2019, Vol. 70, No. 3

nr ISSN 1641-9251

INTERNATIONAL MARITIME HEALTH

Official scientific forum of the:

International Maritime Health Association

Indexed/abstracted in: CrossRef, DOAJ, EBSCO, ESCI, FMJ, Google Scholar, Index Copernicus, Medical Journals Links, Medline, Ministry of Science and Higher Education, Polish Medical Bibliography, Scopus, SJR, Ulrich's Periodicals Directory, WorldCat

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INTERNATIONAL MARITIME HEALTH

Former: Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia, issued since 1949
Owner: International Maritime Health Foundation
The international multidisciplinary journal devoted to research and practice in the field of: maritime medicine, travel and tropical medicine, hyperbaric and underwater medicine, sea-rescue, port hygienic and sanitary problems, maritime psychology.

Supported financially by:

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Publisher of the International Maritime Health
Publishing, Subscription and Advertising Office:
VM Media sp. z o.o. VM Group sp.k.
ul. Świętokrzyska 73, 80–280 Gdańsk, Poland
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"International Maritime Health" is edited by: International Maritime Health Foundation (IMHF) and Polish Society of Maritime, Tropical and Travel Medicine in Gdynia (PSMTTM).
Address: 9B Powstania Styczniowego street, 81–519 Gdynia, Poland
Secretary: Leszek Mayer MD, e-mail: leszekm@gumed.edu.pl

"International Maritime Health" is indexed at: CrossRef, DOAJ (Directory of Open Access Journals), EBSCO, ESCI (Emerging Sources Citation Index), FMJ, Google Scholar, Index Copernicus, Medical Journals Links, Medline, Ministry of Science and Higher Education, Polish Medical Bibliography, Scopus, SJR, Ulrich's Periodicals Directory, WorldCat.
Position in Index Copernicus ranking system is available at: www.indexcopernicus.com.

Printed in the Republic of Poland
ISSN: 1641–9251

INTERNATIONAL MARITIME HEALTH

EDITORIAL ADVISORY BOARD:

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VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2019; 70, 3: 143–150
DOI: 10.5603/IMH.2019.0023
www.intmarhealth.pl

ISSN 1641–9251

Comparative analysis of the medicinal compounds of the ship's "medicine chests" in European Union maritime countries. Need for improvement and harmonization

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ABSTRACT

Background: *The contents of the ship pharmacy, namely "medicine chest" and its compliance with the respective regulations concerning the type of drugs to be provided for merchant vessels involved in long distance voyages and without a doctor on board were analysed. The current existing disparity between regulations can make medical assistance more complicated, and more often of low quality, due to frequent off-label use of supplied drugs. This study may represent a starting point leading to a model high-quality medicine chest on board ships.*

Materials and methods: *A comparative analysis between the medicine chest requirements of 12 European countries and the CEE Directive 31 March 1992 n.92/29 was made. Prescriptions of the aforementioned Directive were compared with the WHO Model List of Essential Medicines (third Edition).*

Results: *The investigation showed a lack of homogeneity of contents. It emerged that some medicine chests lack of several pharmaceutical categories required by the reference standards. The subsequent comparison of the European Directive with the WHO Model List of Essential Medicines has highlighted the absence of some therapeutic categories that in the ship environment can be of important to ensure adequate therapy in many situations.*

Conclusions: *There are disparities regarding regulations concerning the ship medicine chests. It is crucial to harmonize these and create a single medicine chest for all the ships without a doctor on board, undergoing periodic updates and revisions, based on epidemiological analysis that will ensure high-quality healthcare to seafarers around the world.*

(Int Marit Health 2019; 70, 3: 143–150)

Key words: healthcare quality, seafarer, medicine chest, standardization, healthcare quality in ship

INTRODUCTION

The set of medicines and other medical supplies on board ships is commonly referred to as the "medicine chest". At the beginning of the eighteenth century and later in the nineteenth century, physicians who embarked carried with them a case containing some therapeutic aids of that time, to be used on board if necessary [1]. In the nineteenth century, with the increase of maritime traffic, various European States began to regulate health, safety and hygiene protocols on board ships. Some countries have compulsorily prescribed the presence of a "box (chest) of medications" on the ships [2]. An effort to harmonize Euro-

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pean regulations on health care on board ships was made at an international health conference held in Paris in 1851. The deliberations and declarations of this conference led to an agreement after which the signatory States undertook to evaluate the hygienic conditions of the vessels, food supplies, the health condition of crews and the presence of a "chest of medicinal products", and in attachment the instructions for their use [3].

A solution to keep the medicine chest updated and equipped according to the progress of pharmacotherapy is a frequent review of international agreements to provide a well-stocked pharmacy on board ships. The lack of standardization of the ship's medicine chest at the global level and the diversity in terms of medicines and medical equipment on board of different flagships make not easy the delivery of enough quality medical assistance on board of seagoing vessels. This is true primarily in case of medical advice provided by international Telemedical Maritime Assistance Services (TMAS).

The first global attempt to address this problem was initiated by World Health Organization (WHO) which published the first edition of the International Medical Guide for Ships in 1967. In this document, the WHO, along with a detailed appendix, recommended a minimum provision of medicinal products as standards that had to be maintained by all the ships in international waters [4]. The lack of consensus on standardized medicine chest on board ships still requires an international collaboration. WHO would represent the best-suited supranational organization to promote efforts of unifying the contents of on-board medicine chests. This problem is further complicated due to the diversity of laws and regulations that govern the distribution and use of medicinal products in different countries. At first, the minimum provision of medicines that each ship must have available on board was shown in two publications. They were namely: a) the International Medical Guide for Ships and b) the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods [5]. On the other hand, many countries have regulated, for their fleet, the types and amounts of drugs which must be available on board.

The European Union in the Directive (92/29/EEC) of the Council of 31 March 1992 on the minimum safety and health requirements for improved medical treatment on board ships, has issued a series of recommendations contained in the various annexes. The Annex II, which deals with the allocation of drugs on board ship is divided into nine large categories of medicines for the treatment of various diseases. For each therapeutic category, various drugs have been recommended [6]. The directive ensures that each ship carries drugs belonging to each therapeutic group, depending on the characteristics of the vessel. It also represents a general guideline for member states of the European Union. European countries having access to international waters must adapt their legislation in compliance with this directive.

The work of harmonization would be useful to reduce the differences in the possibility of delivering high-quality medical care to seafarers. Standardized protocols would get numerous benefits in the unified management of resources, in the preparation of uniform guidelines and treatment protocols and optimization of service on all ships. These efforts would bring economic benefits such as monitoring of costs and consumption of drugs, and especially a minor bureaucratic commitment for port authority which must check and inspect the drugs on board. The final result would be the implementation of a standardized management of onboard pharmacy allowing administering a drug to the patient from the symptoms until pre-hospitalization.

Guidelines on the contents of the medicine chest could represent a relevant point to improve health conditions on board ships. In this analysis, we have compared the contents of medicine chests, in terms of drugs, recommended by the legislation of the European States, for each therapeutic class, referring to Annex II of the Directive (92/29/EEC), which is divided into nine major categories of medicinal products for the treatment of various pathologies [7]. The presence or absence of essential medicines indicated by WHO [8] in the different medicine chests was also analysed.

MATERIALS AND METHODS

In the "Annex II of the Directive (92/29/EEC)" published by the European Commission in March 1992 are reported the 9 major categories of medicinal products required to be on board for the treatment of various pathologies. This work has compared the contents of the "medicine chests" of some European reference maritime countries: France, Germany, Italy, Malta, Spain, United Kingdom, Denmark, Finland, Greece, Netherlands, Cyprus, and Portugal.

The active principles included in the various medicine chests were classified into the nine major categories according to the classification of the Annex II of the Directive (92/29/EEC) [7].

CYPRUS (CY), Section A. This section, published in 2010, lists medicines and medical aids required by Cyprus legislation for sea-going or sea-fishing vessels, with no limitation on the length of voyage [9].

DENMARK (DK), Section A. This section, published in 2007, lists medicines and medical aids required by Danish legislation refers to the minimum provision of the medicine chest for ships with permission for worldwide voyages [10].

FINLAND (FI), Section A. This section, published in 2015, lists medicines and medical aids required by Finnish regulations for sea-going or sea-fishing vessels, with no limitation on the length of voyage [11].

FRANCE (FR), Section A. This section, published in 1996, lists medicines and medical aids required by French regulations for vessels that do not carry passengers and are more than 24 hours away from the port of departure or 8 hours or 100 miles from a nearby port which is equipped with a proper first aid [12].

GERMANY (DE), Section A2. This section, published in 2006, lists medicines and medical aids required by German regulations for ships for merchant traffic and to international navigation short and long with 20 persons or more [13].

GREECE (GR), Section AII. This section, published in 1995, lists the medicines and medical aids required by Greek regulations for vessels that do not carry passengers and with no limitation on the length of voyage [14].

ITALY (IT), Section C. This section, published in 2015, lists medicines and medical aids prescribed for domestic vessels and merchant ships for short and long international navigation [15].

MALTA (ML), Section A. This section, published in 2013, lists medicines and medical aids required by Maltese regulations of the minimum provision for ships (including fishing vessels) with no limitation on length or voyages [16].

NETHERLANDS (NL), Section A. This section, published in 2006, lists medicines and medical aids required by Dutch regulations refers to the limitation on the length of voyage [17].

PORTUGAL (PT), Section A. This section, published in 1997, lists medicines and medical aids required by Portuguese regulations for sea-going or sea-fishing vessels, with no limitation on the length of voyage [18].

SPAIN (SP), Section A. This section, published in 1995, lists medicines and medical aids required by the Spanish regulations for vessels engaged in ocean voyages and without a doctor on board [19].

UNITED KINGDOM (UK), Section A. This section published in 2003, lists medicines and medical aids required by UK regulations for merchant ships or fishing boats navigating international waters without travel time restriction and without a doctor on board [20].

As a second step, the list of medicines published in the above Annex II and those of the different countries considered were compared with the WHO Model List of Essential Medicines [8].

RESULTS

The results of the comparative analysis of the contents of medicinal products for systemic use recommended by the European Directive 92/29/EEC and of the 12 European countries examined are summarized in Tables 1 (Cardiovascular system, Gastro-intestinal system, Analgesics and antispasmodics, Nervous system) and 2 (Anti-allergic and anti-anaphylactic, Respiratory system, Anti-infection, Compounds promoting rehydration, caloric intake and plasma expansion).

As shown in Table 1, all 5 classes of cardiovascular drugs indicated by the European Directive are present. For the medicines acting on the gastrointestinal system, Histamine H2 receptor anti-ulcer antagonists are missing from the German, Danish, Finland, French and Dutch medicine chests, whereas the other 6 classes of gastro-intestinal compounds are present. It should be mentioned that in the above five on-board medicine chests, proton pump inhibitor drugs, such as omeprazole, replace the H2-antagonist antiulcer. Even if these are drugs with a different mechanism of action and pharmacokinetics, the therapeutic use is the same, and they can be therefore considered to be interchangeable.

Analgesic and antispasmodics are present in the medicine chests of all countries, except for spasmolytics missing in the Danish, Finnish and Dutch chests. All recommended nervous system compounds are present in the medicine chests of the 12 countries considered.

Analysis of Table 2 shows that all classes of Anti-allergic and anti-anaphylactic, Respiratory system, Anti-infection, Compounds promoting rehydration, caloric intake and plasma expansion, recommended by the European Directive are included in the medicine chests of the 12 countries examined, except for the anti-bacterial sulphonamide, which is missing in the Finnish and French medicine chests.

Table 3 summarizes medicines for external use indicated in the European Directive included in the medicine chests of the 12 countries examined. In general, there is a good correspondence between the European recommendations and the contents of single country medicine chests. The only exceptions are for skin medicines, antibiotic ointments/ /creams missing in the Danish medicine chest, the antibiotic and anti-inflammatory drops missing in the eye medicines required by Dutch regulations, the antibiotic solutions listed in the ear medicines section absent in the Danish and Germany medicine chest. The antibiotic or antiseptic mouthwashes of the section Medicines for oral or throat infections missing in the Finnish medicine chest.

Data of the analysis of the presence in the "Annex II of the Directive (92/29/EEC)" the so-called Model List Essential Medicine proposed by the WHO, serving as a guide to the development of the national and institutional essential medicine lists [8] are summarized in Table 4. As shown, the main inconsistencies are in the absence of antimalarial, antileprosy, antituberculosis and anthelminthics and antiprotozoals medicines for the Anti-infective medicines class. For the class of Medicines affecting blood, the lack of antianaemia medicines, blood coagulation factors, plasma-derived medicines, and plasma substitutes is noticeable. In the section Hormones, other endocrine medicines and contraceptives, the lack of insulins and other medicines used for diabetes and thyroid hormones and antithyroid

Table 1. Cardiovascular system, Gastro-intestinal system, Analgesics and antispasmodics, Nervous system medicinal products listed in the Annex II of the Directive (92/29/EEC) included (P) or not included (A) in the medicine chests of the 12 European countries examined

Drugs	CY	DE	DK	FI	FR	GR	IT	ML	NL	PT	SP	UK	WHO
Cardiovascular													
Cardio-circulatory analeptics — sympathomimetics	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-angina preparations	P	P	P	P	P	P	P	P	P	P	P	P	P
Diuretics	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-haemorrhagics including uterotonics if there are women on board	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-hypertensive	P	P	P	P	P	P	P	P	P	P	P	P	P
Gastro-intestinal system													
Medicines for gastric and duodenal disorders													
— Histamine H2 receptor anti-ulcer antagonists	P	**A**	**A**	**A**	**A**	P	P	P	**A**	P	P	P	P
— Anti-acid mucous dressings	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-emetics	P	P	P	P	P	P	P	P	P	P	P	P	P
Lubricant laxatives	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-diarrhoeals	P	P	P	P	P	P	P	P	P	P	P	P	P
Intestinal antiseptics	P	P	P	P	P	P	P	P	P	P	P	P	P
Haemorrhoid preparations	P	P	P	P	P	P	P	P	P	P	P	P	P
Analgesics and anti-spasmodics													
Analgesics, anti-pyretics and anti-inflammatory preparations	P	P	P	P	P	P	P	P	P	P	P	P	P
Powerful analgesics	P	P	P	P	P	P	P	P	P	P	P	P	P
Spasmolytics	P	P	**A**	**A**	P	P	P	P	**A**	P	P	P	P
Nervous system													
Anxiolytics	P	P	P	P	P	P	P	P	P	P	P	P	P
Neuroleptics	P	P	P	P	P	P	P	P	P	P	P	P	P
Seasickness remedies	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-epileptics	P	P	P	P	P	P	P	P	P	P	P	P	P

CY — Cyprus, DE — Germany, DK — Denmark, FI — Finland, FR — France, GR — Greece, IT — Italy, ML — Malta, NL — Netherlands, PT — Portugal, SP — Spain, UK — United Kingdom; WHO — World Health Organization

medicines was observed. Medicines used for depressive disorders are missing in the section Medicines used in mood disorders.

The results of a further analysis of the presence or absence of medicinal products included in the WHO Model List of Essential Medicines in the different medicine chest of the 12 European countries examined are summarized in Table 5. As shown, several inconsistencies are noticeable.

DISCUSSION

In addition to the legal and logistic issues pertaining to the procurement of specific drugs in different countries of the world, this lack of standardization can be an additional obstacle to effective treatment of diseases and accidents on board ships. A fundamental requirement to guarantee high-quality care is the availability of drugs that increase the possibility of an appropriate therapeutic choice for the treatment of various diseases more often occurring on board ships. Ideally, the medicine chest, taking into account this particularly sensitive category of workers, has to be validated and be uniform for all the ships worldwide, independently from the flags that they are registered under. Life-saving medicines, that are required to treat certain serious medical conditions emergencies, should have priority and serve as the starting point for the desirable standardization of regulation of this matter, both in terms of types and quantities of therapeutic principles to carry on ships.

Table 2. Anti-allergic and anti-anaphylactic, Respiratory system, Anti-infection, Compounds promoting rehydration medicinal products listed in the Annex II of the Directive (92/29/EEC) included (P) or not included (A) in the medicine chests of the 12 European countries examined

Drugs	CY	DE	DK	FI	FR	GR	IT	ML	NL	PT	SP	UK	WHO
Anti-allergics and anti-anaphylactic													
H1 Anti-histaminics	P	P	P	P	P	P	P	P	P	P	P	P	P
Injectable glucocorticoids	P	P	P	P	P	P	P	P	P	P	P	P	P
Respiratory system													
Bronchospasm preparations	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-tussives	P	P	P	P	P	P	P	P	P	P	P	P	P
Medicines used for colds and sinusitis	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-infection													
Antibiotics (at least two families)	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-bacterial sulphonamide	P	P	P	**A**	**A**	P	P	P	P	P	P	P	P
Urinary antiseptics	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-parasitics	P	P	P	P	P	P	P	P	P	P	P	P	P
Intestinal anti-infectives	P	P	P	P	P	P	P	P	P	P	P	P	P
Anti-tetanus vaccines and immunoglobulins	P	P	P	P	P	P	P	P	P	P	P	P	P
Compounds promoting rehydration, caloric intake, and plasma expansion	P	P	P	P	P	P	P	P	P	P	P	P	P

Abbreviations are the same as in the legend to Table 1

Table 3. Medicines for external use listed in the Annex II of the Directive (92/29/EEC) included (P) or not included (A) in the medicine chests of the 12 European countries examined

Drugs	CY	DE	DK	FI	FR	GR	IT	ML	NL	PT	SP	UK	WHO
Medicines for external use													
Skin medicines													
— Antiseptic solutions	P	P	P	P	P	P	P	P	P	P	P	P	P
— Antibiotic ointments	P	P	**A**	P	P	P	P	P	P	P	P	P	P
— Anti-inflammatory and analgesic ointments	P	P	P	P	P	P	P	P	P	P	P	P	P
— Anti-mycotic skin creams	P	P	P	P	P	P	P	P	P	P	P	P	P
— Burn preparations	P	P	P	P	P	P	P	P	P	P	P	P	P
Eye medicines													
— Antibiotic drops	P	P	P	P	P	P	P	P	P	P	P	P	P
— Antibiotic and anti-inflammatory drops	P	P	P	P	P	P	P	P	**A**	P	P	P	P
— Anaesthetic drops	P	P	P	P	P	P	P	P	P	P	P	P	P
— Hypotonic myotic drops	P	P	P	P	P	P	P	P	P	P	P	P	P
Ear medicines													
— Antibiotic solutions	P	**A**	**A**	P	P	P	P	P	P	P	P	P	P
— Anaesthetic and anti-inflammatory solutions	P	P	P	P	P	P	P	P	P	P	P	P	P
Medicines for oral and throat infections													
— Antibiotic or antiseptic mouthwashes	P	P	P	**A**	P	P	P	P	P	P	P	P	P
Local anesthetics													
— Local anaesthetics using freezing	P	P	P	P	P	P	P	P	P	P	P	P	P
— Local anaesthetics given by subcutaneous injection	P	P	P	P	P	P	P	P	P	P	P	P	P
— Dental anaesthetic and antiseptic mixtures	P	P	P	P	P	P	P	P	P	P	P	P	P

Abbreviations are the same as in the legend to Table 1

Table 4. Comparison between the WHO Essential Model List and those listed in the "Annex II of the Directive (92/29/EEC)"

WHO Model List of Essential Medicines, 2017	Included in the European Directive 92/29/EEC
MEDICINES FOR PAIN AND PALLIATIVE CARE	Present
ANTIALLERGICS AND MEDICINES USED IN ANAPHYLAXIS	Present
ANTIDOTES AND OTHER SUBSTANCES USED IN POISONINGS	Present
ANTICONVULSANTS/ANTIEPILEPTICS	Present
ANTI-INFECTIVE MEDICINES	
Antibiotics (at least two families)	Present
Anti-bacterial sulphonamide	Present
Urinary antiseptics	Present
Anti-parasitics	Present
Anti-malarial*	Absent
Intestinal anti-infectives	Present
Anti-tetanus vaccines and immunoglobulins	Present
Antileprosy medicines*	Absent
Antituberculosis medicines*	Absent
Anthelmintics and Antiprotozoals*	Absent
ANTIMIGRAINE MEDICINES	Present
MEDICINES AFFECTING THE BLOOD	
Antianaemia medicines*	Absent
Medicines affecting coagulation	Present
Blood coagulation factors*	Absent
Plasma-derived medicines and Plasma substitutes*	Absent
CARDIOVASCULAR MEDICINES	Present
DERMATOLOGICAL MEDICINES (topical)	Present
DIAGNOSTIC AGENTS	Present
DISINFECTANTS AND ANTISEPTICS	Present
DIURETICS	Present
GASTROINTESTINAL MEDICINES	Present
HORMONES, OTHER ENDOCRINE MEDICINES, AND CONTRACEPTIVES	
Adrenal hormones and synthetic substitutes	Present
Insulins and other medicines used for diabetes*	Absent
Thyroid hormones and antithyroid medicines*	Absent
MUSCLE RELAXANTS (PERIPHERALLY-ACTING) AND CHOLINESTERASE INHIBITORS	Present
OPHTHALMOLOGICAL PREPARATIONS	Present
MEDICINES USED IN MOOD DISORDERS	
Anxiolytics	Present
Neuroleptics	Present
Medicines used in depressive disorders*	Absent

*Categories of medicinal products not included in the "Annex II of The Directive (92/29/EEC)"

Among the most relevant Essential Medicines not included in the medicine chests, there is a major shortage for the class "Medicines Affecting Coagulation" in terms of content of drugs interfering with coagulation mechanisms. Seafarers are particularly exposed to the risk of serious accidents [21], which can result in bleeding. Circulatory system diseases

Table 5. Analysis of the availability of pharmacological specialties reported in the WHO Model List of Essential Medicines, not included in the European guidelines (Annex II European Directive 92/29/EEC), as shown in Table 4

Drugs	CY	DE	DK	FI	FR	GR	IT	ML	NL	PT	SP	UK
Anti-malarial	A	P	P	P	P	P	P	P	P	A	A	A
Antileprosy medicines	A	A	A	A	A	P	A	P	A	A	A	A
Antituberculosis medicines	A	A	A	A	A	A	A	A	A	A	A	A
Anthelminthics and Antiprotozoals	P	P	P	A	P	P	P	P	A	P	P	P
Antianaemia medicines	A	P	A	A	A	A	A	A	A	A	A	A
Blood coagulation factors	P	P	A	P	P	P	A	P	P	A	P	A
Plasma-derived medicines and Plasma substitutes	A	A	P	A	A	P	P	P	P	P	P	P
Insulins and other medicines used for diabetes	A	A	A	P	P	A	P	A	A	A	A	P
Thyroid hormones and antithyroid medicines	A	A	A	A	A	A	A	A	A	A	A	A
Medicines used in depressive disorders	A	A	A	A	A	A	A	A	A	A	A	A

Abbreviations are the same as in the legend to Table 1

are the most frequent death causes, followed by external causes such as accidents and violence [22]. In view of this, availability of certain life-saving drugs is desirable for giving as much as possible proper health care and preventing fatalities. Another shortage is represented by antiprotozoal, antimalarial, anthelmintic, scabicides and pediculicides. The "Annex II of the Directive (92/29/EEC)" as well as other European Medicine chests lack of many products of this class (Table 2). This may be problematic as infectious and parasitic diseases occupy the 3rd place among the causes of death on board ships [22]. Moreover, "Medicines used in mood disorders" such as subclass of antidepressants, included in the WHO Model List of Essential Medicines, are missing from the "Annex II of the Directive (92/29/EEC)" (Table 2). This is another important lack, because seafarers may experience psycho-emotional problems and increased fatigue [23]. Another class of drugs absent from European Medicine chests are antidiabetic drugs such as insulin, metformin, glucagon and other specialties, provided by the WHO Model List of Essential Medicines, present only in Finland, France, Italy and United Kingdom medical chests. The lack of certain types of drugs may force doctors to make different prescriptions from those, which they would have made in the case of availability of more specific therapeutic agents [24]. One consequence of this shortage may be a great off-label use of medications. Off-label prescriptions is allowed and from time to time is useful, but if exaggerated can lead to non-negligible problems [25–26].

