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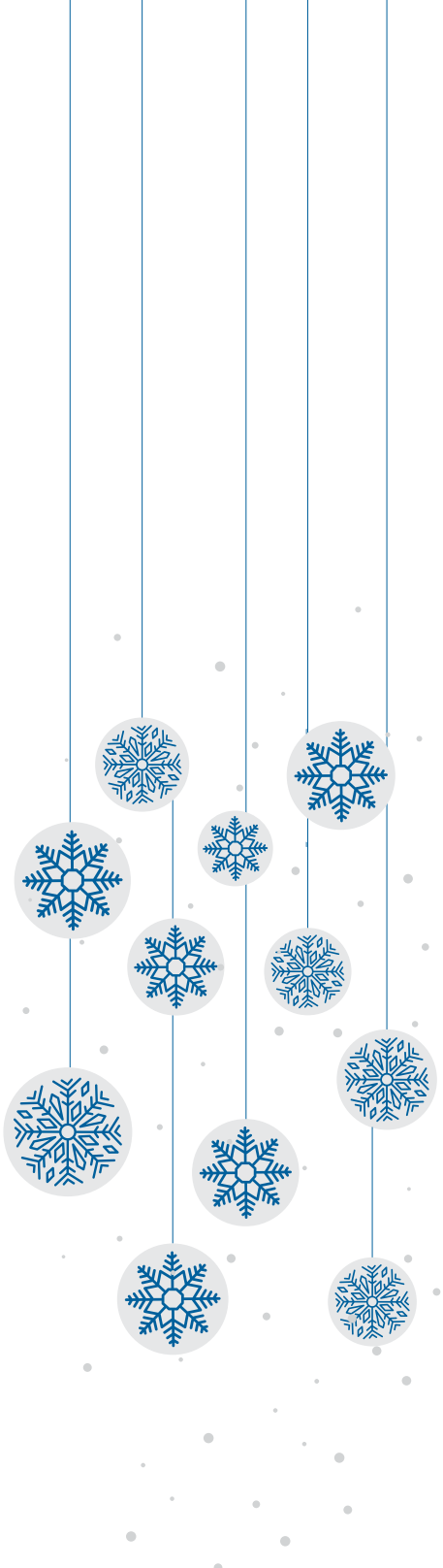

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and
Happy New Year 2019

Dear readers,
Dear writers,
Dear colleagues,

The passing year was very important and revolutionary for the **International Maritime Health** Journal **(IMH)**. In 2018 we established the **International Maritime Health Foundation (IMHF)** — all details can be found on our new website: **IMHF.pl**. The IMHF became the new owner of the IMH and took over the responsibility for the IMH development and financial security. The IMHF as the new owner, however, is not a guarantee of the high scientific quality and professional standard.

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Maria Jeżewska
IMH Editor-in-Chief

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EDITORIAL

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Vessel sanitation inspection scores and acute gastroenteritis outbreaks on cruise ships

Eilif Dahl

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In the early 1970s, when Caribbean cruising was in its infancy, there were few rules and regulations regarding vessel sanitation. Midnight buffets were served on deck in subtropical temperatures for hours without any cooling systems, and hand washing units for food handlers were few and far between. Not surprisingly, some ships had massive outbreaks of acute gastroenteritis (AGE) from "food poisoning". The cruise companies downplayed the risks, but the United States Public Health Services (USPHS) and the United States Centers for Disease Control and Prevention (CDC) reacted and started a comprehensive Vessel Sanitation Programme (VSP) which all ships of a certain size visiting United States ports after 1975 had to follow [1].

The VSP was not popular. The extensive unannounced audits covered all areas of the ship and compliance with all the new rules meant a lot of extra work, especially for the ships' management, engineers, housekeepers, food handlers and medical staff. The score system, from 0 to 100 points, let a ship with 86 points pass, while 100 was a perfect score [1]. In the first 3 months after the inspections were started in 1975, not one of 60 inspected ships passed the CDC inspection [2]. However, despite some initial reluctance from the ships, over the next 10 years compliance improved, the average VSP scores increased and the number of AGE outbreaks declined despite steadily more ships. Through the first half of 1985, 70% of the vessels were passing regularly [2].

In 1986 CDC lost their VSP funding and the programme was terminated [1]. Ship employees were pleased and looked forward to easier workdays with less vigorous sanitation routines. But just a few weeks after routine inspections stopped, three highly publicised outbreaks of AGE that affected more than 1200 passengers hit the headlines [2]. Cruise industry, public, political and media pressures resulted in CDC reinstating an updated VSP in 1987 — from then on entirely funded by the cruise industry [1]. This time cruise companies and employees were far more positive; more sanitation measures were accepted to reduce the risk of disruptive outbreaks.

Vessel Sanitation Programme's comprehensive food safety and environmental sanitation inspections clearly worked against foodborne outbreaks: During 1990 to 2000, VSP inspection scores increased steadily, the proportion of vessels failing sanitation inspections decreased (from 27.3% to 7.4%) and the incidence of outbreaks of diarrheal disease fell (from 6.2 to 3.7 outbreaks per 1000 cruises) [3].

After 2002, however, the incidence rates of AGE outbreak again increased — despite consistently high VSP scores. Explosive vomiting was a more distinct symptom than diarrhoea, and the main cause was no longer bacterial, but viral. As opposed to bacterial food poisoning, the very contagious norovirus is associated with person-to-person and environmental transmission of disease [4]. Infected passengers caused most outbreaks by bringing the virus aboard and they spread it by vomiting or defecating in the public facilities or simply touching surfaces with unclean hands. A stricter and even more comprehensive VSP was started — with increased focus on proper hand-washing, disinfection of surfaces, quick isolation of symptomatic patients, close surveillance of patient contacts and systems to avoid getting the virus aboard [1].

A United States study of AGE on cruise ships between 2008 and 2014 showed that norovirus caused 92% of the outbreaks. The number and severity of AGE outbreaks varied during the study period, but were lower than rates reported during 2001–2004 [5].

In this issue of "International Maritime Health", Dr. Christopher James Taylor presents a study based on USPH information from the period 2012–2017 [6]. The VSP inspection scores throughout the industry were consistently high but for vacation planners who want to find a ship with a low risk of an AGE outbreak, they are useless: The study

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shows that the VSP inspection scores had no prognostic value regarding future AGE outbreaks on cruise ships [6].

Although VSP inspection scores are not correlated with AGE outbreaks caused by norovirus, scores and specific categories of violations on cruise ships are clearly associated with common-source foodborne illness [4]. Constantly high inspection scores show that a ship takes hygiene seriously and is working hard to maintain a high level of sanitation. On the other hand, those who just want to be on "the cleanest ship afloat" might consider cruising on a vessel that has recently failed a VSP inspection — because the crewmembers on that ship are expecting a new VSP inspection fairly soon and are doing their very best to keep their ship spic-and-span to avoid a second VSP failure.

Compliance with the VSP has improved the hygienic conditions aboard cruise ships tremendously over the years and who knows how many health disasters it has prevented. Although time-consuming, work-intensive, expensive and at times utterly frustrating, the VSP has undoubtedly been a blessing for the cruise industry. It is viewed as an international model of cruise ship sanitation and collaborates with multiple global partners to improve ship safety [7, 8]. But, as the VSP scores have no predictive value and adequate vessel hygiene does not guarantee prevention of AGE outbreaks by norovirus, further measures must be sought and evaluated to identify those ships at greatest risk of future outbreaks. The main focus must be on ways to interrupt and preferably prevent person-to-person and fomite transmission aboard [9, 10].

Health care providers offering pre-travel services should emphasize the importance of rigorous hand sanitation aboard and actively encourage use of ship-board greetings that do not involve touching of potentially contaminated palms or fingertips [11]. They should also strongly discourage self-medication for AGE aboard cruise ships. But it is currently rather common for travel clinics to supply cruise passengers with a short course of broad-spectrum antibiotics to take if they experience any gastrointestinal symptoms during their voyage. For AGE caused by norovirus, a self-limiting condition, antibiotics are of no value, while isolation must be done quickly to prevent further transmission. Tentative self-medication causes contagious patients to continue to use — and contaminate — public areas while waiting for expected improvement. Necessary isolation is thus delayed. Instead, travel clinics should instruct prospective passengers to never try to treat themselves but to promptly contact and to cooperate closely with the ship's infirmary staff at the slightest abdominal upset.

CONFLICT OF INTEREST

The author has no commercial, financial or other relationships related to the subject of this article. He has worked as ship´s doctor and medical consultant for many cruise companies.

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Gastroenteritis outbreaks on cruise ships: are sanitation inspection scores a true index of risk?

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ABSTRACT

Background: *The utility of cruise ship sanitation scores as indicators of future gastroenteritis outbreak was investigated by means of a 5-year review of inspection scores and outbreaks of gastroenteritis as reported under the Vessel Sanitation Programme of the United States Public Health Centers for Disease Control.*

Materials and methods: *Between 2012 and 2017 a total of 1197 inspections were published online, with a mean score of 95.7 out of 100. During the same interval there were 50 separate outbreaks of acute gastroenteritis.*

Results: *No significant difference was found between pre-outbreak inspection scores, mean 96.4, and inspections that were not followed by an outbreak, mean 95.1 ($z = 0.81$, $p = 0.42$).*

Conclusions: *This study shows that the current format of the inspection audits carried out under the Vessel Sanitation Programme generates scores that have no prognostic value with regard to future outbreaks of gastroenteritis on board cruise ships.*

(Int Marit Health 2018; 69, 4: 225–232)

Key words: acute gastroenteritis, outbreak, Vessel Sanitation Programme, United States Centres for Disease Control and Prevention, cruise ships, norovirus

INTRODUCTION

An outbreak of acute gastroenteritis (AGE) on a cruise ship represents a significant concern for all concerned: the cruise line's management, the ship's crew-members and certainly the ship's passengers. The enclosed nature of cruise ships, in combination with a resident population that remains more or less constant throughout a voyage, presents ideal conditions for the proliferation of infectious agents such as norovirus, the commonest cause of AGE outbreak on ships [1].

To mitigate the threat, cruise lines take a very pro-active approach to hygiene and sanitation on their vessels by implementing procedures and policies aimed at preventing and reacting to cases of AGE on board. Assistance in this endeavour is provided by the United States Centres for Disease Control and Prevention (CDC) which, since 1975, has been running the Vessel Sanitation Programme (VSP). This programme applies to cruise ships that enter the United States carrying 13 or more passengers. It has two major components: continual surveillance of AGE cases on-board and periodic audit inspections of on-board hygiene and sanitation standards, as defined within the VSP Operations Manual [2].

Disease surveillance mandates that all ships sailing into a United States port from outside the country are required to report every case of AGE arising amongst the crew and passengers throughout the voyage. Compliance with the VSP Operations Manual is assessed by means of unannounced sanitation inspections that are periodically undertaken by the VSP's own environmental health officers. Each inspection generates a final score, with points being subtracted from 100 for each important infringement. A score above 85 is considered acceptable, a pass.

An outbreak of AGE is defined as gastro-intestinal illness that cumulatively affects three or more per cent of either the crew population or the passenger population over the entire duration of the cruise, or over the 15 days immediately prior to arrival in a United States port for longer voyages [2]. Data from each outbreak and each audit inspection are made available on the VSP website [3, 4]. The site provides

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a variety of resources for public health professionals, travel agents and cruise ship travellers seeking information about gastro-intestinal illness on cruise ships. There is a searchable database of inspections extending back to 1990, along with individual pages listing recent inspection scores and inspections that resulted in a perfect score of 100. The website encourages use of the data by the general public, viz., "The cruising public can take a proactive approach to staying healthy on vacation by finding out a ship's sanitation score..." [5].

By analysing data drawn from the online VSP databases this study sought to examine the extent to which outbreaks of AGE on cruise ships are related to the inspection scores of food hygiene and environmental sanitation on-board.

MATERIALS AND METHODS

The study was based on information collected from cruise ships visiting United States ports and made public by the CDC. A search was made of the VSP website page: "Advanced Cruise Ship Inspection Search" [4], to retrieve the available data for ship inspections under the programme. Data for voyages registering outbreaks of AGE were retrieved from a second page of the same website: "Outbreak Updates for International Cruise Ships" [3].

The study concerned the five complete calendar years between January 1st, 2013 and December 31st, 2017. If a ship reported outbreaks on two consecutive voyages they were, for the purposes of this study, viewed as a single event and details from the initial voyage were used in the subsequent analysis.

The total number of inspections were recorded and charted by score. The number of individual ships inspected was noted. Mean, median and interquartile range (25th to 75th centile) were calculated from the data for all inspections, from all inspections that preceded outbreaks and from all inspections that were not followed by outbreaks.

For each case of AGE outbreak the following data were registered: causative pathogen; month when the outbreak occurred; percentage of passengers and percentage of crew members affected; the ship's last VSP inspection score prior to the outbreak and the lead time (number of weeks between the last inspection and the outbreak); inspection scores over the 12 month period prior to each outbreak for all ships of the same cruise line as the outbreak ship (from which a mean was calculated that included data from the outbreak ship itself); inspection scores over the 12 month period prior to each outbreak for all ships in the VSP at that time (from which a mean was calculated that included data from the outbreak ship itself).

There were 7 instances where an outbreak occurred in the first year of the study and the most recent inspection had taken place in the previous calendar year. Data from these inspections were collected and included in the analysis of outbreaks even though they predated the study interval.

The results were tabulated according to whether the ship faced a single outbreak during the study (Table 1) or had several distinct outbreaks (Table 2).

Statistical analysis of inspection scores that preceded an outbreak and inspection scores not followed by outbreak was undertaken using the Mann-Whitney U test, owing to the skewed distribution of the data. A corrective calculation of standard deviation was undertaken [6, 7] in view of the many tied ranks.

RESULTS

During the 5-year study 1197 inspections were conducted on 182 ships as part of the VSP. The highest possible score of 100 was also the modal score and was achieved on 194 (16.2%) occasions. A failure score of 85 or less was recorded in 40 (3.3%) inspections. The distribution pattern of inspection audit scores was not Gaussian (Figs. 1, 2). The mean score of all inspections was 95.7, the median score was 96 and the interquartile range (IQR) was 93 to 99.

There were 54 reported AGE outbreaks on 37 cruise ships visiting United States ports. On four occasions ships reported outbreaks on two consecutive voyages; these 'back-to-back' outbreaks were viewed as a single event. Most of the 50 outbreaks occurred in the winter and early spring, with 70% (35/50) of outbreaks occurring in the first 4 calendar months and 24% (12/50) in the last 4 months of the year (Fig. 3).

Of the 50 outbreaks, 3 occurred on ships that had never previously been inspected, leaving 47 outbreaks with all data available for review. Inspection details are presented in Table 1 for ships reporting an outbreak on only one occasion and in Table 2 for those reporting an outbreak on more than one occasion during the 5-year period.

Every one of the 50 outbreaks in this study occurred within the passenger population, involving 3.3–30.3% of the passengers. In 4 cases there was also a crew outbreak, involving 3.3–4.7% of the crew population. There were no crew-only outbreaks.

The causative agent was identified in 46 of the 50 outbreaks (Tables 1, 2). Norovirus was the sole agent involved in 89.1% (41/46) and was found along with Enterotoxigenic Escherichia coli (ETEC) in two other outbreaks. On the four occasions when a ship reported outbreaks on two consecutive voyages, norovirus was the cause for both voyages in all instances.

INSPECTION SCORES FOLLOWED BY OUTBREAKS

The mean pre-outbreak inspection score in the 47 previously inspected ships (Fig. 2) was 96.4, the median score

Table 1. Vessel Sanitation Program inspection details of the 28 cruise ships that had only one gastroenteritis outbreak within the 5-year study period 2013–2017. The data were accumulated and/or calculated from information published by the United States Centres for Disease Control and Prevention [3]

Case number	Infectious agent responsible	Passenger % reporting symptoms	Crew % reporting symptoms	Ship's pre--outbreak score[1]	Lead time[2] [weeks]	Fleet 12 month mean score[3]	Industry 12 month mean score[4]
1	Norovirus	7.5	1.6	90	1	95.5	94.5
2	Unidentified	5.7	0.2	100	34	96.7	94.6
4	Unidentified	22.8	3.3	94	53	94.0	94.9
5	Norovirus	8.0	0.8	91	13	96.7	95.0
6	Norovirus	3.3	0.5	96	7	96.7	95.0
7	Norovirus	4.6	0.2	99	9	96.7	95.0
8	Norovirus	3.6	0.3	100	27	96.2	95.7
10	Norovirus	4.9	2.8	96	35	96.7	95.7
11	Unidentified	3.4	0.5	93	25	89.8	95.5
12	Norovirus	4.9	1.4	99	19	98.4	95.9
13	Norovirus	30.3	1.7	96	28	96.0	95.8
16	ETEC	6.2	3.6	98	7	96.0	95.8
17	Norovirus	5.8	0.4	100	44	95.6	95.8
18	Norovirus	3.3	1.0	–	–	96.5	95.8
19	Norovirus & ETEC	10.5	1.8	–	–	97.3	95.8
25	Norovirus	5.2	1.5	96	5	96.6	95.5
26	Norovirus	5.8	1.4	96	100	95.2	95.3
29	Norovirus	7.7	0.9	–	–	97.0	95.3
31	Norovirus	5.9	1.2	95	18	95.6	95.3
32	Norovirus	4.9	0.7	97	14	96.9	95.1
40	Norovirus	20.6	4.7	95	1	96.3	95.3
41	Norovirus	5.6	1.2	94	12	95.4	95.3
43	Norovirus	15.3	1.4	99	4	97.0	94.8
44	Norovirus	6.3	1.7	90	40*	95.7	95.5
45	Norovirus	15.3	3.9	96	31*	95.3	95.5
47	Norovirus	6.4	0.2	95	58*	95.4	95.5
49	Norovirus	8.5	0.8	99	17*	97.1	95.8
50	Norovirus	5.9	0.4	95	20*	97.2	95.8

[1] The most recent inspection score prior to the outbreak voyage.
[2] The number of complete weeks between the most recent inspection and the outbreak.
[3] The mean score of all inspections of the outbreak ship's parent company fleet over the 12 months prior to the ship's outbreak voyage, including the outbreak ship.
[4] The mean score of all inspections of all ships of all companies over the 12 months prior to the ship's outbreak voyage, including the outbreak ship.
*Outbreak occurred in the first quarter of 2013 and the most recent inspection before the outbreak was in 2012. Data for comparative 12-month averages includes some inspection scores from 2012 accordingly.
ETEC — Enterotoxigenic Escherichia coli

was 96 and the IQR was 95 to 99. These calculations include 7 instances where the outbreak arose in the first year of the study interval and the most recent pre-outbreak inspection had taken place in the preceding year.

INSPECTION SCORES NOT FOLLOWED BY OUTBREAKS

The mean score of the 1157 inspections that were not followed by an AGE outbreak (Fig. 1) was 95.1 with a median

Table 2. Vessel Sanitation Programme inspection details of the 9 cruise ships (A-I) that had more than one (range: 2–4) gastroenteritis outbreak within the 5-year study period 2013–2017. The data were accumulated and/or calculated from information published by the United States Centres for Disease Control and Prevention [3]

Ship	Case number	Infectious agent responsible	Passenger % reporting symptoms	Crew % reporting symptoms	Ship's pre-outbreak score[1]	Lead time[2] [weeks]	Fleet 12 month mean score[3]	Industry 12 month average score[4]
A	3	Clostridium perfringens	6.2	1.0	99	5	95.0	94.8
A	21	Norovirus	5.9	2.1	97	33	97.1	95.7
A	34	Norovirus	5.3	1.2	91	24	94.5	95.1
A	35	Norovirus & ETEC	3.9	2.6	95	21	95.8	95.3
B	14	Norovirus	8.1	0.8	96	2	95.0	95.8
B	20	Norovirus	3.2	0.0	94	6	94.7	95.8
B	24	Norovirus	6.4	1.6	94	38	95.4	95.8
C	22	Norovirus	5.1	1.9	100	16	97.5	95.9
C	38	Norovirus	9.0	1.7	99	3	96.7	95.4
C	46	ETEC	4.9	1.7	92	27*	95.3	95.5
D	9	Norovirus	7.8	2.8	100	1	96.4	95.7
D	28	Norovirus	5.1	1.4	97	24	96.1	95.3
E	23	Norovirus	5.0	1.1	99	11	97.2	95.9
E	39	Norovirus	5.8	1.0	98	17	95.8	95.4
F	27	Norovirus	5.9	2.1	95	18	97.4	95.3
F	37	Unidentified	5.9	1.4	99	12	97.2	95.3
G	30	Norovirus	5.0	0.6	100	0	97.6	95.3
G	48	Norovirus	4.8	2.1	97	23*	95.1	95.7
H	33	Norovirus	10.2	1.2	99	5	96.6	95.1
H	36	Norovirus	5.2	0.8	94	16	96.2	95.3
I	15	Norovirus	4.4	0.6	97	29	95.4	95.7
I	42	Norovirus	4.3	0.3	100	17	95.1	95.2

[1] The most recent inspection score prior to the outbreak voyage.
[2] The number of complete weeks between the most recent inspection and the outbreak.
[3] Mean score of all inspections of the outbreak ship's parent company fleet over the 12 months prior to the ship's outbreak voyage, including the outbreak ship.
[4] The mean score of all inspections of all ships of all companies over the 12 months prior to the ship's outbreak voyage, including the outbreak ship.
*Outbreak occurred in the first quarter of 2013 and the most recent inspection before the outbreak was in 2012. Data for comparative 12-month averages includes some inspection scores from 2012 accordingly.
ETEC — Enterotoxigenic Escherichia coli

score of 96 and IQR of 93 to 99. There was no significant difference at the 5% level between the median scores of the 1157 inspections not followed by outbreak and the 47 inspections that were: z = 0.81, two-tailed p = 0.42.

