personal protective advice and primary prevention in the workplace) export of personal data for trend analysis related to for example hypertension and obesity increase over the previous years e) export of data is also needed for monitoring and epidemiological research in the whole population and f) a safe personal identity number system to protect the privacy of the data g) Finally the personal data should be exportable to the seafarers' own smart phones.

Phase4: Pilot testing and evaluation

Implementation of the electronic system involves medical practices across the globe. Initially they may operate on a voluntary basis and in parallel with the existing storage system in these medical clinics.

Phase 5: Dissemination

The team is planning to communicate the results through publications in scientific journals, participation in international conferences, workshops, open days and symposia. Furthermore via communications with all the relevant stakeholders and publications in lay language in their newsletters

Discussion

Illness in a seafarer while at sea poses an increased risk for the individual as full medical care is absent. It also puts a strain on other crewmembers because of reduced manning and the need to care for the sick person. Illness at sea can cause both risks and operational problems if emergency evacuation is needed or the ship has to divert to the nearest port to land the ill person. Some infectious diseases and behavioural issues, such as impulsiveness or aggression can also pose a direct risk to other crewmembers.

Assessments to identify any health related impairments that can interfere with capability to perform duties and to consider whether there is an increased risk of any serious health problem developing or recurring while at sea and thus reducing the reliability of a seafarer have been part of maritime medical practice for over one hundred years (ILO/IMO 2013). Medical examination

and certification is part of both national and international maritime regulation as well as part of the employment practices. Decisions on fitness can be contentious, as the benefits of reducing risks by prohibiting someone from working at sea have to be balanced against the loss of that person's skills and their own loss of employment and income. The standards and their application is an area where agreement among different interest groups might be difficult.

A person who is considered unfit has the right to appeal and this may create delays and financial constraints. The implementation of a framework of digitalized health care records could provide continuous access and awareness to the parties involved in relation to seafarers' health and wellbeing, while it could empower seafarers to retain and/or improve their health and wellbeing (King et al. 2010). In order to keep confidentially in the new system a unique personal ID number will be assign to every participant based on the Danish system relevant experience. Many countries have such personal ID systems but in other, especially in the developing countries such systems are missing .Passport numbers are subject to change every 10years. According to a recent study all sea farers need to have a unique identity number (National Identification System 2005).

A global digitalized health system can be a great support for remote employees highlighting the active interest of all the responsible stakeholders including authorities and member states. Big data solutions are growing very fast making the collection and storage of health records highly efficient and cost-effective. In addition, the prevention of work place hazard scan be integrated in the shipping companies employment prevention policies.

It should be noted, however, the challenges with the communication systems in the ships. Satellite communication is not always available while sailing the high seas, thus making it difficult to access the Internet, maintain video conferences or inter change information in platform (Greenhalgh et al. 2010).

Of line the system working possibilities would be available as well as access via a different kind of devices such as computer, tablet and smartphones.

The realisation of the research will provide better information about seafarers' health and their work fitness to the maritime authorities. It will help global harmonization of work fitness practices, while doctors will be able to implement disease management and prevention with an obvious benefit for seafarers. The project can help physicians to better diagnose the start of hypertension, diabetes overweight and other acute and chronic diseases and seafarers to better comply with prescribed treatment. The early diagnosis is essential to start early prevention and

establish a specific monitoring and advice. The implementation of the project could be of assistance to the navigator helping him to decide whether calling the Telemedical Service or not. Furthermore the data could be used for research nationally and through international co-operation to provide better health services according to seafarers health needs. The seafarers' family doctors will also benefit from access to their health record. Researchers, under the rules of confidentiality, will be able to do studies by drawing out the data from the global seafarers' health records, helping the responsible parties to make informed policy decisions.

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Competing interest None

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