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JTL

Journal of Transportation and Logistics
7 (1) 2022

İSTANBUL UNIVERSITY PRESS

DOI: 10.26650/JTL.2022.1050330

RESEARCH ARTICLE

Determining Maritime Health Online Training Needs for Seafarers and Doctors in Maritime Transportation*

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ABSTRACT

After the liberalization of the air transportation sector in 2003, we investigate the factors affecting the preference of air transportation as a mode of transportation and the changes in the air transportation preferences of the Turkish households over the years. For this purpose, we analyze the micro datasets of the household budget surveys using logistic regression and decision tree methods. We find that the most critical factors affecting the air transportation preference of the households for the 2003-2017 period are the income level and the occupation of the household head. The fuel expenditures and the existence of transportation subsidies reduce the air transportation preference of the households. In addition, since 2003, there has been a significant increase in the rate of households preferring air transportation in Turkey. So much so that air transportation is the only mode of transportation that has risen over time. A remarkable finding is that air expenditure of the low-income group is not observed in the 2003 survey, whereas it was a small amount in 2017. The literature on transportation preferences is generally based on primary survey data. This study contributes to the literature as it is applied to a relatively large sample of household micro datasets.

Keywords: Air Transportation Expenditure, Household Preferences, Liberalization Effect

Submitted: 29.12.2021 • **Revision Requested:** 08.01.2022 • **Last Revision Received:** 19.01.2022 • **Accepted:** 08.02.2022

* This article is produced from the EU Erasmus + Project entitled "Maritime Health Trainings for Seafarers and Doctors (MariHEALTH)" (Project grant no: 2019-1-TR01-KA202-076813) and has received funding from the Turkish National Agency (EU) "KA202 - Strategic Partnerships for vocational education and training" program.

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Citation: Arici, S.S., Uflaz, E., Akyuz, E. & Arslan, O. (2022). Determining maritime health online training needs for seafarers and doctors in maritime transportations. *Journal of Transportation and Logistics, 7*(1), 157-167. https://doi.org/10.26650/JTL.2022.1050330

Introduction

Seafarers have more isolated living and working environments compared to people ashore. In case of any health problem, medical intervention has to be carried out on the vessel. This means that although seafarers are in a more dangerous atmosphere than people on land, health care for seafarers has quite different responsibilities and consequences, since their health care needs are not the same as other people's. (Idnani, 2013). The maritime environment includes many risk factors such as threats from chemical and biological materials, harsh weather conditions, physical challenges, a range of different critical operations, the fact that it is a place where accidents can easily happen, its being a stressful working environment, and unsatisfactory health conditions.

In addition, seafarers are at risk not just physically but also psychologically due to intense working hours, insomnia, and fatigue (Andrei et al., 2020). Distance from their homes and loved ones is often a significant contributor to distress. Roberts et al. (2013) underlined that the seafaring profession is among the occupations with the highest risk for suicide. This information shows that seafarers are exposed to various dangers and risks both at work and in their leisure time. The risky nature of the maritime industry can become even more critical as a result of limited medical facilities and inadequate response.

Although an officer is in charge of medical treatment on merchant ships, their skill in providing treatment is not the same as a doctor's. Seafarers without a medical background can easily apply the wrong treatment as a result of lack of knowledge and loss of control. Panic, confusion, and wrong interventions in emergency situations can cause loss of life. Therefore, it is very important for seafarers to have the medical qualifications to perform their duties and to be able to respond correctly in times of stress. Seafarers who become sick or injured at sea should be provided with good essential medical treatment and care until they are transferred to an onshore medical facility so that their lives can be saved (Zhang and Zhao, 2017).

The maritime industry is international for reasons such as its international destinations, partnerships, and contracts of carriage, and seafarers of different nationalities working together. For this reason, maritime standards are protected by international rules. Accordingly, the establishment of global marine health standards is also provided within the framework of international conventions. The IMO (International Maritime Organization) sets minimum training requirements and standards relating to first aid and medical care for seafarers under the STCW (Standards of Training Certification and Watchkeeping) (STCW, 2010).