FAILED INSPECTIONS

There were 40 failed inspections during the study period, affecting 34 ships. On no occasion did an outbreak arise on a ship that had failed its most recent inspection. Six ships failed on two occasions; none of them had an outbreak, either before or after the failed inspection. No ship failed three or more inspections.

There were 148 ships that never failed an inspection; outbreaks occurred in 32 (22%) of these ships. Of the 34 ships that failed one or more inspections, 5 (15%) had outbreaks of AGE, either before or after the inspection date. In every case a subsequent inspection had been passed in the interim. Two of the five ships had an outbreak after failing an inspection (8 months and 18 months later, respectively) and two ships failed inspection following an outbreak (2 weeks and 5 weeks later, respectively). There was one ship that had outbreaks either side of the failed inspection: an outbreak occurred 6 months after failing an inspection and three other outbreaks occurred 35 months, 30 months and 15 months before the failed inspection.

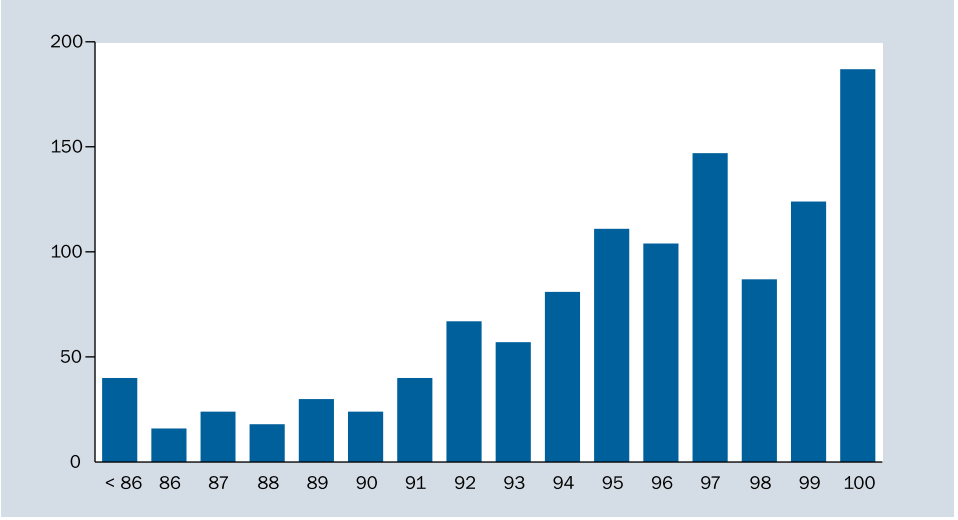

Figure 1. All Vessel Sanitation Programme inspection scores not followed by a gastroenteritis outbreak during the 5-year study period 2013–2017 (n = 1157) [4]

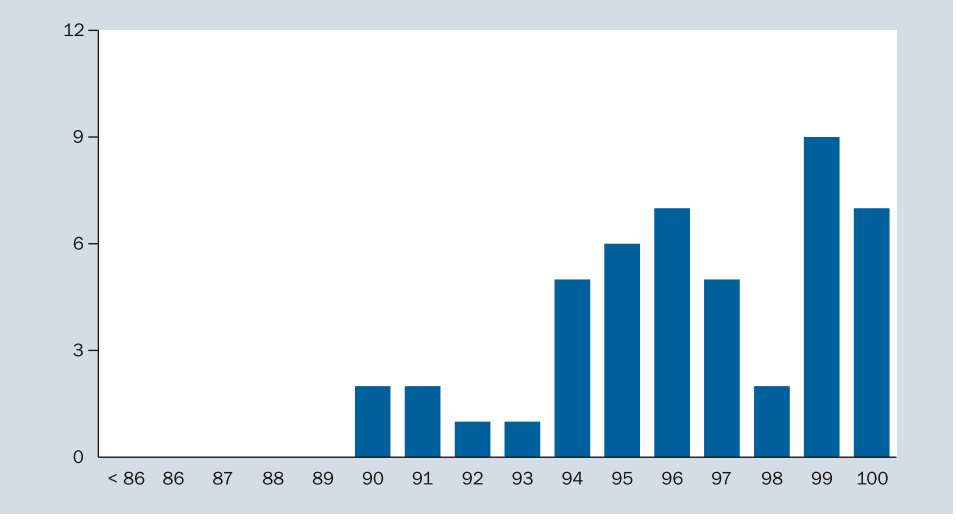

Figure 2. All Vessel Sanitation Programme inspection scores that preceded a gastroenteritis outbreak in the 5-year study period 2013–2017 (n = 47) [4]. This includes 7 inspections from 2012 which were the most recent pre-outbreak inspection for 7 ships that had outbreaks in the first months of 2013

OUTBREAKS AFTER FAULTLESS INSPECTION SCORES

On seven occasions a ship had an outbreak after scoring 100% on the most recent inspection. In 2 cases this inspection very closely preceded the outbreak (by 11 days in 1 case and 0 days in the other, i.e. the inspection took place on the same day that the outbreak voyage commenced).

INSPECTION SCORES IN RELATION TO PARENT COMPANY AND INDUSTRY STANDARDS

In 72% of cases (36/50) the ship having an outbreak belonged to a cruise line whose average inspection score over the previous 12 months was greater than the industry-wide average for the same interval. In 64% of cases (30/47) the most recent pre-outbreak inspection score exceeded the mean industry-wide score of all ships in the preceding 12 months. The pre-outbreak score exceeded the parent cruise line mean over the 12 months prior to the outbreak in 55% of cases (26/47).

SINGLE OUTBREAKS

Twenty-eight ships experienced a single outbreak. This included the three never-inspected ships. In 60% of cases (15/25) the outbreak ship's most recent inspection score was greater than the industry-wide mean score over the 12 months prior to the outbreak in 60% of cases (15/25) and

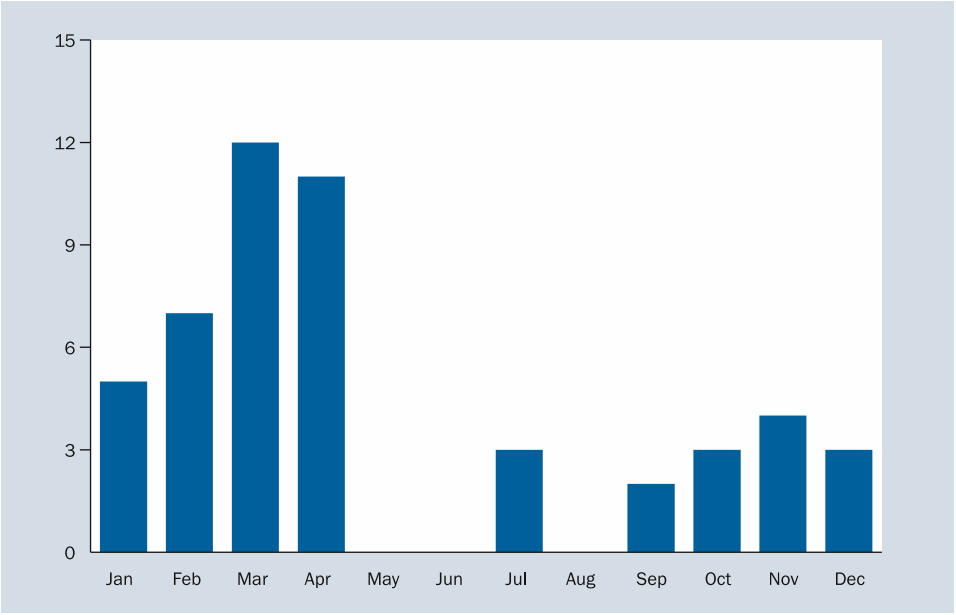

Figure 3. Distribution of gastroenteritis outbreaks (n = 50) by month during the 5-year study period 2013–2017 [3]. Outbreaks on consecutive voyages are counted as a single event

greater than the parent company mean in 48% of cases (12/25). The score of the outbreak ship was identical to the parent company mean in two other cases.

MULTIPLE OUTBREAKS

Nine ships had multiple outbreaks involving non-consecutive voyages. Only one failed an inspection at any time during the study (see above). These 9 ships accounted for 22 outbreaks. The most recent pre-outbreak inspection score of these ships exceeded the industry-wide mean score in the 12 months prior to the outbreak in 73% of cases (16/22) and was greater than the parent company mean in 64% of cases (14/22).

DISCUSSION

Cruise lines commit considerable resources towards implementing the food hygiene and environmental sanitation standards defined in the VSP Operations Manual [2]. The results of periodic audit inspections assessing on-board compliance with these directives are posted online and are of great consequence for an industry dependent on further bookings for its success; a poor audit performance can jeopardize not only future sales but also present-day seafaring careers. The audits are lengthy, thorough and exacting. Achieving a perfect score requires a sustained prioritisation of health and hygiene procedures by the ship's crew and management. This study found that successful audit inspections did not translate into fewer AGE outbreaks; the mean scores of audits that preceded an AGE outbreak did not significantly differ from those that were not followed by an outbreak (96.4 vs. 95.1; p = NS).

Ships having outbreaks of AGE had pre-outbreak inspection scores that were higher than the industry-wide mean for the 12 months leading up to the outbreak in 64% of cases. In 72% of cases the outbreak ships belonged to cruise lines with a mean inspection score that was greater than the industry-wide mean over the 12 months prior to the outbreak. Thus, outbreaks occurred more often on the better scoring ships and on ships belonging to the better scoring cruise lines.

Scoring highly on VSP sanitation inspection audit, even a perfect score of 100, did not confer less likelihood of future outbreak. In one case an outbreak voyage began the same day that an audit inspection had scored the ship 100 for sanitation standards. Overall, 15% of ships having outbreaks scored 100 in their most recent inspection, a rate similar to that found for all inspections (16%).

Failing a VSP audit (a score below 86 out of 100) was an uncommon outcome and happened in only 3% of inspections. However, failing an inspection was not associated with greater likelihood of AGE outbreak. Of the ships found to have sub-standard levels of on-board sanitation, 15% had an outbreak of AGE during the study interval. In comparison, an outbreak occurred in 22% of ships that passed every inspection.

Nine ships in the study had an outbreak on more than one non-consecutive voyage. These multi-outbreak ships might logically be suspected of having questionable standards of food hygiene and environmental sanitation. However, this study found that in 73% of cases, these ships had pre-outbreak inspection scores that exceeded the in-

dustry-wide mean score for the 12 months leading up to each outbreak.

Norovirus is the leading cause of acute gastroenteritis outbreaks worldwide [8–10] with a known greater prevalence in winter months [9–11], such that it is sometimes referred to as "winter vomiting disease" [12–14]. Accordingly, this study found that norovirus was the agent partly or totally responsible in 93% (43/46) of cruise ship outbreaks where a cause was identified and that the overwhelming majority of outbreaks occurred in the months of winter and early spring.

Transmission of norovirus is faeco-oral or through exposure to infectious vomitus [8, 15]. Infected food workers transferring virus onto food by means of unhygienic food preparation methods has been said to be a frequent source of outbreak [15]. Whether this is applicable on-board cruise ships is unclear. Outbreaks of acute gastroenteritis in this study arose within the passenger population in 100% of instances but in only 8% of cases was there a concurrent outbreak within the crew population. It is difficult to imagine that the food preparation methods used in crew dining areas are of a higher standard than those in the galleys where meals for passengers are prepared, suggesting that on cruise ships factors other than unhygienic food preparation are responsible.

This study is not the first to describe a relative rarity of gastroenteritis outbreaks amongst crew members. Previous authors have commented that the earlier reporting of gastrointestinal symptoms by crew members and enforced hand washing in their dining areas may be contributory factors to the unexpectedly low prevalence of crew outbreaks [1]. These proposals lend support to a hypothesis of transmission primarily via contact with contaminated surfaces rather than through the ingestion of contaminated food.

If the chief mode of transmission in AGE outbreaks on cruise ships really is by means of contact with contaminated surfaces, then the relative stability of the crew population may to some extent explain the lower incidence of outbreak within this group. Replenishment of the passenger population at the end of each voyage generally approaches 100% whereas the proportion of new crew members joining the ship is often in the order of only 5–10%. Accordingly, there is a greater likelihood that new persons harbouring infectious disease will board within the passenger group than there is within the crew population, leading to more surfaces being affected in public areas than in the crew-only areas on-board.

The VSP seeks to address the prevention and management of communicable disease on-board passenger ships. The VSP operations manual is extensive and detailed; it focuses chiefly on the management of potable and recreational water, food storage and preparation as well as disease surveillance and reporting [2]. The number of outbreaks and individual gastroenteritis cases that over the years have been avoided by the implementation of the VSP operations manual procedures are incalculable. However, relatively little space within the manual is given over to general housekeeping measures, thus drawing attention away from what may well be the main mechanism of norovirus transmission on-board cruise ships.

For each inspection audit within the VSP a fee is charged to the cruise line, in accordance with a sliding scale of charges based on the size of the vessel being inspected [16]. With around 250 inspections per year, the annual cost to the cruise lines is in the region of 3 million dollars. This paper has shown that the scores generated by these inspection audits have no prognostic value in terms of future AGE outbreaks. Identifying the specific aspects of the VSP Operations Manual that truly influence AGE outbreaks and focussing the scoring of audit inspections on those key areas might result in scores that do have a predictive value. In the current format, however, VSP sanitation scores cannot be considered at all indicative of the future risk of AGE outbreak on a cruise ship.

CONCLUSIONS

This study has shown that the scores generated by the food hygiene and environmental sanitation inspection audits carried out under the VSP over the most recently completed 5-year interval had no prognostic value in regard to which ships and which cruise lines were likely to have future outbreaks of acute gastroenteritis on board.

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Occupational risk perception, stressors and stress of fishermen

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ABSTRACT

Background: *The aim of this survey was to assess the stress in fishermen by analysing its relationship with sociodemographic and professional characteristics, by evaluating work stressors, and by estimating psychosomatic symptoms.*

Materials and methods: *This cross-sectional survey involved representative sample of 828 artisanal and coastal fishermen. All participants were men and had a regular activity for at least 2 years. We used an individual questionnaire inspired by those of the National Institute for Research and Security of France and of the Karasek's Job Content Questionnaire.*

Results: *The prevalence of self-reported stress was 53.9%. The average age was 36.7 ± 8.7 years, it was higher among stressed than non-stressed. The prevalence of stress was higher in subjects with dependents (69.1%) versus 30.9% without dependents, and among those living alone (61%) versus 47.5% among those living in couple. The prevalence of harmful habits was 68.5% for tobacco smoking or snuff, 36.8% for cannabis smoking, 35.4% for alcohol consumption, 8.6% for other psychotropic substances and medications, and 21.4% for antalgic drugs. These toxic habits were significantly higher in stressed individuals. Thirty-three point seven per cent had self-reported chronic pathologies (40.5% among stressed vs. 25.7% non-stressed). Thirty-four per cent were overweight (38.3% among stressed vs. 28.8% non-stressed), and 14% obese (19.3% among stressed vs. 7.6% non-stressed). The average daily working hours were 11.2 h (12.8 h among stressed subjects vs. 10.5 h non-stressed). Psychological demand was higher in stressed subjects, while decisional latitude and social support were lower. Psychosomatic symptoms were higher among stressed than non-stressed. The main suggestions of the fishermen were to improve income, social welfare, health insurance, safety on board, quality of lifestyle, sport and leisure activities, information and awareness campaigns of occupational stress, and fight against addictive behaviours.*

Conclusions: *Fishermen were at a high risk of chronic stress with its health consequences. Health promotion and education initiatives should be conducted to raise fishermen's awareness of the dangers of occupational stressors.*

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Key words: fisheries, occupational, stress, health risk

INTRODUCTION

It has long been known that fishing is one of the most dangerous occupations [1]. The relentless struggle of traditional fishermen with the sea continues since centuries, and the maritime environment remains particularly dangerous to those who work there, especially in developing countries [2]. In these countries, risk-taking behaviour among fishermen is still an epidemiological reality, associated with significant morbidity and mortality [3, 4].

Fishing is highly stressful and fishermen are particularly affected by stress because they are exposed to high psychosocial factors at work and organisational constraints

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related to difficult working conditions and financial difficulties with worries about their daily gain. The dangerousness and complexity of this profession is explained by an arduous and laborious activity with numerous and countless constraints requiring a sustained degree of attention. The main stressors of fishermen are working conditions (atypical work schedules, long work hours, density of work, unsafe job, workplace injustice and violence), lifestyle (high prevalence of consumption of psychoactive substances, sedentary, unbalanced meals, lack of leisure, etc.), and socio-economic difficulties (precarious work, low income, piecework, work-family conflict) [5]. The pathophysiologic effects of chronic stress, resulting from work-related stressors, contribute to a wide range of unhealthy behaviours, psychosomatic symptoms, and illnesses, including mental disorders, gastrointestinal disorders, cardiovascular diseases and its risk factors (hypertension, obesity, diabetes, and the metabolic syndrome), musculoskeletal disorders, and acute traumatic injuries [5]. Abusive behaviour in relation to working conditions and lifestyle is associated with health problems in fishermen: pattern of taking meals, obesity, high consumption of psychoactive substances, etc. [6].

However, few studies have in some way investigated the occupational stress of fishermen in Morocco. The aim of this survey was to assess the level of stress in fishermen by analysing its relationship with sociodemographic and professional characteristics, by evaluating work stressors among self-reported stressed and non-stressed fishermen, and by estimating psychosomatic symptoms.

MATERIALS AND METHODS

FRAMEWORK AND TYPE OF STUDY

This observational and cross-sectional study was conducted from January to April 2018 in two ports of northern Morocco.

TARGET POPULATION

The survey involved representative sample of 1038 fishermen (40.7% of the exhaustive administrative list of 2552 fishermen). All participants were men, had a regular activity for at least 2 years, and worked in the coastal and artisanal fishing sector with small embarkations.

QUESTIONNAIRE

We used an individual questionnaire inspired by those of the National Institute for Research and Security of France [7], and the Karasek's Job Content Questionnaire (KJCQ) [8]. It comprised five parts:

- **Socio-demographic data**: age, body mass index, family status (living alone, living in couple), dependents (children, parents, and relatives), toxic habits (tea/coffee, tobacco, cannabis, alcohol, other psychoactive substances and medicines, antalgic drugs), regular physical activities — sports (at least three times per week), and chronic diseases.
- **Socio-professional data**: professional category, educational level, length of employment, choice of profession, daily working, income, medical coverage, welfare, and accidents during last 12 months (occupational, road ,and home accidents).
- **Work stressors:** (i) A self-reported global question evaluated stress ("Since six months, do you feel stressed?"); (ii) Nine items inspired by the KJCQ, and regrouped in three domains related to the psychosocial environment in the workplace: psychological demands, decision latitude, and social support. The responses were on a 4-point Likert discontinuous scale from "totally disagree" to "totally agree". The answers "totally disagree" and "disagree" were considered as negative and the answers "agree" and "totally agree" as positive.
- **Psychosomatic symptoms related to stress**: The items were assessed with responses on a 4-point Likert scale from never to often. The answers "never" and "rarely" were considered as negative and the answers "sometimes" and "often" as affirmative.
- **Free-text zone** to allow fishermen to suggest priority actions to reduce stressors.

ETHICAL AND DEONTOLOGICAL ASPECTS

We previously contacted the Ministry of Fisheries delegate, the representatives of the fishermen associations and the occupational physicians to explain the purpose of the study and to obtain their support. The interviews took place within the occupational health service of fishermen and lasted approximately 20 minutes for each person. The singular colloquium with each fisherman was carried out with full respect of the confidentiality.

STATISTICAL ANALYSES

The statistical analyses were performed using the SPSS version 11.5 software package. The differences between groups were compared using t tests for continuous variables and chi-square tests for categorical ones. The statistical level of significance was established at 5%.

RESULTS

Eight hundred and twenty-eight people agreed to answer the questionnaire; the participation rate was 79.8%. To the question "Since six months, do you feel stressed?" 446 people responded positively. The prevalence of self-reported stress was 53.9%.