The comparative analysis between the "Annex II of the Directive (92/29/EEC)" and the WHO Essential Model List confirms the presence on board ships of active substances, which are considered to be lifesaving such as penicillin, hydrocortisone, adrenaline, furosemide, anti-tetanus immunoglobulin. These are all included in the ship medicine chest, although a greater possibility of choice in terms of formulation for these active principles would be desirable. In general there is a good correspondence between essential medicines recommended by the WHO Model List, those required by the European Directive — Annex II 92/29CEE (see Table 5) and the contents of the 12 medicine chests studied. However, the lack of antimalarial medications in some flag states regulations remains an issue, taking into account that merchant ship may sail in areas identified as epidemiological outbreaks of this parasitosis.

Seafarers should benefit of both preventive and therapeutic health care approaches. This requires the ability to identify and assess risks in workplaces and the systematic recording of environmental stress and their pathological, pathophysiological and psychological effects. To ensure an adequate level of medical care, the appropriate stocks of drugs and medical equipment is necessary. From this availability depends on much of the opportunity to provide quality medical assistance to seafarers. An adequate provision of drugs, together with enough quality telemedical assistance, may guarantee health/life protection of seafarers at sea [27].

CONCLUSIONS

The results of this work suggest the need of a revision of national and international regulations, aimed at the development of a universal ship's medicine chest, based on dedicated pharmacoepidemiologic studies. Another issue that should be considered is the periodic and frequent update of these lists. In this way, thanks to technological evolution we will be able to shorten distances and take advantage of a high quality medical assistance at sea. The best solution to the problem of medicine chest standardization is to homogenize them to ensure that any ship sailing in international waters carries well-equipped and standardized

medicine chest. This will be helpful for seafarers and those from ashore are treating them.

ACKNOWLEDGEMENTS

The support and the provision of data from C.I.R.M (International Radio Medical Centre, Rome, the Italian TMAS), and the Centre of Telemedicine and Telepharmacy of the University of Camerino, Italy is gratefully acknowledged.

FUNDING

This research was funded by C.I.R.M. (0.5% charitable tax-free donations). Giulio Nittari, Gopi Battineni and Graziano Pallotta received a PhD scholarship from the University of Camerino.

CONFLICT OF INTEREST

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2019; 70, 3: 151–157
DOI: 10.5603/IMH.2019.0024
www.intmarhealth.pl

ISSN 1641–9251

Design and evolution of the Seafarer's Health Passport for supporting (tele)-medical assistance to seafarers

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ABSTRACT

Background: *Seafarers undergo periodic medical examination for their employment. This information in most cases is not effectively used when requesting for medical assistance during service on board ships. The medical history of an individual is important for provision of medical care and can be critical to the outcome. There is growing adoption of digital applications and electronic health records that are adding great value to the care provided. The Seafarer's Health Passport (SHP) is an application specifically designed for improving the quality of medical assistance provided to seafarers both through telemedicine or classic medical check-ups in ports/hospitals worldwide. The SHP provides a secure and unique way to archive and retrieve the seafarer's medical history in an electronic support.*

Materials and methods: *The SHP that we have developed is a product with specific hardware and software specifications. The basic features of this software are Linux operating system Debian/Ubuntu, Apache Web server 2.x, Server database MySQL/Maria DB PHP programming language 5.6.xx, and secure connection in https.*

Results: *The SHP represents a helpful hint to physicians providing medical advices to seafarers enabling them to make more decisions that are informed and curtailing possible complications due to misdiagnosis.*

Conclusions: *Provision of high quality medical assistance requires knowledge of patient's medical history. The availability of an easy access and friendly use system of own medical history is useful for a population of travellers, such as seafarers to guarantee a reasonable level of medical care at any time.*

(Int Marit Health 2019; 70, 3: 151–157)

Key words: seafarers, electronic health record, medical information management, health passport, personal health tracking

INTRODUCTION

Shipping is one of the world's oldest professions. Due to the nature and duration of their voyage, ships could be on the high seas for days or weeks before going back on shore [1–5]. Most merchant ships have less than 25 crewmembers onboard and according to the Maritime Labour Convention (MLC) 2006 [6] are not required to carry a healthcare professional. It is a duty of the ship's captain to take care of the crew's health [1–5]. According to MLC 2006, all measures should be taken to ensure that seafarers onboard are provided with quality healthcare services, which are like those offered onshore. Due to the optimised workforce and the importance of the crew health, ship owners and managers are keen to provide prompt and effective medical assistance to sailing crew [3, 6].

The fact that ships with no medical facilities are at sea for a given elapse of time before they can reach a port, makes seafarers in a disadvantageous condition compared

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to ashore workers which can be reached by a health professional within less than 1 hour [1]. In this situation, the only possible, solution developed thanks to the invention of radiotelegraphy by Guglielmo Marconi in 1897, is to provide medical advice to ships via telecommunication systems [7]. From the beginning of 21th century, advanced telemedicine solutions are taking the place of medical assistance via radio and this can result in a real improvement of the assistance delivered to people on board ships [1, 5, 7].

The physician taking care of a remote patient has never seen the patient and probably will never see him/her [7] and knowledge of the medical history of a seafarer is a prerequisite for delivering high quality medical assistance at sea. Healthcare systems and services compatible with electronic records are particularly dynamic due to their accessibility, quality, and efficiency provided by information technology developments. Electronic health record (EHR), used during clinical encounters, has become increasingly popular all around the world [8, 9]. Information and communication technologies defined as "electronic health" may also increase the capability to identify target groups of patients for specific interventions, improving clinical healthcare quality, especially for specific patient groups [10, 11]. Clinical information, called "personal health record", refers to the collection of data about an individual's health and health care, stored electronically [9–11]. In general, an EHR is integrated with a hardware and software platform, which provides and supports a dataset for each patient [9]. The present study consisted in the development of a Seafarer Health Passport (SHP) device/system dedicated to the collection and storage of medical data that can be accessed if and when a seafarer requires medical attention.

MATERIALS AND METHODS

The SHP collects in an easy accessible system seafarer's medical history with the purpose to use these data everywhere and at any time when necessary. The purpose of the initiative is to share patient clinical data through online services accessible to users and their doctors depending on the user's choice, for an efficient and rapid health service delivery.

IDENTIFICATION OF DATA TO BE COLLECTED IN THE SHP

Analysis of International Labour Office guidelines [12] and discussion with doctors working at Centro Internazionale Radio Medico (CIRM, International Radio Medical Centre), the Italian Telemedical Assistance Services (TMAS), resulted in us drafting the minimum data required for the tool. The minimum information that the tool must record are shown in Table 1.

Based on this information an EHR dedicated for the specific needs of seafarers was developed. The system allows seafarers access to their medical history if a need arises. Each seafarer thanks to the SHP will have always with him/her his/her medical data. Medical data will be contained in a water-proof personalised USB drive provided to each seafarer.

Table 1. Minimum health information of a seafarer that should be included in the Seafarer's Health Passport

Type of information	Details
Personal information	Name, rank, age, nationality
Medical history	Family and personal medical history
Basic data	Height, weight, body mass index
Medical data	Blood pressure, blood glucose and other essential vitals
	Previous clinical tests and laboratory results if available
Medical notes	Allergies, prescriptions, medicines taken chronically etc.

SOFTWARE AND HARDWARE SPECIFICATIONS FOR THE SHP

The basic features of the software in this project are Linux operating system Debian/Ubuntu, Apache Web server 2.x, Server database MySQL/Maria DB PHP programming language 5.6.xx, and secure connection in https. For securing the data completely, the access to the application is only permitted from an internal connection and therefore not directly from a connection outside.

- USB Version: 2.0 or higher USB with minimum 4 GB space for storage of medical information.
- Operating System: Windows. Web Version: Access to internet. Chrome or Safari browser.
- How the system works: A company signs up for the service to cover their seafarers with the SHP. Candidates will be invited to sign-up for the tool. The candidate provides consent for using the application and using the various features of the application. The candidate syncs his account with the User Identifier (UID). This step is essential for integration of his pre-employment medical records to be synced with his SHP.

DATA PROTECTION

Medical information is highly sensitive [13]. Data protection and privacy represent the first goal of the system, with the SHP conceived to include two types of information, those freely accessible and those password-protected. Freely accessible information will include name and surname of the seafarer, place and date of birth, home address, blood group, any eventual major allergy, date of the fitting certificate, results of it and who issued it. The remaining information are password-secured and cannot be accessed

Figure 1. The Seafarer's Health Passport device

unless the password is known. The system is totally General Data Protection Regulation (GDPR) [14, 15] compliant and servers collecting SHP medical data are located in the European Union (Italy) [14, 15] to guarantee to the user of the service the highest levels of data protection worldwide.

The seafarer will be asked whether he/she wants to have disclosed his/her confidential medical information in case of medical emergencies. The seafarer's wishes should be clearly indicated in the informed consent form. Upon receiving the authorisation to disclose the seafarer's medical information, these will be shared with the ship's captain or with the doctor/ /hospital taking care of the patient. If not authorized the wishes of the seafarer/patient should be respected.

RESULTS

The software SHP collects in an easy accessible system the medical history of seafarers with the purpose to use these data everywhere and at any time when necessary. It consists of a water-proof personalised USB drive provided to each seafarer (Fig. 1). Insertion of the USB device in a PC launches software containing seafarer medical data accessible to users and their doctors, for an accurate health service delivery.

SEAFARER HEALTH PASSPORT WORKFLOW AND ORGANISATION

The procedures of how to comply with data protection regulations and ensure complete confidentiality the process are summarised below. The shipping company is provided with a secure login to upload list of the seafarers for which the company has subscribed the service. The pre-employment medical centre is provided with a secure link to upload the medical reports of the seafarer. This link is automatically generated when an appointment is created by the company for the seafarer at the specific medical centre. As an alternative possibility, the candidate can upload his own medical records.

Figure 2 shows the SHP home page of an imaginary seafarer. On opening the application we have first an access page **A**. After access the seafarer is directed into a menu to choose among 7 different sections **B**. The "about me" section **C** includes the seafarer's personal data, whereas the "emergency contacts" section **D** indicates who to contact in case of need. This section can be updated and modified autonomously by the seafarer.

Figure 3 shows where the seafarer medical history can be found (A) and the section for uploading the results of new medical data (B) for updating the contents of the SHP.

Through the sections "vitals and measurement" (Fig. 4), the seafarer can have access to his own vital signs (A) and weight (B) values.

The SHP has been already introduced as a form of trial to seafarers working for CMA CGM (France) and Marnavi (Italy). No problems or difficulties were raised by the approximately 600 seafarers using it on a voluntary basis. The idea was very much appreciated and people feel themselves safer and with an additional health protection in case of diseases on ships (data not shown). The information contained in the SHP are shared with the TMAS for use in case of request of telemedical advice.

DISCUSSION

An EHR is a digital version of a patient's paper chart [8, 9]. EHRs are real-time, patient-centred records that make information available instantly and securely to authorised users. While an EHR does contain the medical and treatment histories of patients, an EHR system is built to go beyond standard clinical data collected in a provider's office and can be inclusive of a broader view of a patient's care. One of the key features of an EHR is that health information can be created and managed by authorised providers in a digital format capable of being shared with other providers across more than one health care organisation. EHRs are built to share information with other health care providers and organisations — such as laboratories, specialists, medical imaging facilities, pharmacies, emergency facilities, and school and workplace clinics — so they contain information from all clinicians involved in a patient's care.

The present work has summarised the development of a portable electronic device, the SHP collecting health data of a particular population of travellers as seafarers.

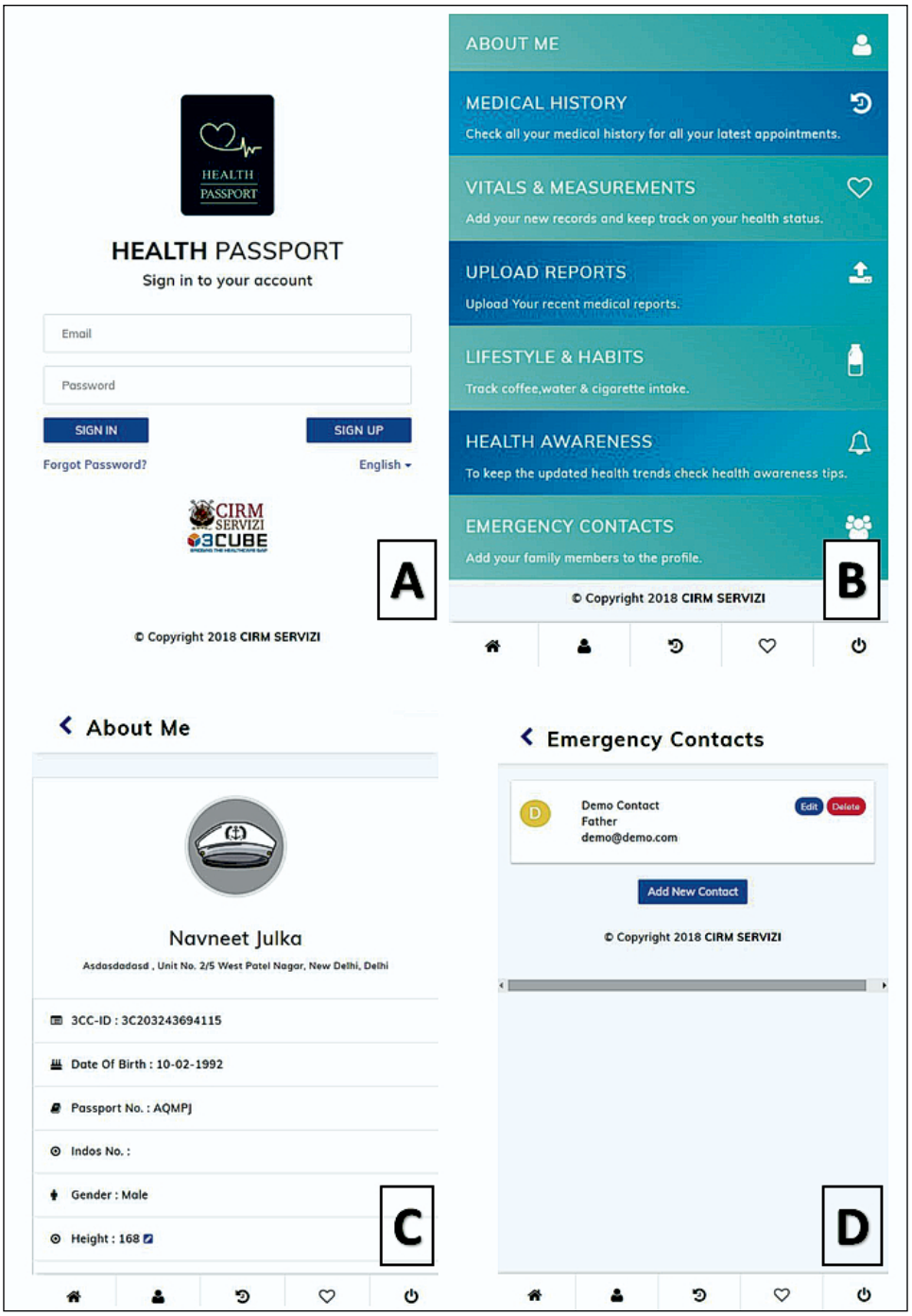

Figure 2. Home page (**A**) of the Seafarer's Health Passport, menu of the sections of it (**B**), basic seafarer personal data (**C**) and emergency contacts (**D**)

Thanks to the SHP health data of seafarers travel with the worker that can access his own medical information at any time and anywhere making them available for medical assistance at sea, visits in ports or hospitalisation. The SHP offers several opportunities in the area of crew health and can lead to a more informed and healthier workforce and may represent the first step for improving the quality of medical care of seafarers.

A first step of our work was an extensive interaction with various stakeholders from which we have identified several areas of concerns which have been discussed. In terms of protection of health information, the seafarer alone has access to his medical information. However, as part of the enhanced crew care programme and based on his consent, this information will be shared with medical doctors who may need to review them in

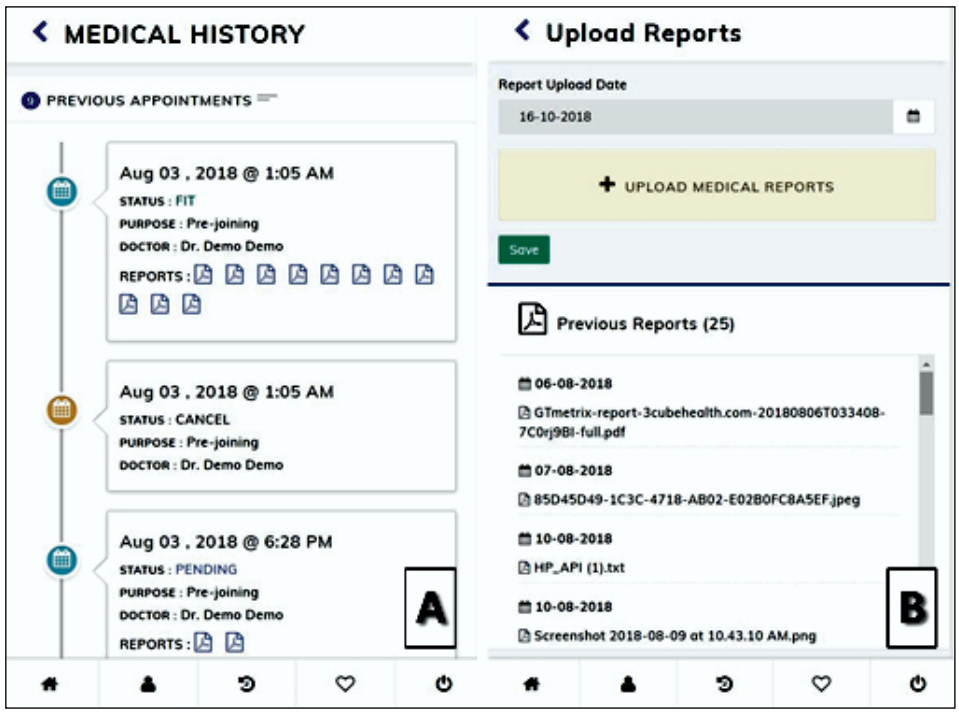

Figure 3. The medical history section of the Seafarer's Health Passport. The seafarer can find in this section the files of the reports of his medical visits uploaded by recruiting clinics and shared with Telemedical Assistance Services (**A**). Updated reports or the results of new clinical tests that can be downloaded by the seafarer through the section shown in panel **B**

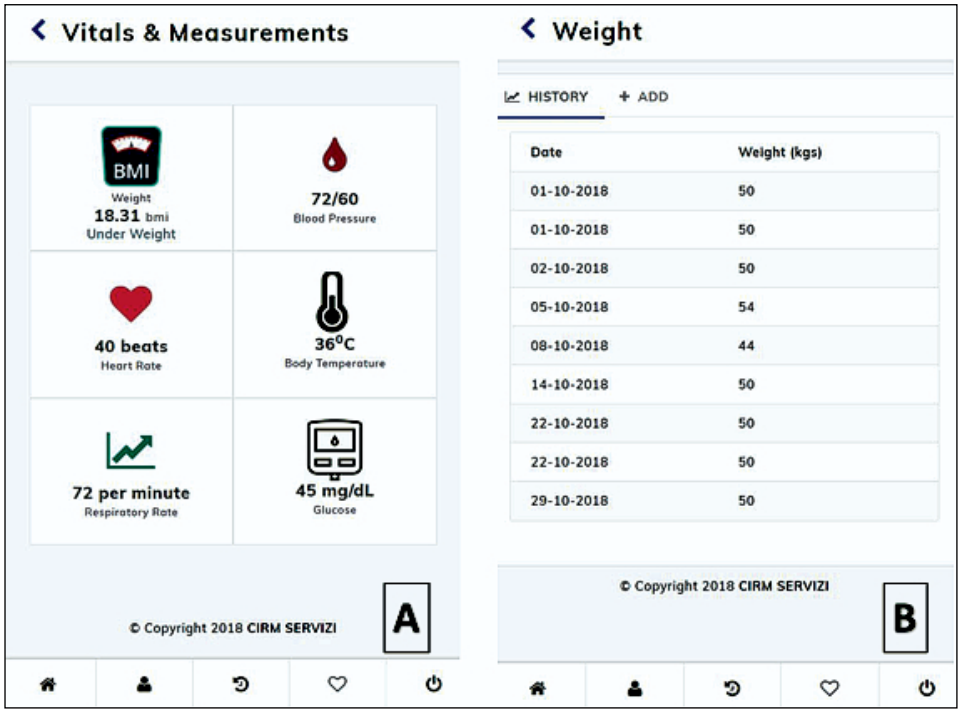

Figure 4. Two screen shots of the Vitals and Measurement section of the Seafarer's Health Passport (SHP). At any time the seafarer can review his basic vital data (**A**) stored in the SHP, and other health information as for instance body weight (**B**). These data constitute a diary that the seafarer is free to consult

case of medical events. The system will continuously evolve to provide automated alerts, reminders and tips on the seafarer's health which the individual can use as a guideline to stay healthy. In terms of GDPR requirements [15] a user can ask for his personal information to be deleted at any time. The debate on the ownership of health data is still ongoing and no definite conclusions have been reached. The account and data added by the individual will be wiped off. However, data added by other data points such as pre-employment medical centres or companies which are only synced with SHP will be de-linked and cease to be referred in the SHP databases. If the seafarer chooses to be forgotten while being serviced by his employer, the employer will be notified of this change. The seafarers can continue to use the SHP as a personal health record application if they stay subscribed to the service.