The WHO (World Health Organization's) International Health Regulations aim to provide an adequate response to maritime and seafarer health, international shipping, health risks, and diseases that can spread between countries (WHO, 2005). The MLC (Maritime Labour Convention) was issued by the ILO (International Labour Organization) in 2006 to specify the responsibilities of both seafarers and ship-owners in matters of health, safety, and the minimum working and living standards of seafarers at sea. Trade Unions such as the ITF (International Transport Workers' Federation) are very sensitive to topics

such as the causes of stress and fatigue at sea and health and safety onboard. In addition, the International Medical Guide for Ships has been published by WHO on behalf of the WHO, ILO, and IMO. The International Ships Medical Guide was first published in 1967. Since its first publication, it has been the standard guide for onboard medical care. It provides a resource for those who need help when seafarers fall ill or are injured onboard.

Standards, trainings, and resources have played an essential role in ensuring that seafarers are effective in responding to shipboard emergencies. However, there is a need for a system where seafarers can get instant information during the implementation and information acquisition phase. The MariHEALTH project aims to design a web-based e-learning/ training platform for seafarers and maritime doctors with a focus on advanced medical response applications onboard. Through a distance learning program, existing knowledge gaps will be filled and information will be updated. The program will provide and keep up-to-date skills that will improve seafarers' practical ability to perform better even in the most challenging situations requiring medical attention. Accordingly, the paper is organised as follows. This section gives the motivation behind the study. Section 2 provides a comprehensive literature review. Section 3 introduces the methodology. Section 4 describes the application stages of the project. Section 5 gives the conclusion and potential contribution of the study.

1. Literature Reviewing

When the literature on seafarers' health is examined, it is seen that various studies emphasise the importance of the physical and mental health of seafarers. Oldenburg and Jensen (2019) conducted a field study to investigate occupational stress and strain, including assessing seafarers' physical activities. However, as the maritime profession is a time-limited field, the study has many limitations. In another interesting study, the authors examined the marine environmental health risks associated with pathogenic microorganisms in seawater. It has been emphasised that bacteria in sea water can cause health problems such as eye infections, fungal infections, skin diseases and dermatitis as a result of contact (Pougnet et al., 20) (2018).

Shah et al. (2018) aimed to determine the perceived training needs of maritime professionals in their study. They conducted a cross-sectional study among maritime professionals attending the 14th International Marine Health Symposium. As a result of the study, the participants emphasised the necessity of medical and safety training onboard. In a different study, the authors critically examined a number of important issues related to the marine health of Chinese seafarers based on fieldwork and available information. The study identified a significant gap between Chinese practice and the desired international standards. (Zhang and Zhao, 2017). Lucas et al. (2016) reviewed in their article the etiological factors of occupational asthma (OA) to which seafarers and other maritime workers are likely to be exposed. In this review, they aimed to update the existing knowledge base on occupational asthma in the maritime industry and to make recommendations regarding the medical surveillance of workers at risk. Hadjichristodoulou et al. (2013) carried out fifty inspections on passenger vessels within the scope of their project. A total of 393 corrective actions were identified during the

audits. These actions have increased the level of compliance with the hygiene standards of cruise ships sailing in EU waters and improved the conditions that threaten health. Stress factors and harsh working conditions are one of the biggest problems encountered onboard and have significant effects on the psychology of seafarers. For this reason, the most studied health topics are usually on psychology (An et al., 2020; Carotenuto et al., 2012; Oldenburg et al., 2009; Moon et al., 2006). Another important issue related to health at sea is communication. It is vital to get help, such as telemedicine, from land health institutions in an emergency. Telemedicine service is provided by doctors and health personnel working on a duty basis in order to provide remote medical assistance for health problems that may occur onboard vessels. These services are very important for seafarers working away from land (Chen and Li, 2020; Henes et al., 2020; Penninga et al., 2020; Sagaro and Amenta, 2020). Furthermore, the Covid 19 pandemic, which has affected the whole world, undoubtedly affects the maritime industry negatively. Therefore, the protection and treatment of the disease are among the most critical topics in seafarers' health (Lucas et al., 2021; Sagaro et al., 2020; Doumbia, 2020; Sossai et al., 2020).