RELATIONSHIP BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND STRESS (TABLE 1)

The average age was 36.7 ± 8.7 years (40.8 ± 9.1 years among stressed subjects vs. 34.5 ± 8.3 years among

Table 1. Relationship between sociodemographic characteristics and self-reported stress

Sociodemographic characteristics	Total (n = 828)	Self-reported stress (n = 446; 53.9%)	No self-reported stress (n = 382; 46.1%)
Age [years]			
< 40	478 (57.7%)	218 (45.6%)	260 (54.4%)
≥ 40	350 (42.3%)	228 (65.1%)	122 (34.9%)
Average age	36.7 ± 8.7	40.8 ± 9.1	34.5 ± 8.3
Body mass index [kg/m²]			
Underweight	64 (7.7%)	31 (7%)	33 (8.6%)
Normal	394 (47.5%)	158 (35.4%)	236 (61.8%)
Overweight	281 (34%)	171 (38.3%)	110 (28.8%)
Obesity	115 (14%)	86 (19.3%)	29 (7.6%)
Family status			
Living alone	392 (47.3%)	239 (61%)	153 (39%)
Living in couple	436 (52.7%)	207 (47.5%)	229 (52.5%)
Dependents (parents, relatives, children, etc.)	645 (77.9%)	446 (69.1%)	199 (30.9%)
Harmful habits			
Tea/coffee consumption	759 (91.7%)	439 (98.4%)	320 (83.8%)
Tobacco smoking or snuff	567 (68.5%)	371 (83.2%)	196 (51.3%)
Cannabis smoking	305 (36.8%)	201 (45.1%)	104 (27.2%)
Alcohol consumption	293 (35.4%)	187 (41.9%)	106 (27.7%)
Other psychotropic substances	71 (8.6%)	32 (7.2%)	39 (10.2%)
Antalgic drugs	177 (21.4%)	139 (31.2%)	38 (9.9%)
Regular physical activities and/or sports	127 (15.3%)	28 (6.3%)	99 (25.9%)
Self-reported chronic diseases	279 (33.7%)	181 (40.5%)	98 (25.7%)
Musculoskeletal	228 (27.5%)	165 (37%)	63 (16.5%)
Neuropsychiatric	218 (26.3%)	159 (35.7%)	59 (15.4%)
Cardiovascular	159 (19.2%)	123 (27.6%)	36 (9.4%)
Respiratory	154 (18.6%)	85 (19.1%)	69 (18.1%)
Digestive	152 (18.4%)	117 (26.2%)	35 (9.2%)
Metabolic	129 (15.6%)	83 (18.6%)	46 (12%)

non-stressed; $p < 0.001$). About half lived in couples (52.7%) and 77.9% had dependents. The prevalence of stress was higher in subjects with dependents (69.1%) versus 30.9% among those without dependents; $p < 0.001$, and among those living alone (61%) versus 47.5% among those living in couple; $p < 0.01$. The prevalence of harmful habits was 91.7% for tea-coffee (more than 4 cups or glasses a day), 68.5% for tobacco, 36.8% for cannabis, 35.4% for alcohol, 8.6% for other psychotropic substances and medications (antidepressants, tranquilizers and sedatives), and 21.4% for antalgic drugs use. These toxic habits were significantly higher in stressed individuals. Thirty-three point seven per cent had self-reported chronic diseases (40.5% among stressed and 25.7% among non-stressed, $p < 0.001$). Their prevalence was 27.5% for musculoskeletal dysfunctions, 26.3% for neuropsychiatric illness (head ache, migraine, anxiety, depression), 19.2% for cardiovascular diseases (16.8% high blood pressure and 13.2% phlebitis), 18.6% for respiratory diseases (17.3% rhinitis, 7.5% asthma, 4.5% chronic obstructive pulmonary disease, and 6.6% chronic bronchitis), 18.4% for digestive disorders (gastritis, heartburn, gastric ulcer), and 15.6% for metabolic diseases (6.3% diabetes, 7.2% hypercholesterolaemia). The prevalence of dermatologic diseases was 71% (67% traumatic skin disorders, 44% fungal infections, and 3% contact dermatitis).

Forty-eight per cent were overweight or obese (57.6% among stressed and 36.4% among non-stressed, $p < 0.05$). Fifteen point three per cent regularly performed sports or physical activity outside work (6.3% in stressed vs. 25.9% in non-stressed).

RELATIONSHIP BETWEEN SOCIO-PROFESSIONAL CHARACTERISTICS AND STRESS (TABLE 2)

The average work seniority was 14.8 ± 4.6 years (15.1 ± ± 4.8 years among stressed vs. 13.6 ± 3.7 years among non-stressed; $p < 0.05$). The average daily working hours were 11 h 12 min ± 22 min (12 h 48 min ± 54 min among stressed vs. 10 h 30 min ± 42 min among non-stressed; $p < 0.05$). In the last 12 months, 28.1% had been victims of accidents (38.8% in stressed vs. 15.7% in non-stressed; $p < 0.001$). The prevalence of stress was lower among those who had chosen their profession than those who had not chosen it (43.3% vs. 56.7%; $p = 0.01$). For fishermen, the

Table 2. Relationship between socio-professional characteristics and self-reported stress

Socio-professional characteristics	Total (n = 828)	Self-reported stress (n = 446; 53.9%)	No self-reported stress (n = 382; 46.1%)
Professional categories			
Pilots/co-pilots	143 (17.3%)	85 (59.4%)	58 (40.6%)
Mechanics	121 (14.6%)	77 (63.6%)	44 (36.4%)
Fishermen	564 (68.1%)	284 (50.4%)	280 (49.6%)
Educational level			
Superior	26 (3.1%)	15 (57.7%)	11 (42.3)
Secondary	209 (25.2%)	116 (55.5%)	93 (44.5)
Primary	509 (61.5%)	291 (57.2%)	218 (42.8%)
Illiterate	84 (10.1%)	24 (28.6%)	60 (71.4%)
Work seniority [years]			
≤ 5	117 (14.1%)	48 (41%)	69 (59%)
6–15	271 (32.7%)	151 (55.7%)	120 (44.3%)
> 15	440 (53.2%)	247 (56.1%)	193 (43.9%)
Average	14.8 ± 4.6	15.1 ± 4.8	13.6 ± 3.7
Average working hours	11.2 ± 0.3	12.8 ± 0.6	10.5 ± 0.2
Daily	67.2 ± 0.7	76.8 ± 0.9	63 ± 0.7
Weekly			
Choice of profession			
Yes	482 (58.2%)	193 (43.3%)	289 (75.7%)
No	346 (41.8%)	253 (56.7%)	93 (24.3%)
Accidents during last 12 months	233 (28.1%)	173 (38.8%)	60 (15.7%)

average income in form of commissions was about 400 dollars per month. Eighty-one per cent underwent occupational health services and 85% received paid sick days.

WORK STRESSORS AND THEIR RELATIONSHIP WITH STRESS (TABLES 3 AND 4)

For the psychological demand, 87.8% thought they had a heavy workload, 76.2% were forced to work overtime and 66.2% complained of time and performance pressure. For the decision latitude, 49.4% found their work boring, 28.7% were satisfied with their work and 55.4% wanted to change it. For the social support, 47.6% suffered from a sense of injustice from the hierarchy, 76.4% felt unsafe with feelings of isolation at sea and distance from the family, and 56.7% felt unfriendly attitudes in the workplace from colleagues with a sense of group pressure. Psychological demand was significantly higher in stressed subjects, while decision latitude and social support were significantly lower.

PSYCHOSOMATIC SYMPTOMS AND THEIR RELATIONSHIP TO STRESS (TABLES 5 AND 6)

The following psychosomatic symptoms were reported; neurovegetative disorders (44%), nervous tension (61.5%), mood disorders (53.3%), cognitive disorders (23.6%), and sleep disorders (43.2%) All the psychosomatic symptoms were significantly higher in the stressed subjects than in the non-stressed ones

SUGGESTIONS OF FISHERMEN TO REDUCE OCCUPATIONAL STRESS

The main suggestions were to improve income (96.6%), social welfare (92.7%), health insurance (89.8%), safety on board (91.8%), quality lifestyle (90.4%), sport and leisure activities (82%), information and awareness campaigns of occupational stress (78.5%), and fight against addictive behaviours (68.1%).

DISCUSSION

The occupational stress process refers to the ways in which sources of stress in the work environment (stressors) can lead to psychological, behavioural, or physiologic manifestations of stress (strain), and to longer-term health effects. The National Institute for Occupational Safety and Health (NIOSH) and the International Labour Office have defined occupational stress as the harmful physical and emotional responses that occur when job requirements do not match or exceed a worker's capabilities, resources, or needs. As NIOSH has stated, stressful working conditions (stressors) "play a primary role in causing job stress," but modifiers "can intervene to strengthen or weaken this influence [9]. These modifiers include individual factors, such as coping style, and other work environment factors, such as social support. Several definitions and models have been proposed to evaluate the psychosocial factors of occupational stress and to integrate its complexity. The

Table 3. Work stressors

Work stressors	Totally agree	Agree	Disagree	Totally disagree
Psychological demands				
Do you think you have a heavy workload with performance pressure?	385 (46.5%)	342 (41.3%)	76 (9.2%)	25 (3%)
Do you have to work overtime?	388 (46.9%)	243 (29.3%)	131 (15.8%)	66 (8%)
Do you think you have a pressure of time and performance?	329 (39.7%)	219 (26.5%)	194 (23.4%)	86 (10.4%)
Decision latitude				
Are you satisfied with your work?	87 (10.5%)	151(18.2%)	326 (39.4%)	264 (31.9%)
Do you feel bored in your work?	268 (32.3%)	142(17.1%)	235 (28.4%)	183 (22.2%)
Would you like to change jobs?	264 (31.9%)	195(23.5%)	248 (29.9%)	121 (14.7%)
Social support				
Do you feel unfriendly attitudes in your work with a feeling of group pressure?	375 (45.2%)	96 (11.5%)	246 (29.8%)	111 (13.5%)
Do you feel insecure in your work with a sense of isolation at sea and/or distance from your family?	195 (23.5%)	438 (52.9%)	65 (7.8%)	130 (15.8%)
Do you think you are treated unfairly in your work?	272 (32.8%)	123 (14.8%)	337 (40.7%)	96 (11.7%)

Table 4. Relationship between work stressors and self-reported stress

Work stressors	Total (n = 828)	Self-reported stress (n = 446; 53.9%)	No self-reported stress (n = 382; 46.1%)
Psychological demands			
A heavy workload with performance pressure	727 (87.8%)	428 (96%)	299 (78.2%)
Overtime work	631 (76.2%)	389 (87.2%)	242 (63.3%)
Pressure of time and performance	548 (66.2%)	370 (83%)	178 (46.5%)
Decision latitude			
Job satisfaction	238 (28.7%)	58 (13.2%)	180 (47.1%)
Boring work	410 (49.4%)	336 (75.3%)	74 (19.3%)
Changing jobs	459 (55.4%)	330 (74%)	129 (33.7%)
Social support			
Unfriendly attitudes in work with a feeling of group pressure	477 (56.7%)	274 (61.6%)	203 (53.1%)
Insecure in work with a sense of isolation at sea and/or distance from family	633 (76.4%)	368 (82.5%)	265 (69.3%)
Treated unfairly in a work	395 (47.6%)	231 (51.7%)	164 (43%)

fields of sociology and labour relations have contributed important insights to the integrated occupational stressor models. Two models were the most used [5]. The first is the Job Demand-Control (JDC) model. It is also known as the job strain model, where stress and subsequent strain is thought to be arising primarily due to characteristics of work. This model assumes that strain arises from an imbalance between demands and decision latitude in the workplace, where lack of control is seen as an environmental constraint on response capabilities. Decision control consists of two components, which are highly correlated in job situations: autonomy and opportunities to develop skills. The JDC model characterises jobs by their combination of demands and control. Jobs with high demands and low control, such as that of fishermen result in strain. The lack of control over all aspects of the job is recognized as a key factor in the development of occupational stress [10]. The Job Demand-Control-Support (JDCS) model includes social support as an additional dimension. Lack of social support can include social isolation from co-workers, few opportunities for collaboration and therefore a lack of new learning, competition among workers, and bullying and harassment [8]. The second model is the Effort–Reward Imbalance (ERI) model. It shares some elements with the JDCS model, while emphasizing social reciprocity and the imbalance between the effort required in a job and the rewards provided by this job. In the ERI model, "effort" can be due to extrinsic factors, such as high workload, or intrinsic characteristics, such as the worker's "over commitment". "Reward" includes esteem reward, such as respect and support, income, and status control, such as job security, job stability, and prospects for promotion or demotion [11].

Table 5. Psychosomatic symptoms

Symptoms of stress	Often	Sometimes	Rarely	Never
Neuro-vegetative disorders				
Do you feel palpitations?	120 (14.5%)	110 (13.2%)	489 (59.1%)	109 (13.2%)
Do you feel pain in your heart?	126 (15.2%)	63 (7.6%)	394 (47.6%)	245 (29.6%)
Do you feel oppression of chest?	107 (12.9%)	84 (10.1%)	371 (44.8%)	266 (32.2%)
Do you feel sweats in the absence of physical effort?	134 (16.2%)	145 (17.5%)	421 (50.8%)	128 (15.5%)
Do you feel dry mouth, nausea and/or digestive disorders?	106 (12.8%)	93 (11.2%)	264 (31.9%)	365 (44.1%)
Do you feel abdominal pain?	121 (14.6%)	151 (18.2%)	267 (32.2%)	289 (35%)
Do you feel muscle pains, cramps or sensations of muscle stiffness?	303 (36.3%)	53 (6.5%)	193 (23.4%)	279 (33.8%)
Nervous tension				
Do you feel sensations of discomfort?	326 (39.3%)	168 (20.3%)	179 (21.6%)	155 (18.8%)
Do you feel tremors of extremities?	60 (7.2%)	96 (11.6%)	221 (26.7%)	451 (54.5%)
Do you have headaches at the end of a workday?	302 (36.4%)	190 (22.9%)	154 (18.6%)	182 (22.1%)
Mood disorders				
Do you have anxiety?	194 (23.4%)	112 (13.5%)	363 (43.8%)	159 (19.3%)
Do you have irritability?	295 (35.6%)	139 (16.8%)	327 (39.4%)	67 (8.2%)
Do you have discouragement or pessimism?	136 (16.4%)	92 (11.1%)	264 (31.9%)	336 (40.6%)
Cognitive disorders				
Do you have difficulty concentrating?	94 (11.3%)	80 (9.6%)	338 (40.9%)	316 (38.2%)
Do you have memory problems?	115 (13.9%)	63 (7.6%)	490 (59.1%)	160 (19.4%)
Sleep disorders				
Do you have difficulty falling asleep?	197 (23.8%)	137 (16.5%)	410 (49.5%)	84 (10.2%)
Do you have interrupted sleep?	221 (26.6%)	78 (9.4%)	489 (59.1%)	40 (4.9%)
Do you feel like you did not sleep?	135 (16.3%)	121 (14.6%)	327 (39.4%)	245 (29.7%)

Table 6. Relationship between psychosomatic symptoms and self-reported stress

Psychosomatic symptoms	Total (n = 828)	Self-reported stress (n = 446; 53.9%)	No self-reported stress (n = 382; 46.1%)
Neuro-vegetative disorders	364 (44%)	233 (52.2%)	131 (34.3%)
Palpitations	230 (27.7%)	194 (43.5%)	36 (9.4%)
Pain in your heart	189 (22.8%)	227 (51%)	38 (10%)
Oppression of chest	191 (23%)	146 (32.7%)	45 (11.8%)
Sweats in the absence of physical effort	279 (33.7%)	151 (33.8%)	128 (33.5%)
Dry mouth, nausea and/or digestive disorders	199 (24%)	140 (31.3%)	59 (15.5%)
Abdominal pain	279 (32.8%)	174 (39.2%)	105 (27.5%)
Muscle pains, cramps or sensations of muscle stiffness	356 (42.8%)	231(51.8%)	125 (32.7%)
Nervous tension	509 (61.5%)	351 (78.7%)	158 (41.4%)
Sensations of discomfort	494 (59.6%)	349 (78.3%)	145 (37.9%)
Tremors of extremities	156 (18.8%)	119 (26.6%)	37 (9.6%)
Headaches at the end of a workday	492 (59.3%)	338 (75.7%)	154 (40.3%)
Mood disorders	441 (53.3%)	343 (76.9%)	98 (25.7%)
Anxiety	306 (36.9%)	213 (47.7%)	93 (24.3%)
Irritability	434 (52.4%)	339 (76%)	95 (24.8%)
Discouragement or pessimism	228 (27.5%)	189 (42.3%)	39 (10.2%)
Cognitive disorders	195 (23.6%)	144 (32.3%)	51 (13.4%)
Difficult concentration	174 (20.9%)	143 (32.1%)	31 (8.1%)
Memory problems	178 (21.5%)	130 (29.1%)	48 (12.5%)
Sleep disorders	358 (43.2%)	237 (53.1%)	121 (31.7%)
Difficulty falling asleep	334 (40.3%)	232 (52.1%)	102 (26.7%)
Interrupted sleep	299 (36%)	183 (41.2%)	116 (30.3%)
Feeling like not have slept	256 (30.9%)	180 (40.3%)	76 (19.8%)

In 2014, the Moroccan National Observatory for Drugs and Addictions reported that the prevalences of tobacco smoking, cannabis consumption and alcohol consumption among Moroccan male in general population aged over 20 were 34.5%, 9%, and 14%, respectively [12]. In our study, the prevalence of these harmful habits was higher: 68.5% for tobacco smoking and snuff, 36.8% for cannabis smoking, and 35.4% for alcohol consumption. Nevertheless, the prevalence was significantly higher among stressed than non-stressed: for tobacco smoking and snuff (83.2% vs. 51.3%; $p < 0.001$), for cannabis smoking (45.1% vs. 27.2%; $p < 0.001$), and for alcohol consumption (41.9% vs. 27.7%; $p < 0.001$). The prevalence was as high as in the previous study on consumption of addictive substances amongst Moroccan fishermen: 58.5% for tobacco smoking, 12.3% for snuff, 36.2% for cannabis smoking, and 36.5% for alcohol consumption [13]. Cannabis is highly consumed in the northern Morocco, because it is cheaper than manufactured cigarettes [14]. Fishermen were classified as a population of heavy consumers of psychoactive substances [15]. In a meta-analysis among fishermen [6, 16], the respective prevalences of smoking tobacco in Turkey (81%), Scotland (38%), Greece (40%) and Spain (60%) were as high as in our study. The fishermen experience a decrease in alertness and extreme fatigue, thus justifying the use of stimulants to maintain satisfactory levels of concentration and arousal. These offsets, which were very high among fishermen in general, were even more important in stressed than non-stressed subjects and were solutions for stress relief. Regardless of its physiological impact, stress also affects our behaviour and our way of thinking. Several studies have reported that increased drug, alcohol consumption, dietary fat, tobacco use, and substance abuse relapse coincide with the presence of stressful life episodes. These studies found that poor lifestyle habits might be more harmful to health than stress itself [6].

Fishing is an occupational activity demanding high energy levels and that provokes overload of the fisheries' employees, thus setting limitations in their ability for other physical activity of desirable type, which could act as protective factor against obesity. There is evidence that low education has been related aetiologically to obesity incidence [6, 17, 18]. Only 15.3% of our fishermen regularly practiced sports or physical activity outside work, and 48% were overweight or obese. In the Greek study, 66% of fishing workers did not perform any kind of exercise outside work, and 78% were overweight or obese [16].

Stress increases with advancing age and the concerns of family life [19]. The average age of our fishermen was 36.7 ± 8.7 years. It was significantly higher among stressed (40.8 ± 9.1 years old) than non-stressed (34.5 ± 8.3 years old). It was close to Andalusian fishermen (40.3 years) [20]. Among our fishermen, the prevalence of stress was higher among those with dependents or living alone. Stress increases with job seniority [19]. In our study, the average of work seniority was 14.8 ± 4.6 years (15.1 ± 4.8 years stressed vs. 13.6 ± 3.7 years non-stressed, $p < 0.001$). The average daily working time of our fishermen was 11 h 12 min (12 h 48 min among stressed vs. 10 h 30 min among non-stressed, $p < 0.001$). The Greek study indicates the irregular working hours' pattern and the nature of the fishing occupational activity itself as causative for physical and psychological overload. It is reported that for Greek fishermen, the average working hours exceeded 10 h per day [16]. This overload has been clearly evidenced in a study conducted among British fishermen in which it was reported that 16% of the fishermen had been involved in a fatigue related accident or incident. Forty-four per cent said they had worked to the point of exhaustion or collapse, 41% had fallen asleep at the wheel, and 43% had been so tired they had slept on the deck or in the gangway [21].

Our fishermen's income is mainly based on the quantity of fishes fished. This system has been shown to induce stress responses. Low income can be conceptualised as a component of socioeconomic position, along with education and occupation, or contributing to exposure to stressors. Low-wage workers are more likely to experience job insecurity, and less likely to receive paid sick days [5].

This exhaustion probably explains the unhealthy dietary habits, heavy consumption of psychoactive substances and lack of exercise. About one-third (28.1%) of our fishermen were victims of accidents during the last 12 months (38.8% among stressed vs. 15.7% among non-stressed, $p < 0.001$). Sleep disorders and stress are the main factors exposing workers to occupational accidents because they induce alertness disturbance at work [22]. According to an English study, work-related accidents among fishermen were four times more deadly than those encountered in miners, who were nevertheless considered to have a profession at high risk of accidents [23]. The profession of the fisherman is universally recognised as one of the most dangerous occupations, and a fisherman is about forty-four times more likely to die at work than a worker on land [2–4]. Fishermen, who had already been victims of an accident, would fear another accident. This behaviour would be part of post-traumatic stress disorder where stress would be a consequence rather than a factor in the occupational accident [24]. However unsafe and unpleasant working conditions can be psychosocial or physical stressors [5].

