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# Maritime health: a review with suggestions for research

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## ABSTRACT

*International maritime health has largely developed within the sphere of occupational health services and international health problems. We reviewed publications in the journal International Maritime Health from 2000 to 2010 to establish the coverage of the journal and the scope of research in maritime health. We identified six thematic categories: healthcare access, delivery and integration; telehealth; non-communicable diseases and physical health problems; communicable diseases; psychological functioning and health; and safety-related issues. We describe the research within these themes and report on their publication prominence. We also analyse the research in terms of its geographical focus, the population groups addressed and the research methodologies used. We suggest a broadening of maritime research to include randomised controlled trials, longitudinal studies and more qualitative research; more research addressing the context for non-European seafarers; and research on seafarers spouses and family supports and obligations. We also recommend more research on psychosocial and cultural issues and on telehealth, as well as the development of a stronger systems perspective for promoting maritime health.*

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Key words: maritime health, global health, systematic review, common challenges

## INTRODUCTION

The International Maritime Health Association (IMHA) conceptualises maritime health as incorporating “a wide range of disciplines that are committed to improving the health of seafarers by developing better approaches to health protection, health promotion, and health treatment both locally and internationally” (www.IMHA.net; downloaded 26 August 2011). Maritime medicine has contributed significantly to the development of maritime health. Maritime medicine has been defined as “any medical activity related to questions concerning the employment, working conditions, living conditions, health, and safety of workers at sea” [1]. This broad defini-

tion embraces workers in the commercial shipping fleet, the military naval services, the fishing fleet, sea piloting, offshore installations, and leisure boats. Historically, maritime medicine has developed within a strong ‘occupational medicine’ ethos, and prior to the 20<sup>th</sup> Century, maritime medicine had strong links with tropical medicine.

The Textbook for Maritime Medicine [2] suggests that within the last three decades several factors have dramatically influenced the health of mariners. These include the globalization of the shipping industry, increased automation and mechanization of work on ships, improvements in navigation techniques, reduction in crew numbers, increased uncertainty of and

short-term contracting for seafarers in commercial fleets, multicultural crewing, and ships operated under flags of convenience [3]. The breadth of these influences is reflected in the recognition that maritime health has to involve a range of players each with different but intersecting interests. For instance, the World Health Organisation's (WHO) International Health Regulations (2005) apply to shipping and seek to enable an effective response to acute public health risks that can spread across countries. The International Maritime Organisation (IMO) focuses on health and safety onboard vessels, with the STCW (Standards of Training, Certification, and Watchkeeping) specifying minimal training requirements relating to first aid and medical care. The International Labour Organisation (ILO) has used the Maritime Labour Convention (2006) to establish the health and safety responsibilities of both seafarers and ship owners. The International Shipping Federation (ISF), representing the interests of maritime employers, seeks to promote best practice in complying with the regulations laid down by the WHO, IMO, and ILO. Trade Unions, such as the International Transport Workers' Federation (ITF), have a particular interest in addressing the causes of stress and fatigue at sea and the health and safety consequences of ships being registered under flags of convenience.

These organisations are only some of the wide array of legitimate stakeholders in maritime health. As such, they also suggest the breadth of issues that should be addressed within maritime health: ranging from biological viral vectors, to compliance with safety regulations; telemedicine to fair employment contracting. Our literature review was motivated by the wish to evaluate the main areas of interest in published research on maritime health. In particular, we ask the question: does research on maritime health reflect the globalisation of the maritime industry, the breadth of stakeholders involved, and does it provide coverage of the full range of maritime health issues? To answer these questions, we have reviewed publications in Maritime Health's reference journal *International Maritime Health* from 2000–2010.

While we recognise that there have been important publications on maritime health in other journals during this period, as the official journal of IMHA, *International Maritime Health* plays a key role in defining the area through its publication practices. Our review thus sought to identify established research strengths, common methodologies, and geographical foci and to identify gaps in the published literature.