Although there are significant studies on seafarers' health in the literature, there is no platform where seafarers can access the medical information required during treatment, obtain new information, and keep their existing equipment up-to-date. This gap will be filled by the MariHEALTH project. In addition, the familiarization of maritime doctors who provide medical support to seafarers will increase the effectiveness of medical aid. Therefore, the project aims to design a web-based e-learning/training platform for seafarers and maritime doctors.

2. Method and Material

This section describes the methods used in the research, including the conceptual framework of the research aimed at designing a web-based e-learning/training platform for seafarers and maritime doctors.

A robust consortium was established, including three maritime-specific universities; one national public body dealing with maritime health affairs, certifications, medical trainings, etc.; one research and development company handling IT (Information Technology) works; one international seafarer staffing agency; and one civil society organization (chamber of marine engineers).

The project partners are qualified marine lecturers, maritime doctors, research and development software specialists, maritime health regulatory bodies, and seafarer (crew) staffing professionals. The data gathering is a very important step in terms of determining the requirements and obtaining valuable outputs. During this phase, documentation review and questionnaire surveys were carried out.

comprehensive literature review on the topic of marine health has been carried out. In the literature review, current health training methodologies, papers on maritime health, international regulations and rules and training contents were carefully reviewed. Also, the database was investigated and analysed using accident reports, which describe the most frequently witnessed maritime accidents and occupational diseases. In the last and

most important stage, a questionnaire was administered to seafarers and doctors. After analysing the questionnaire and performing statistical analysis, the training needs and focal points were determined. Then, in line with the data analysis and focal points, a total of 24 training modules were created for officers, ratings, and maritime doctors. Finally, a helpful platform was created by transforming the modules into e-learning courses.

3. Application

In the application step, the data gathering phase consisting of documentation review and questionnaire processes, and the data processing phase consisted of module preparation and creating web platform processes.

3.1. Data Gathering

The data gathering phase is very significant to determine the scope of the training modules to be created as a project output. At this stage, a comprehensive survey on health at sea was conducted with seafarers and maritime doctors. In addition, 2015-2017 Turkish telehealth service records were analysed in order to gain knowledge about the most common health problems on ships in recent years.

4.1.1 Documentation Review

Creating a web-based health education platform for seafarers and maritime doctors is a process that requires considerable attention and care. For this reason, determining the needs, content, and scope of trainings is very important. First, the Turkish Telehealth service records were examined, and the most common diseases and health problems that doctors faced were listed. The information received from the Turkish Telehealth service covers all flags and ship types that Turkish personnel work on, such as Panama, Malta, Liberia, and Marshall Islands, and especially Turkish flagged vessels.

The most common occupational health problems that occurred onboard ships from 2015-2017 are shown in Table 1. The most experienced disease types from 2015-2017 are shown in Table 2.

Table 1. The most common occupational accidents that occurred onboard ships

Type of occupational accidents	Percent
Crash, compression, bruise, ingrowth of objects	22.5%
Accident during welding	19.3%
Unclassified physical injuries	18.0%
Heat/burn injuries	12.5%
Heart attack and brain haemorrhage	10.0%
Suicide attempt	4.0%
Others	8.7%

Table 2. The types of diseases experienced onboard ships.