Studies have shown that the psychological demand of the worker increases with the level of education and the size of the job [25]. In our survey, stress was lower among illiterate fishermen (28.6%). It was more important for specialised fishermen and managers with complex tasks and

heavy responsibilities than fishermen without qualification, and with less complex duties. The choice of occupation, job satisfaction and decision-making are significant protective factors against stress [26]. The prevalence of stressed among our fishermen, who had chosen their profession, was significantly lower (40%) than those who did not had chosen their job (73.1%).

In our study, the psychological demand was high: about ninety per cent (87.8%) of fishermen thought they had a heavy workload with performance pressure, 76.2% were forced to work overtime and 66.2% complained of time pressure and performance. All these stressors were higher among stressed than non-stressed. Time constraints refer to the impression felt by the individual to work under time pressure and/or to have too much work in too short a time [27]. A United States study of shrimp fishermen in the Gulf of Mexico has shown that psychological demand in general and the heavy workload in particular remains a major stressors for fishermen [28]. The strong psychological demand is even more pronounced among the pilots directly responsible to the boat owners for performance. The professional stress among the fishermen is born from the strong psychological demand including work schedules exceeding 12 h continuously, a non-respect of the sleep-wake and work-rest time, of strong quantitative demands with a pressure of time and performance [28]. Another exogenous stressor lies in the geographical peculiarity of the port of Tangier being at the entrance to an important maritime crossroads, the Strait of Gibraltar, which requires special attention. The bad weather and the strong winds of the region further aggravate the situation [4].

The low decision latitude lies in the repetitiveness of the spots becoming monotonous and always controlled and supervised by the pilot even for simple and ordinary gestures leaving no room for manoeuvre. The decision latitude of our fishermen was low; only 28.7% were satisfied, 49.4% found their work boring, and 55.4% wanted to change the job.

Social support remains low amongst fishermen [29]. Hierarchical superiors, in particular ship-owners, have no recognition at work even during days of good fishing. Work on board requires artisanal and coastal fishermen to survive together in small embarkations. This co-existence is not always successful and "clans" are constantly forming (drug addict group, alcoholic group, anti-pilot group, etc.). Although the atmosphere seems calm, unapparent conflicts, discriminations and harassments occur and the support of colleagues is different depending on being or not being a member of the same group. There are even conflicts within the same group about its "leader". The work-family conflict is a type of role conflict in which the demands of work and family are incompatible, making participation in both more difficult. It can be due to the number of work hours or inflexibility of work schedules, or lack of supervisor or spousal support [5]. A French study reported that the decision latitude was significantly lower among seafarers compared to non-mariners and 16.6% of fishermen were in the "high risk of stress" category. Social support was low, 47.8% suffered from a sense of injustice from the hierarchy, 75.8% did not feel safe, and 50.3% felt unfriendly attitudes in the workplace from colleagues with a sense of group pressure [29]. An American study has confirmed the existence of a high rate of job dissatisfaction and feelings of injustice [28]. Thus, fishermen are exposed to increased levels of stress that are also fuelled by feelings of isolation at sea and by distance from the family [30]. Long working hours at sea do not give fishermen enough time to pay attention to their families, and even the moments they spend on the land are divided between sleep and the fishermen's cafes.

The majority of studies agree that fishing is a profession with high psychological demands, low decision latitude, and low social support [28–30].The combination of low latitude/ /high demand in a work situation defines the "job strain" and places the employee in the "tense" dial. "Isostrain" is the coexistence of a situation. Job strain and low social support can have a negative impact on the health and safety of workers [8]. If the stress is not diagnosed and taken care of early, the stressed fisherman ends up somatising his psychological problems and developing true psychosomatic and organic pathologies.

Neurovegetative stress-related symptoms may manifest as palpitations, precordialgia, chest tightness, sweating, or digestive disorders. The latter are exacerbated by shortened, off-the-shelf meals, sometimes not taken [24]. In our study, these disorders affected 44% of fishermen with a predominance of digestive complaints (32.8%). The literature confirms that gastrointestinal disorders are the leading symptom of fishermen and are largely stress-related [31]. The stress increases muscle tone, which can be manifested by pain, cramps, body aches and muscle stiffness. These symptoms were found in 42.8% of our fishermen.

This hypertonia of the striated musculature is further increased by the musculoskeletal disorders caused by the strong physical demands of the fishing profession [6]. Nervous tension at work, poor adaptation to stress, is responsible for sensations of headaches, discomfort and tremors of the extremities. In our survey, the prevalence of these different manifestations was 59.6%, 18.1% and 59.3%, respectively. Nervous tension was present in 61.5% of our fishermen. This condition leads to fatigue, a decrease in productivity and increases the risk of occupational accidents. This situation, known as "tension at work", increased in Europe from 1991 to 1996, rising from almost 25% to 30%, according to the results of the surveys of the European

Foundation for the Improvement of Living and Working Conditions [32].

Mood disturbances, the direct consequences of emotional or physical exhaustion, are expressed as anxiety, irritability and depression [33]. Mood disorders were found among 53.3% of our fishermen. These mood disturbances can have disastrous consequences, including suicide, especially among susceptible individuals [34]. Stress has the ability to reduce performance because all the cognitive functions of the individual are then disturbed. Disruptions in cognitive function may manifest as concentration difficulties, memory problems, difficulties in maintaining the quality of work, or a lack of confidence in its value and abilities. All these disorders result from a mental overload which causes in the immediate time a decrease in the reliability of the cognitive process and which induces a greater probability of errors [31, 32].

Among our fishermen, 23.6% had cognitive disorders (20.9% difficult concentration and 21.5% memory problems). Stress does not seem to affect the cognitive functions of fishermen too much compared to other functions and occupations. A Japanese study has shown that the cognitive processes of perception, memory and comprehension are highly developed and functionally coordinated, especially among artisanal and coastal fishermen, as these processes are daily used at home for the identification and choice of fishing points [35]. Sleep disorders are often the first symptoms of stress, and lead to decreased alertness with delayed reaction. In our study, they were present in 43.2% of subjects: difficulty falling asleep (40.3%), interrupted sleep (36%) and feeling like not have slept (30.9%).

More than a third of our fishermen (33.7%) self-reported chronic diseases (40.5% among stressed vs. 25.7% among non-stressed; $p < 0.05$). Among them there were 27.5% with musculoskeletal disorders. The literature confirms that professional fishing is an exhausting profession, which includes musculoskeletal disorders related to significant physical and psychological constraints [19, 20]. The prevalence of metabolic and cardiovascular diseases was 15.6% and 19.2%, respectively. However, among people older than 40 years, the prevalence was 26.1% and 31.3%, respectively.

LIMITATIONS OF THE STUDY

Our study encountered two main limitations. Our survey was cross sectional; the healthy worker effect could create a selection bias. The weak points of self-reporting must be underlined especially for the consumption of psychoactive substances, mainly for alcohol. The prevalence of alcohol use was probably underestimated because the Muslim religion of our subjects prohibits its consumption and the related issues remain taboo. There was no solution to avoid or limit individual variation in self-reporting. The target was a global quantification and approach.

CONCLUSIONS

Artisanal and coastal fishermen were at a high risk of chronic stress with its health consequences. Health promotion and education initiatives should be conducted to raise fishermen's awareness of the dangers of stressors. Collective and individual prevention measures such as psychosocial safety climate (organizational policies, practices, and procedures) is designed to protect fishermen psychological health and safety [5].

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Patterns of injury amongst cruise ship passengers requiring hospitalisation

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ABSTRACT

Background: *The number of commercial cruise ship passengers continues to rise and is projected to reach 27.2 million passengers worldwide in 2018. Accidental injury aboard these ships can result in serious morbidity and mortality. This study examines the injury mechanisms, patterns, demographics, and outcomes of these injuries which are serious enough to require hospitalisation in order to facilitate administrative, financial, and medical decision making to aid in injury prevention and treatment.*

Materials and methods: *This is a cross-sectional, retrospective, registry-based study of adult patients sustaining injury while on a cruise ship admitted to a Level I Trauma Centre in the United States over a 2-year period. Data on demographics, injury type and severity, surgical management, hospital charges, length of stay, mortality, and discharge disposition were recorded.*

Results: *Sixty seven patients were identified and included in the analysis. 70.1% of patients were 65 or older and a majority were female (59.7%). The most common mechanism of injury was a ground level fall (79.1%), and the most common injury encountered was a femur fracture (52.2%) which involved the acetabulo-femoral joint in 85.7% of cases. Traumatic brain injuries were uncommon occurring in 7.5% of cases. There were no fatalities in this series.*

Conclusions: *The most common injuries aboard cruise ships requiring hospitalisation occur in the geriatric population as a result of a ground level fall. Most commonly, the injuries are long bone fractures, with femur fractures occurring most frequently and accounting for over half of all injuries sustained. Resources and protocols for pre-hospital management of cruise ship injuries should prioritise these patients, and fall prevention measures for this demographic should be mandatory aboard all cruise ships.*

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Key words: cruise ship, travel medicine, trauma, injury

INTRODUCTION

Trauma is one of the leading causes of hospitalisation and death in the United States [1]. Breakthroughs in research and technological developments continue to advance the health of our aging population. Traumatic injury, however, once considered a major health burden primarily for the young, has seen a dramatic increase in risk in individuals 65 years of age and older as of 2017 [2].

According to Cruise Lines International Association (CLIA) the number of commercial cruise passengers is projected to climb again in 2018 with 27.2 million passengers expected worldwide [3]. According to the current United States Maritime Administration's cruise statistics report, South Florida is home to the top two busiest passenger cruise ports in the United States: Port Everglades in Broward County and Port of Miami in Miami-Dade County. Together, the two ports service over 8 million cruise passengers a year, with over 50% of cruise passengers between the ages of 50–74 [3, 4]. Aboard the ship poolside activities, dancing, slippery decks, stairs, rough seas, and ship maintenance hazards pose trauma risks to both passengers and staff. Broward Health Medical Centre (BHMC) in South Florida, United States is a primary receiving point for many of these injured passengers. While institutions such as the American

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College of Emergency Physicians and International Council of Cruise Lines have developed preventive protocols for the provision of emergency medical care for passengers [5], effective preventative measures are difficult to implement due to a lack of research on the mechanisms and outcomes of cruise ship traumas. A retrospective analysis on passengers and crew members admitted to BHMC was performed for trauma injuries to characterise the mechanisms of injury and their outcomes to facilitate administrative, functional, and medical decisions to prevent and treat serious cruise ship injuries.

MATERIALS AND METHODS

This study took place at BHMC in Fort Lauderdale, Florida, and the study population included all patients who presented to BHMC's Level I trauma centre from any passenger cruise ship between the dates of November 1, 2015 to August 31, 2017. The study design is a retrospective, cross-sectional study. Data for this retrospective study was identified through the BHMC trauma registry utilizing the Trauma One® database software.

The following variables and outcomes were studied: gender, age, mechanism of injury, anatomic injury location, Glasgow Coma Scale (GCS) on arrival, Injury Severity Score (ISS), type of surgeries required, transfusions required, mortality, length of hospital stay, total hospital charges, and discharge status. The definition of variables was adopted from the Data Dictionary of the National Trauma Data Standard approved by the American College of Surgeons and from Florida Trauma Registry Manual Data Dictionary [6, 7]. The relevant variables were queried and extracted from the Trauma One® registry and were supplemented by data obtained from patients' electronic medical records available through hospital database.

The study population was defined as all patients transferred to BHMC from passenger cruise ships due to accidents within the above-mentioned period. These criteria yielded a final study population of 67 patients. Because our study population originated out of one medical centre, it excluded patients who may have been transferred to other nearby trauma centres.

RESULTS

Sixty seven patients were identified and included in the analysis. A majority (70.1%) were 65 years or older (Table 1). Females (40) were more commonly injured than males (27) (59.7% vs. 40.3%, ratio 1.48). A fall from ground level was the most common mechanism of injury (79.1%) (Table 2) with lower extremity injuries being the most common location (67.2%) (Table 3). The most common injury was a femur fracture, occurring in 35 (52.2%) patients. Of these 35 patients, 30 (85.7%) were classified as "hip" or acetabulo-femoral joint fractures (defined as intertrochanteric, subtrochanteric, and femoral neck fractures) (Table 4). Orthopaedic operations (44/47 or 93.6%) were the most

Table 1. Cruise passenger injuries presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017 by age (n = 67)

Age groups [years old]	Number (%)
≤ 17	1 (1.5%)
18–64	19 (28.4%)
65–74	21 (31.3%)
≥ 75	26 (38.8%)

Table 2. Cruise passenger injuries presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017 by mechanism of injury (n = 67)

Mechanism of injury	Number (%)
Ground level fall	53 (79.1%)
Fall down stairs	6 (9.0%)
Pool or water sports accident	3 (4.5%)
Other (burn, impaled by broken golf club shaft, cut by glass, struck by falling object, ATV crash)	5 (7.5%)

Table 3. Cruise passenger injuries presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017 by location of primary injury (n = 67)

Injury location (primary injury)	Number (%)
Lower extremity	45 (67.2%)
Upper extremity	5 (7.5%)
Intracranial	5 (7.5%)
Spinal	4 (6.0%)
Head injury without intracranial injury	3 (4.4%)
Pelvic	2 (3.0%)
Chest wall/ribs	2 (3.0%)
Vascular (brachial artery)	1 (1.5%)

Table 4. Cruise passenger injuries with femur fractures presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017 by type of femur fracture (n = 35)

Femur fractures	Number (%)
Acetabulo-femoral joint	30 (85.7%)
Femoral shaft	4 (11.4%)
Distal femur (condyle)	1 (2.8%)

Table 5. Additional characteristics of cruise passenger injuries presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017

Other characteristics	Mean	Median	Range	SD
Age [years]	65	70	7 to 89	19
Length of stay [days]	6.56	7	1 to 41	6.02
Total hospital charges	$50,178.09	$45,569.26	$1,089.00 to $408,319.76	$51,011.52
GCS on arrival	14.63	15	3 to 15	2.06
ISS	7.3	9	1 to 17	3.07

GCS — Glasgow Coma Scale; ISS — Injury Severity Score; SD — standard deviation

commonly performed type of surgery. The average length of stay in the hospital was 6.6 days, with average total hospital charges of $50,178 per patient hospitalisation. Incoming patients had an average GCS score of 14.6, with an average ISS of 7.3. (Table 5). Only 9 (13.4%) patients required a blood transfusion. 64 (95.5%) patients arrived with a GCS of 15, and only 1 (1.5%) patient had an ISS > 15, a marker for a severely injured patient. There were no deaths in this series (Table 6). Discharge disposition is shown in Table 7, but was most commonly to home (37.3%) or to an acute inpatient rehabilitation facility (29.9%).

Table 6. Additional characteristics of cruise passenger injuries presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017 (n = 67)

Other characteristics	Number (%)
Transfusions required	9 (13.4%)
GCS 15 on arrival	64 (95.5%)
ISS ≥ 15 on arrival	1 (1.5%)
Deaths	0 (0.0%)

GCS — Glasgow Coma Scale; ISS — Injury Severity Score

Table 7. Cruise passenger injuries presenting to Broward Health Medical Centre between November 1, 2015 and August 31, 2017 by discharge status (n = 67)

Discharge status	Number (%)
Home	25 (37.3%)
Rehab	20 (29.9%)
Skilled nursing facility	8 (11.9%)
Home health	7 (10.4%)
Other	4 (6.0%)
Left against medical advice	1 (1.5%)
Medivac to home facility	2 (3.0%)

DISCUSSION

With the ever-increasing number of commercial cruise ship travellers, traumatic injuries sustained while aboard these ships are becoming a public health concern, particularly among the elderly. Reports describing injury patterns occurring aboard cruise ships are uncommon and largely report on injuries that do not require hospitalisation. Studies specific to series injuries suffered by patients aboard cruise ships are limited in number and have relatively small sample sizes [8]. The studies with larger sample sizes are either not specific to cruise ships [9] or deal with injuries that do not require onshore hospitalisation [10]. This leaves a significant knowledge gap concerning the demographics, comorbidities, mechanism of injury, treatment modalities, and outcomes for patients who are injured seriously enough aboard passenger cruises to require transfer to an onshore hospital.

Our analysis of patients who sustained an accidental traumatic injury warranting hospitalisation found that the geriatric population constitutes a substantial majority of this group (70%), and these injuries occur more often in women (60%). These findings are similar to those of Dahl [10] who found that 62% of all injuries who were treated in their onboard clinic occurred in women and the median age was 72. Bansal et al. [8] reported that 88% of the patients requiring hospitalisation from injury sustained on cruise ships were female and had a median age of 55. The findings of Hudson et al. [9] indicate that 61% of nonresidents of Alaska hospitalised for injuries occurring aboard vessels were from cruise ships, and 34% of those injuries involved patients who were aged 65 and older. Furthermore, our findings indicate that while accidents involving stairs, water sports, etc. do occur, the most common mechanism of injury by a significant margin is a ground-level fall (79%). Bekics et al. [11] likewise found this to be the most common mechanism requiring hospitalisation (49%). The second most common mechanism in both series was fall down stairs, occurring slightly more often (14% vs. 9%) in their series compared to this series [11]. The Bansal et al. [8] series had a majority of their hospitalised patients (63%) suffering from a fall down stairs. Hudson et al. [9] reported that 60% of all injuries in the series were due to a slip, trip or fall.

Lower extremity injuries occurred most frequently and femur fractures accounted for most of these injuries. In fact, more than half (52%) of all patients in our study sustained a femur fracture, and of those, 86% were hip fractures (involving the acetabulo-femoral joint). These findings are similar to Dahl's series in which 63% of patients requiring hospitalisation from onboard injuries were hip fractures [10]. Likewise, Hudson et al. [9] found that femur fractures were the most common injury sustained in all patients hospitalised for injuries aboard water craft. This is a particularly relevant finding given that hip fractures are associated with increased morbidity and mortality in the geriatric population. In the United States of America, patients 65 and older with hip fractures have a 5- to 8-fold increased risk of all-cause mortality during the 3 months after the fracture and almost half of the mortality risk during the first year has been attributed to in-hospital deaths [12].

Relatively few patients in our series sustained traumatic brain injuries (7.5%), and 96% of all patients arrived to our facility with a GCS of 15. The rarity of serious traumatic brain injury is somewhat surprising in an era with so many elderly patients on anticoagulants, but this finding may be somewhat reassuring because these are the injuries with the most serious adverse consequences and those who need the most rapid transport to a trauma centre. These findings are similar to other series in which the range of serious traumatic brain injury was 1–12% of all serious injuries sustained on the cruise ship [8, 10, 11].

The average ISS was also quite low with only 1 patient arriving with an ISS of > 15. Our study saw no patient fatalities. This suggests that the need for rapid and emergent transport mechanisms for serious injury is quite low and most injuries can be stabilised on board and transported urgently with diversion to the nearest port of call without the need for emergent air or sea transport. Despite this lack of necessity for emergent transport, the overall burden on the healthcare system from traumatic injuries aboard cruise ships is significant. It is inordinately expensive to transport, stabilise, treat, and properly discharge these patients to and from a Level I trauma centre. The average length of stay for our study was 6.6 days with average total hospital charges amounting to approximately $50,000 and an overall cost of hospital stay ranging up to as high as $400,000. These figures do not include any pre-hospital care and transportation or any post hospital rehabilitation charges. This cost burden alone can be used to justify spending the resources that will be required to improve safety aboard the ships.

Our data reveals that elderly females are by far the most at risk, with ground level falls serving as the most common mechanism. Due to these specific and definitive findings, we believe this data begins to fill the large knowledge gap surrounding these injuries and can be useful in focusing the preventative efforts of the passenger cruise ship industry, as they develop safety protocols and procedures. It can also guide the preparation and practices of those caring for these patients, in both the pre-hospital stabilisation and transportation and the hospital care. The number of people, particularly the elderly who participate in cruise ship vacations continues to increase. Given this, resources should be allocated to help prevent and care for the injuries that will surely follow. This data can be beneficial in ensuring that those funds are utilised in the most effective manner.

CONCLUSIONS

Hip fractures among elderly females constitute the lion's share of all injuries sustained aboard passenger cruise ships requiring transportation to an offshore facility. Further studies examining specific sites and circumstances involving injury aboard cruise ships would be helpful to better identify safety measures to assist in prevention of these injuries. Fall prevention workshops have worked in community settings and may be amenable to an onboard education setting as well. Partnerships should be developed between the cruise ship industry and the medical community who care for these patients to promote research gathering and prevention strategies to elucidate specific causes and potential solutions. Given the previous knowledge gap surrounding these injuries, this data can be used to justify and focus the appropriate funds and resources towards safety changes in the passenger cruise industry.