## MATERIAL AND METHODS

We reviewed all publications in the journal *International Maritime Health* from 2000 to 2010, a period of 11 years. We identified higher-order categories based on our familiarity with the literature and identified key themes from each of the papers. We found that all papers reviewed could be categorised under one of the six high-order categories. Further content analysis was conducted for each paper in terms of the geographic focus of the paper, the population group that the paper was focusing on, and the research methodologies used.

The papers reported here and referred to in the Tables below do not include those listed under the journal subsections "Events" and "Chronicles" as we judged them not to be scientific papers in their own right.

## RESULTS

### NUMBER OF PAPERS PUBLISHED

Table 1 reports the number of papers contained in each annual publication of the journal. Across the 11 years 198 papers were published ranging from 13 (2000) to 35 (2010) per year

### THEMATIC CATEGORIES

Thematic content analysis of the abstracts was used to identify papers in each of the categories. We identified and defined six thematic areas as follows:

**Healthcare access, delivery, and integration:** this refers to papers which involved any aspect of access to health care (on board or in port), emergency healthcare, the way in which healthcare was delivered (on board or in port), all public health issues, and integrated services.

**Telehealth:** this includes papers which were concerned with telemedicine or telehealth in general, how it is delivered, or the use of equipment designed to further the possibility of telehealth.

**Non-Communicable Diseases and physical health problems:** this covers all physical disease, congenital disorders, chronic illness, fitness levels, and dietary and lifestyle factors associated with diseases such as obesity and diabetes.

**Communicable Diseases:** this covers infectious disease only, such as malaria and AIDS/HIV.

**Psychological Functioning and Health:** This includes stress, fatigue, substance abuse, cognitive functioning, levels of alertness, psychosocial factors concerning life as a seafarer, cultural differences, and all areas of mental health.

**Safety-Related Issues:** This covers work-related accident and injury, health and safety issues in general and in relation to equipment, facilities, and supplies on board (including food, water, and air quality).

As can be seen in Table 2, non-communicable diseases and physical health problems is the category in which there is the greatest number of publications, followed by the category of healthcare access, delivery, and integration. Communicable diseases and safety issues had an equivalent number of mid-level

publications, while psychological functioning and health, and telehealth, had the fewest publications. A separate analysis of keyword frequencies under each of the above six categories resulted in a comparable pattern of results.

#### ANALYSIS OF THEMATIC CATEGORY CONTENT

For the 'healthcare access, delivery, and integration' theme, earlier years seem to have focused relatively more on access to medical care and advice on board, with more recent papers addressing how services can work together (nationally and internationally) and on the regulation of standards for medical care, training of practitioners, public health programmes, and so on. There has also been an increasing number of papers on the medical chest/kits/equipment on board and links which would support and further the introduction of telemedicine, both for the purposes of treatment and diagnosis on board. The related telehealth theme has featured more recently with aspects such as relaying ECG readings ashore, telephonography, automatic defibrillators, medical kits, reference to medical information, and support being discussed.

Within the non-communicable diseases and physical health problems theme, cardiovascular disease, heart attack, and lifestyle factors feature strongly. Increasing awareness of obesity and diabetes are discussed along with the necessity for public health initiatives relating to these (in addition to treatment).

Table 1. Published papers in *International Maritime Health*, 2000–2010

Year	Number of papers	Percentage	Cumulative Per cent
2000	13	6.6	6.6
2001	15	7.6	14.1
2002	17	8.6	22.7
2003	19	9.6	32.3
2004	13	6.6	38.9
2005	17	8.6	47.5
2006	24	12.1	59.6
2007	19	9.6	69.2
2008	13	6.6	75.8
2009	13	6.6	82.3
2010	35	17.7	100.0

Table 2. Publication frequency in *International Maritime Health*, 2000–2010 by thematic category

Year	Healthcare access, delivery and integration	Telehealth	Non-communicable disease and physical health problems	Communicable disease	Psychological functioning and Health	Safety-related issues
2000	4	0	4	3	0	2
2001	8	2	2	1	0	2
2002	4	3	7	2	0	1
2003	4	0	6	2	3	4
2004	1	0	6	3	3	0
2005	5	2	6	2	0	2
2006	3	4	3	3	2	9
2007	5	1	5	2	2	4
2008	2	0	4	2	3	2
2009	3	2	2	2	2	2
2010	4	1	9	12	6	3
Total number of papers	43 (21.72%)	15 (7.58%)	54 (27.27%)	34 (17.17%)	21 (10.61%)	31 (15.56%)

Problems relating to diving were also included in this section. For the communicable diseases theme the main diseases addressed were malaria, HIV/AIDS, STDs, gastrointestinal infections, chicken pox, and dengue fever, with malaria featuring most prominently.