Type of disease	Percent
Dorsalgia	15.0%
Renal colic	14.0%
Foreign object in eye	11.0%
Pain (unclassified)	10.5%
Eye diseases	9.0%
Skin disease (Dermatoses)	8.0%
Dental cavities	5.0%
Others	27.5%

The results confirm the challenging nature of the maritime industry. The most obvious health problem is "bumps, compression, crushing, inward growth of objects while working on the ship" with a percentage of 22.5%. The second most common health problem in the records is "accident during welding" with 19.3%, and "unclassified physical injuries" is in third place with 18%. Moreover, it has been seen that dorsalgia, which occurs as a result of difficult work conditions is the most common disease type, with 15.0% percent. The second is renal colic, with 14.0%, and the following one is foreign object in eye, with 11.0% percent.

The IMO provides regulations regarding the provision of health standards of seafarers and the determination of the content of medical training of the seafarers with the STCW Convention. The STCW Convention requires that every seafarer shall hold a valid medical certificate issued in accordance with the provisions of regulation I/9 and of Section A-I/9 of the STCW Code. (STCW, 2010). For this reason, the content of the STCW code's seafarer medical training tables has been examined in detail. Table A-VI/1-3 indicates the scope of the specifications for minimum standards of competence in elementary first aid courses required for all seafarers. The scope of the course, which is required for officers and determines the specification of the minimum standard of competence in medical first aid, is given in table A-VI/4-2. And finally, the scope of the specification of minimum standard of competence in medical care course, which is required for chief officers and masters, is table A-VI/4/1 of the STCW Code. In addition, the chapters of the International Medical Guide for Ships, which is an important source, were used in determining the module contents.

4.1.2 Questionnaire Survey

The online questionnaire was prepared in two parts, consisting of different questions for seafarers and maritime doctors. A total of 314 seafarers and medical doctors participated in the survey. Two hundred seventy-nine were seafarers, and 35 were medical doctors dealing with maritime affairs. Among the sailors who participated in the survey, together with officer and rating levels, on average 65.0% work on deck, 25.0% in machinery, and 10.0% in other positions. More specifically, the participants surveyed included 110 ocean-going masters, 47 ocean-going chief officers, 34 ocean-going watch officers, 43 ocean-going chief engineers, 17 first engineers, 8 second engineers, 17 deck and engine cadets, and 26 other positions. Also, the maritime doctors were 32 general practitioners and 3 specialists.

In order to identify the issues that seafarers feel are inadequately handled in medical treatment onboard, the 11 most common health problems onboard were added to the questionnaire (Table 3).

Five topics were identified by seafarers as the most important training needs related to maritime health and medical treatment onboard ship: medical first aid application (72.04%); burns, scalds, and the effects of heat and cold (62.01%); injection and serious fluid application (54.48%); fractures, dislocations, and muscular injuries (47.67%); and pharmacology and drugs (47.31%). In another part of the survey, seafarers were asked to choose the first 3 additional training programs they would like to see during the information acquisition phase. As a result, it has been determined that the seafarers want to receive training where they can gain experience with the practices; they think that model courses should be developed, and need online platforms where they can easily access information.

Table 3. Most important training needs related to maritime health and medical treatment, according to seafarers

Health Problem	Response percentage	Response number
Medical first aid application	72.04%	201
Burns, scalds, and effects of heat and cold	62.01%	173
Injection and serious fluid application	54.48%	152
Fractures, dislocations, and muscular injuries	47.67%	133
Pharmacology and drugs	47.31%	132
Physical examination of casualty or patient	40.86%	114
medical care of rescued persons	40.86%	114
Pandemic and infectious diseases	34.77%	97
Drowning and intoxication	31.9%	89
Spinal injuries	22.58%	63
Sterilization	19.35%	54

The second stage of the questionnaire was conducted with maritime doctors. This section aims to determine the subjects on which doctors need training related to the maritime industry and vessels, and the extent of seafarers' medical knowledge based on the experience of doctors. On average, 85% of the doctors surveyed had more than 10 years of professional experience. Doctors were asked whether seafarers had adequate training in the practice of medical first aid. 15% of the doctors said that the seafarers are