The subscription can be paid for by the employer or the individual. Once the subscription ends, the account will be made inactive for a definite period within which it can be re-activated. Telemedicine may solve the problem of healthcare related to remote patients, like seafarers, which do not have direct and/or easy access to medical services. Several studies indicate the transforming nature of telemedicine in health care. For seafarers it is an important resource on the high seas. For more effective tele medical services, it is essential to have access to the medical histories of the seafarers to allow physicians to be more informed and conclusive on their diagnosis and treatment. SHP can reveal the clinical history of the patient over time and this peculiarity reduces the need to track down patients' previous paper medical records. Therefore, SHP is a real innovation in making the telemedicine system as easiest as possible. It decreases the risk of lost paperwork, leads to a reduction of misdiagnoses which contribute to 10% of patient deaths. It can contribute to keep the patients and physician safe, and cuts out billing of accountants-commercialist and lawyers [8, 9].

The SHP is the beginning of a whole new perspective of crew care. The tool can be used to keep the seafarer engaged with his/her health by conducting timely health surveys, mental health questionnaires, provide personalised care to the seafarer by analysing the health data and providing preventive or proactive measures. Big data analysis in the future can indicate the trend of health concerns globally and areas of attention required and provide means of making pre-employment medicals more adaptive and effective. For instance, a definite diagnosis of allergies is needed to establish adequate treatment options and proper preventive measures [13].

CONCLUSIONS

The SHP is a promising tool to improve the efficiency and efficacy of telemedical and medical support to seafarers. Based on the experience obtained in the maritime environment, it can also be beneficial for people with limited or difficult access to medical facilities. On the other hand, it can be a useful data resource to support comparative. In this study, we have considered maritime workers. They work in a particularly dangerous environment, far from the land, and without a physician close to them. This innovation can contribute to change the life of citizen as well as of specific categories of workers.

The SHP is not only a useful indicator for the employer but also to medical doctors required to provide remote assistance. However, the ultimate beneficiary of the tracking, timely awareness and other value-added features of the tool is the seafarer, who could use this facility as a good tool for measuring his own health conditions and fitness throughout his active life.

ACKNOWLEDGEMENTS

The authors are greatly indebted to Dr Marc Samad, Médicin Conseil of CMA CGM, Marseille (France) for the suggestions and useful discussions. The support and the provision of data from CIRM (International Radio Medical Centre, Rome, the Italian TMAS), and the Centre of Telepharmacy and Telemedicine of the University of Camerino (Italy) are gratefully acknowledged. We thank 3 Cube Services Pte. Ltd. (Private Limited company in Singapore) for their collaboration to the study and for providing insights on the development of the Seafarer Health Passport. We would like to thank Marnavi SpA and CMA Ships SA for their collaboration to evaluation of the SHP. This research was funded by CIRM (0.5% charitable tax-free donations) and University of Camerino, Department of Telemedicine and Telepharmacy supported this study. Drs Nittari, Battineni and Pallotta received a PhD bursary from the University Camerino.

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VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2019; 70, 3: 158–166
DOI: 10.5603/IMH.2019.0025
www.intmarhealth.pl

ISSN 1641–9251

Epidemiology of physician interventions in maritime environment by the Marseille Fire Brigade (BMPM) from 2005 to 2017

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ABSTRACT

Background: *Marseille is the second largest city in France. The Marseille Fire Brigade (BMPM) is the largest unity of the French Navy. This organization is in charge of rescue operations and medical intervention in the Marseille area. The aim of the study was to describe the epidemiology of interventions that required a physician to be present that were performed by the BMPM between the years of 2005 to 2017.*

Materials and methods: *The statistical office database of the BMPM and the medical interventions forms (FIM) acquired from the BMPM medical ambulances (SMUR) archives were analysed from the years 2005 to 2017.*

Results: *The BMPM performed a total of 2,375 interventions in the maritime environment between 2005 and 2017. A physician was necessary for intervention a total of 186 times. The extraction and analysis reports of 107 medical intervention forms found the BMPM archives revealed a significant number of interventions (67%) in the southern bay of Marseille and Frioul, specifically from the If and Planier islands. The majority of interventions (77%) took place within the 300m band. The most common cause of medical intervention was due to an accidental fall into the water, followed by boating (sailing and motor), and swimming. Drowning was the most common cause of mortality, consisting of 34% of all interventions. Diving accidents represented 14% of interventions. Trauma affected 22% of the study population and 83% of trauma patients were transported to the hospital under the supervision of a physician.*

Conclusions: *Potential areas for improvement in the management of drowning victims are the use of Szpilman's classification, sonography, and non-invasive ventilation. A recertification course for medical education training of BMPM doctors on the management of diving accidents could help to optimize the information recorded on FIM. Accident prevention training should be continued and reinforced when it comes to maritime activities.*

(Int Marit Health 2019; 70, 3: 158–166)

Key words: firefighters, drowning, diving, emergency service, first aid, naval medicine

INTRODUCTION

Marseille is the second largest city in France. Its commercial and cruise ports are the largest in France and are among the largest in Europe (2.5 million passengers including 1.5 million cruise passengers per year). Its seafront, compromising 57 km, includes 14 ports, 21 islands, dozens of beaches, and 20 km of creeks. Significant fishing activity is reported with 138 vessels. Many leisure activities are organized in Marseille: 100 diving sites can exceed 50 m in depth and as many as 200 regattas are held annually. The city is currently planning to host the sailing competition for the 2024 Summer Olympic Games.

The Marseille Fire Brigade (BMPM) is the largest unit in the French Navy. It is under the direct authority of the mayor and is subject to civil security regulations. The battalion provides an average of 120,000 annual interventions, 81% of which are for the relief of people. Some of these interventions can be performed by the physician of one of the 3 medical ambulances (SMUR) of the fire brigades (Plombières, Endoume and Louvain) at the request of the Bouches-du-Rhône Emergency

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Medical Service (SAMU 13). Medical support for firefighters in interventions is provided by the medical support vehicle (VMS).

Some platoons of the battalion have a specific focus on the maritime environment. The aquatic section (SOS AQUA) has 158 personnel, including 36 divers and 13 boats. The helicopter section (SOS HELI) allows firefighters to be deployed by helicopter for operations at sea. The depollution section (SOS DEPOL) ensures among its missions, the protection of the coastline and sensitive sites and the recovery of pollutants. The Fire and Survival Techniques Training Centre (CETIS) is in charge of shipboard response training (IBN), survival in extreme environments, and survival at sea. Since 2016, the capacity to respond to disasters on board ships (CAPINAV) has been the means of zonal and national reinforcement to ensure the coverage of a large-scale maritime rescue in French territorial waters. The Maritime Medical Response Unit (UMIMM) is an integral part of CAPINAV.

Despite this important sea-based rescue structure, there is no study describing the marine interventions carried out by the BMPM. The purpose of the study was to establish the epidemiological characteristics of interventions with a physician in the maritime environment by the BMPM between the years of 2005 to 2017.

MATERIALS AND METHODS

TYPE OF STUDY

Monocentric retrospective descriptive analysis.

PARTICIPANTS, INCLUSIONS AND DATA COLLECTION

Global data on BMPM maritime interventions

The statistical office of the BMPM is in charge of analysing data from BMPM interventions. The information is collected by means of a standardized questionnaire at the Marseille Fire and Rescue Services Operational Centre (COSSIM) and by standardized ambulance intervention reports. This office provided the following data: mission number, date, type of intervention, place of intervention, type of vehicle and connecting base.

Data on interventions with a doctor

For each patient, the doctor wrote a medical intervention form (FIM) on paper format and since 2016 in computer format. The FIM were extracted from the archives and database of the T-SMUR® software (GIP e-SANTE ORUPACA®, Hyères, France). Demographic, environmental, and medical data related to the intervention were manually entered into a specific table.

STATISTICAL ANALYSIS OF THE RESULTS

The statistical analysis of the study data was performed using Excel® 2010 software (Microsoft Corporation, Redmond, USA). Quantitative variables were described by mean and confidence intervals and qualitative variables by frequency and percentage.

RESULTS

GENERAL DATA ON BMPM MARINE RESPONSE

The BMPM carried out 2,375 marine interventions between 2005 and 2017 involving 4,644 vehicles. The annual average of interventions was 183 (CI 95: 180.04; 185.96) (min = 101, max = 362) (Fig. 1).

The majority of maritime interventions took place in the summer season (from June to September) with a total of 1,434 interventions over the period 2005 to 2017 compared to 941 from October to May.

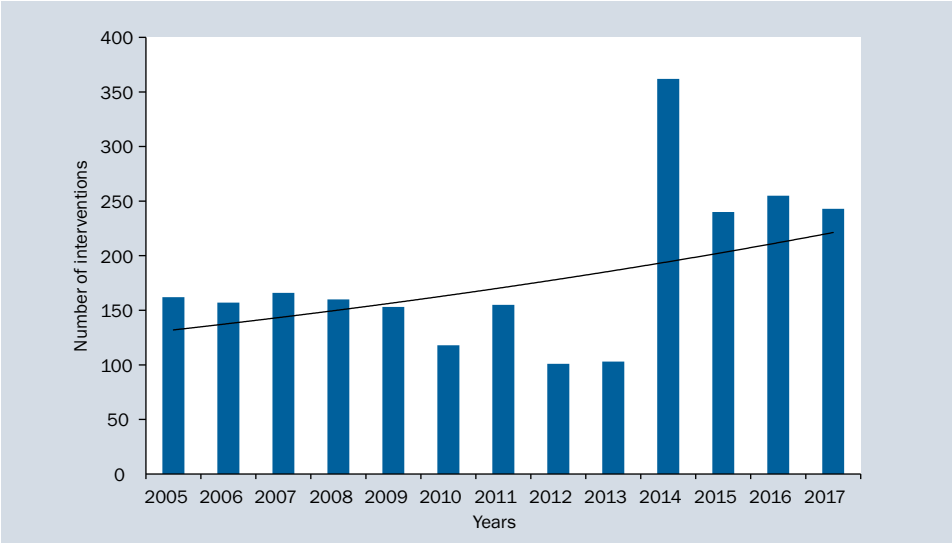

Figure 1. Annual distribution of BMPM maritime interventions

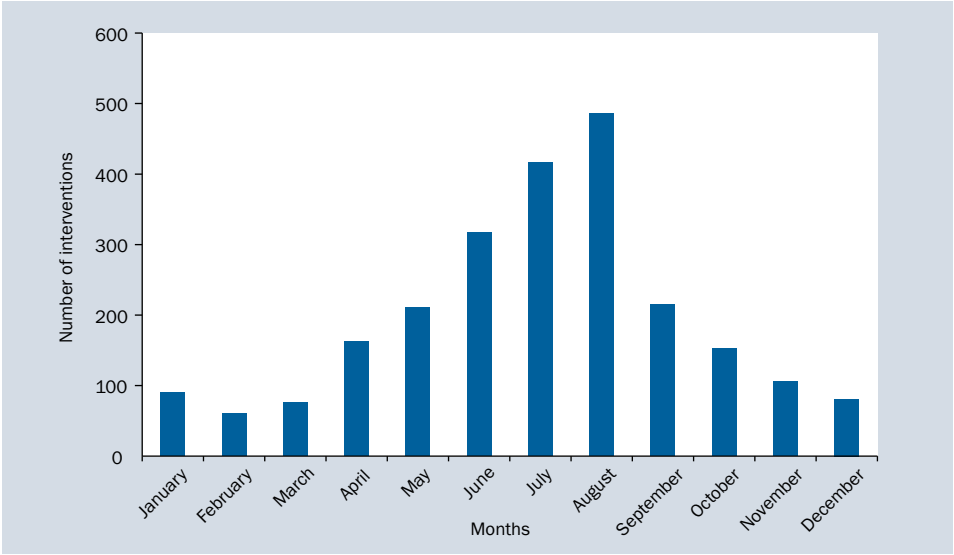

Figure 2. Monthly cumulative of the BMPM maritime interventions

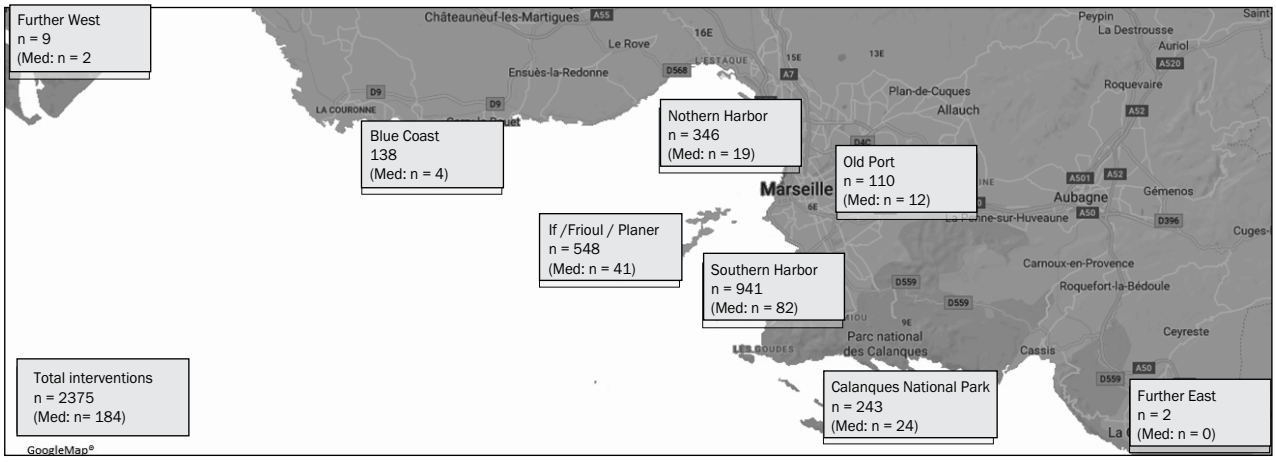

Figure 3. Geographical distribution of BMPM interventions

July and August were the most active months (902 interventions) with a peak of 486 cumulative interventions in August (Fig. 2).

The coast, the southern harbour of Marseille and the If, Frioul and Planier islands accounted for 64% of BMPM's maritime interventions (Fig. 3).

INTERVENTIONS INVOLVING A DOCTOR

General information

The BMPM referred 186 interventions to a physician between 2005 and 2017, involving 215 medical vehicles. The most frequent medical vehicles involved were the VMS (n = 63), the SMUR Louvain (n = 56), and the SMUR Endoume (n = 36).

The average annual number of interventions with a doctor was 14 (CI95: 13.12; 14.88) (min = 8, max = 28) (Fig. 4).

The majority of these interventions took place during the summer season (from June to September) with a total of 110 interventions over the period 2005 to 2017, compared to 76 from October to May. August was the busiest month with 41 interventions (Fig. 5). The coast, the southern harbour of Marseille and the islands If, Frioul and Planier concentrate 67% of interventions requiring a doctor (Fig. 3).

As a result of searches in the BMPM SMUR database, 59 interventions were not related to patient management (ship in difficulty, operational medical support, cancelled outings, etc.) and 20 FIM were not found at the time of data collection. A total of 107 FIM were analysed. Regarding the location, 98% of the interventions took place in the municipality of Marseille and 2% in the municipality of Cassis. The gender distribution was 64% male, 32% female, and 4% unspecified.

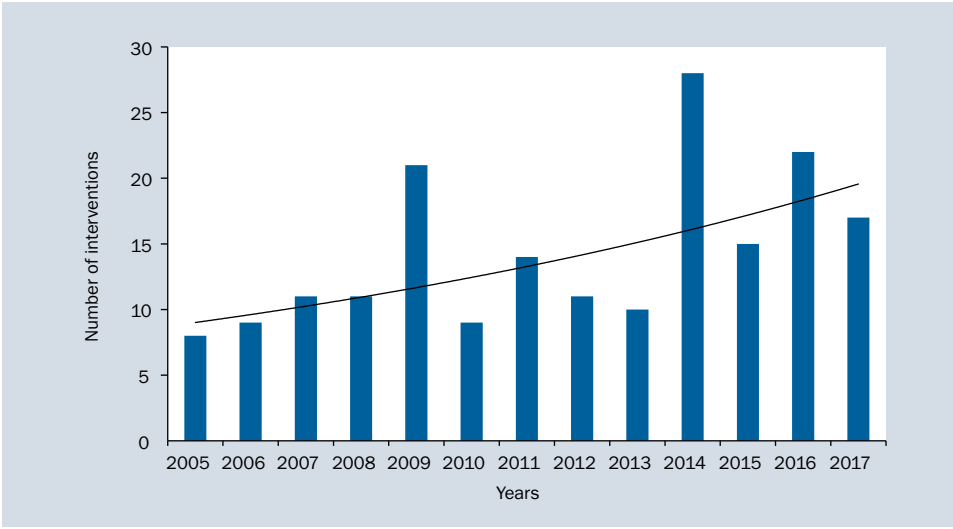

Figure 4. Annual distribution of BMPM medical maritime interventions

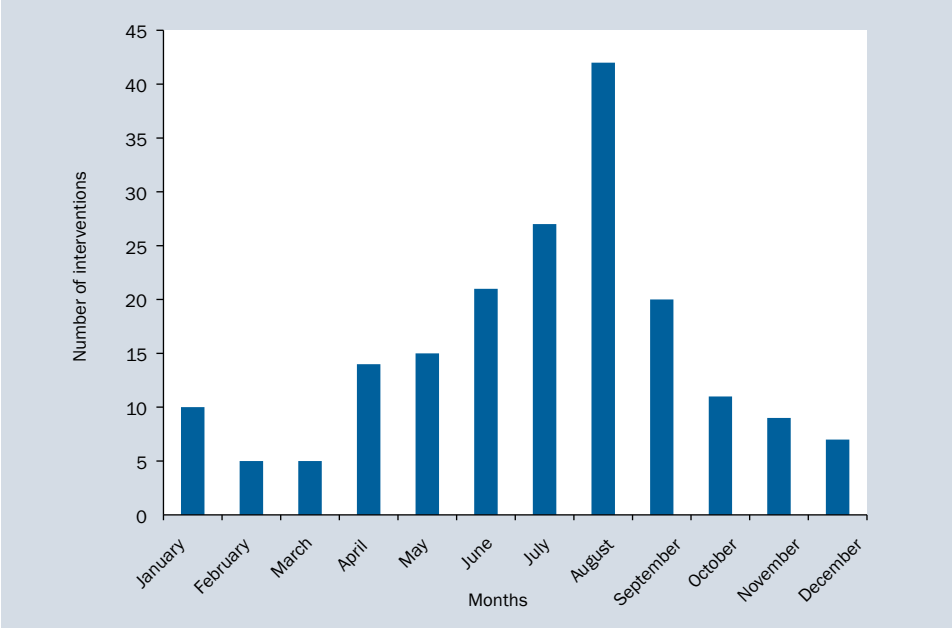

Figure 5. Monthly cumulative of the BMPM medical maritime interventions

Out of 98 interventions specifying the age of patients, the average age was 42 years (CI 95: 37.8; 45.4), with a distribution by sex: 46 years (CI 95: 35.1; 48.9) for women and 39 years (CI 95: 34.8; 43.6) for men. People in the 25–44 age group (n = 35) were the most represented, followed by people aged 45–64 (n = 27) and those over 65 (n = 15). The 6–12 age group was the least represented (n = 0), followed by the 0–5 age group (n = 3), the 13–19 age group (n = 8) and the 20–24 age group (n = 8) (Fig. 6).