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Offshore workers and health behaviour change: an exploration using the Theoretical Domains Framework

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ABSTRACT

Background: *Previous research has identified the importance of promoting behaviour change within the offshore workforce. This qualitative study sought to: identify self-care behaviours perceived to require behaviour change within the offshore workforce, and explore perceived potential behavioural determinants.*
Materials and methods: *This study included the perspectives of both offshore workers (OWs, n = 16) and healthcare practitioners (HCPs, n = 12) from the global workforce. Telephone interviews were conducted, recorded electronically and transcribed. Transcripts were analysed independently by two researchers using a Framework Approach and the Theoretical Domains Framework (TDF) to support coding.*
Results: *Healthy eating and alcohol intake were behaviours perceived by OWs and HCPs to require change within the offshore workforce. Knowledge (e.g. availability of nutritional knowledge), intentions (e.g. role of motivation), memory, attention and decision process (e.g. effect of boredom), environmental context and resources (e.g. influence of environmental stressors), social influences (e.g. influence of others), emotion (e.g. influence of emotional state) and behavioural regulation (e.g. influence of willpower). TDF domains were reported by both OWs and HCPs in relation to OWs' healthy eating and physical activity behaviours.*
Conclusions: *The determinants identified as mechanisms of behaviour may be targeted in future interventions which aim to promote engagement in self-care within the offshore workforce.*

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Key words: health, behaviour, health promotion, occupational health

INTRODUCTION

The Oil and Gas Industry is a key employer globally comprising a large number of personnel who are committed to travelling offshore and working in remote and hazardous environments [1]. Offshore workers (OWs) operating in the United Kingdom Continental Shelf are required to undergo a preliminary health assessment prior to commencing employment and every 2 years thereafter to sustain certification [2]. Installations and vessels tend to be located in remote geographical locations thereby impeding access to onshore medical services. Consequently, emergencies, minor ailments and injuries are treated on-board in a 'sick bay' by a qualified healthcare professional (HCP), often termed 'offshore medic' [3–5].

In the United Kingdom, offshore HCPs typically possess training in medical or nursing specialties and may be qualified nurses, paramedics or medical doctors [5]. In addition, they are required to undertake training approved by the Health and Safety Executive [4]. The certified offshore HCP may be supported by an onshore physician in terms of guiding treatment and response [3–5]. As outlined by Health and Safety Executive, whilst HCPs' role offshore is primarily focused on responding to acute medical scenarios, their general responsibilities also include *"...to give simple advice on the provision of a healthy living and working environment offshore"* [4, 6, 7].

Previous research has identified the importance of health promotion and promoting behaviour change within the offshore workforce [6, 8]. Our recent narrative review synthesising the literature on health and wellbeing within the offshore workforce identified a number of individual

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Table 1. Behaviours identified by participants as requiring behaviour change

Behaviour	Offshore workers		Healthcare professionals	
	Identified as requiring behaviour change	Discussed by any interviewee	Identified as requiring behaviour change	Discussed by any interviewee
Healthy eating	5	12	3	9
Physical activity	3	10	2	4
Smoking	2	4	1	5
Sleep management	2	3	0	0
Alcohol	2	3	3	7
Work-life balance	1	1	0	0
Stress management	1	1	0	0
Improving mental health	0	0	1	1

topics which represented the unique issues facing the workforce, including: musculoskeletal pain; shift work disorder, and increased body mass index. The review highlighted the need for further exploratory research within the offshore workforce particularly around aspects of self-care [Gibson Smith K et al., J Institute Remote Health Care 2015; 6(2): 10]. In response, we conducted a cross-sectional survey to determine engagement with self-care within the offshore workforce of which the outcomes highlighted key areas of health and wellbeing which may require addressing. Hence, the study concluded that OWs may benefit from the implementation of a self-care intervention to promote behaviour change [Gibson Smith K et al., J Institute Remote Health Care 2015; 6(2): 10]. The Medical Research Council (MRC) strongly advocates the use of behaviour change theory to support intervention design and delivery. The use of theory may also be a critical component in sustaining behaviour change over the longer term [9]. However, the selection of relevant behaviour change theories may not be straightforward due to the number that are available to researchers [10].

The Theoretical Domains Framework (TDF) was developed in an effort to overcome the aforementioned issues and to synthesise behaviour change theory into one framework [11]. The TDF outlines 14 individual domains (Table 1), which comprise a number of behavioural constructs that can be traced back to one of the 33 health psychology theories included in the synthesis [11, 12]. TDF domains may then be matched to relevant behaviour change techniques (BCTs) considered to be active ingredients of an intervention, and which may be used to promote engagement in the target behaviour [13, 14].

Whilst the perspective of OWs themselves is clearly pertinent when considering behaviour change within the population, a dual perspective that includes HCPs is imperative due to their critical role in managing the health of the offshore workforce. Further, it has previously been advised that HCPs should be consulted, and involved, in the development of health promotion programmes delivered offshore, particularly since their involvement could ensure that the requirements of the workforce are adequately evaluated [6]. Thus, this unique qualitative study sought the dual perspectives of OWs and HCPs respectively to explore the: (i) self-care behaviours which they perceived important to change, and (ii) associated behavioural determinants.

MATERIALS AND METHODS

RESEARCH DESIGN

Qualitative semi-structured one-to-one telephone interviews were conducted with OWs and HCPs with experience of working in the global oil and gas industry.

SAMPLING AND RECRUITMENT

The sample of OWs were recruited from a local operational training facility, which specialises in training offshore personnel. They were identified from OWs who completed a survey (n = 352) from an earlier stage of the research [Gibson Smith K et al., J Institute Remote Health Care 2015; 6(2): 10], the inclusion criteria for which was: prior experience of working in an offshore environment, and the requirement to travel and stay overnight accordingly. Those OWs (n = 134) who submitted their contact details to receive further information about the qualitative study were subsequently sent a consent form and information sheet either by email or postal mail, depending on their preference as a means of ensuring eligibility for participation.

The sample of HCPs were recruited by an independent academic body, who sent an email (n = 651) on behalf of the research team to members of their voluntary register of global HCPs working in remote locations. The recruitment email was sent to all members regardless of their specialty;

hence members who did not have expertise in offshore health may have also received the email. It was not possible to purposefully select members based on their expertise since this information was not recorded on the membership database; however, the inclusion criteria (prior experience of delivering healthcare to the offshore workforce or assessing the health of OWs) were outlined in the recruitment email. The email also contained a link to a recruitment questionnaire containing a participant information sheet and consent form.

All of those from both samples who returned a consent form (OWs [n = 37]; HCPs [n = 31]) were selected at random for the interview using SPSS 21. Potential participants were contacted via email thereafter to arrange a suitable interview date and time.

DATA GENERATION

The interviews were conducted by K.G.S. between March and November 2015. The TDF (14-domain) was used to develop semi-structured interview schedules and guide the nature of the questioning. The interview schedules endeavoured to identify a single health behaviour that OWs themselves and HCPs perceived as being important for OWs to change. Determinants of the single health behaviour identified were explored thereafter using questions which had been structured in accordance with the TDF. Whilst the remainder of the interview centred on the single behaviour identified, other behaviours were also discussed within the interview. Both interview schedules were reviewed by an expert panel comprising HCPs and academics with relevant experience in health, self-care and psychology, and subsequently piloted with an OW and HCP to test credibility and comprehensibility. As limited changes were made to the interview schedules after the pilot interviews, they were included in the final data set. All interviews were conducted via telephone and digitally recorded. Duration of the interviews ranged from 25 to 75 minutes. All interview content was transcribed using a pragmatic approach which permits researchers to omit key linguistic features where appropriate, including pauses and breaks, whilst still retaining depth with regard to verbatim data [15].

DATA ANALYSIS

Data pertaining to behavioural determinants (of both the single health behaviour and any additional behaviours discussed) were analysed by two coders (FQ and KGS) using the Framework Approach [16]. The TDF was used to guide the deductive analysis of determinants of behaviour whereby interview content was coded in accordance with TDF domains. Coders met to discuss the application of codes and resolve any incongruities. Codes, and corresponding TDF domains, were then charted to represent key themes and sub-themes. Themes may be duplicated across TDF domains since the coders assigned elements to multiple domains (e.g. where a theme was represented by goals and intentions). The saturation principle was applied in relation to the behavioural content of the interviews (e.g. the single behaviour which OWs felt important to change or which HCPs felt was important for OWs to change). In practice, saturation was perceived to have occurred when no new behaviours were discussed by interviewees and no new themes emerged from the data in relation to the behaviour perceive to require change [17].

ETHICAL APPROVAL

Ethical approval was granted by the Robert Gordon University School of Pharmacy and Life Sciences Ethical Review Committee. Petrofac Training Services approved access to the recruitment site for OWs. The Institute of Remote Healthcare granted permission to recruit from their member database. Written/electronic consent was obtained from participants.

RESULTS

Data saturation, in terms of the behaviour identified by interviewees as important to change, was achieved after interviewing 16 OWs. Interviewees were aged 28–57 years and predominantly male (n = 15). Eating healthily (n = 5) and increasing physical activity (n = 3) were the principal behaviours perceived by the interviewees as requiring behaviour change. Other behaviours identified were inclusive of: alcohol use; smoking; sleep management; stress management, and work-life balance (Table 1). For the purpose of this paper, however, the focus is on the two principal behaviours perceived to require change by both OWs and HCPs (i.e., eating healthily and increasing physical activity).

While the principal focus of the interviews centred on the specific behaviour that the interviewee wished to change, the majority of interviewees described a number of additional self-care behaviours (Table 1). Consequently, extracts referencing additional behaviours were also included in the analysis of behavioural determinants. For example, if a participant identified they wished to change their diet but also made reference to determinants of physical activity in their interview, the data relating to physical activity were also included in the analysis.

Key themes, representing behavioural determinants along with exemplar quotes, are presented in accordance with each of the TDF domains relating to individual healthy eating and physical activity behaviours (Table 2). It should be noted that TDF domains may only be relevant to one of the behaviours. For example, knowledge and reinforcement pertained only to healthy eating whereas goals pertained only to physical activity.

Table 2. Behaviours identified by participants as requiring behaviour change, corresponding Theoretical Domains Framework (TDF) domains and exemplar quotes

TDF domain	Theme	Quote
Knowledge	Nutritional knowledge and healthy eating	"…you know if you were cooking a bit of fish at home you would know exactly what you've done with it, you are never completely sure what they [chefs offshore] have added with it, so you could have quite a lot of sugar in a dish that you wouldn't expect" Interviewee 6 [OW]
Skills	NA	NA
Beliefs about capabilities	Confidence and physical activity	'…probably wouldn't be able to stick with it' Interviewee 9 [OW]
Optimism	NA	NA
Beliefs about consequences	Outcomes associated with healthy eating and physical activity	'…I feel better if I am eating healthy stuff, I know that I feel better' Interviewee 14 [OW]
Reinforcement	Positive reward and healthy eating	'…then you think oh I will just have a treat, a can of a coke, and then you end up drinking it, you know, three or four cans a day' Interviewee 2 [OW]
Intentions	Stability of intentions, healthy eating and physical activity	"…if they wanted to [eat healthily] and they had the impetus to do it they could do it, but it does come from themselves I think" Interviewee 18 [HCP]
Memory, attention and decision processes	Ownership, decision making and healthy eating	'…it is down to the individual to want to pay attention to it and address the diet" Interviewee 22 [HCP]
	Willpower and healthy eating	'…sometimes you are even just, you go for the first thing you see' Interviewee 2 [OW]
	Inattention, healthy eating and physical activity	'I am much less likely to eat healthily if I am tired' Interviewee 14 [OW]
	Eating unhealthily is an automatic process for offshore workers	"…then you're just there watching your video, you know, on your own, and anybody knows, themselves, sometimes you open a pack of biscuits, the next thing you look down and they're gone, you don't even know that you're eating them all. I think that that's a problem" Interviewee 29 [HCP]
Goals	Goal setting and physical activity	'…to try and like em set goals , then once you have achieved those, keep revaluating, pushing, looking farther ahead em' Interviewee 2 [OW]
Environmental context and resources	Offshore environmental stressors and healthy eating	"…certainly the cold, you know in the middle of winter you know maybe people want to get something high fat, high calorific, that is probably more the times when they would be eating all the kind of rubbish" Interviewee 20 [HCP]
	Food provisions offshore and healthy eating	'…you just get it all the time, it is always in your face, it is like you can't avoid it, it is temptation, it is there all the time 24/7, well 24/7 during the meal times' Interviewee 8 [OW]
	Environment, resources and physical activity	'…I guess perhaps some better facilities' Interviewee 9 [OW]
Social influences	Influence of others on healthy eating and physical activity	'…I think em I did have a colleague who was quite good at helping me, em like go to the gym and get healthier when I was sort of at my biggest em so I would say if you have got a group of people, perhaps around you that might support you then they will maybe go to the gym with you em and sort of encourage you' Interviewee 2 [OW]
Emotion	Emotional states and healthy eating	'…it is like, boredom too, a lot of boredom offshore that makes you eat, that you know, I am bored of this, I have been waiting two or three days for a permit, you are bored, you know, so it is very difficult to go no I am not going to have a rhubarb crumble today' Interviewee 8 [OW]
Behavioural regulation	Habits, healthy eating and physical activity	'…yeah it is too easy just to get in the habit of eating whatever, rather' Interviewee 15 [OW]
	Willpower and healthy eating	'…but then again it is up to, it is up to the individual to try and do their best not to get you know, sucked in to going back to like you know, fizzy drinks, you know regularly throughout the day and taking a bit more responsibility so I think that up to me as well' Interviewee 2 [OW]
	Action planning and healthy eating	'…um well I tend to take my own snacks with me, or try to, so that that will sort of help me to not go and eat cakes when they are on offer if I have got some nuts or a protein shake or something like that, that I can go and have instead, so if I get hungry I am not just grabbing the nearest thing' Interviewee 14 [OW]
	Self-monitoring and physical activity	'…and it [pedometer] sets you a target and em even if you get to 7,000 [steps] you think well if I walk another mile and a half I will get to 10,000' Interviewee 9 [OW]

OW — offshore worker; HCP — healthcare professional; NA — not applicable

KNOWLEDGE

Nutritional knowledge and healthy eating

Interviewees highlighted the lack of information on the nutritional content of prepared food offshore. Relatedly, it was also suggested that having knowledge of what foods were healthy, and which were unhealthy, was associated with eating healthily.

BELIEFS ABOUT CAPABILITIES

Confidence and physical activity

Self-efficacy, with regard to ability to execute a behaviour, was believed to influence engagement in physical activity. For example, OWs may not be confident in their ability to engage in physical activity, and thus were less likely to enact positive behaviours.

BELIEFS ABOUT CONSEQUENCES

Outcomes associated with healthy eating and physical activity

The importance of being cognisant of the positive outcomes associated with eating healthily and engaging in physical activity on subsequent behaviour was stressed. Conversely, the influence of associated negative outcomes on behaviour was also highlighted. For example, if unhealthy eating was associated with poor sleep quality or incidence of disease, it may increase the likelihood of eating healthily. It was also noted that being aware of this relationship when making decisions on food choices left OWs feeling more encouraged to eat healthily.

REINFORCEMENT

Positive reward and healthy eating

The use of food as a reward or incentive was highlighted. It was reported that eating unhealthily was often used by interviewees to reward themselves whilst they were offshore.

INTENTIONS

Stability of intentions, healthy eating and physical activity

The influence of having stable, relatively unchangeable, intentions to eat healthily increased the likelihood of enacting the behaviour whilst having unstable intentions had a negative effect on subsequent endeavours. In addition, it was highlighted that delaying making dietary changes had a negative effect on behaviour and that behaviour change required a strong resolve to eat healthily.

The influence of environment on intentions and subsequent engagement in physical activity was highlighted. For example, having ability to exercise outdoors may increase motivation to exercise and subsequent likelihood of engaging in physical exercise. In addition, being motivated was perceived as facilitating those efforts whilst a lack of motivation impeded that engagement. The effect of planning on increasing intention, and the likelihood of engaging in physical activity, was stressed. Scheduling time to attend an exercise class lead to a greater probability that the behaviour was executed.

GOALS

Goal setting and physical activity

Goal and target setting increased engagement in physical activity with interviewees suggesting that setting goals and targets to increase their physical activity or improve on specific areas (e.g. to achieve 10,000 steps a day) facilitated performance of the behaviour.

MEMORY, ATTENTION AND DECISION PROCESSES

Ownership, decision making and healthy eating

The influence of making concerted efforts to eat healthily and engage in physical activity on subsequent positive behaviours, whilst also assuming personal ownership of the decision, was highlighted.

Willpower and healthy eating

The positive effect of willpower on eating healthily was noted whereby the greater the level of willpower the greater the extent of engagement with positive behaviours.

Inattention, healthy eating and physical activity

It was highlighted that both boredom and tiredness reduced individual's ability to make decisions and often resulted in an increased likelihood of eating unhealthily. Similarly, tiredness had a negative impact on willingness to engage in physical activity.

Eating unhealthily is an automatic process for offshore workers

One interviewee reported that unhealthy eating behaviours were automatic and often beyond conscious awareness.

ENVIRONMENTAL CONTEXT AND RESOURCES

Offshore environmental stressors and healthy eating

Environmental stressors offshore, such as extreme temperatures, increased the likelihood of eating unhealthily amongst interviewees.

Food provisions offshore and healthy eating

The availability of healthy/unhealthy food options offshore was described as a key influence on healthy eating behaviour. For example, the volume of unhealthy food available, poor quality of food, inability to cater for specialised diets and lack of nutritional information made it difficult

to eat healthily. The restrictive eating times offshore was also purported to negatively affect healthy eating. It was suggested that increasing the volume and availability of healthy foods offshore may positively impact behaviour.

Environment, resources and physical activity

Both home, and offshore environments, were perceived to negatively impact on engagement in physical activity. For example, weather conditions, season and exercise facilities offshore may all impede on willingness to engage. Interviewees suggested that increasing the number of opportunities for OWs to exercise and improving gym facilities offshore may better promote engagement. It was further recommended that space on offshore installations was better utilised and that investment in gym facilities was increased.

SOCIAL INFLUENCES

Influence of others on healthy eating and physical activity

The social nature of eating in both onshore, and offshore, environments was perceived to have a negative influence on behaviour. For example, it was reported that there may be pressure from others to eat unhealthily or deviate from diets. Similarly, the negative influence of others on engagement with physical activity was also highlighted. One OW interviewee noted that they found some gym members offshore intimidating and this had a negative effect on their willingness to exercise. The positive influence of others on exercise was also highlighted. Interviewees stressed the role of others in motivating them to exercise and cited partners, friends and colleagues as being instrumental.

EMOTION

Emotional states and healthy eating

Enjoyment, as a consequence of engagement in physical activity, was highlighted as a factor which positively influenced OWs. Negative emotional states were believed to adversely affect healthy eating and physical activity behaviours. For example, boredom experienced whilst offshore often led to unhealthy decisions and overeating.

BEHAVIOURAL REGULATION

Habits, healthy eating and physical activity

The importance of breaking habits was highlighted in relation to both healthy eating and physical activity. The relative ease of adopting poor eating and exercise habits was also emphasised. For example, one interviewee reported that it was easy to acquire poor eating habits and to not be mindful of what food was being consumed.

Willpower and healthy eating

The effect that lacking or having willpower had on eating healthily was stressed. Interviewees noted that they often lacked the willpower to eat healthily, which resulted in unhealthy food choices.

Action planning and healthy eating

Delaying making changes impacted negatively on eating behaviour whilst making contingencies, and action plans, promoted healthy eating. For some interviewees being prepared meant ensuring that they had the appropriate ingredients to eat healthily stocked at home and taking their own healthy food supplies with them when they went offshore. Establishing a routine was also important in order to withstand the transient nature of the offshore lifestyle.

Self-monitoring and physical activity

Self-monitoring strategies, which enable tracking of physical activity levels, were perceived to have a positive effect on engagement. For example, it was suggested that a pedometer providing feedback may motivate individuals to exercise so as to achieve their daily targets.

DISCUSSION

This qualitative study aimed to explore, in-depth, the perceived causes of self-care behaviours of OWs from a dual perspective. Healthy eating and increasing engagement in physical activity were identified by OWs and HCPs as key areas warranting concern. A number of potential determinants of OWs' healthy eating and physical activity behaviours were identified in relation to TDF domains. Both OWs and HCPs reported that OWs' healthy eating and physical activity behaviours were associated with: knowledge; intentions; memory; attention and decision process; environmental context and resources; social influences; and emotion and behavioural regulation domains.

INTERPRETATION

The findings from this study may be used to inform the development of an intervention and serve as a guide to potential behavioural determinants of OWs' healthy eating and physical activity behaviours. The theoretical framework adopted has enhanced understanding of potential behavioural determinants and ensured that the research was developed in accordance with MRC guidelines [9]. As such, the TDF behavioural determinants identified may be used to ascertain relevant intervention targets, in relation to the factors which were perceived to both positively and negatively influence engagement with healthy eating and physical activity behaviours, and matched to relevant BCTs using published taxonomies [13, 18].

For example, the taxonomies mapped provision of information (BCT) to the TDF knowledge domain [13, 18]. Similarly, the environmental context and resources domain may be linked to the behaviour change technique of cues/

prompts. Cues/prompts may include nutritional information since they serve to prompt healthy eating. The availability of nutritional information about food provided offshore was often reported lacking by OWs. Hence, they did not always have knowledge of what was in the food they were eating. Evidence from a systematic review on the impact of nutritional labelling of foods has demonstrated that presenting information on the nutritional composition of foods may have a positive impact in enabling individuals to make informed choices [19].