Table 4. Most important training needs related to maritime health and medical treatment, according to maritime doctors

Health Problem	Response percentage	Response number
Medical first aid application	97.14%	34
Injection and serous fluid applications	71.43%	25
Fractures, dislocations, and muscular injuries	65.71%	23
Burns, scalds, and effects of heat and cold	65.71%	23
Pandemic and infectious diseases	60.00%	21
Drowning and intoxication	51.43%	18
Physical examination of patient	34.29%	12
Medical care of rescued persons	34.29%	12
Sterilization	25.71%	9
Pharmacology and drugs	25.71%	9
Spinal injuries	22.86%	8

definitely inadequate, while 40% said they are not adequate. Maritime doctors assessed the topics that reflect the most important training needs related to maritime health and medical treatment for seafarers onboard ships (Table 4).

34 out of 35 doctors surveyed emphasised that seafarers need training in medical first aid burns and fractures (second place) and drowning and intoxication (third place). The questionnaire, documentation review, and research of previous year records are an essential basis for creating training modules.

3.2. Data Processing

The data processing step refers to the period in the project when the carefully collected data is evaluated and implemented. In this step, training modules were prepared with the analysed data and the joint participation of all partners. The project aimed to create a platform that seafarers and maritime doctors can easily access by transforming the prepared modules into e-training courses (web-based e-learning/training platform).

4.2.1 Modules Preparation

A total of 24 training modules were prepared according to the result of the survey. The modules consist of three parts. These include Training Module for Rating Level of Seafarers (indicated by R), Training Module for Officer Level of Seafarers (indicated by O), and Training Module for Maritime Doctors (indicated by MMD).

The training modules have been prepared based on the subject scopes in the STCW code training content tables. The modules for ratings enable seafarers to remain competent at implementing basic life-saving techniques and know-how to handle an emergency. The purpose of the training for the officers is to provide refreshment courses and increase practical capabilities in harsh medical environments, such as applying bandages, placing intravenous access, suturing wounds, administering strong painkillers, treating hypothermia, treating toothaches, etc. Finally, the training modules created for maritime doctors aim to familiarise them with the working environment onboard and improve their knowledge of marine diseases, injuries, and accidents. Under three main headings, 24 training modules have been created for ratings, officers, and maritime doctors **(Table 5).** Each module consists of a handout section that provides information in the form of a reading, a multiple choice question section to test what participants have learned, and a 2D/3D animation/video section based on visual learning.

4.2.2 Creating Web Platform

In addition to training modules, a Web platform was created to allow information sharing related to a common set of medical concerns of seafarers, health and safety risk assessment based on historical data regarding accidents and injuries, and health problems. Furthermore, the e-training courses (web-based e-learning/training platform) provide instant access to information in modules. Users will access the training courses by logging into their accounts with their user IDs and password. Hence, seafarers, maritime students, maritime medical students, and maritime professionals can continue their medical training anywhere.

Table 5. Content of training modules.

Trainings	Modules	Content of training
Training-1	MMD	Familiarisation to shipboard working environment
Training-2	O	Maritime medical environment and publications
Training-3	MMD	Maritime accidents and injuries
Training-4	MMD	Common maritime diseases
Training-5	O	Medical equipment used onboard
Training-6	R & O	Using materials in emergency medical kits
Training-7	R & O	Body structure and functions (including circulatory and respiratory system)
Training-8	R & O	Medical first aid application (including position casualty, causality assessment, resuscitation technique, bleeding control, cardiac massage, basic shock management, etc.)
Training-9	O	Burns, scalds, frostbite, and the effects of heat
Training-10	O	Fractures, dislocations, and muscular injuries
Training-11	O	Head and spinal injuries
Training-12	O	Wounds, wound healing, and infection (including sterilisation, bandaging, etc.)
Training-13	O	Cardiac arrest, drowning, and intoxication (chemical, gas, etc.)
Training-14	O	Food poisoning and seasickness
Training-15	O	Minor surgical treatment (including technique of sewing and clamping)
Training-16	O	Injection and serous fluid application
Training-17	MMD	Psychologic and mental problems of seafarers
Training-18	O	Tropical and infectious diseases (including pandemics)
Training-19	O	Dental care
Training-20	R & O	Rescue and transport causality (including elementary medical care of rescued person)
Training-21	O	Basic pharmacology and drugs
Training-22	MMD & O	Telemedicine
Training-23	R & O	Evacuation of casualty from enclosed space
Training-24	MMD	Seafarer's medical examination for doctors