Out of 88 interventions in terms of geographical location to the coast, 77% of the interventions took place in the 300 m band compared to 17% above 300 m and 6% on the coast.

Accidental falls into the water were the most frequent cause of intervention requiring attention by a physician (n = 21), followed by boating (n = 17, motor = 10, sailing = 7), swimming (n = 16), and diving accidents (n = 16, diving = 15, freediving = 1) (Fig. 7).

Based on mission order schedules (n = 105), interventions involving a physician took place during the day (between 10 am to 7 pm) and sometimes at night, with a peak of 13 interventions at 4 pm (Fig. 8).

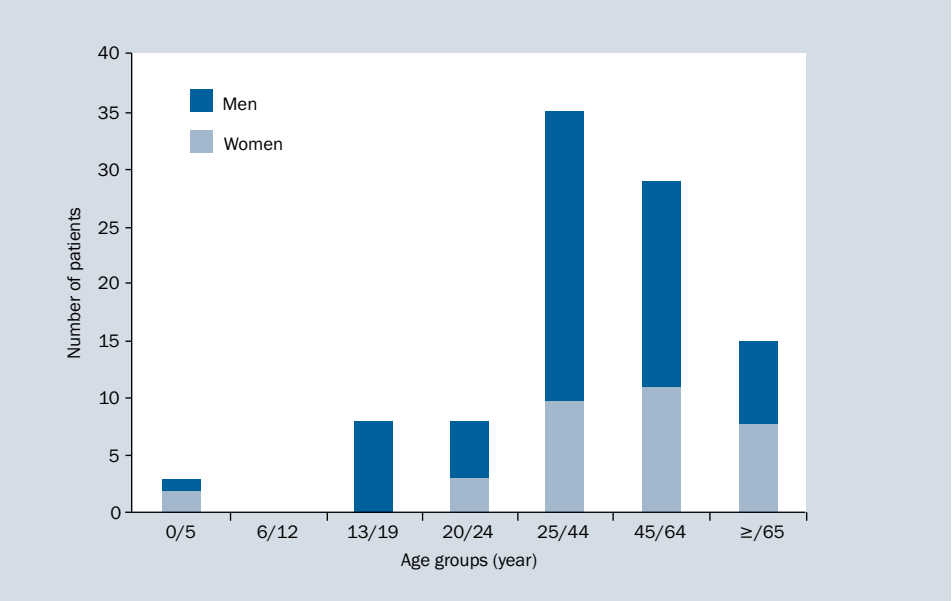

Figure 6. Breakdown of BMPM medical interventions by age groups

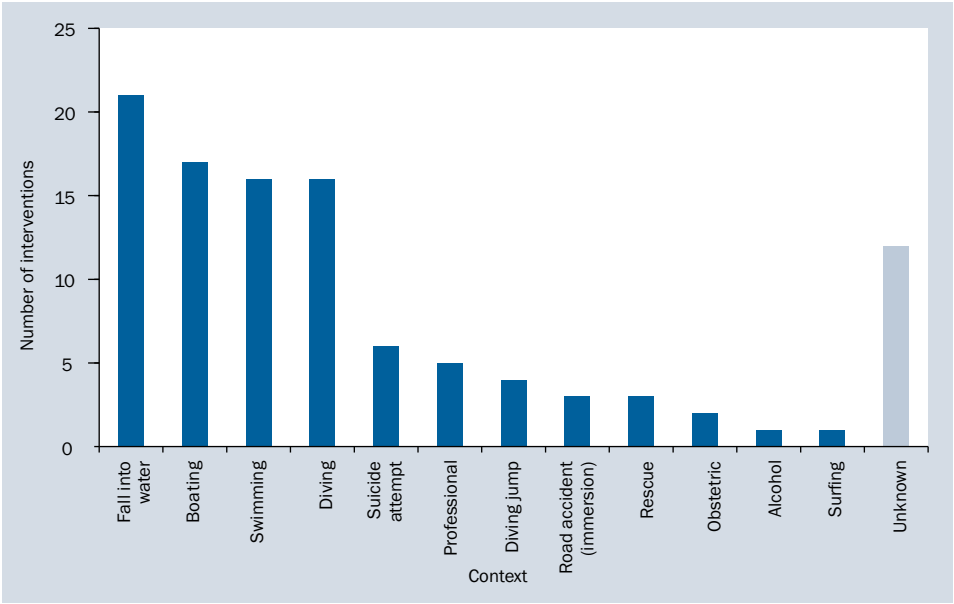

Figure 7. Breakdown of BMPM medical interventions by context

The BMPM's SMURs had an average response time of 15 minutes (CI 95: 10.23; 19.77) (n = 97). Regarding transport, 53% of patients were cared for by a physician, compared to 21% without. Approximately 19% of patients died during surgery and 4% of patients were not transported to a hospital. The average time from call to arrival at the destination for medical transport was 83 minutes (CI 95: 75.65; 93.35), (101 min > 300 m and 78 < 300 m).

A total of 78 patients were transported to the emergency departments (ED) (n = 49), intensive care unit (ICU) (n = 17), hyperbaric chamber (n = 4), cardiology (n = 3) or other services (n = 3). Circumstantial pathologies constituted 50% of SMUR diagnoses, followed by traumatic pathologies (23%).

Concerning circumstantial pathologies: 36 were drownings, 15 were diving accidents, and 2 suffered from hypothermia.

Drowning

Referring to FIM, 36 drowning victims had SMUR reinforcement from the BMPM, including 14 *stages 6* and 5 *deaths* from the Szpilman classification [1] (Fig. 9).

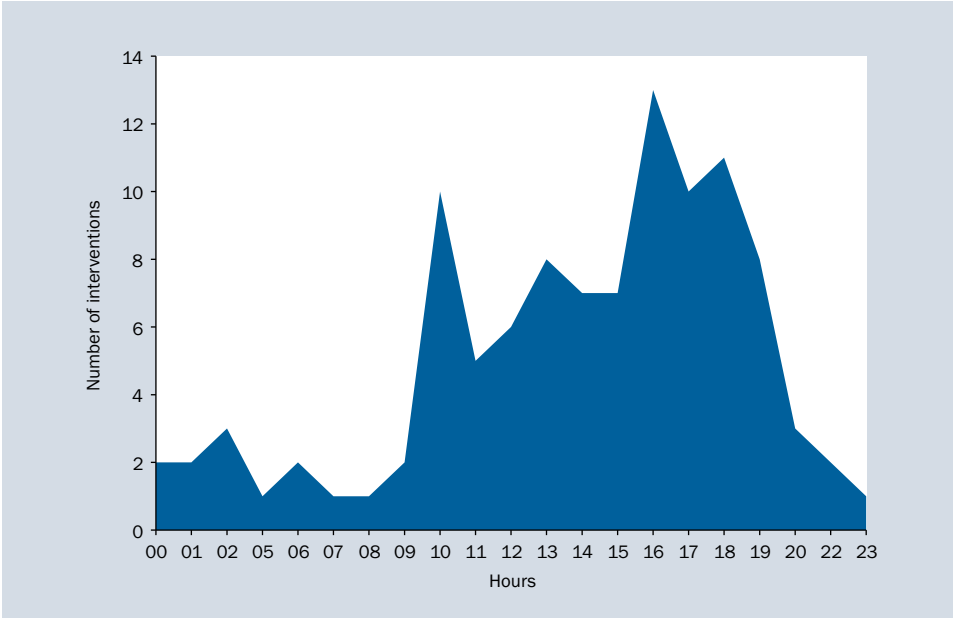

Figure 8. Time allocation of medical interventions of the BMPM

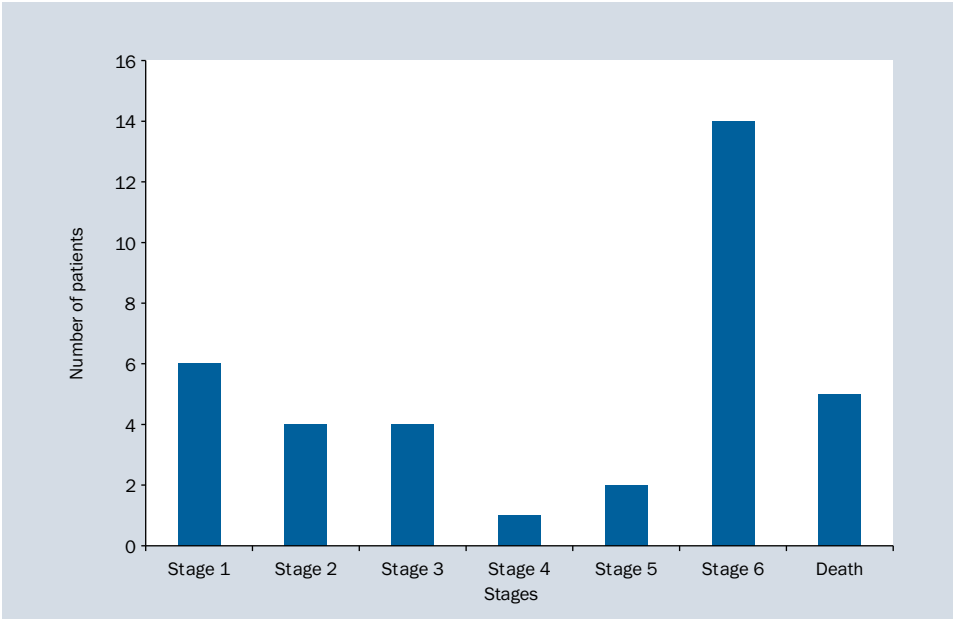

Figure 9. Breakdown of drowning according to Szpilman classification

The breakdown by sex was 56% male, 39% female and 6% unspecified.

The average age of patients by drowning (n = 30) was 42 years old (CI 95: 34.36; 49.64; 3–76), 44 years old (CI 95: 31.3; 49.64) for women and 40 years old (CI 95: 30.63; 49.37) for men. Nine patients that drowned were between the ages 25 to 44, 7 drowned between the ages 45 to 64, 6 drowned aged over 65, 4 drowned between the ages 13 to 19, 3 drowned between the ages 20 to 24, and 1 infant under the age of 5. The 45–64 year old age group was the most severely affected with 5 *stage 6* and 1 *death* according to Szpilman classification. Only 1 child under 5 years old was recorded (*Stage 6*).

The majority of drownings occurred in the 300 m band (n = 29).

Pertaining to documented management, 72% of the drowned patients received oxygen therapy, 36% intubation,

8% rapid sequence induction (RSI), 31% had cardiopulmonary resuscitation (CPR) without delivered shock, 6% received non-invasive ventilation (NIV) and no use of ultrasound was noted in the intervention forms.

Regarding transport, 57% of patients were transported by a SMUR, 43% were reported deceased on site and 20% were transported without a physician. Over 50% of all transported patients were referred to the ED and ICU.

The diving accident

Based on the FIM, 15 diving accidents received BMPM'S SMURs support between 2005 and 2017, 7 women and 8 men.

The average age of diving accidents was 44 years (CI 95: 40.23; 55.77), 48 years (CI 95: 40.23; 55.77) for women, 41 years (CI 95: 33.3; 48.7) for men. The age distribution by age group included 8 divers aged between 25 and 44 years, 6 divers between 45 and 64 and 1 diver aged over 65.

The maximum average dive depth was 35 m (IC95 = 8.6) for an average dive time of 15 min (IC95 = 10.8)

Concerning the documented treatments, all divers received hydration, 80% by VVP, 73% of patients received oxygen therapy, 40% acetylsalicylic acid, 27% orotracheal intubation, 7% RSI, 20% CPR, 7% NIV and 7% received a delivered shock.

Concerning transport, 54% of the divers were transported under the supervision of a doctor, 33% without a doctor and 13% were declared deceased on site. 47% of divers were transported to the ED, 27% to the hyperbaric chamber and 13% to ICU.

Traumatology

The FIM analysis identified 24 trauma patients, 18 males and 6 females. The average age was 29 years (15–60), 43 years (30–60) for women and 26 years (15–52) for men. Four age groups were represented: 25–44 years (n = 7), 45–64 years (n = 6), 13–19 years (n = 4) and 20–24 years (n = 2).

Trauma-related activities included: power boating (n = 7), accidental falls into the water (n = 6), sailing (n = 5), diving (n = 4), road accidents with immersion (n = 1) and rescue (n = 1).

Pre-hospital diagnoses of patients included 5 severe traumas, 5 shoulder dislocations, 4 whiplash injuries (2 with cardiac-circulatory arrest), 2 chest injuries, 2 head injuries, 2 thoracolumbar spinal injuries, 1 traumatic pneumothorax, 1 femoral fracture, 1 thigh injury, and 1 with injury with minor bruises.

Out of the 23 patients that were transported, 20 were monitored by a physician as compared to 3 not needing intervention by a physician. The majority of patients were admitted to the ED (n = 20) and 3 patients were admitted directly to the ICU.

DISCUSSION

The purpose of the study was a descriptive analysis of the BMPM's medical interventions from 2005 to 2017.

The annual number of marine interventions by the BMPM was lower than in other specialized marine rescue structures [2, 3]. The BMPM's rescue activity was not exclusive to the sea and its area of responsibility was geographically limited. The number of interventions requiring a physician increased in contrast to those that did not. There were an increased number of interventions in the summer with a peak frequency in August [2, 4]. The peak in medical interventions between 4 p.m. and 6 p.m. was correlated with peak times in attendance.

The presence of a physician in 8% of marine interventions was similar to the terrestrial environment (BMPM data).

Nearly 2/3rds of interventions in the maritime environment are carried out in the sector of the southern harbour of Marseille and the Frioul, If and Planier islands. This sector, easily accessible from the city, is concentrated in many activities related to as marine environment (yachting, sailing schools, surfing area, diving activity, beaches, etc...). This observation also explains why SMUR Louvain, Endoume and the VMS "pointe rouge" (local connecting bases) are the most involved in sea-related interventions. The frequency of interventions in the 300m band (77%) coincides on that recorded by the SCMM Toulon (70%, summer season 2014).

The average delay time upon arrival on the spot was 15 minutes, which was correlated with the time in town (source SMUR of the BMPM). This can be explained by the vast majority of interventions that were carried out near the shore. The average delay time upon arrival to the hospital was 83 minutes (78 min in the 300 m band and 101 min beyond). This delay time could be due to many factors associated with an intervention at sea such as climate, small rescue boats and could be explained by complex evacuations. However it remains below some studies due to the proximity to the shore [5, 6].

The most common aetiologies of trauma were accidental fall into the water, boating accidents, swimming, diving, and surfing accidents. The incidence of these accidents can be prevented with increased preventive measures such as compliance with regulations, display of information panels, and dissemination of prevention messages before summer activities.

The analysis of the FIM showed that circumstantial and trauma based accidents were the most common pre-hospital diagnoses found, accounting for 73%. According to the 2015 INVS drowning report, the majority of drownings occurred in the 300 m range.

Drowning was the leading cause of mortality (57%) managed by the BMPM SMUR (58.3% *stage 5*, *6* and *death* of Szpilman). This severity is observed in other studies [4, 7–9].

While adults between ages 45 and 64 were the most commonly affected, the one infant (under age 5) that drowned was also a Szpilman *stage 6* [1]. These results can be interpreted by an erroneous sense of control of the hazards of the maritime environment increasing with age, cardiovascular risk factors, and vulnerability of younger people [4, 10].

The management of drowned patients included intubation (36%), CPR (31%), and only one NIV was established (on 4 stages 3 of Szpilman) without any documented ultrasound.

The use of the Szpilman classification and ultrasound seems to be a way of improving the management of drowned persons by the BMPM SMURs, as demonstrated in the study by Michelet et al. [11]. The significant rate of CPR and intubation that can be performed under sometimes difficult conditions supports the interest of exercises in exceptional situations and the probable interest of using a message board in a difficult and isolated environment. While the duration of submersion is an essential prognostic factor [12], this parameter is rarely found on FIM. The same applies to associated factors such as alcohol use (INVS drowning survey 2012 and 2015). Finally, prevention remains at the heart of public health issues [1, 10, 13].

Diving accidents, the second most common cause of circumstantial pathology, accounting for 28%, predominately affected patients over the age of 25. While the depth and duration of dives are systematically recorded, the type of dive, the gas mixtures used, and the number of stops were not frequently recorded on the FIM [14]. All divers received hydration. Of hydration treatment administered, 80% was by IV, and 73% of divers received oxygen therapy. 31% of patients were transported to hyperbaric units and 15% to the ICU. Investing in further education for BMPM medical teams on the main principles of diving accident management would make it possible to better document the key points of this pathology.

Finally, trauma represented 22% of the interventions requiring a physician's attention with the BMPM. Nearly 83% of patients were transported to a local hospital for medical care and 25% were diagnosed with multiple traumatic injuries. Boating, accidental falls, and diving were the most common high-risk activities. Evaluation of necessary regulations, with a focus on prevention on the dangers of certain maritime activities, must be continued and further strengthened.

STUDY LIMITATIONS

The retrospective, monocentric nature of the study, located in the municipality of Marseille and the surrounding areas, did not allow the results to be encompassing to the entire French coastline. The heterogeneity of the quality of FIM data entry and loss of partial FIMs, made it possible to identify trends on the variables studied.

CONCLUSIONS

The BMPM carried out a total of 2375 marine interventions between the years of 2005 to 2017. The presence of a physician was necessary on 186 occasions. The extraction and analysis of the 107 medical intervention forms found in the BMPM archives revealed a concentration of 67% of physician intervention in the southern harbour of Marseille and the islands of Frioul, If and Planier. 77% of interventions took place in the 300m band. Accidental falls into the water were the most frequent cause of intervention requiring a physician, followed by boating (sailing and motor), and swimming. Drowning was the most frequent pathology requiring a physician making up 34% of all interventions. The potential areas for improvement in the management of drowned patients are the use of the Szpilman classification, ultrasound, and non-invasive ventilation. Diving accidents represented 14% of missions requiring a physician. A reorientation of the training of BMPM physicians on the clinical management of diving accidents would help to optimize the entry of information on FIM. Trauma affected 22% of the study population and 83% of trauma patients were transported to hospital for medical care. Accident prevention plans and actions should be continued and reinforced in regards to water sports, diving, and recreational swimming. The increase in maritime traffic and the current international security situations requires that the skills of UMIMM personnel be strengthened and maintained.

The authors of this study have declared they have no competing or secondary interests in relation to this study.

ACKNOWLEDGEMENTS

Mrs. Melissa Renee Faulk, Physician assistant certified in Tampa (Florida) has participated to the work by controlling the English language.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest in connection with the study.

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VIA MEDICA

CASE REPORT

Int Marit Health
2019; 70, 3: 167–170
DOI: 10.5603/IMH.2019.0026
www.intmarhealth.pl

ISSN 1641–9251

An acute coronary syndrome in Antarctica

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ABSTRACT

Cruise tourism to Antarctica is constantly growing. Passengers and crewmembers may experience illnesses or injuries while traveling to remote areas with harsh weather conditions from where prompt evacuation is mostly unavailable. While a small explorer ship was at Wilhelmina bay (64°39' South and 62°08' West) in the Antarctic Peninsula, a 73-year-old male passenger presented with acute chest pain after two short excursions off the vessel in cold weather conditions. He was treated on board and remained clinically stable until the ship reached Ushuaia at the end of the cruise which was 5 days after the symptoms onset.

(Int Marit Health 2019; 70, 3: 167–170)

Key words: acute coronary syndrome, chest pain, myocardial infarction, cruise ship, Antarctica

INTRODUCTION

Antarctic cruise tourism has steadily increased — from 6,704 tourists in 1992 to 27,537 in 2004 and 45,083 in 2016–2017. The cruises typically last 10 to 15 days and most passengers are elderly and American [1]. The seas are often rough and the remote Antarctic Peninsula exhibits extreme weather conditions, all factors that prohibit medical evacuation [2]. Very cold and windy weather, which are weather conditions encountered in Antarctica, can contribute to acute coronary syndrome [3]. Myocardial infarction is a condition that physicians on board fear. This report concerns a 73-year-old cruise passenger who experienced acute chest pain while his ship was at Wilhelmina Bay, in the Antarctic Peninsula.