Stability of intentions was perceived to be a potential factor influencing OWs' healthy eating and physical activity behaviour. The BCT taxonomies suggest that establishing a behavioural contract, which would require individuals to express either their behavioural intentions in a written statement, or commitment, may support behaviour change [13, 18]. Whilst there is some evidence that implementing a contract may support behaviour change across physical activity [20], a review article discussing commitment contracts in relation to health behaviour change highlights that implementation should be carefully considered, particularly in terms of the acceptability of contracts to target populations e.g. what effect they may have on uptake [21].

Social influences was perceived to influence OWs' physical activity and healthy eating behaviours. For example, colleagues may have been supportive of exercise, particularly in terms of serving as a motivator, thereby increasing OWs' engagement with physical activity or, as reported, may feel pressure from others to not eat healthily. The social influences TDF domain may be linked to the social support BCT [13, 18], and existing evidence appears to support its use. For example, social support was a strong predictor of both physical activity and healthy eating behaviours in users of an eHealth intervention [22].

Emotion was regarded as a potential behavioural determinant of physical activity and healthy eating in that OWs' engagement in the behaviour may be affected by emotional states either as a precursor to the behaviour or as an outcome of engagement. The taxonomies highlight that the TDF emotion domain may be linked to the emotional consequences BCT [13, 18]. The BCT stresses how providing information on the emotional consequences of performing the behaviour may increase engagement. The evidence from a longitudinal study on engagement in physical activity supports the role of emotional consequences in facilitating the behaviour [23].

In terms of memory, attention and decision processes and behavioural regulation, the positive effect of willpower was highlighted in relation to physical activity. Self-monitoring, according to BCT taxonomies, may be a key technique to integrate into an intervention where the aforementioned TDF domains are identified as potential determinants [13, 18]. A systematic review which aimed to evaluate the most effective BCTs used in physical activity and healthy eating interventions highlighted that studies which were inclusive of self-monitoring were more effective in achieving behaviour change [24].

Although the findings provide evidence in which to move forward with intervention development, further work is recommended to build on these novel qualitative findings. For example, in order to ensure the acceptability of an intervention to OWs it may be beneficial to conduct additional qualitative work. In accordance with MRC guidance, future work should also endeavour to test the feasibility of the intervention and conduct a pilot prior to evaluating the intervention to determine its effectiveness and adequate implementation, including appropriate monitoring and follow-up [9].

STRENGTHS AND WEAKNESSES

The study used a dual perspective and theoretical framework to provide an in-depth exploration of OWs' healthy eating and physical activity behaviours from their own perspective and was considered a strength of the research. Whilst recent research has used an Intervention Mapping approach within a sample of OWs [25], to our knowledge this is the first study to identify theoretical determinants of these behaviours within the workforce. Although the interviews were semi-structured and guided by the interview schedule, they were flexible in the sense that interviewees identified the behaviour which they perceived important to change. This ensured that the direction of interviews was influenced by the interviewee and, hence, the behavioural content of the interviews was truly representative of those areas that interviewees themselves perceived important to change.

Use of the TDF to guide data generation and analysis is perceived to be a key strength of the search. The TDF, due to the synthesis of a number of behaviour change theories, ensures that a broad range of behavioural constructs are considered and thereby optimises capture of potential behavioural determinants in research [11]. Whilst the theoretical approach is considered advantageous, it is not without critique and may be considered a weakness of the research. For example, researchers using the TDF have noted 'perceived overlapping' of domains [26]; an issue that was also experienced in this study and highlighted in the methods.

Research trustworthiness was integrated via a plethora of strategies to enhance the strength of the research. Measures were undertaken to promote credibility, transferability, dependability and confirmability. These strategies were: utilising methods with a favourable evidence-base

and deemed fit for purpose; the past interview experience of the interviewer; provision of detailed and accurate reporting and recording of research procedures, and being mindful of the effect that personal beliefs and values may have on interpretation of the data.

CONCLUSIONS

The evidence from this study suggests that OWs' healthy eating and physical activity behaviours may be influenced by a number of factors. The findings further suggest that OWs' behaviour, as perceived by offshore workers and HCPs, may be improved across healthy eating and physical activity behaviours. The theoretical domains identified in this study as potential determinants of behaviour may be embedded within the evidence-base in which to inform the development of future interventions.

DECLARATIONS

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was granted by the Robert Gordon University School of Pharmacy and Life Sciences Ethical Review Committee. Petrofac Training Services approved access to the recruitment site for offshore workers. The Institute of Remote Healthcare granted permission to recruit from their member database. Written/electronic consent was obtained from participants.

CONSENT TO PUBLISH

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and/or analysed during the current study are not publicly available due to reasons pertaining to confidentiality.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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Seafarers' views on the impact of the Maritime Labour Convention 2006 on their living and working conditions: results from a pilot study

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ABSTRACT

Background: *The Maritime Labour Convention 2006 (MLC2006) entered into force in 2013 and is the first comprehensive set of standards for better living and working conditions covering aspects such as wages, contracts, food, medical care and social security. Currently, the Convention covers more than 90% of the world's shipping fleet. The aim of the study was to investigate the impact of the MLC2006 on the living and working conditions of seafarers and to test and adjust the methods for future use through a pilot study. This article presents the seafarers' perceived impact of MLC2006.*

Materials and methods: *A mixed-method research approach was used (February to April 2018). The quantitative data of 55 seafarers were analysed using descriptive statistics. Qualitative data obtained through a focus group interview and thematic content analysis was applied.*

Results: *Remarkably, one third of the respondents pointed out a complete lack of improvement, while 43.6% stated that the MLC2006 had improved their working and living conditions "somewhat" and only 7.3% "to a great extend". The focus group participants agreed that the MLC2006 did not improve working conditions but mostly increased paperwork. Other issues of concern were the safety on board including safety training, long working hours connected to low manning, food and social difficulties.*

Conclusions: *For Danish seafarers, the MLC2006 did not have a significant impact, as most standards were in place before. It must be further investigated what the MLC2006 achieved for other flag states, especially in the light of its 5-year anniversary. Both methods yielded valuable data. Focus groups are an ideal setting to study the views of seafarers.*

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Key words: MLC2006, seafaring, working conditions, occupational health, pilot study

INTRODUCTION

Worldwide, approximately 1.5 million seafarers work and live in unique, often hazardous conditions that can negatively affect physical and mental health. Not only are seafarers exposed to an environment with constant exposure to heat, noise and movement, poor diet and accommodation, shift work and the separation from family and friends, they also often have to face exploitation and financial pressure through non-compliance with contracts or non-payment of wages [1–5]. Inadequacy of available knowledge and difficulty to reach seafarers have hindered the implementation of standards enhancing seafarers' safety and health on board for a long time. A recent milestone to improve the conditions across the globe was the Maritime Labour Convention, 2006 (MLC2006). Adopted by the International Labour Organisation (ILO) in 2006, it entered into force on August 20, 2013 and now regulates more than 90% of the world's shipping fleet [6]. Also called the "Seafarers Bill of Rights", the MLC2006 is the first global set of comprehensive standards for better working and living conditions for seafarers. Across five chapters (Titles), the MLC2006 addresses aspects such as employment contracts, wages,

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hours of work and rest, career opportunities, accommodation, food, medical care and social security [7]. Furthermore, the Convention provides a level playing field and fair competition within the industry as the same standards apply to all ships arriving in ports of ratifying countries, regardless of their flag [6].

The study described in this paper was conducted in Denmark, one of the world's largest shipping nations that transports almost 10% of global trade with a strong influence in the maritime sector [8]. As many countries in the European Union, Denmark often takes a pioneering role, issuing more stringent and protective regulations than those in force on a global level [9, 10]. Prior to the MLC2006, the Danish Merchant Shipping (Master's and Seamen's) Act, regulating living and working conditions, has been in force since 1974 and is regularly updated [11, 12]. While covering an extensive range of aspects, the MLC2006 is still, in some parts, substandard to the Danish law (e.g. regarding pregnancy and maternity leave) [7, 12]. However, an analysis of register-based studies conducted between 1970 and 2010 on the health of Danish seafarers and fishermen found elevated rates of mortality, hospitalisation, specific diseases (e.g. obesity, cancer, tuberculosis) and accidents when comparing seafarers to the total Danish working population [13]. Seafarers working in Denmark therefore can provide unique accounts on the impact of the MLC2006 in a country with historically high employment standards. The insights might help to shed some light on the adequacy of the standards of the MLC2006 and contribute to the harmonisation and improvement of global regulations protecting seafarers' rights.

Knowledge on the impact of the MLC2006 is very limited and current research focuses on either administrative issues or the process of implementation of the MLC2006. Mixed results with both negative and positive aspects regarding the impact of the MLC2006 have been reported. Available studies investigated the impact of the MLC2006 on the protection of seafarers' welfare [14], the employment policies for Filipino seafarers employed overseas [15], the Egyptian law compared to MLC2006 [16], the living and working conditions for seafarers employed at a Thai subsea company [17], food provision on liner ships [18] and the availability of recreational facilities in connection to the standards of MLC2006 [19]. Only the study comparing the Egyptian law to the provisions of the MLC2006 draws a solely positive conclusion regarding the potential impact of the MLC2006 in Egypt [16]. All other studies present an ambivalent or critical view. There is a lack of studies focusing on seafarers' views of the MLC2006.

The goals of this pilot study were 1) to investigate the impact of the MLC2006 on the living and working conditions of seafarers from their perspective, to identify remaining issues and establish suggestions for future actions and 2) to test the suitability of the methods for future use aiming to enhance the existing knowledge and contribute to a larger research effort on the subject. In this article, the results referring to the seafarers' perceived impact of the MLC2006 on their working and living conditions are presented.

MATERIALS AND METHODS

A mixed-method research approach was applied, using an online questionnaire and a focus group interview to collect data on 1) working and living conditions and 2) health and safety of seafarers. The data were evaluated using the Titles 1–4 of the MLC2006 as guiding framework.

QUESTIONNAIRE

The Yale Study of Seafarer Health and Wellbeing was chosen and permission for use was obtained from the Yale Maritime Research Centre [20]. Small adjustments increased the suitability of the tool for the Danish reality and the purpose of the study. The final questionnaire contained 33 items (some with sub-questions) distributed across seven sections: 1) demographic information, 2) the latest tour of duty, 3) the ship, 4) the nature of the work, 5) health and safety, 6) internet access and cell phone use, and 7) personal opinion and expertise. The first three sections provided data on baseline characteristics, section (6) took an additional look at the situation of connectivity and the last section allowed free text entries. Google forms was used to create an online questionnaire. Through contacts at the Danish Maritime Cluster, the link and an invitation letter were posted in two Facebook groups for seafarers. All professional seafarers were eligible to answer the questionnaire. A consent form was obtained by each respondent. The link was kept active for 1 month (February 2018).

To facilitate the analysis and reduce complexity of this small-scale study, some variables have been transformed into categorical variables. Descriptive statistics were calculated in the form of percentages. The data transformation and analysis were done using the statistical software Stata, version 14.2 for Windows 10. The free text entries were categorised into common topics.

FOCUS GROUP

Participants in the focus group were recruited through an education facility of the Danish Maritime Authority. Four officers volunteered to participate in the group discussion that lasted approximately 50 min and was held in English in April 2018. All participants were Danish master mariners, i.e. officers or captains, but had various backgrounds and experience with diverse types of vessels. Apart from attending the educational facility at the same time for training, they were not previously acquainted. English was the second language for all four.

The interview guide was developed in collaboration with maritime experts focusing on the MLC2006 and taking the

results of the questionnaires into account. It contained five sections: 1) introduction by moderator and participants, 2) general work and work atmosphere, 3) safety on board, 4) opinion on the MLC2006, and 5) a group exercise where the participants were asked to order six frequent issues from the questionnaire from least to most problematic [21]. The discussion was recorded using an iPad and an iOS application and transcribed the following day. Participants were informed of this and assured that they will remain anonymous. Common themes were identified using thematic content analysis [21] and categorised into the three sections that constitute the research goal of this study: 1) impact of the MLC2006, 2) remaining issues, and 3) suggestions for future actions.

RESULTS

QUANTITATIVE RESULTS

The main characteristics of the participants are presented in Table 1.

In general, almost one third of the participants (27.3%) stated that the MLC2006 did not improve their conditions at all, while (43.6%) responded that it improved their conditions somewhat. Seafarers with more work experience reacted more negative to the MLC2006. Almost half of those with more than 10 years of experience (47,6%) selected not at all. In relation to rank, 38.5% of officers stated that the MLC2006 did not improve their conditions at all, while around 70% of non-officers stated somewhat. When it comes to the flag of the ship, more than half (54.1%) of those working on ships flying the Danish flag felt that the MLC2006 improved their conditions somewhat or to a great extent (Table 1).

Additional issues of concern were their performance and work place culture. Almost 80% stated that it is sometimes necessary to work at a rapid pace, and 67.2% stated to either sometimes or often/always perform tasks for which they need more training. Nine (16.4%) seafarers stated that they have sometimes been exposed to threats or violence at work during the last 2 years. Regarding workplace culture almost 51% stated that their workplace was either rather or very much competitive. Also, 67.3% think their workplace is rather or very much rigid and rule-based. However, 63.6% of the participants were either rather or very much satisfied with their job.

QUALITATIVE RESULTS

Qualitative data were collected through the last section of the questionnaire and the focus group.

In the questionnaire, respondents had the chance to list their concerns, opinion and other comments in free text. The answers were aggregated and categorised. The four most frequently reported issues were safety problems (n = 25), negative emotions such as stress and pressure (n = 14), the food on board (n = 14), and social difficulties among the crew (n = 12). These were used as background material to initiate discussion in the focus groups.

Safety issues that worried the seafarers were especially the differences in training standards for crew from other nationalities, a risky work environment on the ship with exposures to e.g. noise, heat and weather and the safety management overall (training, equipment, drills). Negative emotions reported were stress, lack of motivation, boredom and a feeling of not being good enough. Sexual harassment was mentioned by 3 of the 8 female respondents. Respondents also complained about bad and unhealthy food and a lack of training for the galley staff. Complaints about crew issue included language difficulties, cultural differences, distrust and different attitudes towards safety.

In the focus group, the discussion was about three categories: 1) impact of the MLC2006, 2) remaining issues, and 3) suggestions for future actions. The general opinion was that the MLC2006 did not have a significant impact for Danish seafarers and Danish vessels. Most of the standards introduced by the MLC2006 existed in Denmark before. The interviewees even mentioned that, in some points, the MLC2006 is inferior to what they were already doing. They all agreed that the MLC2006 mostly increased administrative tasks and the amount of paperwork and checklists. However, they also acknowledged an increase of safety awareness and a potential improvement for other flags, especially regarding employment contracts. Other remaining issues regarding the MLC2006 in particular are low manning standards, the lack of required proficiency of the working language and the lack of reliable internet connection for the crew.

DISCUSSION

IMPACT OF THE MLC2006

Consistent with existing literature [14, 16, 18, 19] the results indicate an ambivalent opinion regarding the impact of the MLC2006. As 92.7% of respondents were born in Denmark and 87.3% stated to work on ships flying the Danish flag, the results mainly indicated the situation among seafarers in Denmark. Approximately half of the questionnaire respondents stated that the MLC2006 improved their working and living conditions greatly or somewhat. It is worth mentioning that 3 out of 10 seafarers did not see any difference following the introduction of the MLC2006. The picture was clearer between the four focus group participants who stated that the MLC2006 did not have a positive impact for Danish seafarers but only increased paperwork and administrative tasks. Officers were overrepresented in the present study, which might skew the results.

Table 1. Descriptive statistics for the study population according to the respondents' opinion on the Maritime Labour Convention 2006 (MLC2006); frequency and percentage

Characteristics	Total	Improvement thanks to MLC2006			
		Not at all	Very little	Somewhat	To a great extent
Total	55 (100%)	15 (27.3%)	12 (21.8%)	24 (43.6%)	4 (7.3%)
Gender					
Female	8 (14.5%)	1 (12.5%)	1 (12.5%)	6 (75%)	0 (0%)
Male	47 (85.5%)	14 (29.8%)	11 (23.4%)	18 (38.3%)	4 (8.5%)
Age					
20–40	38 (69.1%)	9 (23.7%)	9 (23.7%)	17 (44.7%)	3 (7.9%)
41–63	17 (30.9%)	6 (35.3%)	3 (17.6%)	7 (41.2%)	1 (5.9%)
Total years as a seafarer					
< 10	34 (61.8%)	5 (14.7%)	9 (26.5%)	17 (50%)	3 (8.8%)
≥ 10	21 (38.2%)	10 (47.6%)	3 (14.3%)	7 (33.3%)	1 (4.8%)
Working hours/day					
< 10	16 (29.1%)	1 (6.3%)	4 (25%)	11 (68.7%)	0 (0%)
≥ 10	39 (70.9%)	14 (35.9%)	8 (20.5%)	13 (33.3%)	4 (10.3%)
Rank					
Officer	39 (70.9%)	15 (38.5%)	9 (23.1%)	13 (33.3%)	2 (5.1%)
Non-officer	16 (29.1%)	0 (0%)	3 (18.8%)	11 (68.7%)	2 (12.5%)
Department					
Deck and/or Bridge	29 (52.7%)	10 (34.5%)	4 (13.8%)	12 (41.4%)	3 (10.3%)
Engineering	25 (45.5%)	5 (20%)	8 (32%)	11 (44%)	1 (4%)
Steward	1 (1.8%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Type of ship					
Container ship	21 (38.2%)	3 (14.3%)	5 (23.8%)	12 (57.1%)	1 (4.8%)
Supply ship	9 (16.3%)	4 (44.4%)	1 (11.1%)	4 (44.4%)	0 (0%)
Tanker	9 (16.3%)	3 (33.3%)	3 (33.3%)	2 (22.2%)	1 (11.1%)
Jack-up vessel	3 (5.5%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	0 (0%)
Passenger ship/ferry	3 (5.5%)	2 (66.6%)	0 (0%)	1 (33.3%)	0 (0%)
Tug	3 (5.5%)	0 (0%)	2 (66.6%)	1 (33.3%)	0 (0%)
Other	7 (12.7%)	2 (28.6%)	0 (0%)	3 (42.9%)	2 (28.6%)
Country of birth					
Denmark	51 (92.7%)	13 (25.5%)	12 (23.5%)	22 (43.1%)	4 (7.8%)
Other	4 (7.3%)	2 (50%)	0 (0%)	2 (50%)	0 (0%)
Flag of ship					
Denmark	48 (87.3%)	12 (25%)	10 (20.8%)	22 (45.8%)	4 (8.3%)
Norway	2 (3.6%)	1 (50%)	1 (50%)	0 (0%)	0 (0%)
Other	5 (9.1%)	2 (40%)	1 (20%)	2 (40%)	0 (0%)

Research from 2009 revealed that only a small number of improvements were recorded for the living and working conditions between 1977 and 2007, which could be associated to the lack of comprehensive labour standards prior to the MLC2006. It was found that extensive ratification increased the impact of other major maritime conventions [22]. The MLC2006 currently covers 91% of the world gross tonnage. Reasoning from the mentioned findings, this extensive coverage suggests an improvement through the MLC2006. While this might be true in general, it is reasonable to assume that improvements gained from the MLC2006 in Denmark were, at best, minimal since these

standards were already in place. This is potentially also the case for other countries. It is however likely that seafarers working on ships flying flags from countries with weaker labour regulations than those introduced by the MLC2006, benefitted from the Convention as exemplified by Noufal and Al Sherif [16] in their analysis of Egyptian law.

REMAINING CONCERNS AND ISSUES

A major issue, raised by the study participants was safety on board. Especially the differences in safety training between nationalities seem to be of great concern. In Title 1, the MLC2006 demands that seafarers are adequately trained to perform their duties (training to be done according to the Standards of Training, Certification and Watchkeeping [STCW]). In the focus group, one respondent argued that the STCW is too weak. Experts from the industry also agreed that training standards still differ between countries Problems with safety training are worsened by language difficulties. Seafaring is an international profession and the working language is English on most vessels. Both the questionnaire and the interview made clear that there are many deficits regarding proficiency of the working language. This might compromise safety especially in situations where quick reactions are needed such as emergencies [1].

The MLC2006 demands a minimum of ten rest hours in any 24 hours period. Nobody reported more than 14 hours of work per day, which indicates compliance with this regulation. Yet, in the qualitative responses, two seafarers emphasized the difficulties to adhere to the required rest hours. Working hours and stress were selected as the most problematic issue in the closing exercise of the focus group and also had high priority for the complaints listed in the free text part of the questionnaire. Rest and fatigue issues were mentioned five times. These findings indicate problems regarding low manning, high workload and the difficulty to adhere to rest hours and confirm the existing literature [3, 4, 14, 23]. Recent results from a global study with seafarers indicated that the high workload was the biggest issue in seafaring [19]. A study with Turkish deck cadets revealed that 32% violated the rest hours mandated by MLC2006 during their training [23]. Working every day means less time to relax, rest and connect with family and friends [24]. Jepsen et al. [25] further criticise current shift work, as it is not possible to get enough rest when the day is separated into unequal portions.