4. Conclusion

Mariners' health is the most critical situation in the safe operation of ships at sea. The safety and health standards of seafarers are essential not only for the themselves but also for maritime safety. For this purpose, continuous improvements are made by maritime and labour organizations around the world to improve the health conditions of personnel working on ships, and the determined working standards are published. Countries serving in the maritime sector also update their legislation and carry out the necessary studies according to these international standards. Seafarers have a different working environment than people on land. It is characterised by huge distances and long periods in which immediate intervention by a doctor is impossible. When someone becomes ill or injured under these harsh conditions, seafarers with little or no medical experience may have to contend with illness or injury for days or in an emergency even need to save the casualty from death. First aid at sea and intervention for the patient in an emergency require practical knowledge. However, the training and courses that seafarers receive are theory-oriented. Therefore, they have difficulties in the implementation phase. The project plans to overcome these difficulties by supporting the training modules with 2D and 3D practical training. Currently, medical attention that can be obtained may be limited to radio medical advice. The study's primary purpose is to enable seafarers to quickly access the medical information they need.

Due to the adverse health effects of harsh working conditions on seafarers and the lack of medical services provided to seafarers, it is very important to improve the scope and quality of services and to create an international medical platform for seafarers around the world to follow.

The target groups of the study are maritime doctors, crew onboard ships (deck and engine ratings as well as deck and engine officers), shore-based maritime professionals such as DPAs (Designated person ashore), HSEQ (Health, Safety, Environment, and Quality) managers, and maritime health authorities. The expected results of the training modules are to enhance the medical knowledge level of seafarers as much as possible to perform medical interventions easily onboard ship, to develop e-training courses (web-based e-learning/training platform), to improve the medical consciousness of seafarers and maritime doctors, to transform theoretical medical knowledge into high-quality practical training, and to increase the knowledge level of maritime doctors about the shipboard working environment as well as marine-specific injuries, diseases, and illnesses. The potential longer benefit of the projects is recognition of the training program by European sea transportation operators, which will raise the health consciousness of seafarers with the result of making them more knowledgeable. However, it will also immensely contribute to the training of maritime doctors. Furthermore, since the project improves training modules for maritime doctors and seafarers, it can be the first unique internationalised web-based e-learning platform.

Peer Review: Externally peer-reviewed.
Author Contributions: Conception/Design of Study- E.A., Ö.A., S.S.A., E.U.; Data Acquisition- E.A., Ö.A., S.S.A., E.U.; Data Analysis/Interpretation- E.A., Ö.A., S.S.A., E.U.; Drafting Manuscript- S.S.A., E.A. ; Critical Revision of Manuscript- S.S.A., E.A.; Final Approval and Accountability- E.A., Ö.A., S.S.A., E.U.
Conflict of Interest: Authors declared no conflict of interest.
Financial Disclosure: This project funding from the Turkish National Agency (EU) "KA202 - Strategic Partnerships for vocational education and training" program.
Acknowledgment: This article is produced from the EU Erasmus + Project entitled "**Maritime Health Trainings for Seafarers and Doctors (MariHEALTH)**" (Project grant no: 2019-1-TR01-KA202-076813) and has received funding from the Turkish National Agency (EU) "KA202 - Strategic Partnerships for vocational education and training" program. Project web-site (https://marihealth-project.maritimehealth.org/).

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