MEDICAL CONDITIONS

On November 23rd, 2017, at 8:00 hours, while the ship was cruising the Wilhelmina Bay (64°39' South and 62°08' West; close to the Antarctic Peninsula), a French 73-year-old male passenger consulted the ship physician because of chest pain. It had started the previous day after a windy and freezing cold zodiac cruise, then disappeared, but recurred in the afternoon during a short hike ashore in similar cold and windy conditions. The chest discomfort, described as "tightness" continued and increased during the night. An occasional smoker, the patient's only known medical condition was an elevated but untreated high cholesterol level. On presentation, the patient's vital signs were: heart rate 70 beats/min, oxygen saturation 98%, respiratory rate 15 breaths/min, blood pressure 160/80 mmHg, and body temperature 98°F. His initial electrocardiogram revealed signs of anterior myocardial ischaemia and left ventricular hypertrophy (Fig. 1). His cardiac enzyme troponin level was increased to 104 ng/L (normal below 50 ng/L). By tele-consultation from the Medical Maritime Consultation Centre in Toulouse, France, a cardiologist confirmed the onboard

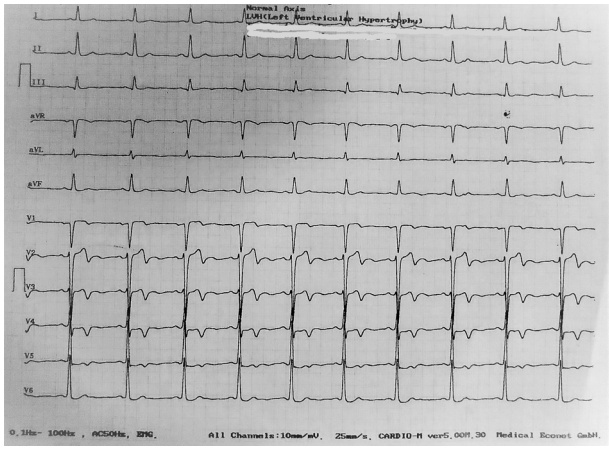

Figure 1. Wellens syndrome. Terminal inversion of T-wave from V1 to V3, showing an epicardial ischaemia. Left ventricular hypertrophy

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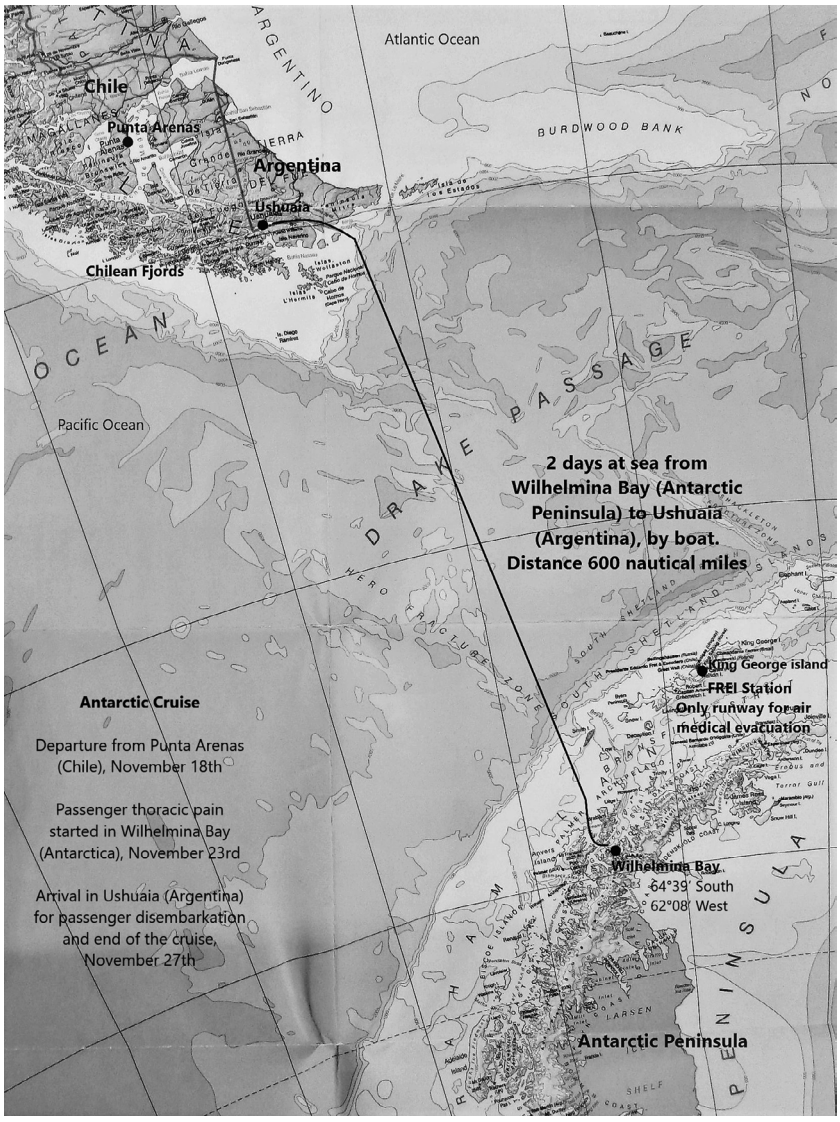

Figure 2. Navigation map between Wilhelmina Bay (Antarctica) and Ushuaia (Argentina) during an Antarctic cruise

diagnosis of acute coronary syndrome and agreed that thrombolysis was not indicated because no ST-segment elevation was seen. The patient was treated with aspirin, enoxaparin, ticagrelor and omeprazole. A trinitrine patch was prescribed to decrease a persistent chest pain. The next day, on November 24th, his troponin level increased to 255 ng/L while the electrocardiogram was unchanged. The patient remained stable under cardiac monitoring on board and was transferred urgently to a hospital upon arrival in Ushuaia on November 27th, which was the date initially scheduled for arrival at Ushuaia.

FOLLOW UP AND OUTCOME

At Ushuaia hospital admission, the electrocardiogram did not show any acute ischaemic signs while the troponin level increased to 710 ng/L. His cardiac systolic function was preserved. On November 29th, 7 days after symptoms' onset, a coronary angioplasty was performed and one vascular stent was implanted. He had an uneventful recovery.

SHIP, ROUTE AND WEATHER CONDITIONS

The ship (length: 466 feet, beam: 59 feet, tonnage: 10700 and 6 decks), had a capacity of 200 passengers and 140 crewmembers. On board, the medical facilities were composed of two ward rooms and urgent care was available. One emergency care doctor was on board since 2 months, with one nurse to help him. He had a previous training in maritime medicine. Small laboratory facilities were available for cardiac enzymes, biochemical and haematological analysis.

The ship left Punta Arenas, Chile, on November 17th and arrived at Ushuaia, Argentina, on November 27th, 2017 (Fig. 2).

After the departure, the ship sailed south in bad weather. Temperatures were between –4°C and 4°C during the whole cruise. On November 18th, passengers took part in a zodiac cruise in front of Garibaldi Glacier in the Chilean Fjords in cold, windy and humid weather. The next day, in Puerto Williams, they experienced heavy snow while they were walking in town. The ship spent 2 days in rough seas with 8-metre swells crossing the Drake Passage to reach the Antarctic Peninsula, where passengers were exposed to freezing wind and snow every day if participating in zodiac cruises or short hikes ashore. Because the weather conditions couldn't allow an air medical evacuation from Frei Station, the only way to return to Ushuaia was to sail back through the Drake Passage. Because of rough seas, the captain decided against an emergency crossing to Ushuaia, but the ship was able to leave Antarctica for Ushuaia in the evening of November 25th.

DISCUSSION

Nowadays, a study carried out on a similar explorer ships, found a passengers median age of 68 years old and cardiovascular diseases represented up to 6% of the pathologies encountered on board [4]. Regarding cardiovascular disease, a study aboard 5 large cruise ships requiring telemedical cardiology consultation, with 100 patients, found that almost a fifth of them had a history of coronary heart disease. This study showed that the most common symptom was chest pain (50%). An abnormal electrocardiogram was present in 92% of the cases and the most common diagnosis was acute coronary syndrome, followed by atrial arrhythmias [5]. In emergency departments ashore, it was reported that acute coronary syndrome is the most common cause of sudden death [6, 7].

The occurrence of coronary heart disease appears to be closely related to weather conditions. Exposure to cold is a triggering factor in myocardial infarction and the risk is higher in the elderly and patients with a coronary history [8–12]. Heavy snowfall and strong wind increase the risk of coronary events among the elderly [13, 14]. Exposure to a 1°C decrease in the daily mean temperature increases by 2% the risk of myocardial infarction for 28 days, with a more pronounced risk between 2 and 14 days post-exposure [15]. Hard climatic conditions — freezing cold, strong wind, heavy snowfall — prevail in Antarctica [2], and may have a drastic impact on passengers when hiking ashore or during a zodiac cruise.

Mechanisms leading to influence of cold on the onset of acute coronary events are known. Cold stimulates skin receptors and sympathetic nervous activity which leads to a rise in catecholamine levels and a peripheral vasoconstriction. It increases blood pressure, heart rate, cardiac work and myocardial oxygen requirements and reduces the ischaemic threshold. A drop in temperature increases diuresis with an increase in blood viscosity and haemoconcentration. Cold causes an increase in coagulation factors as fibrinogen and platelets counts which may promote acute thrombosis [8, 10, 16–19].

Considering the remoteness and the extreme weather conditions of the Antarctic Peninsula and its surroundings, the area presents a high risk for navigation as well as for medical care. Medical evacuations are hazardous and mostly not available [2, 20]. The combination of temperatures below 0°C, strong winds with heavy gusts and snowfall compromises medical aircraft rescue [2]. Indeed, in the Antarctic Peninsula, the only way for a medical evacuation by air is from Frei Station located on King George Island (South Shetland Island — 62°12'0'' South; 58°57'51'' West) where the availability of the only aircraft runway depends on freezing, wind and visibility conditions [20]. In case of the unavailability of this runway, 2 days at sea crossing the Drake Passage, often on rough seas, are compulsory to reach Ushuaia. This isolation, although often forgotten on board, is strongly felt in these critical situations.

Before an Antarctic cruise, passengers with history of heart diseases should be aware of the increased cardiovascular risks because of the weather conditions. They must know that medical evacuations may be hard and delayed because of the area remoteness combining to its hard weather.

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VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2019; 70, 3: 171–179
DOI: 10.5603/IMH.2019.0027
www.intmarhealth.pl

ISSN 1641–9251

Dockworkers' health and safety. A cross-sectional study of self-perceived safety and psychosocial work environment amongst Danish dockworkers

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ABSTRACT

Background: *This study aimed to determine the characteristics and association between self-perceived safety and psychosocial work environment amongst dockworkers in Denmark.*

Materials and methods: *A cross-sectional study was conducted among dockworkers in three harbours in Denmark, using a triangulation strategy approach, with a questionnaire survey and telephone interviews. Both collection methods included questions on workplace safety, accidents, work environment, colleagues and management. The majority felt confident about the safety at the work place (88.8%) and agreed that good collaboration and teamwork among colleagues (95.4%) was the reason they felt safe. The majority were very satisfied with their job (76.1%). Moreover, the majority stated that they were thriving well in the changeable working hours (85.1%) and did not find it stressful to be a part-time worker with no guarantee of work (80.2%). 46.1% had never felt stressed, and only 7.9% had felt stressed often the last 2 weeks. The main source of feeling stressed was the combination of work and personal life (39.3%). The study population was 88 and the response rate of the questionnaire was 41%.*

Results and Conclusions: *Due to the small study population and the distribution of answers, it was not possible to measure an association between self-perceived safety and psychosocial work environment; however, it was found that dockworkers were greatly satisfied with the working conditions, primarily because of good colleagues, flexible working hours and a satisfying pay cheque.*

(Int Marit Health 2019; 70, 3: 171–179)

Key words: dockworkers, self-perceived safety, psychosocial work environment, Denmark

INTRODUCTION

The psychosocial work environment has been a global focus for many years. It has been demonstrated that a poor psychosocial work environment increases the risk of various diseases including stress and cardiovascular disease [1]. Each year social costs related to stress cost the Danish society approximately 14 billion kroner and citizens with cardiovascular diseases cost annually 1.87 billion kroner, due to lost earnings, negative effects on production and sick leave [2–4]. Despite the increased focus on the psychosocial work environment, dockworkers are a target group where there is a tendency to focus primarily on the physical work environment (Wang et al.). Dockworkers play an important role in international trade and commerce and have a history of hard physical labour. Dockworkers' job has traditionally consisted of heavy, manual lifting, and although automation has reduced the workload, there are still many factors which may influence the health of the dockworkers. These factors make the job hazardous in different ways [5–7].

The literature suggests that working different shifts, suffering from fatigue or not paying enough attention to the work are factors which may influence the level of safety in the workplace [6, 8]. Therefore, psychosocial work environment may have an impact on safety, as the tasks dockworkers perform are hazardous. This requires dockworkers to work well together, as their safety depends upon the

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collaboration with, and the relation to, each other [5, 6, 9]. Based on this, workplace health and safety should be considered in relation to both the physical work environment *and* the psychosocial work environment, as the psychosocial work environment also influences the degree to which employees are able to work safely. This study therefore aims to determine the characteristics of, and association between, the self-perceived safety amongst dockworkers and the psychosocial work environment.

MATERIALS AND METHODS

STUDY DESIGN

A cross-sectional study design was used to examine dockworkers' self-perceived safety and the psychosocial work environment in Denmark [10–12]. A triangulation strategy approach, combining quantitative and qualitative approaches was used to enhance the validity of the study [10, 13–15]. The collection of data was done through a questionnaire survey and telephone interviews [16]. The study area was the major harbours in Denmark [17, 18].

STUDY POPULATION

Dockworkers from the four biggest harbours in Denmark (Copenhagen, Aarhus, Aalborg and Esbjerg) were invited to participate. A representative from each harbour was contacted by e-mail. Copenhagen, Aalborg and Esbjerg replied and were supplied with an electronic questionnaire. Esbjerg reported back, that they would prefer the questionnaires in paper format and the request was fulfilled. Aarhus never replied and was excluded from the study.

The study population included all dockworkers at the three Danish harbours who were > 18 years old and either part-time or full-time employees. Consent to participation was obtained before filling out the questionnaire; those who did not want to participate, or filled out the surveys incorrectly, were excluded from the study.

DATA COLLECTION

Data was collected via a 77-item questionnaire, which was sent out electronically to 214 dockworkers. The questionnaire was available over a 2-month period. In Esbjerg, the questionnaire was available both electronically and in paper form. The researchers were aware that there may be more errors or missing responses on the paper version of the questionnaire and accounted for this by both researchers thoroughly checking the answers before uploading them electronically [19].

This resulted in a total of 88 participants (Fig. 1). The response rate was 41%. Copenhagen represented 46.6% of the responders, Esbjerg 40.9%, and Aalborg 12.5% (Table 1).

In addition to the survey, semi-structured interviews were held. The participants were asked at the end of the questionnaire if they would like to participate in an interview and, if so, to provide their email-address. Out of the 88 responses, 21 participants agreed to participate in an interview. Due to various reasons as shown in Figure 2, 14 were unable to participate, resulting in a sample population of 7 participants. The participants who agreed to an interview were predominantly from Copenhagen, with only one from Aalborg and one from Esbjerg. All 7 interviews were conducted via telephone, and all interviews were done by the same person to ensure homogeneity in the interview [20–24].

STATISTICAL ANALYSIS

All data from the questionnaire survey was analysed using STATA 15, encoded into categorical data, and are presented in the attached tables. Descriptive statistics were used to describe the basic characteristics of the data, and to show the percentage distribution of the different responses.

VARIABLES

All relevant characteristics of the participants are listed in Table 2. Items used in the questionnaire survey are listed in Tables 3–8. The items listed in Table 3 pertain to the dockworkers' self-perceived safety, and the items listed in Tables 4–8 pertain to their psychosocial work environment.

ETHICAL ISSUES

Measures were taken to ensure good scientific practice. The purpose and aim of the study were explained to all participants orally and in written form in the introduction to the questionnaires. Confidentiality was ensured in the questionnaire phase through the participants completing the questionnaires anonymously. Responses from the interview phase were de-identified to preserve the participants' anonymity. Furthermore, the participants were free to withdraw from the study at any time. All participants signed an informed consent form.

RESULTS

CHARACTERISTICS OF THE PARTICIPANTS

Mean age of the respondents was 50.4 years, with a standard deviation of 10.7 years, and a range from 25 to 69 years. All respondents were males, and were from Copenhagen (46.6%), Esbjerg (40.9%) and Aalborg (12.5%). Almost half (46%) of the participants were casually employed, 40.2% had permanent employment. The majority of the respondents were either responsible for security (63.2%), stacking cones and twist locks (63.2%), lashing of containers (62.1%) or Ro/Ro (72.4%), but all participants worked within several different work fields. The three main reasons for working as a dockworker was that they found the work exciting (64.8%), a decent salary (63.6%), and flex-

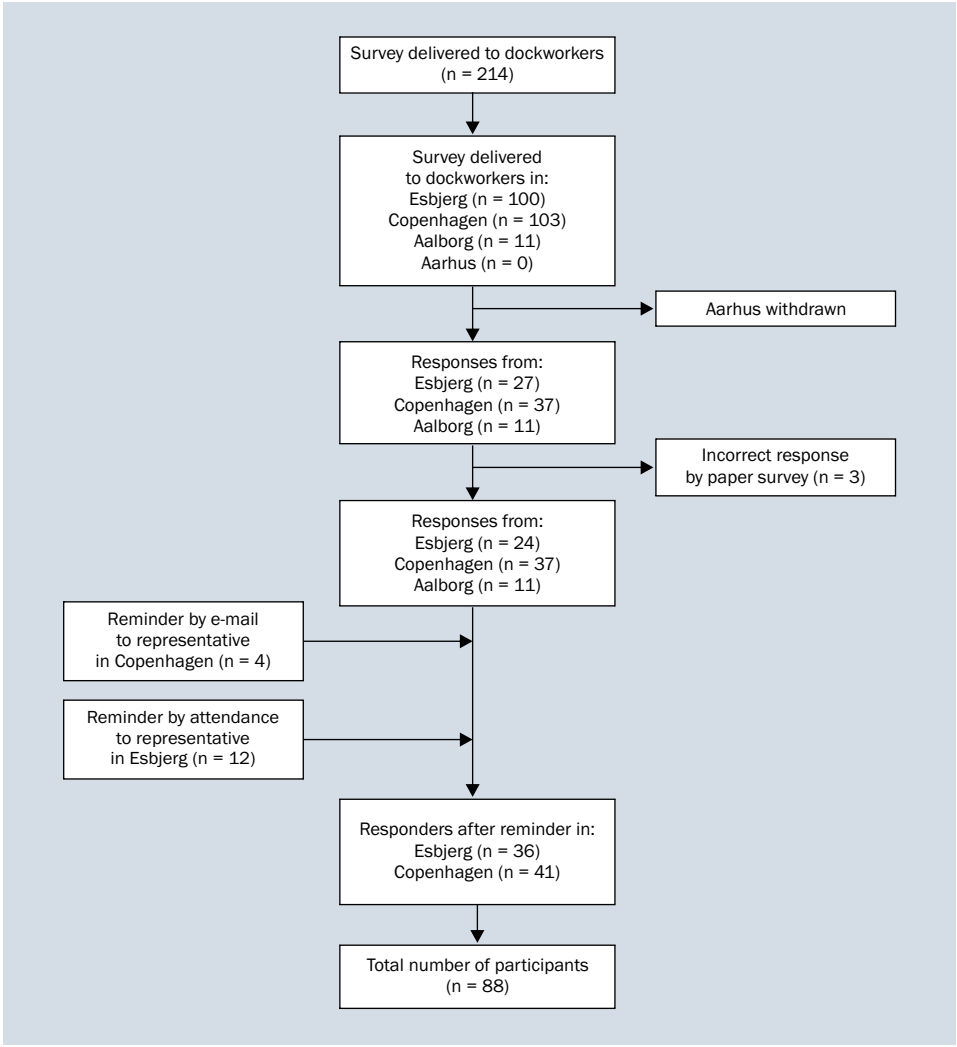

Figure 1. Study participation flow of participants in questionnaire survey

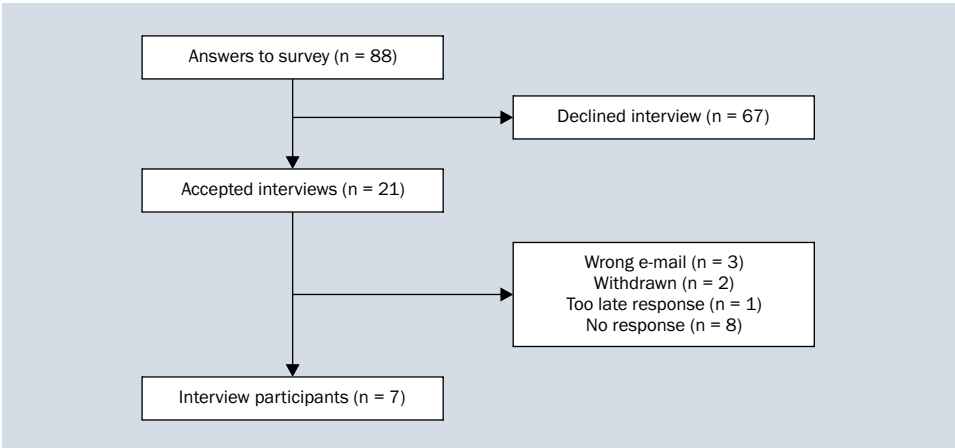

Figure 2. Study participation flow of interview participants

Table 1. Response rate calculation

Cities	Issued questionnaires	Number of replies	Response rate
Copenhagen	103	41	39.8%
Aalborg	11	11	100%
Esbjerg	100	36	36%
In total	**214**	**88**	**41%**

ible working hours (50%). Other characteristics are shown in Table 2.

SELF-PERCEIVED SAFETY

According to data (as shown in Table 3) concerning self-perceived safety, 88.8% of the dockworkers agreed on feeling confident about the safety at the workplace. 95.4% of the dockworkers agreed they helped each other to work safely, and 92.1% agreed they tried to find a solution together if a safety problem occurs.

Interviewee no. 1 indicated that the feeling of safety occurs at the workplace because of good teamwork, but the interviewee also stated that the material conditions were getting worse: *"I am very comfortable when I go to work, because there is an incredibly good cohesion, there is a lot of help from my colleagues, whereas [my] faith in the quality of the work materials, gets worse." — Interviewee no. 1*

Interviewee no. 3 agreed on the fact that the feeling of safety is related to the colleagues, and that trust plays a central role: *"The safety is high. It is a very hazardous workplace... but it is the people who are employed at the workplace, they are really competent people... And I trust them 100%, so that makes me feel safe." — Interviewee no. 3*

Regarding whether minor accidents are a part of the everyday work life, 62.9% disagree, and 79.5% disagree with the statement that breaking safety rules is necessary to get work done in time (Table 3).