All four focus group participants were satisfied with the food and determined it to be the second least critical issue in the group exercise. In the questionnaire however, food was the second most frequent issue mentioned in the free text section. The seafarers from the focus group work on vessels that undertake shorter voyages and operate close to shore, which might be an explanation for the discrepancies. A nutritious and varied diet is not only important for physical health but also essential for mental wellbeing and socialising on board [26, 27]. The MLC2006 includes the phrase that the members "shall" (Regulation 3.2, 1) serve enough and nutritious food. The Regulation does not define nutritious food and does not specify the quantity of nutrients that should be provided [18]. The kind of food that is provided is therefore largely left to the ratifying countries.

When living and working together in close quarters for prolonged periods, conflicts are a natural occurrence. Social issues among the crew were the third most frequent issue in the questionnaire and emphasized during the group discussion. It is possible that seafarers feel more comfortable with colleagues with the same nationality as they understand jokes and other cultural customs for social interaction. Multinational crews have previously been associated with increased stress [1]. Opposing this, other research found that multinational crews were successful and popular with both seafarers and companies [28, 29]. In the study presented here, the majority of respondents worked on Danish flagged ships and in Danish crews. The importance of specific preferences and attitudes between seafarers of different nationalities has been identified [29] and it is possible that Danish seafarers are a subpopulation that prefer single-nationality crews.

Women are outnumbered in shipping and often experience discrimination. In the questionnaire 3 out of 8 women (37.5%) aged 22–31 years mentioned sexual harassment or harassment as an issue. Two women were officers. Other researchers found numbers between 17% and 50% and stated that sexual harassment mainly affects younger women. They also found, that officers are not affected as much, which slightly contradicts the results found here [30]. However, the numbers are very small and no definite conclusions can be drawn. Across both genders, more than 15% (n = 9) reported having been exposed to threats or violence within the last 2 years. A new amendment to the MLC2006 includes guidelines to avoid harassment and bullying on board and will enter into force in January 2019. It remains to be seen whether it will be effective.

LIMITATIONS OF THE STUDY

The study presented here was conducted as a pilot study, thus the results must be interpreted with caution. Nevertheless, they provide an insight of the seafarers' views and opinions of the MLC2006.

The mixed method approach allowed the collection of informative, more complete and useful data. Cross-references and comparisons between the results were possible and deepened the insight. However, several adjustments could increase the success of a larger study.

The questionnaire was successfully used by researchers from the Yale University. Its length allows the collection of diverse and detailed data, but might also hinder respondents to answer. The instrument should be further adjusted in

a comprehensive way. An additional problem might have been the long invitation letter that should be kept more concise.

Using an online questionnaire is advantageous as the distribution is easy and the data are immediately available in electronic form. By publishing the link on social media, large numbers of potential respondents can be reached without much effort. However, only 55 seafarers answered, which indicates limitations of the approach. No data on the number of people who saw the link is available; therefore, no response rate can be calculated. The survey was open to all seafarers but only 3 responses were from seafarers who had neither Danish nationality nor worked on a Danish flagged ship. For a future study, international contacts for the distribution should be established. Using social media may also cause selection bias. Only those who are registered can answer the survey. The study population contained 8 women, representing 14.5% of all participants. Comparing this to the 1–2% of female seafarers overall, women are overrepresented in the sample of this study [30], confirming that women are more likely to participate in surveys. For a future study, the use of other channels for distribution such as email or newsletters should be taken into consideration. The distribution of paper versions in e.g. training centres is another option. Using different paths increases the likelihood to reach a diverse study population and limits bias.

The setting of a focus group is more casual than the classic interviewer-to-interviewee situation. It resembles a natural conversation among likeminded people. Common issues and annoyances are more easily discussed [21]. This theory could be confirmed as the participants felt comfortable sharing sensitive issues such as the lax usage of checklists or the near breach of the rest hours demanded by the MLC2006. They were eager to share many aspects of their daily working conditions, despite working in different roles and on different ships. Concerns regarding anonymity and confidentiality did not seem to be big issues for the participants. Seafarers put a lot of focus on camaraderie, which makes focus groups a good method to study their views.

SUGGESTIONS FOR FUTURE ACTIONS

Moving forward, there are some suggestions for action that could be drawn from the results of this study. Stricter requirements should be enforced regarding seafarer training, either within MLC2006 or through other Conventions. Low manning is still a problem and it could be considered to increase the current minimum safe manning standards to lighten the overall workload, reduce stress and avoid the violation of rest-hours, at least during periods with increased danger, e.g. in winter or during loading [22]. Ultimately, this would help to increase health and safety as the seafarers will be better rested and focused. The results indicate that a mandatory proficiency of the working language (usually English) for seafarers working internationally could help to improve safety and contribute to comradery and thus social wellbeing. Other researchers have also mentioned the importance for adequate language proficiency for the avoidance of accidents [1]. More detailed food provision standards should be established and included in the MLC2006. The current text does not achieve to provide an adequate level of healthy and nutritious food, something that has also been criticised by others [18]. Food is essential for physical and mental health and wellbeing and should therefore be a priority for all ship-owners and managers [1, 27].

A new and most likely increasing problem, that also was mentioned by several seafarers during the data collection procedure, is connectivity. As a natural part of daily life, most people take the internet for granted. This is not the case for seafarers due to inadequate technological possibilities and lack of prioritisation from ship owners. It should be considered to make internet connection mandatory under the MLC2006, at least where this is possible with the available technology. This has also been proposed by others and found beneficial for satisfaction and health [3, 5, 14, 19]. Reliable and mandatory internet connection could also assist to overcome recruitment problems, as more young people will be attracted to the industry. This pilot study can only present preliminary results and the benefit of these recommendations must be confirmed in a larger study.

CONCLUSIONS

The hypothesis that the MLC2006 had succeeded in improving the living and working conditions of seafarers could not be confirmed. It remains unclear whether the overall impact of the MLC2006 is solely positive. Certainly, several issues remain and the MLC2006 does not cover all necessary aspects of seafarers' living and working conditions. Significant issues that remain for seafarers are the long working hours coupled with low manning, safety on board, social difficulties (especially regarding language) and food. Should the MLC2006 not have the desired outcome of protecting seafarers, further measures must be undertaken to ensure adequate living and working standards for this essential workforce. It is likely that the MLC2006 did not greatly influence the conditions in developed shipping nations such as Denmark, at least not for officers. Therefore, it is important to assess the impact of the MLC2006 in other flag states. Such an assessment might be more useful in the light of its 5-year anniversary. The international nature of shipping demands that all stakeholders and nationalities get a voice. Scientists may use the findings from this pilot research to inform a larger study on this topic in the future.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Danish Data Protection Agency.

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VIA MEDICA

CASE REPORT

Occupational disease due to *Anisakis simplex* in fish handlers

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ABSTRACT

Background: Anisakis *is a marine nematode. Its larvae can be found encysted in several species, both in the abdominal cavity and in the adjacent musculature. The most commonly affected commercial species are hake, whiting, cod, and mackerel. The prevalence in fish varies according to the fishing area and the size of the host.*

Materials and methods: *Until now only three species have been confirmed to be involved in human anisakiasis, the most common ones being* A. simplex *sensu stricto (s.s.) and* A. pegreffii, and anecdotally, A. physeteris. *Infestation in humans occurs when they eat raw or undercooked parasitized fish or cephalopods (pickled, cold-smoked, salted, semi-preserved, prepared in certain Asian styles like sushi or sashimi, ceviche).*

Results: *The majority of anisakiasis cases have been described by Japanese authors. However, over the last few years there has been an increase in the number of cases reported in other countries including Italy and Spain. It is estimated that its incidence in the European Union is 0.32/100,000, and in the Basque Country (Spain), this parasite is responsible for 10% of anaphylaxis cases and 32% of urticaria cases in adults aged 40–60 years, around 300 cases/year.* Anisakis*-related disease in the work environment (occupational disease) is less common.*

Conclusions: *We present three cases of the occupational disease in Spain due to a type I hypersensitivity to* Anisakis simplex *in individuals who handle fish (one fishmonger, one supermarket employee, and one chef).*

(Int Marit Health 2018; 69, 4: 264–269)

Key words: *Anisakis*, occupational disease, type I hypersensitivity, acute urticaria, protein contact dermatitis

INTRODUCTION

Anisakis is a marine nematode. Its larvae can be found encysted in several species, both in the abdominal cavity and in the adjacent musculature. Large marine mammals (cetaceans and pinnipeds) are the natural definitive host, and the parasite matures to its adult stage in the gastrointestinal tract, from where its unembryonated eggs are released in the host's faeces. The eggs then embryonate in the marine environment and the larvae mature in encapsulated phases (L1-2/L3), at a variable speed depending on the water temperature (4 to 8 days if between 13 and 18 °C, 57 to 82 days if below 5 °C) [1], until they begin the "free-swimming" L3 phase, in which they are still encapsulated, but can infect microcrustaceans, crustaceans, fish, and cephalopods. Copepods (microcrustaceans) and euphausiids (crustaceans — krill) act as intermediate hosts, and fish (teleosts) and cephalopods (squid in particular) are paratenic hosts, that is, while the larvae are transmitted through predation between fish and squid, they remain in L3, and if they are ingested by definitive hosts, they mature into L4 and the adult phase. If ingested by humans who have eaten infected fish, the larvae will only develop as far as stage L4 (Fig. 1) [2].

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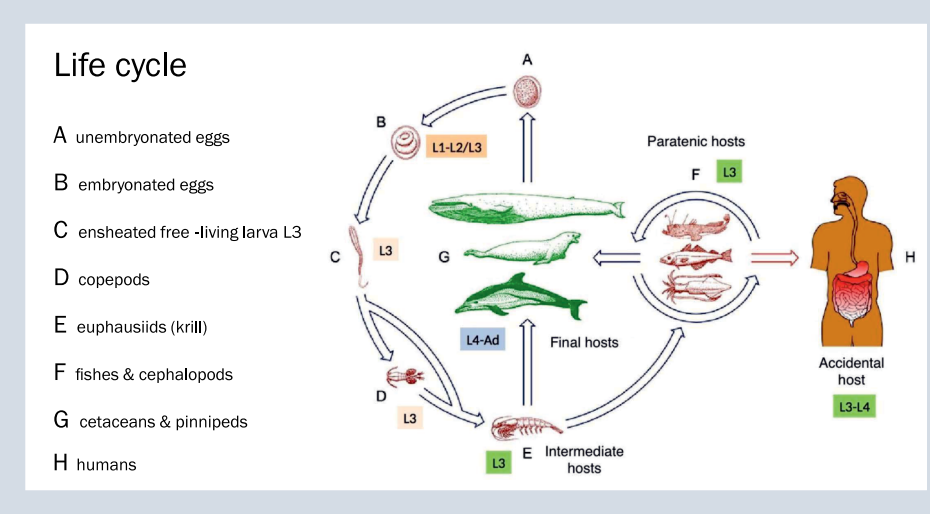

Figure 1. Life cycle of *Anisakis* spp. Source: By courtesy of F.M. Ubeira. Parasitology Laboratory. Santiago de Compostela University, Spain [2]

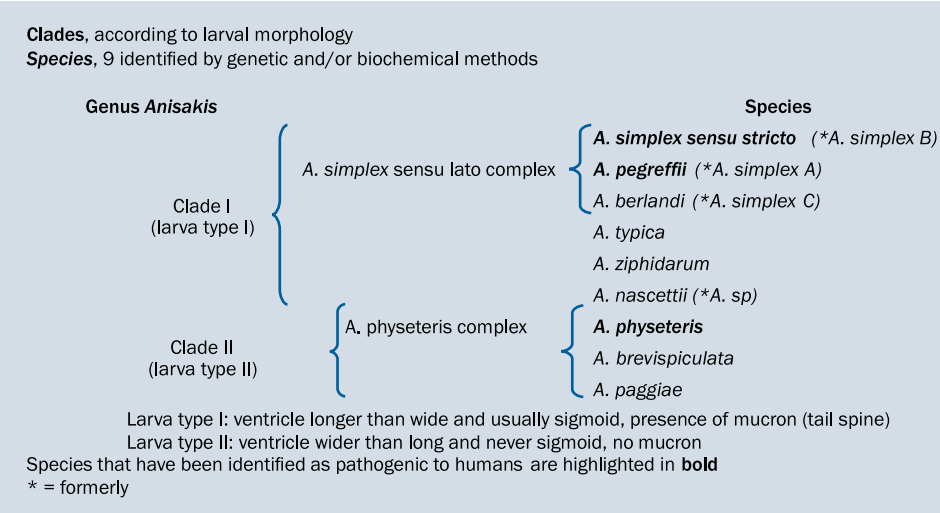

Figure 2. The different species of *Anisakis*. Source: Prepared by the authors, based on Bao Domínguez M, Thesis [9] and Iglesias R et al. [10]

GEOGRAPHICAL DISTRIBUTION

Anisakis are found from the Arctic Circle (66° 33' 46" N) to 50° S, the species varying depending on the latitude. *Anisakis simplex* sensu stricto (s.s.) is found between the Arctic Circle and 35° N, except for the Mediterranean Sea, where the prevalent species is *A. pegreffii*, also found between 35° N and 50° S latitude [3].

The most commonly affected commercial species are hake, whiting, cod, and mackerel, but the parasite has also been identified in a large variety of fish such as sole, john dory, sea bream, horse mackerel, herring, blue whiting, sardine, anchovy, haddock, monkfish, salmon, conger, and turbot, and in cephalopods, such as squid, octopus and cuttlefish [4–7]. We should also point out that studies confirm that the prevalence in fish varies according to the fishing area and the size of the host, with larger fish having more infestations [7, 8].

The different species identified are listed in Figure 2 [9, 10]; it is difficult or even impossible to differentiate the larval morphology based on microscopy alone.

PATHOGENESIS

Until now only three species have been confirmed to be involved in human anisakiasis, the most common ones being *A. simplex* s.s. and *A. pegreffii*, and, anecdotally, *A. physeteris*. The geographic distribution of *A. simplex* s.s. and *A. pegreffii,* the species that are responsible for almost all cases of the disease described in humans, is presented in Figure 3 [10].

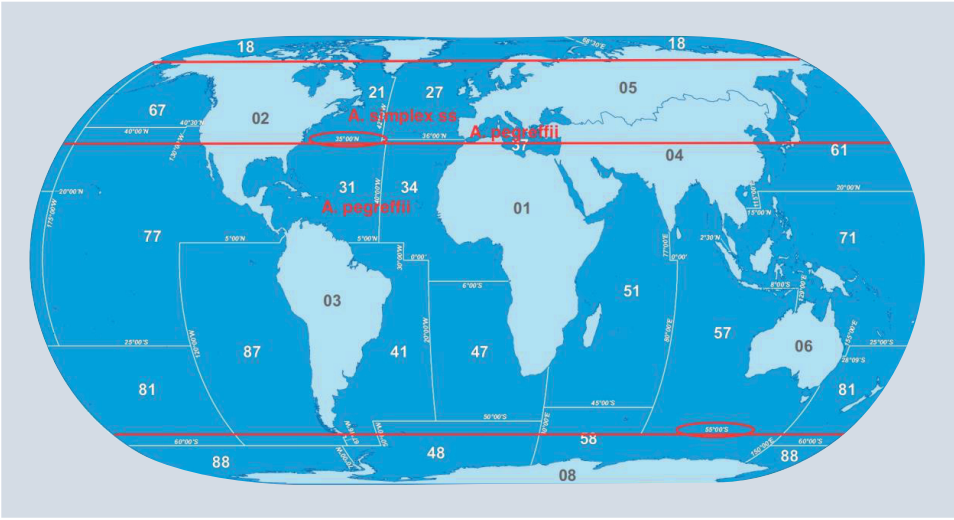

Figure 3. Distribution of *Anisakis* spp. Source: Prepared by the authors, based on FAO Fisheries map and Iglesias R et al. [10]

Infestation in humans occurs when they eat raw or undercooked parasitized fish or cephalopods, that is, those prepared with culinary techniques that do not kill the larvae. Thus, products that are pickled, cold-smoked, salted, semi-preserved, prepared in certain Asian styles (e.g. sushi, sashimi), or products such as ceviche, are responsible for practically all associated infections.

The first case of human infection by a species of the Anisakidae family was reported in the Netherlands by Van Thiel in 1960. The author described the presence of a marine nematode in the centre of an eosinophilic intestinal phlegmon from a patient suffering from acute abdominal pain, as a "very unusual finding." Later the nematode was identified as *Anisakis* spp., a common parasite of marine fishes and mammals, and the human parasitosis was named anisakiasis. Since then, the majority of anisakiasis cases have been described by Japanese authors, reflecting the frequent consumption of raw fish in that country [11].

However, over the last few years there has been an increase in the number of cases reported in other countries including Italy [8, 12] and Spain [6, 13].

The parasitic disease is caused by larvae in the gastrointestinal tract following the ingestion of infected fish, in which the larvae are still alive and can hook onto the walls of the gastrointestinal tract. This parasitic infection may present in two ways:

- non-invasive or luminal form: the parasite attaches to the stomach wall causing gastritis or even perforation, and in some cases migrating to the small intestine causing symptoms of enteritis, intestinal obstruction, or malabsorption syndrome;
- invasive form: the larvae attach to and penetrate the intestinal mucosa and occasionally invade other organs (pancreas, liver, lungs) causing more severe symptoms.

The most common symptoms are those of intestinal inflammation: abdominal pain, nausea, vomiting, diarrhoea, and sometimes fever. Endoscopy is the most effective diagnostic technique and can also be used therapeutically. It can also be helpful to perform total IgE serology testing, which is elevated in acute parasitic infection and decreases gradually, or *Anisakis*-specific IgE which increases in the first days of reinfection and remains high for months. Abdominal ultrasound or computed tomography can raise suspicion of the disease in cases of very active parasitic infection.

Involvement of the respiratory tract has also been described but is rare. One report describes "two patients that provide evidence for occupational asthma caused by *A. simplex*, based on *in vivo* and *in vitro* tests for *Anisakis*-specific IgE" [14].

Anisakiasis is a well-known, common, frequently-described disease. It is estimated that its incidence [15] in the European Union is 0.32/100 000, and in the Basque Country [16], this parasite is responsible for 10% of anaphylaxis cases and 32% of urticaria cases in adults aged 40–60 years, around 300 cases/year. *Anisakis*-related disease in the work environment (occupational disease) is less common.

We present three cases of occupational disease due to a type I hypersensitivity to *Anisakis simplex* in individuals who handle fish (one fishmonger, one supermarket employee, and one chef).

CASE REPORTS

CASE 1

The first case was a 47-year-old woman, who had been working as a fishmonger for 27 years. She had a history of sensitivity to cobalt, nickel, and hair dyes, and had smoked 8 cigarettes per day for 25 years.

Table 1. Complete battery of foods (Abelló and Allergy Therapeutics laboratories)*

Egg and egg proteins (white, yolk, ovalbumin, ovomucoid)
Cow's milk and allergenic proteins (alpha-lactalbumin, beta-lactoglobulin, casein)
Nuts and cereals (peanut, almond, walnut, hazelnut, pine nut, chestnut, sunflower seeds, wheat, rye, barley, oat, cacao)
Wheat gluten, legumes (soya, haricot bean, lentils, chick-peas)
Meats (rabbit, pork, chicken, turkey)
Fish and seafood (mixture of white fish, mixture of oily fish, mackerel, tuna, cod, hake, sole, salmon, prawn, crab)
Vegetables (potato, tomato, peas, carrot, onion, spinach, celery)
Fruits (peach, apple, cherry, orange, strawberry, banana)
Spices (cumin, aniseed, bay leaf, black pepper, white pepper, curry, nutmeg, saffron, parsley, mustard, sesame)

*Controls: ALK Abelló laboratory: positive — histamine hydrochloride 10 mg/mL; negative — glycerinated saline

She reported a 1-year-history of pruritus and wheals, occurring predominantly on the upper limbs while at work, with remission of symptoms at weekends, during holidays, and while off work due to illness.

A skin prick test was performed with a complete battery of food allergens (Table 1), with negative results. Prick test (ALK Abelló laboratory) was negative to latex and positive to *Anisakis simplex* (12 × 15 mm papule; positive if ≥ 3 mm). She had a positive result of 11 × 12 mm to histamine hydrochloride and a negative response to glycerinated saline.

In vitro testing for specific IgE to *Anisakis simplex* (UniCAP; Pharmacia) was clearly positive with a result of 48 KU/L (positive if > 0.35 KU/L).

The diagnosis was compatible with recurrent acute urticaria due to type I hypersensitivity to *Anisakis simplex*.

CASE 2

The second case was a 38-year-old woman with no relevant past personal or family medical diseases. She was a non-smoker, with no alcohol or drug abuse. She had been working in a supermarket for 10 years, specifically, in the delicatessen, butcher's, and fish sections.

The patient reported that in the previous 6 weeks she had had two acute outbreaks of wheals with intense pruritus, on both occasions when she was working in the fish section.

In the first episode she had pruritic wheals on the hands and various parts of the body. Symptoms improved 6 hours after treatment with oral antihistamines and corticosteroids.

Twelve days later, also while working in the fish section, she had a second episode of widespread wheals and intense pruritus. She was given 5 days of oral antihistamines and corticosteroids. The patient reported that she could not link the symptoms with ingestion of any foodstuff, and that she did not have any symptoms when working in the butcher or delicatessen sections. She was not taking any medications.