The psychological functioning and health theme featured stress, fatigue, substance abuse, cognitive functioning, and other psychological issues. Performance-related stress, fatigue, and alertness levels featured most prominently in this section, with a few papers on psychosocial issues and support. There was a notable lack of papers on substance abuse. Papers addressing suicide were also included in this category. Finally, as regards the safety-related issues theme, the majority of papers focused on work-related accident and injury. A few papers addressed evacuation equipment (e.g. gas permeable material for life-rafts) and general health and safety. Issues arising from the condition of facilities such as air-conditioning and sewage were covered, as were problems with gas contamination.

In general, we note a trend for fewer papers addressing physical access to healthcare (whether on board or ashore) and the examination of mortality/accident/incident data, and more papers addressing physical health problems and lifestyle issues. There is also a trend for more papers on telehealth, as well as stress, fatigue, and other psychological issues. Lifestyle factors which contribute to cardiovascular disease and diabetes featured more prominently in recent years, as did papers on the screening of seafarers for disease, fitness, and lifestyle factors that could present a risk to the seafarer. There seems to be a greater level of openness towards perhaps previously taboo subjects such as depression, general psychological wellbeing, and sexually transmitted disease.

### GEOGRAPHICAL FOCUS

Table 3 indicates the countries of origin of the authors and/or relevant geographic sectors of interest addressed within the papers; it therefore gives some impression of 'where' maritime health research is focused. Only countries with eight or more papers are listed, along with papers that explicitly addressed issues on a worldwide basis.

It is clear from Table 3 that Central and Northern European countries are the areas of major concern to authors publishing in *International Maritime Health*.

### POPULATION GROUPS

Table 4 summarises the relevant population group that the papers addressed. Unsurprisingly seafarers were the primary group of interest, with fishermen and cruise-

ship passengers each having more than ten publications. Interestingly, there was only one paper directly addressing the spouses and families of seafarers.

### RESEARCH METHODOLOGIES

Table 5 shows the research methods that were used in the published studies. Cross-sectional studies were the most popular, although there were also a significant number of review and position papers. Interestingly, no randomised controlled trials (RCTs) or longitudinal research and relatively few qualitative studies were found.

Table 3. Geographic areas of interest in papers published in *International Maritime Health*, 2000–2010

Region	Number of Papers
Worldwide	39
Poland	40
Norway	19
Germany	17
UK	11
France	10
Croatia	8
United States	8 (cut off )

Table 4. Population groups addressed in papers published in *International Maritime Health*, 2000–2010

Population Group Focused on	Number of papers
Cruise ship crew	4
Cruise ship passengers	5
Cruise ship passengers and crew	11
Divers	13
Engine room crew	1
Fishermen	16
General Population	10
Maritime students	2
Military	2
Mobile workers	1
Navy	11
Oil rig workers	4
Pilots	1
Seafarers	109
Travellers	7
Spouse and families of seafarers	1

Table 5. Research methodology used in papers published in *International Maritime Health*, 2000–2010

Type of Study	Frequency	Percentage
Cross-sectional	63	32
Position Paper	50	25
Review article/ Literature Review/ Systematic Review	32	16
Survey	17	9
Case Series/Study	15	8
Correlation Study	7	3.5
Pilot Study	4	2

## DISCUSSION

### RESEARCH THEMES

The journal *International Maritime Health* is a reference journal for maritime health, and its publications over the period 2000–2010 may be taken to reflect research interests within the field. While there has been a steady flow of papers over these years, the range numbers of papers published per year (13–35) is quite large. Of the six thematic areas identified in our content analysis of papers, non-communicable diseases and physical health problems along with healthcare access, delivery, and integration were the themes attracting most research publications while psychological functioning and health, and telehealth, had the fewest publications. Increasing awareness of mental health problems and increasing acceptance of initiatives to address these by maritime organisations [4] should encourage more research in this area.