PSYCHOSOCIAL WORK ENVIRONMENT

Tables 4 to 8 show all data concerning the status of the dockworkers' feeling about the psychosocial work environment including job satisfaction, major changes, feelings of stress, and relations to colleagues and the management. Only the answers which are considered most relevant are mentioned in these results, but more data are shown in the tables.

Sixty per cent of the surveyed dockworkers answered that they were affected by the job uncertainty, but only 19.8% found it stressful not to be guaranteed work every morning. 57.5% of participants agreed that major changes had happened during the last year (Table 4). The way the management had handled the changes was reported to be somewhat unsatisfactory. 58.2% felt to a low extent that

Table 2. Characteristics of the participants

	%	n
Age	**100**	**86**
25–34	11.4	10
35–44	13.6	12
45–69	72.7	64
Conditions of employment	**100**	**87**
Day by day employment	46	40
Permanent employment	40.2	35
Other	18.4	16
Work field	**100**	**87**
Responsible for security	63.2	55
Stacking cones and twist locks	63.2	55
Lashing of containers	62.1	54
Ro/Ro	72.4	63
Purge by the bulk	8	7
Hatchclerk (controller and responsible for safety)	2.3	2
Driving machines in bulk (excavator + front loader)	18.4	16
Ship to shore crane driver (container bridge)	20.7	18
Transportation of containers with terminal tractors, reach stackers, straddle carrier	52.9	46
Stripping/unstrapping, lashing of containers at the storehouse	6.9	6
Reception and delivery of containers to lorry (reach stackers, straddle carrier)	21.8	19
Transportation from the port to customers (terminal tractors or mover)	21.8	19
Other	17.2	15
Reasons for working as a dockworker	**100**	**88**
The work is exciting	64.8	57
My family has always worked here, so it was the obvious choice	20.5	18
I was inspired by my acquaintance	28.4	25
The salary is good	63.6	56
The flexible working hours	50	44
I did not fit in elsewhere	4.5	4
It was the easy choice	3.4	3
It is an investment in my future	3.4	3
I see it as a challenge	27.3	24
Other	6.8	6

Table 3. Effects on self-perceived safety (n = 88)

Variable	Agree	Disagree
We help each other to work safely	95.4% (n = 84)	4.5% (n = 4)
If there is a safety problem, we try to find a solution (n = 89)	92.1% (n = 82)	7.9% (n = 7)
I feel like listened to if in connection to accidents (n = 86)	91.8% (n = 79)	8.2% (n = 7)
I feel confident about the safety of my workplace (n = 89)	88.8% (n = 79)	11.2% (n = 10)
Our work is unsuitable for "sissies" (n = 89)	58.4% (n = 52)	41.6% (n = 37)
Minor accidents are a normal part of our daily work (n = 89)	37.3% (n = 33)	62.9% (n = 56)
Breaking safety rules to get work done in time is necessary	20.45% (n = 18)	79.5% (n = 70)

Table 4. Effects on the psychosocial work environment (n = 88)

Variable	Yes	No
Major changes have happened at the workplace in the last year (n = 87)	57.5% (n = 50)	42.5% (n = 37)
Exposed to bullying at work, within the last 12 months	29.5% (n = 26)	70.5% (n = 62)
Exposed to threats at work, within the last 12 months	23.4% (n = 21)	76.1% (n = 67)
Discriminated at work because of gender, age, ethnicity, religion or other within last 12 months	14.7% (n = 13)	85.2% (n = 75)
Exposed to sexual harassment at work, within the last 12 months	1.1% (n = 1)	98.9% (n = 87)
Exposed to physical violence at work, within the last 12 months	0% (n = 0)	100% (n = 88)

Table 5. Effects on the psychosocial work environment (n = 88)

Variable	Agree	Disagree
Thriving well in changeable working hours and shifts (n = 87)	85.1% (n = 74)	11.4% (n = 13)
The job uncertainty does not affect my mood (n = 85)	60% (n = 51)	40% (n = 34)
Time pressure affects my mood negatively (n = 86)	25.6% (n = 22)	74.4% (n = 64)
It is stressful, not to be guaranteed work when attending each morning (n = 81)	19.8% (n = 16)	80.2% (n = 65)
Due to emotional problems, I have not achieved as much at my job as I would like (n = 85)	11.8% (n = 10)	88.2% (n = 75)

the management adequately informed about new changes. 67.3% did not feel adequately involved in the changes. 23.6% answered that they were generally satisfied with how changes were handled by the management (Table 6).

According to interviewee no. 6 the dockworkers are informed, but are not as informed as desired and there is a lack of involvement: *"...they call it dialogue meeting, it is monologue, so... we do not have much to say, we just have to listen... Lack of information may create some conflicts sometimes." — Interviewee no. 6*

Interviewee no. 2 agreed on the statement that management's communication with employees is inadequate: *"...Occasionally, we have the opinion that higher up in the system, the information does not drift down to us as quickly as it should." — Interviewee no. 2*

Dockworkers had mixed feelings about treatment and respect from the management. 43.2% of the participants rarely feel fairly treated by the management, and 51.1% often feel fairly treated. 54.5% feel respected by the management and 40.9% feel there was a good cooperation between management and employee (Table 7).

Another factor that was shown to affect the psychosocial work environment was the relation and cooperation with the colleagues. 77.3% of the dockworkers feel there is a sense of unity and cohesion among colleagues. 81.8% answered that colleagues will keep each other informed about important tasks, to accomplish the job well. When a problem occurs, 86.4% answered that the colleagues were good at working together to find solutions. 74.2% trust their colleague's ability to do the job well (Table 7).

In response to items regarding stress, there were mixed opinions (Table 8), with 7.9% often feeling stressed within the last 2 weeks and 38.6% never feeling stressed. Furthermore, 36.4% felt they often had to work very fast. The

Table 6. Effects on the psychosocial work environment (n = 88)

Variable	To a great extent (n)	Partial (n)	To a low extent (n)
The tasks are meaningful	87.5% (77)	10.2% (9)	2.2% (2)
Motivated and committed to my job	84.1% (74)	12.5% (11)	3.4% (3)
Proud to have a job at this workplace	80.7% (71)	15.9% (14)	3.4% (3)
This job gives me confidence and job satisfaction	79.5% (70)	15.9% (14)	4.5% (4)
My workplace inspires me to do my best (n = 89)	68.5% (61)	23.9% (21)	7.9% (7)
I'm telling friends that my workplace is a good place to work	67% (59)	21.6% (19)	11.4% (10)
This job is interesting and inspiring	61.4% (54)	35.2% (31)	3.4% (3)
I would recommend others to apply for a job at this workplace	45.5% (40)	36.4% (32)	18.2% (16)
The reasons for implementing the changes is understandable (n = 55)	30.9% (17)	27.3% (13)	45.5% (25)
The job takes so much of my time that it affects my personal life	27.3% (24)	43.2% (38)	29.5% (26)
Generally satisfied with the way the management has handled changes (n = 55)	23.6% (13)	18.2% (10)	58.2% (32)
The job takes so much of my energy that it affects my personal life	22.7% (20)	40.9% (36)	36.4% (32)
Employees have been adequately involved in changes (n = 55)	14.5% (8)	18.2% (10)	67.3% (37)
The management has adequately informed employees about changes (n = 55)	12.7% (7)	29.1% (16)	58.2% (32)
Conflicts arise in my personal life because of the job uncertainty (n = 83)	1.2% (1)	14.5% (12)	79.5% (70)

Table 7. Effects on the psychosocial work environment (n=88)

Variable	Never (n)	Rare (n)	Often (n)
When problems, all colleagues are good at working together and find a common solution	0% (0)	13.6% (12)	86.4% (76)
To accomplish the job well all colleagues keep each other informed about important tasks	2.3% (2)	15.9% (14)	81.8% (72)
Colleagues generally trust each other	3.4% (3)	18.2% (16)	78.4% (69)
There is a sense of unity and cohesion amongst colleagues (n = 89)	3.4% (3)	19.3% (17)	77.3% (68)
Trusting colleagues' ability to do the job well (n = 89)	1.15% (1)	24.7% (22)	74.2% (66)
Expressing opinions and feelings to your closest colleagues	3.4% (3)	27.3% (24)	69.3% (61)
All colleagues agree on what work tasks is the most important	3.4% (3)	27.3% (24)	69.3% (61)
Feeling respected by the management	11.4% (10)	34.1% (30)	54.5% (48)
Treated fairly by management	5.7% (5)	43.2% (38)	51.1% (45)
The management encourage all employees to come up with ideas for improvement	25% (22)	25% (22)	50% (44)
Conflicts are resolved fair	3.4% (3)	50% (44)	46.7% (41)
Employees and managers are good at working together to improve the workstream	11.4% (16)	40.9% (36)	40.9% (36)
Work performance is recognized and appreciated in at the workplace	12.5% (11)	47.7% (42)	39.9% (35)
When making important decisions at the job there is a clear explanation	18% (16)	42.7% (38)	39.3% (35)
Suggestions for improvements are dealt with seriously by the management (n = 89)	26.9 (24)	35.9% (32)	37.1% (33)
Feeling working under time pressure	22.7% (20)	59.1% (52)	18.2% (16)
Variable	**Scale 1–4**	**Scale 5–7**	**Scale 8–10**
General job satisfaction on a scale from 1 to 10	1.1% (1)	22.7% (20)	76.1% (67)

Table 8. Effects on the psychosocial work environment (n = 88)

Variable	Never (n)	Rare (n)	Sometimes (n)	Often (n)
When working, there are relationships that are emotionally difficult to handle	61.4% (54)	28.4% (25)	9.1% (8)	1.25 (1)
I do not achieve all tasks (n = 89)	56.2% (50)	37.1% (33)	5.6% (5)	1.1% (1)
Lagging behind with work	53.4% (47)	40.95 (36)	5.7% (5)	0% (0)
The job causes emotionally demanding situations	52.3% (46)	32.95 (29)	12.5 (11)	2.3% (2)
I have deadlines that are difficult to comply with (n = 89)	43.8% (39)	42.7% (38)	13.5% (12)	0% (0)
Feeling stressed within the last 2 weeks	38.6% (34)	26.1% (23)	27.3% (24)	7.9% (7)
Contact with people who are reluctant or aggressive (n = 89)	36.4% (32)	38.2% (34)	22.5% (20)	3.4% (3)
I get unexpected tasks that puts me under time pressure	31.8% (28)	43.2% (38)	20.5% (18)	4.5% (4)
The pace of work so high that it affects the quality of the work	22.7% (20)	55.7% (49)	18.2% (16)	3.4% (3)
It is necessary to work very fast	2.3% (2)	11.4% (10)	50% (44)	36.4% (32)
Variable	**No stress (n)**	**Work (n)**	**Personal life (n)**	**Work and personal life (n)**
The main source of feeling stressed (n = 89)	46.1% (41)	11.2% (10)	3.4% (3)	39.3% (35)

majority (74.4%) did not feel that time pressure affects their mood negatively (Table 5). 59.1% have rarely felt that they are working under time pressure, 22.7% never felt they worked under time pressure (Table 7). The main source of feeling stressed (39.3%) was a combination of both work- and personal life factors, 46.1% have not been feeling stressed at all.

According to the interviews, working at the dock is not stressful by itself, but some tasks can be stressful, and the more experience you have, the less stress you feel:

"...I feel that I can't keep up... I'm loading cars on and off, no matter when you look, there are always 15 cars in the queue. The first many years... it annoyed me... but today... if there were no cars queueing, I wouldn't have any work." — Interviewee no. 1

"...Fortunately, not so often [stressed]... when we hand over containers to the cargo trucks... we are two machines loading and unloading... sometimes it's really busy... There's a lot of rotation in the work tasks at the workplace, so you don't have that specific task as often." — Interviewee no. 6

Interviewee no. 7 reported not feeling any stress at work: *"I do not take the work with me home. So, in this way, I will not be stressed at all." — Interviewee no. 7*

When dockworkers were asked in the survey about their general job satisfaction on a scale of 1–10, 76.1% answered 8 or more, and 22.7% rated their job satisfaction between 5 and 7 (Table 7). The 7 interviewees all rated their job satisfaction between 7 and 10. However, in response to the question of what could improve job satisfaction, all the interviewees commented on the desire for more information and involvement from the management.

DISCUSSION

According to Word Health Organization (WHO) a good psychosocial work environment is based on interactions between several factors, namely the job task itself, the physical conditions, the social aspect in the work environment, the role of the management, and the employment conditions [25]. This study found that 88.8% of the surveyed dockworkers agreed on feeling safe at work, even though interviewees agreed that it is a dangerous job, and the material conditions have worsened.

This is similar to the findings of a previous study that dockworkers are exposed to a hazardous work environment every day [9]. In the study, Wang et al. [9] stated that even though there are many prevention interventions, further prevention measures are needed to reach the goal of total prevention of occupational hazards. The article emphasizes many physical prevention strategies, but also training needs among the employees. This study had similar findings, with several of the interviewees stating that hazardous physical work tasks, like lashing containers down, are self-taught. Despite this, dockworkers still reported a strong feeling of safety.

The reason for the feeling of safety is found to be primarily due to colleagues. Safety at the harbour relies heavily upon the dockworkers' ability to do their job well, as their different work tasks depend on each other [26]. 95.4% agreed that everyone help each other to work safe. Furthermore, there is a feeling of cohesion and sense of unity at the work place, which are conducive to a positive psychosocial work environment [6]. 76.1% put job satisfaction on 8 or more on a scale of 1–10 which indicates that the majority of dockworkers are very satisfied with their job. This is also similar

to other literature which states that a safe work environment is dependent on collaboration among dockworkers, due to the hazardous work tasks involved [5, 6, 26].

When considering the role of the management, which WHO states is an important factor when looking at the psychosocial work environment [25], dockworkers have mixed opinions. 23.6% agreed on being satisfied with the management, while 58.2% felt to a low extent that the management adequately informed about changes. 67.3% did not feel they have been involved when changes need to be made. Lack of involvement is one of the factors which, according to Karasek [27, 28], might increase the risk of a bad psychosocial work environment.

Karasek has developed a theory called the Job-Demand-Control-(support) model (JDCS-model). It helps to describe how the number of tasks at work and the amount of control affect the employee in relation to stress, and how support from people around might affect the feeling of work-related stress. An important point in this model is that a high degree of job autonomy and influence at work may prevent from stress related to the job, even when job demands are high [27–29].

Based on Karasek's model, there appears to be a great amount of support among the dockworkers, which will help prevent a bad psychosocial work environment [27, 28]. Physical and mental demands at the job were investigated in a maritime port in Brazil in 2016 [30]. The study showed 48.7% of the study population felt they had a high level of mental strain related to their job as a dockworker, which had a significant effect on the overall workload [30]. For comparison, this study found that 59.1% rarely felt they were working under time pressure and 22.7% never felt they worked under time pressure. 38.6% never felt stressed, while 7.9% answered they were often stressed within the last 2 weeks. 56.2% never felt they did not complete all tasks. According to Karasek's JDCS-model, these results show that dockworkers are not exposed to excessively high job demands compared to what they can handle, which means the job demands are balanced, and dockworkers are therefore not at risk for a bad psychosocial work environment [27, 28].

The main limitation of this study is its cross-sectional design, in which the association between self-perceived safety and psychosocial work environment could not be demonstrated [12, 31]. However, the results indicate that there is a high level of self-perceived safety and a good psychosocial environment. Another limitation is the sampling method and the small sample size used in this study which may affect the generalisability of the findings of this study. However similar results were obtained in this study on both quantitative and qualitative methods, which arguably may strengthen the results and increase the generalisability [13, 14, 32, 33]. Also non-response bias has to be taken into account because of the fact that some potential important responses might be missing out as there might be dockworkers who are not satisfied with their job and might find it easier to refuse to respond to the survey. This non-response bias is taken into account by sending out reminders by email to increase the response rate.

CONCLUSIONS

Overall, the dockworkers seemed to be satisfied with the safety at the work place due, primarily, to faith in their colleagues. Trust amongst colleagues, a feeling of cohesion and sense of unity in the workplace, is a big part of a dockworkers' work life, which also is an important part of the psychosocial work environment. Based on Karasek's JDCS-model it can be concluded from this study that dockworkers in Denmark are satisfied with their level of safety in the workplace and, furthermore, a positive psychosocial work environment exist throughout Danish harbours. Due to the small sample size and the distribution of answers, it was not possible to measure an association between the self-perceived safety and psychosocial work environment. Further research is recommended to investigate other risk factors and focus on a greater study population, as this study must be seen as a pilot study. In addition, further research can add some focus on the role of the management since it is found to be one of the great concerns from the survey.

ACKNOWLEDGEMENTS

This article is based on the unpublished Thesis for the MSc Public Health degree. Both authors contributed equally to the idea, the protocol, the data collection, analysis of data and writing of all sections of the article.

We thank our supervisor Olaf Chresten Jensen for skilful technical assistance and guidance. We are also grateful to the dockworkers for their keen participation in this study.

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VIA MEDICA

ORIGINAL ARTICLE

Int Marit Health
2019; 70, 3: 180–186
DOI: 10.5603/IMH.2019.0028
www.intmarhealth.pl

ISSN 1641–9251

Development of physical training smartphone application to maintain fitness levels in seafarers

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ABSTRACT

Background: *In recent years, the prevention of non-communicable diseases represents one of the main problems of preventive medicine. Significant risk factor for these diseases is sedentary lifestyle; in other words, lack of physical activity. It is happened, especially in seafarers, since they do not have much facilitates to do physical exercise on board. The present study is designed to develop a simple user-guide mobile application to conduct activities with available equipment on board a ship.*

Materials and methods: *We held two pilot tests for app evolution. In the first phase, we selected members (n = 13) and produced a questionnaire related to usability, feasibility, and accessibility of the app. Based on the responses from users, we developed the second version of the app and provided to (n = 15) random seafarers for testing and operating.*

Results: *On average, 93.3% of seafarers mentioned that app was easy to use, while in the first phase it was equal to 84.6%. At the same time, 89.9% of users were satisfied with feasibility, and we had accomplished 95% satisfaction rate in the second phase. Ultimately, we had achieved better responses in the second evolution phase when compared with the first phase.*

Conclusions: *This app is made for planning a quality physical activity program for seamen that allows a seafarer to choose the adequate activity in line with his physical characteristic, fitness level, and motivations.*

(Int Marit Health 2019; 70, 3: 180–186)

Key words: physical training, internet, mobile applications, fitness levels, body mass index

INTRODUCTION

In recent years, the prevention of non-communicable diseases represents one of the main problems of preventive medicine. These diseases, like cancer, diabetes, cardiovascular, and chronic respiratory diseases, are responsible for most of the deaths, and around 35 million deaths every year globally [1]. The leading causes can be attributed to various factors such as consuming alcohol and tobacco, hyperactive calorific diets, hypertension, and elevated blood cholesterol levels [2–3]. Another important risk factor for these deaths is sedentary lifestyles; in other words, lack of physical activity. Unfortunately, on board a ship opportunities for sport and fitness are limited [4]. Ships do not have sufficient space for conducting physical education or sport facilities. Especially in seafarers, continuous work hours and strict organization of work does not allow having time for exercise [5].

Physical fitness is an essential element of a healthy lifestyle. Physical activity or exercise can improve health and reduce the chance of getting type 2 diabetes, cardiovascular diseases (CVD), and cancer [6]. Substantial interest and workout will have instant and long-term health benefits. Spending little time on physical activity can allow a person to become more active and fit. Most importantly, regular exercise can improve individual fitness levels. Based on the World Health Organization (WHO) suggestions, adult men (18 to 64 years) should spend at least 150 minutes per week doing moderate aerobic activity (such as brisk walking or running in moderate speed) [2–7], or at least 75 minutes per week doing intense aerobic exercise (such as vigorous running), or a combination of both. These kinds of activities are easy to perform for everyone and can be optimized without effort. People exercise for many reasons:

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work, health, recreation, competition, or for their appearance. The amount of training depends on starting point, goal to achieve, time, age, personal abilities, and preferences. If a seafarer can take obligation for their health inside the working environment and operating surroundings, there are full-size fitness benefits [8].

Recently, possibilities for encouraging occupational health and wellbeing among seafarers have become an essential topic in the maritime community [9]. Shipping companies and government bodies started to cooperate to achieve this goal. Seafarers stay on board for four weeks or longer at a time; therefore, it is important to provide them with the opportunity to incorporate physical activity into their daily routine on board. The environments for conducting physical activities are different at workplace and home, concerning the time and facilities provided. In addition, the lack of motivation and seasonal factors such as cold or hot weather influences the level of physical activity [10]. Thus, to give physical training to seafarers, it is essential to design a simple and user-friendly mobile application.

The mobile app "wellness on a ship (WOS)" has the objective of directing the sailor to a healthy lifestyle through physical activity. The sailors who participated in the project could improve their physical fitness through exercises, tailored exclusively for them, based on their physical fitness and characteristics. The improvement of lung, heart, and muscle capacity are the objective of the training plan suggested. The seaman is continuously monitored by update reports, and the training program will be modified according to seaman's achievements. Also, seafarers do not have much access for the internet; mentioned app designed that aim to work on offline as well.

MATERIALS AND METHODS

The "wellness on ship" app was designed to provide individually tailored physical training for seafarers according to their body mass index (BMI). It was developed based on the following instructional model design: Analysis, Designing, Development, Implementation, and Evolution.

PHASE 1. ANALYSIS

An insight review of available smartphone fitness apps that were relevant to seafarer's physical education was conducted to find out similar apps. Conducted search yielded many apps about fitness and bodybuilding for people ashore. Our search could not identify the other apps that related to seafarers physical education, and no single app is available that can work offline.