While the areas of communicable and non-communicable disease will remain a priority for maritime health – particularly those related to life-style factors – healthcare access, delivery and, above all, integration are likely to become increasingly important from the perspective of ensuring an adequate health systems-level approach to addressing maritime health problems [5]. With seafarers clearly being a ‘hard to reach’ population, greater efforts have to be made to address their ‘right to health’ [6].

### GEOGRAPHICAL FOCUS

The vast majority of papers had a geographical focus in Northern or Central Europe. This is perhaps understandable given the prominent role that countries in this region have had in the development of

maritime health. However, it is noteworthy that some of the countries that provide perhaps the largest number of seafarers (for example, the Philippines, China, and India) [7] have a low publication profile, despite the numbers of seafarers they have in training. For maritime health to be more inclusive, greater efforts should be made to support research in these countries, where contextual and cultural differences may have important implications for health [8].

### POPULATION GROUPS

While the large number of papers focusing on seafarers as a group in general is to be expected, there were few with a focus on maritime students or the spouses and families of seafarers. Given the widely reported family strains associated with seafaring [9, 10], this would certainly seem to be an area justifying more research attention. There is also a well established high attrition-rate among maritime students, and it would be important to establish to what extent this is related to psychosocial health, their aptitude for a maritime life, or other issues that may be amenable to intervention.

### RESEARCH METHODOLOGIES

The largest number of papers used a cross-sectional research methodology, meaning that they looked at a particular health issue across a range of situations and circumstances, such as employer, type of ship, and area of operation. Such studies can be very valuable, and it is understood that maritime research is very challenging and often needs to be opportunistic within the real-world context in which it must operate and in which the results must be applied. Randomised controlled trials and longitudinal studies are recognised as two strong research methodologies as they help to identify causal relations that can only be inferred through cross-sectional designed research, and so we call for more research of this type, along with the increased levels of research funding that it requires. While the relatively large number of position papers and literature reviews are welcome, more qualitative research papers could also make an important contribution to understanding the patterning of seafarers’ lives, the sources of health problems, and the coping methods adopted.

### CONCLUSIONS

The journal *International Maritime Health* has played a leading role in establishing a research literature and ethos in maritime health. In the introdu-

ction section we asked: does research on maritime health reflect the globalisation of the maritime industry, the breadth of stakeholders involved, and does it provide coverage of the full range of maritime health issues? The results of this review suggest that more needs to be done to give affirmative answers to these questions, both by *International Maritime Health* and related journals in the area. The scope of geographical maritime activity and the country of origin of crews are not proportionately represented in publications. More papers should seek to address the multi-stakeholder perspectives – owners, unions, port authorities, international regulatory bodies – which are salient to the challenges of addressing many maritime health problems.

Utilising a systems approach to addressing problems which affect seafarer health at sea could be valuable as such a perspective has proven successful in other industrial fields such as the aviation [11, 12] and the process industries [13]. The ship, its crew, and the cargo are contained in one vessel, but they do not exist in isolation. There are environmental, organisational, operational, safety, and cultural elements that all have a bearing on maritime health. Many of the challenges that seafarers face, such as long periods away from home, certain environmental conditions, the inability to leave the workplace, cannot be avoided; however, a systems-based approach to future research can facilitate the targeting and implementation of integrated healthcare interventions. We also note that ships must carry medical equipment and a range of potent drugs. The “Medical Locker” is checked as part of the Port State Control system; however, more research on the most effective way of training staff to safely and effectively provide such care would also be worthwhile.

Finally, better integrated care through effective maritime health systems, maritime health policy, psychosocial health, and e-health are just some of the areas that deserve greater research attention. Research in these areas needs to complement ongoing research in the important areas of communicable and non-communicable diseases and safety. The

positioning of maritime health in relation to the rapidly developing field of global health – with a stronger emphasis on health rights, social and organisational justice, health systems and policy, and innovations in access to care – might be of strategic advantage to both of these domains.

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