PHASE 2. DESIGNING

The objective of the study is to design a user-friendly app for seafarers that can provide physical education based on their BMI values. Generally, BMI is derived from the height and weight of the person [11]. It is calculated as body mass (in kg) divided by a square of height (meters) and expressed in kg/m^2. We developed a code for BMI calculator with the help of Html and CSS programming languages. Body weight was classified into four types based on BMI metrics as:

— underweight: BMI < 18.5,
— normal weight: BMI = 18.5–24.9,
— overweight: BMI = 25–29.9,
— obesity: BMI ≥ 30.

PHASE 3. DEVELOPMENT

Several tasks were performed in this phase.

Database collection. Complete list of exercises and instructions how to perform them were obtained from MySQL database at Centro Internazionale Radio Medico (C.I.R.M.), Rome (International Radio Medical Centre). The database contains information about workout names and exercise instructions with images that specially designed by our trainer.

Trainee group categorization. Personal fitness level means the body's ability to withstand a physical workload (how much) and to recover promptly. The fitness level of a person can be assessed through exercises and activities that accurately measure person ability to participate in aerobic, or cardiovascular, training as well as muscular strength, endurance, and joint flexibility. Therefore, we broadly categorized trainees into the following three distinct groups:

— Beginners are either completely new or at least somewhat new to physical training. People who did not perform physical exercise on a regular basis (3 times a week) for the last 6 months were considered as beginners;
— Intermediates present a higher level of physical fitness than the beginners. A seafarer who did physical training consistently for (at least) the previous 6 months most likely qualifies as an intermediate trainee.
— Advanced is the highest level of physical fitness. Seafarers who trained consistently for the last 24 months or more most likely qualify as (at least) advanced trainees.

Build seafarer workout routine. A severe workout program should be developed around a person's biology, age, goals, diet, free time, etc. This workout is created for all seafarers who are willing to build a workout routine in three simple steps that had shown in Figure 1.

Workout list. As mentioned, trainee classification was done into three groups. Based on trainees' fitness level and BMI values, we designed workouts, and each workout consists of different exercises specially designed for seafarers. These exercises are elementary and easy to do with available equipment on the ship.

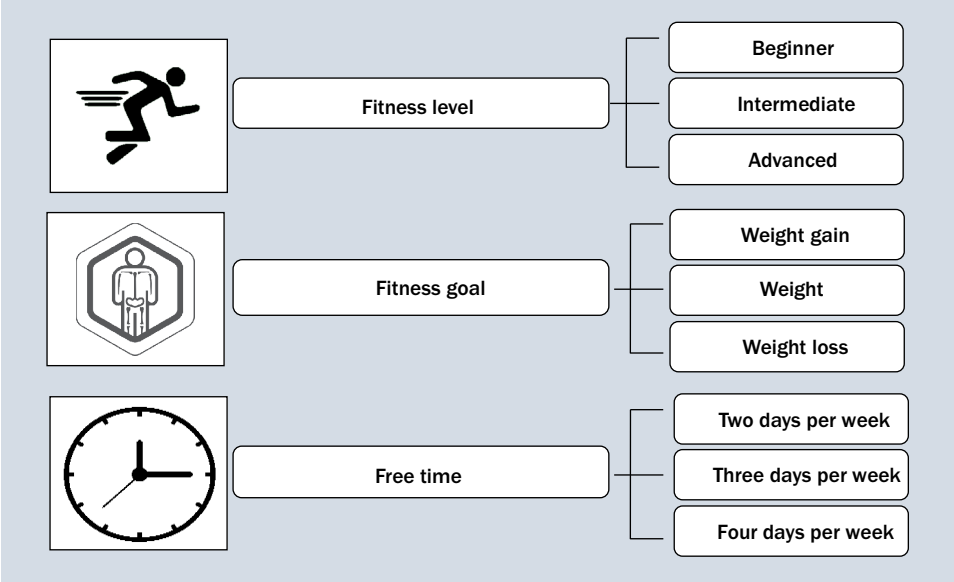


Figure 1. Creating a seafarer's workout routine

Table 1. User response table that explores the usage and recommendations of the app

Parameter	1st trial N (%)	2nd trial N (%)
Usage		
Is it easy to use?	11 (84.6)	15 (100)
Are you satisfied with the images?	12 (92.3)	14 (93.3)
Are you satisfied with theme selection?	10 (76.9)	13 (86.6)
Feasibility		
Does the app provide all workout information you need?	12 (92.3)	15 (100)
Does the app quickly respond?	9 (75.0)	13 (86.6)
Is the app quickly searching the workout?	13 (100)	15 (100)
How satisfied are you about gym manual?	12 (92.3)	14 (93.3)
Acceptability		
I felt comfortable during the usage	9 (75.0)	13 (86.6)
I would recommend this app to my friends	12 (92.3)	14 (93.3)

PHASE 4. IMPLEMENTATION

In the first trial, we provided the app to five staff members in C.I.R.M. and eight Camerino University students. We asked them to give feedback on the usage of the app and register their response based on the questionnaire. Participants were asked to use the app about a week and keep tracking the problems that they had encountered while using the app. With the inputs from the respondents, we updated the app by adding new features. In the second trial, we asked another 15 random selected seafarers to test the app and to note down the problems they had encountered during usage. Written informed consent was obtained from the participants of the two trials.

PHASE 5. EVOLUTION

After using the app for 2 weeks, all participants filled out the questionnaire and scores were assigned to participants' responses. We designed a survey assessing usability, feasibility, and satisfaction based on the Likert scale (0 — very unsatisfied and 5 — very satisfied). Some participants were interested in writing their responses on notes. We gathered all the answers and made qualitative data analysis using ATLAS tool with open coding method. Highlighted and similar codes were grouped at the end to identify critical opinions expressed during the implementation phase.

RESULTS

IMPLEMENTATION, FIRST TRIAL

In the first phase, among 13 participants, most of them were satisfied with usage functionality (on average 85%). From Table 1, it is evident that 11 members agree that the mentioned app is easy to use. Twelve members ultimately decided that training images provided adequate information

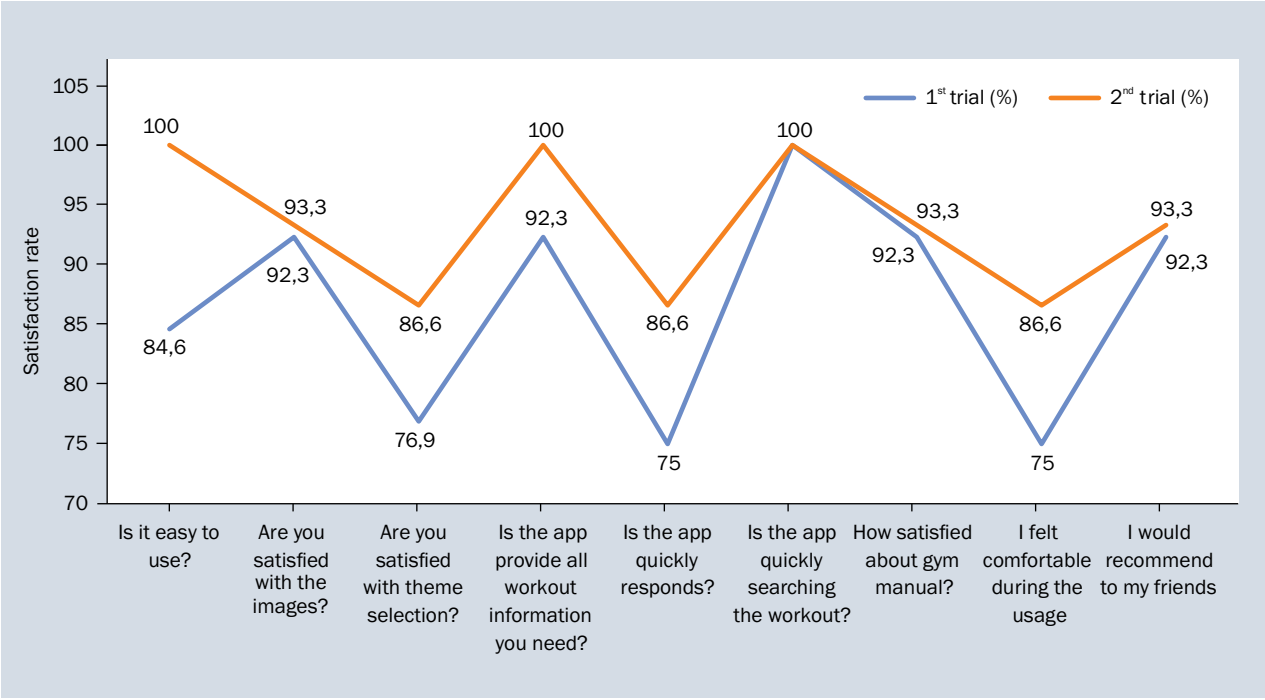


Figure 2. Comparison of satisfaction rates between two pilot tests

how to do exercises, and ten members were satisfied with theme selections.

In the questionnaire about feasibility, 12 (92.3%) members provided consent on availability of workout information in app and satisfaction on gym manual that was attached with the app. All members were satisfied with the workout search menu, and 9 (75%) members agreed that the app is responding quickly. Nine users felt comfortable while using the app, and 12 members decided to recommend this app to their colleagues.

IMPLEMENTATION, SECOND TRIAL

Based on the report from the first trial, we revised the app and offered it to 15 random seafarers. In the second test, we found that the app is more usable (100%), and thanks to adding some extra workouts, seafarers were satisfied (100%) with the exercises provided and the app responded quickly (86.6%). The acceptance rate was gradually getting higher (86.6%) when compared with the first pilot test. The enlarging of Table 1 is explained in Figure 2.

APP FUNCTIONALITY

To access the application, seafarer will sign up into the app by email. Application functionality mainly designed with BMI metrics, and with corresponding workout lists.

BMI calculation

Seafarer will enters weight and height using standard or metric measures on our dedicated page (Fig. 3), and BMI will appear in our mobile app. For confirming the situation of overweight and obesity, we strongly suggest measuring also waist circumference. Waist circumference is an assessment tool that can complement the BMI measurement for the assessment of overweight and obesity (Table 2). Excess fat located in the upper abdominal region is associated with a higher risk than fat found in other areas.

Workout list

We can treat this page as the heart of the app. According to their fitness level, goal (based on BMI), and free time, seafarers can choose their perfect workout (Table 3). Once a seafarer chooses the fitness level, the app will display all the workouts designed by the trainer (Fig. 4). Depending on seafarer's choice, the app will view an exercise list along with instructions.

DISCUSSION

For better or worse, not many 21st-century seafarers fill their exercise quotas in the workplace. As recently as the 1850s, about 30% of all the energy used for agriculture and manufacturing in the United States depended on human muscle power [12]. In our society, we have replaced stairs with escalators, brooms with vacuums, and a lot of other things, also in the maritime industry [13]. Freed from physical work, people have used mental work to create a society of enormous convenience and comfort. In the process, though, we have created a hidden energy crisis, not

Figure 3. Body mass index interface in the second version of the app

Table 2. The goal of the activity, according to body mass index (BMI) and waist measurement

BMI	BMI status	Waist measurement	Final status	Objective
> 18.5	Underweight	< 94 man < 80 woman	Underweight	Increase muscles
18.5–24.9	Healthy Wt. Range	< 94 man < 80 woman	Healthy Wt. Range	360 approach
25.0–29.9	Overweight	< 94 man < 80 woman	Healthy Wt. Range	360 approach
30.0–34.9	Obese	< 94 man < 80 woman	Healthy Wt. Range	360 approach
35.0–39.9	Extreme Obesity	< 94 man < 80 woman	Healthy Wt. Range	360 approach
> 18.5	Underweight	> 94 man > 80 woman	Overweight	360 approach
18.5–24.9	Healthy Wt. Range	> 94 man > 80 woman	Overweight	Lose weight
25.0–29.9	Overweight	> 94 man > 80 woman	Overweight	Lose weight 2
30.0–34.9	Obese	> 94 man > 80 woman	Obese	Lose weight 3
35.0–39.9	Extreme Obesity	> 94 man > 80 woman	Extreme Obesity	Lose weight 4

a shortage of fossil fuels, but a lack of the physical activity the human body needs to ward off disease and reach its full potential.

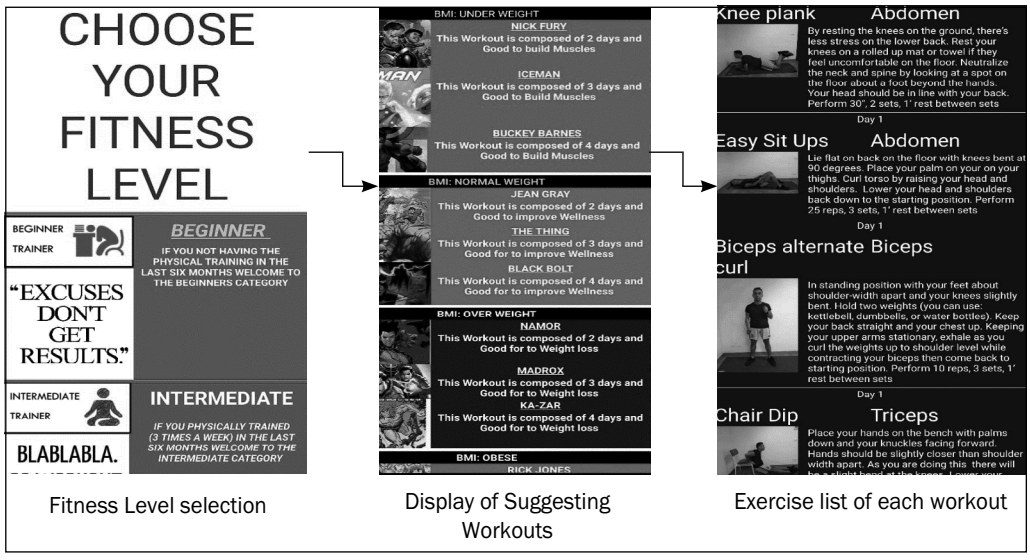
Seafaring is a particular profession in which workers are usually exposed to several stressors that are related to the different duties on board ships [14, 15]. Seafaring is still associated with relevant mental health risks, but exercise is also one of the most effective ways to improve mental health. Regular exercise can have a high impact on depression, anxiety, and more. It also relieves stress, improves memory, and helps to sleep better [14–16]. The "wellness on ship" app was designed to provide physical education for seafarers. It is user-friendly and can work without internet, since it getting access to internet may be difficult while traveling on the ship [17].

As a first phase of the project, we designed a navigational-based app, and it could be beneficial to seafarers who lack physical training. Based on BMI selection and waist measurements, the app automatically displays seafarers' activity levels and BMI scores. Seafarers can choose particular workout corresponding to their requirements. To the best of our knowledge, it could be the first app for seafarers that can manage physical training having the unique feature of offline working.

During the app development process, a significant challenge step design, and upload them in our database and later incorporate it into our app. We adopted the local database server to store workout list and exercise descriptions. In the first version, we displayed major workouts based on fitness levels only. In the second version, we tried to explore many workouts depending on user fitness levels, BMI metrics, availability, and focus. A comparison between the first and second evaluation of the app showed that the usability, feasibility, and accessibility rates gradually improved due to

Table 3. Designed work list and seafarers focus on body mass index (BMI) values

Workout name	Focus	Level	BMI	Days per week
NICK FURY	Build muscle	Beginner	Underweight	2
ICEMAN	Build muscle	Beginner	Underweight	3
BUCKY BARNES	Build muscle	Beginner	Underweight	4
JEAN GREY	Wellness 360°	Beginner	Normal weight	2
THE THING	Wellness 360°	Beginner	Normal weight	3
BLACK BOLT	Wellness 360°	Beginner	Normal weight	4
NAMOR	Lose weight	Beginner	Overweight	2
MADROX	Lose weight	Beginner	Overweight	3
KA-ZAR	Lose weight	Beginner	Overweight	4
RICK JONES	Lose weight	Beginner	Obese	2
MORPH	Lose weight	Beginner	Obese	3
ADAM WARLOCK	Lose weight	Beginner	Obese	4
HAWKEYE	Build muscle	Intermediate	Underweight	2
LUKE CAGE	Build muscle	Intermediate	Underweight	3
BEAST	Build muscle	Intermediate	Underweight	4
BETA RAY BILL	Wellness 360°	Intermediate	Normal weight	2
MIMIC	Wellness 360°	Intermediate	Normal weight	3
X-23	Wellness 360°	Intermediate	Normal weight	4
QUASAR	Lose weight	Intermediate	Overweight	2
HOWARD THE DUCK	Lose weight	Intermediate	Overweight	3
SHANG-CHI	Lose weight	Intermediate	Overweight	4
JUBILEE	Lose weight	Intermediate	Obese	2
ERICK O'GRADY	Lose weight	Intermediate	Obese	3
SPECTRUM	Lose weight	Intermediate	Obese	4
MOON KNIGHT	Wellness 360°	Advanced	Normal weight	3
WAR MACHINE	Wellness 360°	Advanced	Normal weight	4



Fitness Level selection | Display of Suggesting Workouts | Exercise list of each workout

Figure 4. The interface between the workout list and exercises based on seafarer's fitness level

particular incorporation of application processing interface (API) that improves app-accessibility speed.

A present study provides relevant knowledge about developing apps for seafarers that can serve as a roadmap for future app developers in the maritime sector. By conducting two pilot tests, we improved the application that is simple to use and accessible for the target audience. Besides, we designed two versions of the app based on user's feedback, and this is the first preliminary study conducted on app designed for seaman physical training. However, the app had a limitation of low sample size and lack of automatic feedback from the customer. As discussed, the designed application is not a web app, and it is a static application working on the local database. We considered this study as the first step in designing apps for seafarers, in particular with physical training sessions. In the future, we would like to develop a chatbot application using artificial intelligence (AI) that can assist sea workers in conducting exercises. They would need to select options displayed on a mobile device's screen. We are confident that this could be a significant advancement in maritime health.

CONCLUSIONS

In conclusion, the WOS app provides an essential guide to physical training for seafarers and enables individual choices of workouts depending on their BMI values and fitness levels. We conducted two pilot tests to evaluate the app and establish the final version with additional features suggested by the users. Our study proved that the app could be easy to use, feasible, and accessible by all the users. Therefore, this app can be used as a simple guide to accessing exercise information while traveling on a ship, and the exercises are designed based on simple equipment available on vessels. In the future, WOS should be tested for its effectiveness and customer follow-ups. It will make sure to prevent sea workers from not exposed to diabetes and other chronic diseases that developed by lack of body workouts.

ACKNOWLEDGEMENTS

We would like to thank CIRM and the Department of Telemedicine and Telepharmacy at the University of Camerino, Italy.

FUNDING

C.I.R.M., Rome, and the University of Camerino supported this study.

CONFLICT OF INTEREST

The authors do not have any conflict of interest.

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VIA MEDICA

REVIEW ARTICLE

Int Marit Health
2019; 70, 3: 187–192
DOI: 10.5603/IMH.2019.0029
www.intmarhealth.pl

ISSN 1641–9251

How to calculate incidence rates from proportionate data

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ABSTRACT

This paper describes the methodological aspects of calculation of incidence rates from incomplete data in occupational epidemiology. Proportionate measures in epidemiological studies are useful e.g. to describe the proportion of slips, trips and falls compared to other types of injury mechanisms within single age-strata. However, a comparison of proportions of slips, trips and falls among the different age-strata gives no meaning and can hamper the conclusions. Examples of a constructed example and some selected studies show how estimates of incidence rates can be calculated from the proportionate data by applying estimates of denominators available from other information. The calculated examples show how the risks based on the incidence rates in some cases differ from the risks based on the proportionate rates with the consequence of hampering the conclusions and the recommendations for prevention. In some cases the proportionate rates give good estimates of the incidence rates, but in other studies this might cause errors. It is recommended that estimates of the incidence rates should be used, where this is possible, by estimation of the size of the population. The paper is intended to be useful for students and teachers in epidemiology by using the attached Excel training file.

(Int Marit Health 2019; 70, 3: 187–192)

Key words: epidemiology, injury, occupational, proportionate, maritime

DEFINITIONS

The basic measurements in epidemiology are incidence and prevalence rates. The unique feature of the incidence and prevalence rates is that they express a risk that is needed to know for prioritisation of the prevention. Further, the risk expressed as the incidence and prevalence is comparable between different populations and between segments of the population, *e.g.* between the age groups [1]. To obtain the incidence and prevalence rates we need two types of information, one is the denominator, the number of persons or better the sum of person-time at risk and the number of incidents, injuries or diseases, the numerator. In most studies we have access to both types of data but sometimes we have no access to the denominator, the number of persons (time) at risk and then we can only calculate the proportionate rate of e.g. per cent of slips trips and falls. The proportionate measures are useful as the first step of the analysis of the risk but they are not comparable directly within different age-groups, which is the problem we address here.

Proportionate measurements or, with other words, the percentages in epidemiology are very useful to study the overall distribution of the variables. However the use of only the percentages is of limited use for identification of the relative risks needed for the prioritisation of the prevention. As the percentages do not present the relative risks, they cannot be used for comparison of the risks in different strata of the population and for comparison with other studies. Still, the proportionate rates are used and give meaning, *e.g.*, for comparison of the percentages of slips, trips, and falls *within* the single-study strata, such as the age-groups. Also the proportional mortality ratio, which is the percentage

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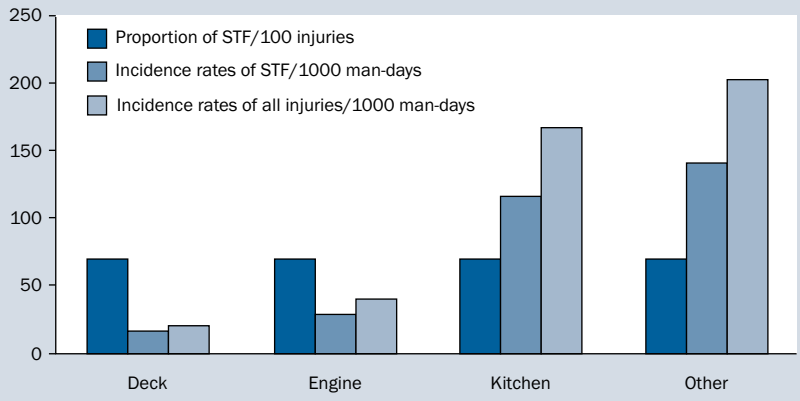
$$(P_{\text{Injury type y in stratum x}}) \times IR_{\text{(All injuries in stratum x)}} = IR_{\text{(Injury type y in stratum x)}}$$

P = The proportion of a specific type of disease or injury y in stratum x
IR = Incidence rate per 10^n man-days

Figure 1. Mathematical relationship between the proportions and the incidence rates



Constructed example		Deck	Engine	Kitchen	Other
1	Man-days at risk	50000	25000	6000	5000
2	Total number of injuries	1000	1000	1000	1000
3	Number of STF-related injuries	700	700	700	700
4	Proportion of STF/100 injuries	70%	70%	70%	70%
5	Incidence rates of STF/1000 man-days	14	28	116.7	140
6	Incidence rates of all injuries/1000 man-days	20	40	166.7	200

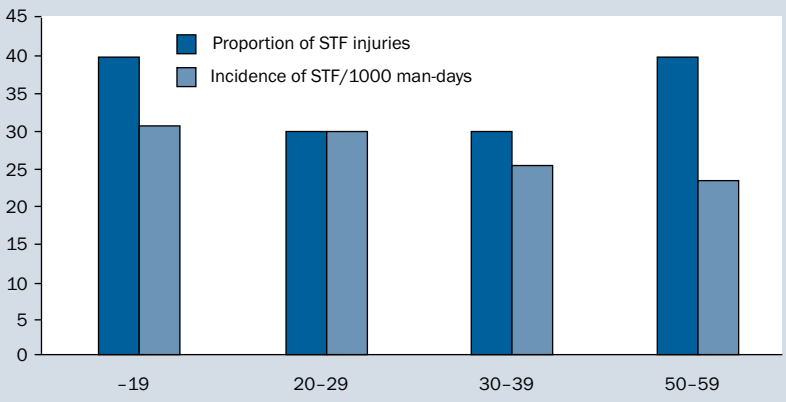
The man-days at risk, the number of injuries and the proportions of slips, trips, and falls (STF) in four departments are chosen in order to illustrate the problem most clearly. Incidence rate of STF in row 5 for Deck = (700/50000) × 1000 = 14. Incidence rates of all injuries in row 6 for Deck = (1000/50000) × 1000 = 20. Based on row 6, the incidence rate of all injuries per 1000 man-days = 20 and the proportion of STF = 70% (0.70); the incidence rate of STF can be recalculated = 0.70 × 20 = 14/1000 man-days.

Figure 2. Constructed example of slips, trips and falls' proportions and incidence rates

of all deaths due to a specific disease in the population during a time period, is used with good meaning. The incidence rate ratio defined as the ratio of two incidence rates gives meaning. However, a direct comparison of the proportions of slips, trips, and falls *among* the strata such as for example different age groups provides meaningless information or can even produce erroneous results. Incidence rates and the relative risks expressed by the incidence rate-ratios are needed to prioritise the prevention. While the proportions, especially on injury data, are still presented in scientific publications, the limitations of its use have not so far been questioned. As we have observed some potential errors related to this problem in different studies, we found it important to inform the readers interested in maritime medicine about these methodological aspects of injury risk analysis. The constructed example and some examples from published studies show how the comparable incidence rates for the relative risks can be calculated from the proportions by applying estimates of the populations at risk in the specific strata of the populations. Based on the constructed example and the examples from the published studies, a mathematical relationship of the proportions and the incidence rates has been explained as in Figure 1. Statistical 95% confidence levels are calculated by comparing 2 person-time rates using *e.g.* the Open-Epi programme [2].

CONSTRUCTED EXAMPLE

The constructed example gives a clear illustration of how the incidence rates can be calculated from proportionate data by applying estimates of the size of the populations at risk (Fig. 2). The denominators, *e.g.*, national population data, are applied (in this case the number of man-days at



	–19	20–29	30–39	50–59
Number of man-days at risk — estimated	13000	8000	8000	12000
Total number of injuries*	1000	800	700	700
Incidence rates of all injuries/1000 man-days	77	100	88	58
Number of STF-related injuries*	400	240	210	280
Proportion of STF-related injuries	0.40	0.30	0.30	0.40
Incidence of STF-related injuries/1000 man-days	31	30	26	23

The proportions of slips, trips, and falls (STF) in four age groups are based on the study data. The man-days at risk and the total number of injuries are estimated in order to illustrate the problem most clearly. Incidence rate of all injuries, age –19 = (1000/13000) × 1000 = 77 per 1000 man-days. The incidence rate of STF injuries, age –19 can be calculated = 0.40 × 77 = 31 per 1000 man-days.

Figure 3. Slips, trips and falls-related injury proportions and incidence rates by age [3]

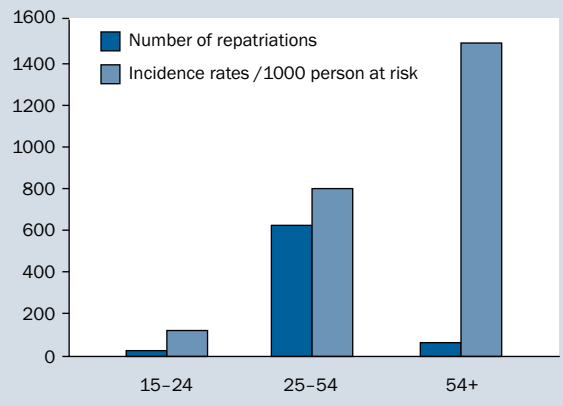
risk). In this constructed example the sizes of the populations at risk in four departments are selected to illustrate the problem most clearly and the proportions of slips, trips, and falls (STF) are chosen to be equal 70% also for the best illustration.

The incidence risks of STF-related injuries based on man-days across the departments are significantly different from the proportionate data; percentages are almost equal in the four groups, while the incidence rates vary significantly. The number of cases and the proportions of the specific sub-groups of cases need to be available together with estimates of the population data. The risks in the strata are calculated by multiplying the incidence rate for all types of injuries in the specific strata (*e.g.*, all injuries on Deck = 20/1000 man-days) by the proportion of STF. In this example the proportion of STF-related injuries was chosen to be 70%, and the incidence rate of STF injuries in this strata = 0.7 × 20 = 14/1000 man-days. Concerning the ethical issues, no personal information is included, so approval from the Ethics Committee or written informed consent was not necessary.

STUDY EXAMPLES

The first example is an analysis of the proportional STF-related injuries in a sample of data for 582 cases of injured commercial fishermen from an emergency department. Information about the number of all injuries and the number of STF-related injuries was available, but there was no information about the population at risk [3]. The proportions of injuries from STF by age was U-shaped and constituted around 40% for men under 20 and over 50, and around 20% for those between these ages. These estimates do not reflect the relative risk for STF-related injuries in the age groups. However, incidence rates for comparison can be calculated by using estimates of the person-time in the age groups as shown in Figure 3.

This type of methodological problem was seen in a study about repatriations of seafarers from the sea. The numbers of repatriations are taken from Figure 3 in the article [4]. There is no information about the age structure among the Filipino seafarers, only the number of seafarers and the number of repatriations. In an attempt to calculate the best estimates of the incidence rates, an estimate of the population of seafarers at risk was calculated by multiplying the percentages for each age group. The Filipino Population Pyramid 2017 for men was applied to calculate the approximate incidence rates [5]. The pattern of the numbers is clearly different from the incidence rates of repatriations with the impact on the results and conclusions (Fig. 4). In the same study, the



Age-groups	15–24	25–54	54+
Persons at risk estimated Filipino Population Pyramid 2017	25000	80000	5000
Number of repatriations	30	650	75
Incidence rates/1000 persons at risk	120	813	1500

The numbers of repatriations in the age-groups are based on the study data. The persons at risk are estimated based on the Filipino Population Pyramid 2017. Incidence rate in the age group 15–24 = (30/25000) × 1000 = 120 repatriations per 1000 persons at risk. There are clear differences between the number of repatriations and repatriation incidence rate in relation to age.

Figure 4. Number of repatriations compared to incidence rates by age groups [4]

length of stay on board and the repatriation rates of seafarers were estimated by the absolute numbers of repatriations related to 150 and 250 days stay on average on board [4]. The relationship between the incidence rate-ratio and the days on board was very different from the relationship between the absolute number of repatriations and days spent on board (Fig. 5). The different results have an important impact on the recommendations given concerning the obligatory routine health examinations in shipping and the safety.

DISCUSSION

This is to our knowledge the first contribution to the solution of the methodological problems with proportionate risk estimates. There is some methodical similarity but this is not the same as the indirect and direct age-standardised methods that were used *e.g.* in the studies of fatal injury in seafaring and fishing [6, 7]. In these studies the observed numbers of fatalities for each age-group was summed up and compared with the expected numbers to yield the standardised mortality ratios. The expected number of fatalities in the reference population was calculated in the age-group by multiplication of the fatality incidence rate with the number of person-years in the index group (seafarers and fishermen, respectively) in the calendar periods. In the direct standardisation we calculate the observed and the expected number of fatalities by multiplication of the fatality rate in the age groups with a standard selected risk population. For both methods, we need to have the information about the incidence rates in each age-group. Our method presented here is a step before, as we don't have the incidence rates and this is what we want to obtain. To do this we need the overall incidence rate of all injuries to calculate the age-specific incidence rates by multiplication of the per cent of slips, trips and falls in the age-groups by the overall incidence rate of all injuries. That also means that the method of age-standardised cancer ratio or more specific for the topic, age-standardised injury ratio, would only be applicable here as the second step for rate-ratio calculations by standardisation or by the logistic regression analyses.

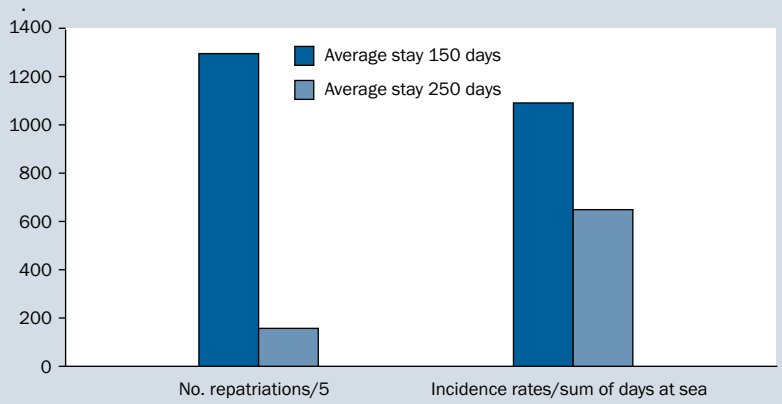
In the study example on slips, trips, and falls-related injuries on fishing vessels, the information on the denominators in the age groups was not available (Fig. 3). The methodological weakness of the study using only proportionate measures of STF in the age groups was not discussed either [3]. However, an estimation of the distribution of the number of days at sea in the age groups among the fishermen could have been applied based on an earlier epidemiological study on injuries among fishermen [8]. The numbers in Figure 6 are adjusted to show that the risk differences of STF-related injuries in the age groups may be even greater than the differences seen in the proportionate measures.

In a Mexican study the overall incidence rates of fatal industrial injuries declined from 1980 to 1995. However, the risks of fatal injuries in the industrial branches (15% in construction, 14% in oil and gas production, and 11% in farming) were based on the proportionate measures and then less useful for the prevention [9].

In a study of repatriations of seafarers, those from India were more frequently repatriated than the Philippines based on proportionate rates [10]. But if information of the populations at risk were applied to calculate estimates of the incidence rates, then the Philippines might have less repatriation incidence rates than the Indians.

In a recent study from Latin America on snakebites, the data were collected from hospital emergency room records. The authors argue that farmers are most affected [11]. But as the occupations of the patients were not registered in the hospital no relative risks for agricultures or other occupations were calculated. Further, when proportionate measures for each age group and no incidence rates are given, this reduces the usefulness of these data for the prevention.

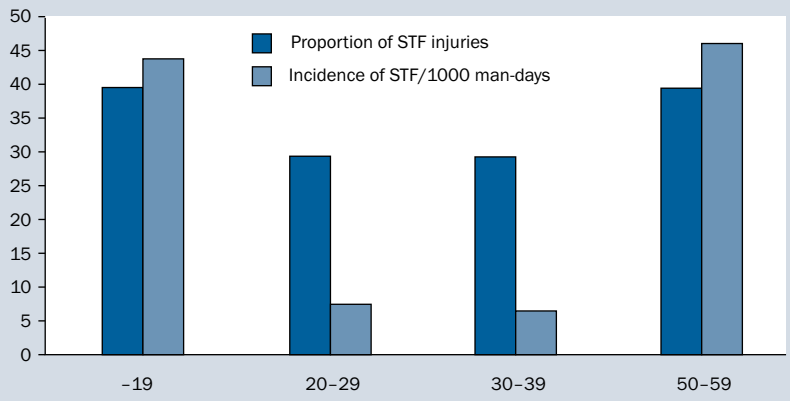
Use of only proportionate rates for age groups was lately also seen in a study among Finnish fishermen [12]. The lack of the age distribution of the population is men-



Average stay at sea	Numbers of seafarers repatriated	Numbers of seafarers	Days at risk	Risk/100000 days
150	6612	388963	58344450	11
250	840	51840	12960000	6

The numbers of repatriations depending on average stay on board and the persons at risk per 100.000 days on board are estimated based on the study data. The contrasts of the numbers of repatriated seafarers in the two groups are clearly different from the incidence rates.

Figure 5. Numbers and incidence rates of repatriations by average stay at sea [4]



Age-groups	–19	20–29	30–39	50–59
Man-days at risk	9000	30000	30000	6000
Total number of injuries	1000	800	700	700
Number of STF-related injuries	400	240	210	280
Proportion of STF-related injuries	40	30	30	40
Incidence of STF/1000 man-days	44	8	7	47
Incidence rates of all injuries/1000 man-days	111	27	23	117

The incidence rates in Figure 3 are recalculated by using an estimation of the distribution of the number of days at sea in the age groups based on an previous study [8].
The risk differences of slips, trips, and falls (STF)-related injury expressed as the incidence rates in the age groups may be even greater than the differences seen in the proportionate measures.

Figure 6. Proportions and incidence rates of slips, trips, and falls-related injuries by age groups [3]

tioned but the impact of the lack of incidence rates was not discussed.

In a review of studies of fishery health research in Latin America, only studies on occupational diseases and no studies of occupational injuries in fishing were found [13]. The lack of studies on occupational injuries in the Latin American fishery with 2–3 million, mainly small-scale fishermen is probably due the absence of register data regarding occupational diseases and injuries in the countries [14]. This situation will be improved when the infrastructure and data systems are modernised and the needed data sources to produce incidence rate studies are available.

RECOMMENDATIONS

The proportionate rates can only give some unprecise estimates of the risks. Supervisors, teachers, reviewers and editors should advice and help the students to get estimates of the populations at risk for calculation of the incidence rates where this is possible. Further, when the training in epidemiology is globally widespread and the availability of data for registers of the workforce is improved, the use of only injury proportionate rates will be reduced and incidence rates be more frequently used. Finally, the public health researchers from the universities can help and inspire governments, industries, Maritime Authorities, Insurances and Unions to compile valid and complete data for registers of the workforce as well as effective reporting systems of diseases and injuries to calculate comparable incidence rates and trends over time.

Excel file for training is available from this Dropbox: https://www.dropbox.com/s/53txv6jjn3p786i/Excel%20Table%201-3%20for%20training.xlsx?dl=0.

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VIA MEDICA

LETTER TO THE EDITOR

Int Marit Health
2019; 70, 3: 193
DOI: 10.5603/IMH.2019.0030
www.intmarhealth.pl

ISSN 1641–9251

Are we underestimating the cardiovascular risks of seafarers?

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In early 2019, France changed the recommendations on alcohol consumption. The key message is to reduce alcohol consumption because even a small consumption leads to health risks. The National Institute of Public Health "Santé Publique France" currently recommends to avoid consuming more than 2 glasses a day, 10 per week, and to ensure to have days of abstinence every week (Santé Publique France. Avis d'expert relatif à l'évolution du discours public en matière de consommation d'alcool en France. 2019 https://www.sante-publiquefrance.fr/les-actualites/2017/avis-d-experts-relatif-a-l-evolution-du-discours-public-en-matiere-de-consommation-d-alcool-en-france-organise-par-sante-publique-france-et-l-insti).

Other countries had also re-evaluated their public health policy in previous years, such as Australia in 2009, Canada in 2011 and the United Kingdom in 2016. These countries have relied on new studies and risk calculation method on whole life. In France, public health policy estimates that a health event risk target of less than 1% in life is acceptable. By respecting this consumption, it is estimated that people have less than 1% chance of developing alcohol-related pathologies such as cancer, diabetes, cardiovascular pathologies, or myocardial infarction [1].

For cardiovascular risks, the literature describes a dose-response relationship in U or J curves [2]. In other words, a small consumption could reduce the cardiovascular risk, while the higher consumption leads to an increase in the prevalence of these pathologies. This ambiguous relationship could sometimes give a positive image of alcohol consumption.

For sailors, cardiovascular risk control is a priority [3, 4]. Because of the geographical distance, care is difficult and can be delayed. Cardiovascular pathologies would represent nearly one in five health emergencies on board ships. We know that alcohol consumption is important in this population. But we do not know exactly how to quantify this consumption. In a study of 136 Filipino sailors, 80% of the subjects had consumed alcohol at least once in the month [4]. Fort et al. [5] showed that 16% of the 1847 seafarers in their study were at risk of addiction. In other words, 16% of sailors had high consumption which also led to an increase in cardiovascular risk [5]. What about the remaining 84%? In a recent literature review of mariners' cardiovascular risk factors, only one study considered alcohol consumption [4]. But alcohol consumption was assessed qualitatively, without quantifying consumption. As we have said, the dose-effect relationship for alcohol may be not linear. Quantifying consumption is therefore important for assessing cardiovascular risk.

Given the new scientific data and the importance of these pathologies in shipboard emergencies, it would seem useful to take alcohol consumption more into account in assessing cardiovascular risk. Any study of mariners' cardiovascular risk factors should quantify the consumption of alcohol in standard units per unit of time. Similarly, targeted prevention of cardiovascular risks in link with alcohol consumption would seem appropriate. This should be done in a program that takes into account other modifiable risk factors such as smoking, stress or organizations.

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INFORMATION FOR AUTHORS

The International Maritime Health will publish original papers on medical and health problems of seafarers, fishermen, divers, dockers, shipyard workers and other maritime workers, as well as papers on tropical medicine, travel medicine, epidemiology, and other related topics.

Typical length of such a paper would be 2000–4000 words, not including tables, figures and references. Its construction should follow the usual pattern: abstract (structured abstract of no more than 300 words); key words; introduction; participants; materials; methods; results; discussion; and conclusions/key messages.

Case Reports will also be accepted, particularly of work-related diseases and accidents among maritime workers.

All papers will be peer-reviewed. The comments made by the reviewers will be sent to authors, and their criticism and proposed amendments should be taken into consideration by authors submitting revised texts.

Review articles on specific topics, exposures, preventive interventions, and on the national maritime health services will also be considered for publication. Their length will be from 1000 to 4000 words, including tables, figures and references.

Letters to the Editor discussing recently published articles, reporting research projects or informing about workshops will be accepted; they should not exceed 500 words of text and 5 references.

There also will be the section Chronicle, in which brief reports will be published on the international symposia and national meetings on maritime medicine and health, on tropical parasitology and epidemiology, on travel medicine and other subjects related to the health of seafarers and other maritime workers. Information will also be given on training activities in this field, and on international collaborative projects related to the above subjects.

All articles should be submitted to IMH electronically online at www.intmarhealth.pl where detailed instruction regarding submission process will be provided.

Only English texts will be accepted.

Manuscripts should be typed in double line spacing on numbered pages and conform to the usual requirements (Ref.: International Committee on Medical Journals Editors. Uniform Requirements for Manuscripts Submitted to Biomedical Journals, JAMA, 1997; 277: 927–934).

Only manuscripts that have not been published previously, and are not under consideration by another publisher, will be accepted.

Full texts of oral presentations at meetings (with abstracts printed in the conference materials) can be considered.

All authors must give written consent to publication of the text.

Manuscripts should present original material, the writing should be clear, study methods appropriate, the conclusions should be reasonable and supported by the data. Abbreviations, if used, should be explained.

Drugs should be referred to by their approved names (not by trade names). Scientific measurements should be given in SI units, except for blood pressure, which should be expressed in mm Hg.

Authors should give their names, addresses, and affiliations for the time they did the work. A current address of one author should be indicated for correspondence, including telephone and fax numbers, and e-mail address.

All financial and material support for the reported research and work should be identified in the manuscript.

REFERENCES

References should be numbered in the order in which they appear in the text. At the end of the article the full list of references should give the names and initials of all authors (unless there are more than six authors, when only the first three should be given followed by: et al.).

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