A complete food skin prick test was performed (Table 1), which was negative. Prick test was also negative to latex and to additives used in the meat industry (Table 2). A prick by prick test for cereals used in minced meat was also negative.

Table 2. Battery of additives used in the meat industry

Sodium nitrite E250
Ascorbic acid E300
BHA E320
BHT E321
Sodium benzoate E211
Xanthan gum E415
Carrageenan E407
Carboxymethyl cellulose (cellulose gum) E466
Dicalcium diphosphate E450 (vi)
Monosodium glutamate E621
Lactose
Aspartame E951

Skin prick test was positive to *Anisakis simplex* (ALK Abelló laboratory), causing a 6 × 7 mm papule (positive if ≥ 3 mm); the response to histamine was 7 × 9 mm and to glycerinated saline, was negative.

In vitro tests detected a mildly positive response for *Anisakis simplex*-specific IgE (UniCAP; Pharmacia) of 0.6 KU/L (positive if > 0.35 KU/L).

The diagnosis was compatible with acute urticaria due to type I hypersensitivity to *Anisakis simplex*.

CASE 3

The third case was a 37-year-old man, who had been working as a chef in a restaurant for 7 years. He had a history of seasonal rhinitis and had smoked 20 cigarettes per day for 18 years.

In the past 6 months he had had pruritic microvesicular lesions on both hands with interphalangeal and palmar fissures.

He reported that at work he handled fish, cephalopods (mainly cuttlefish) and crustaceans (prawns), and that his symptoms improved when he was not working.

Skin prick tests with the complete battery of foods (Table 1) were performed, with negative results. Prick test to latex was also negative.

Prick test to *Anisakis simplex* (ALK Abelló laboratory) was positive with a 7 × 8 mm papule (positive if > 3 mm),

a 9 × 10 mm response to histamine, and a negative response to glycerinated saline.

In vitro testing gave the following results: elevated total IgE of 279 UI/L (high if > 150 UI/L). The results obtained from quantification of specific IgE to *Anisakis simplex* (UniCAP; Pharmacia) were positive at 0.8 KU/L (positive if > 0.35 KU/L).

The diagnosis was compatible with protein contact dermatitis due to type I hypersensitivity to *Anisakis simplex*.

In six healthy control patients a prick test was performed with the complete battery of foods, meat additives, latex, and *Anisakis simplex*, all of which were negative.

DISCUSSION

The spectrum of allergic reactions to *Anisakis simplex* is wide and includes rhinitis, conjunctivitis, asthma, urticaria/ /angioedema, allergic contact dermatitis, and anaphylactic shock [4, 13, 14, 17].

The condition may be caused through the consumption of infected fish, or from occupational contact. The sectors most affected by *Anisakis*-related diseases are fishermen/ /women, fishmongers, and chefs: in general, anyone whose work involves catching, cleaning, handling, selling, or preparing contaminated fish [13, 18].

Purello-D'Ambrosio et al. 2000 [18] conducted a study on sensitisation in fishermen and fishmongers, of 28 individuals studied, four had a positive prick test to *Anisakis simplex*.

The cases we have discussed in this paper are all cases of occupational diseases secondary to *Anisakis simplex* including two cases of acute urticaria and one case of protein dermatitis, all of which are attributable to type I hypersensitivity to *Anisakis simplex*. These findings are in line with the results obtained by Conde-Salazar et al., 2002 [19]; Barbuzza et al., 2009 [20], and Vicente Pardo, 2016 [5].

The diagnosis of the cases was based on the occupational history, the clinical presentation, the allergen exposure pattern (at work vs. off work), and the additional tests including both *in vivo* skin prick tests and *in vitro* tests quantifying *Anisakis simplex*-specific IgE levels.

Recently-developed molecular testing methods may be used to identify cross-reactivity between the protein from *Anisakis* and other allergenic sources such as crustaceans. When a patient is diagnosed with hypersensitivity to *Anisakis*, a molecular test determines the exact protein to which they are sensitised and may therefore be useful for predicting the potential development of reactions to allergens that show cross-reactivity [21, 22].

Prevention should encompass tasks undertaken when fishing (gutting is performed on board the fishing boat), and in the subsequent handling of the product prior to (wholesalers) and during (retailers) its sale to the final consumer, and, lastly, during food preparation. Thus, rapid gutting, correct freezing (see Food and Drug Administration [FDA] recommendations) and adequate cooking of fish are the most pertinent steps to avoid parasitic infection in the end consumer.

Regarding the prevention and treatment of the occupational disease we have looked at, the best options to reduce exposure are barrier methods that protect the mucous membranes and exposed skin in individuals who carry out the tasks mentioned above, along with the provision of prior information and training.

The FDA recommendations [23] for parasite destruction by freezing (3-402.11) are:

(A) Except as specified in (B) of this section, before service or sale in READY-TO-EAT form, raw, raw-marinated, partially cooked, or marinated-partially cooked FISH shall be:
  (1) Frozen and stored at a temperature of –20°C (–4°F) or below for a minimum of 168 hours (7 days) in a freezer;
  (2) Frozen at –35°C (–31°F) or below until solid and stored at –35°C (–31°F) or below for a minimum of 15 hours; or
  (3) Frozen at –35°C (–31°F) or below until solid and stored at –20°C (–4°F) or below for a minimum of 24 hours.

(B) Paragraph (A) of this section does not apply to:
  (1) MOLLUSCAN SHELLFISH;
  (2) A scallop product consisting only of the shucked adductor muscle;
  (3) Tuna of the species Thunnus alalunga, Thunnus albacares (Yellowfin tuna), Thunnus atlanticus, Thunnus maccoyii (Bluefin tuna, Southern), Thunnus obesus (Bigeye tuna), or Thunnus thynnus (Bluefin tuna, Northern); or
  (4) Aquacultured FISH, such as salmon, that:
    (a) If raised in open water, are raised in net-pens, or
    (b) Are raised in land-based operations such as ponds or tanks, and
    (c) Are fed formulated feed, such as pellets, that contains no live parasites infective to the aquacultured FISH;
  (5) FISH eggs that have been removed from the skein and rinsed.

CONCLUSIONS

Health conditions caused by *Anisakis* are highly relevant for consumers of fish and represent a significant public health issue. It should also be borne in mind that exposure to *Anisakis* can cause an occupational disease in individuals who handle fish (particularly fishermen/women, fishmongers, supermarket workers, and chefs).

Preventative measures should be strengthened to avoid or minimise the health effects that exposure to *Anisakis* can cause, both in the general population and in those exposed in their work environment.

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Food hygiene knowledge and awareness among undergraduate maritime students

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ABSTRACT

Background: *Reducing the crew size of the galley department on merchant vessels causes heavy workload for the remaining food handlers on board. This situation in return, could trigger risky behaviours and create an unsanitary environment which can facilitate the spread of various gastrointestinal disorders on ships. In such cases, ensuring and supervising food hygiene and food safety on board is up to maritime captains and officers. In addition to that, each crew member on board should maintain a general awareness of food hygiene to prevent any outbreaks. However, these personnel's knowledge and awareness to prevent such risky behaviours and cases are questionable. In this context, this study aims to examine food hygiene knowledge as well as awareness among maritime students. A survey has been conducted to discover the risky behaviours seen on merchant vessels regarding food hygiene. Specified training needs to achieve food safety culture on merchant vessels are discussed.*

Materials and methods: *The study was conducted by proposing an anonymous questionnaire to undergraduate students of maritime faculties in Turkey. The questionnaire form was adapted from the previous works of Grappasonni et al., Walker et al. and Alpuguz et al. This questionnaire examines the basic attitudes towards food hygiene and risky behaviours among seafarers. Convenience sampling technique was adopted, and 251 Turkish participants have joined the study.*

Results: *Foodborne disease knowledge among maritime students was determined to be low especially for disease recognition. They have failed to identify characteristics and symptoms of food borne diseases. There were also serious misconceptions of which behaviours are considered risky regarding food hygiene. A knowledge gap was observed in cross-contamination, food temperature control, and food storage condition subjects. Some of these, such as high-risk foods and adequate storage of foods should be common knowledge for all personnel on board. It is also revealed that food hygiene awareness of many maritime students was limited to environmental hygiene and food handlers' hygiene.*

Conclusions: *Food hygiene appears to be an underrated problem on board, yet it is one of the major health problems in the maritime industry threatening the seafarers. Promoting food safety culture and food hygiene knowledge in maritime students could be a key factor to tackle this problem. Development of standardised health and disease training for seafarers should be considered.*

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Key words: food hygiene, risky behaviours, shipboard food handling, foodborne diseases

INTRODUCTION

Working conditions and life on board ships differ a lot from the working conditions of other professions. Individuals working on vessels have to spend their time on board. This means activities such as; sleeping, resting, socialising and eating are done on board. In a way, a ship's crew form a small community responsible for each other in many various factors such as hygiene conditions in common areas and cabins and providing positive conditions for the overall well-being of others. However, preparing and cooking three meals a day besides cleaning the ship's kitchen and storages is usually entrusted to a single person. Therefore,

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food professionals on board ships play an important role in protecting people from foodborne diseases [1].

Manning merchant vessels with a dedicated galley crew is a widely accepted practice in the maritime industry for some time. Cleaning and maintaining the quarters, preparing and serving food are in the responsibility of this department. As a rule of thumb, a galley crew in merchant vessels includes a chief cook and stewards. Some shipowners and managers might also hire dedicated cleaning personnel or second cook while other owners and managers might discard all personnel except the chief cook. These conditions are circumstantial and may differ from vessel to vessel. However, disregarding most of the galley crew to reduce costs, results with a single food handler who is also responsible for the cleaning and maintaining of stores and quarters, in addition to cooking and serving. This heavy workload could trigger risky behaviours and a change in food safety culture or awareness may create unhealthy conditions. This situation combined with confined spaces and limited fresh food supply on board poses a potential threat to the general well-being of seafarers [2, 3].

It can be argued that each person on board should be aware of the nature and condition of their food before consuming any. However, it might not always be practical to inspect every step of food preparation. Therefore, the master or the chief officer usually acts as the supervisor of the galley department, depending on the company policy and job descriptions. It is in their responsibility to inspect and keep overall hygiene conditions in check. Yet, without adequate knowledge and awareness, it is impossible for a ship's crew to take precautions for risky behaviours. In the end, these risky behaviours result in gastrointestinal disorders and disease outbreaks [4]. Underestimating the outbreaks on board of cargo ships may create fatal outcomes. Inspections revealed that deficiencies in food and cookery hygiene are indeed relevant problems for ships [3]. This situation is especially more concerning when we consider the fact that a ship's crew is isolated and spending long times at sea, sometimes in remote regions of the world and without adequate medical care [5].

The literature on food hygiene is rather extensive. A research conducted by Grappasonni et al. [4] investigates the food hygiene knowledge of seafarers and ashore personnel for a certain maritime firm. Another study conducted by Mouchtouri et al. [6, 7] examines the food hygiene and safety on passenger ships. There are also several studies conducted on students from various domains [8–14] and some of them focus on more specific groups like health and tourism undergraduate students [15–19]. However, studies on food hygiene and food safety culture in the maritime domain are limited even though food hygiene is an important factor for the health of the crew.

This paper discusses knowledge, awareness and risky behaviours related to food hygiene seen on merchant vessels. In this context, we evaluate different grade maritime students' knowledge and asses their awareness regarding the food safety conditions on board. We also survey the possible risky behaviours of young seafarers related to food hygiene. This way we aim to identify suitable ways to promote food safety on board ships.

MATERIALS AND METHODS

A survey was conducted on undergraduate students of maritime faculties located in Turkey to make an assessment on food hygiene and food safety culture. The questionnaire used in this survey was adapted from the works of Grappasonni et al. [4], Walker et al. [20], and Alpuguz et al. [21]. This questionnaire consisted of three different sections. Each section assesses different aspects of food related attitude and awareness. Knowledge of food poisoning and diseases transmitted through food, attitudes in dining areas, high-risk food groups, cross-contamination and awareness of incorrect food handling are evaluated within these sections.

The survey was proposed in the Turkish language to maritime students. To ensure that the instruments perform practically the same way as it does in English, a back-and-forth translation has been carried out on the reference questionnaires. As the first step of this process, each author translated the questionnaire from English to the Turkish language. Each text was then separately translated back to English by third parties to assure validity. In the final step, two forms were compared with each other to eliminate any discrepancies. The final form included an introduction and consent section which explained the purpose of the research and listed the procedures of the survey for the participants.

The survey was conducted online using internet resources. Recruitment for the study was done with the help of student representatives and academic staff. These individuals distributed questionnaire link to those who were interested in joining the study. The questionnaire form was reviewed and approved by the related departments of universities before the distribution. Each participant was asked for consent before filling out the form and was reminded that they can reject to participate in the research. Therefore, the participation in the survey was on a voluntary basis. Only one response per participant was allowed. Data collection was carried out between 01.05.2018 and 21.05.2018. Two hundred fifty-one Turkish participants joined the study. All participants possessed a government-issued seafarer license (ranging from cadet to ocean going watch keeping officer/engineer) and were studying to get a bachelor's degree in maritime related areas. The carried-out study is a cross-sectional research and adopts convenience sampling technique.

STATISTICAL ANALYSIS

Data collected from the participants were stored and processed in excel spreadsheets. SPSS (Statistical Package for the Social Sciences) 22.0 software was utilised for the statistical analysis. Main findings and results were obtained through the descriptive statistics and from chi-square analysis. Statistical significance was established at $p < 0.05$.

RESULTS

Questionnaire answers of 251 maritime students were analysed in accordance with their classes and their undergraduate departments. Participants' answers were arranged by their years in education so that the 1st and 2nd graders (freshman and sophomore) and 3rd and 4th graders (junior and senior) represent two different groups. This grouping allowed a comparison between the experienced and inexperienced students. This was possible since maritime students in Turkey go through an open-sea training on merchant vessels before they advance to their 3rd year. All participants were either studying Marine Transportation Engineering (MTE) or Marine Engineering (ME). Since these two departments also represent different departments on ships as deck and engine departments, a comparison between these groups was also made in this study. The sample group comprised mostly male students (84.9%) which appear to be ordinary, considering the overall population of maritime students. The average age of the participants was 21.36. Demographic characteristics of the participants are shown in Table 1.

Table 1. Demographic characteristics of participants

Department	
MTE	175 (69.7%)
ME	76 (30.3%)
Total	251 (100%)
Class	
Freshmen and sophomores	159 (63.3%)
Juniors and seniors	92 (36.7%)
Total	251 (100%)
Gender	
Female	38 (15.1%)
Male	213 (84.9%)
Total	251 (100%)
Age	
Minimum	18
Maximum	28
Total	21.36

ME — Marine Engineering; MTE — Marine Transportation Engineering

The first section in the survey investigated participants' food selection and consumption behaviours. Answers by the participants revealed food cost as the main influencer (50.6%) in food selection of the individuals. 25.1% pointed out that they often settle for their families or friends' food choice. 18.7% of the participants did not think there were any major influencers in their food selection. Likewise, 48.2% of the participants noted that they do not discern between packaged or unpackaged foods. On the other hand, 41% indicated that they prefer packaged foods if there is any available. There weren't any observable significant differences in this section between class and department of students. Figures 1 and 2 show the distribution of these responses.

Table 2 shows the items that individuals pay attention (if available) before consuming food when they are on board. Answers revealed that majority of the participants (70.1%) check the expiration date of the food as the first item. Nearly half of the participants (49%) indicated that they pay attention to the brand of the food and 53.4% indicated that they check whether or not the package of the food is intact. On the contrary, only 16.3% stated that they inspect the storage conditions of the food. A worrisome finding showed that 84.9% of the participants do not check if there is a food related organisation's approval on packages. Even though the attention towards storage conditions was low among all participant groups, it is observed that ME students were significantly less interested than the MTE students in checking the storage conditions of the foods on board ($p < 0.05$). Another significant difference between groups was on the consideration of the food's brand. Experienced students were significantly less interested in the brand of the food than the freshmen and sophomore students ($p < 0.05$). In a similar manner, ME students were paying significantly less attention to the brand of the food than the MTE students when they are on board ($p < 0.05$). Ingredients and nutritional values of the foods were also significantly less important for the experienced students than the other groups ($p < 0.05$).

Table 3 summarises the answers to the questions that were designed to assess knowledge of food poisoning, food hygiene, high-risk food groups, and cross-contamination. Answers revealed that nearly all participants (98%) had knowledge that certain diseases can be transmitted through food. The overall knowledge of the students was rather limited on food handling and storing processes. Highest correct answer (64.9%) was on the effect of refrigeration on pathogens. Another relatively high correct answer (64.5%) was to the question of the symptoms of food poisoning. Most of the participants were unsuccessful to distinguish high-risk foods from relatively safe ones. Only 41.4% identified the favourable conditions for micro-organism multiplication in foods and only 21.5% recognised the cooked rice as a high-

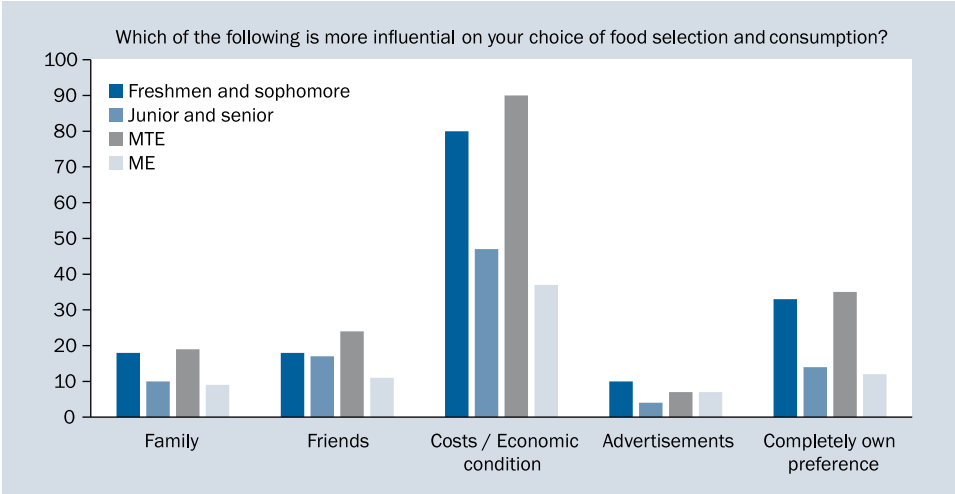

Figure 1. Main influencers in food selection; ME — Marine Engineering; MTE — Marine Transportation Engineering

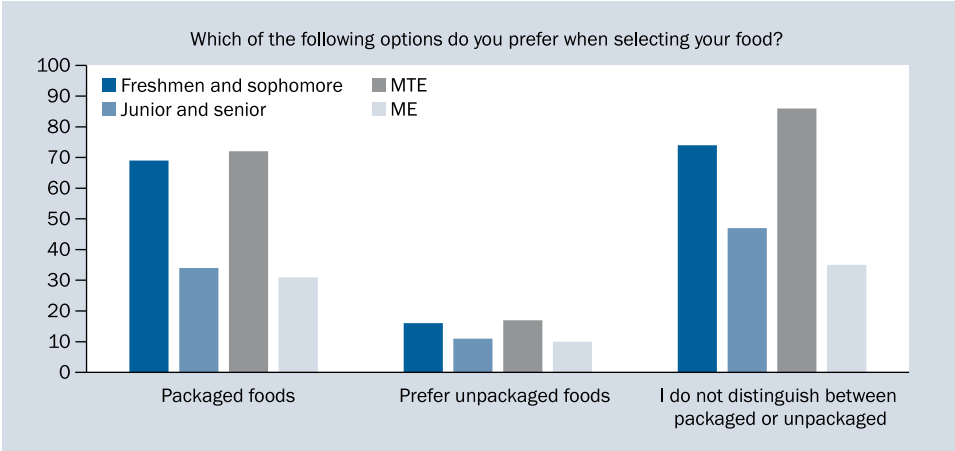

Figure 2. Packaged/unpackaged food preferences; ME — Marine Engineering; MTE — Marine Transportation Engineering

Table 2. Distribution of the points students pay attention to on packaged foods

Survey questions	Class		Department		Total
	Freshmen and sophomore	Junior and senior	MTE	ME	
What are the things you pay most attention to in packaged foods?	**Yes**	**Yes**	**Yes**	**Yes**	
Expiration date	70.4%	70.7%	73.1%	64.5%	70.1%
Whether the package is open or not	54.1	52.2	56.0%	47.4%	53.4%
Brand	**57.2%***	**35.9%***	**54.9%***	**36.8%***	49%
Ingredients	**40.3%***	**27.2%***	38.3%	28.9%	35.5%
Calorie value	23.3%	16.3%	23.5%	14.5%	20.7%
Nutritional values	**25.8%***	**10.9%***	**24.6%***	**10.5%***	20.3%
Storage conditions	17.6%	13.0%	**19.4%***	**7.9%***	16.3%
Related food organization's approval	15.1%	15.2%	16.0%	13.2%	15.1%
The place of production	10.7%	6.5%	**12.0%***	**2.6%***	9.2%
None of these	1.3%	1.1%	1.1%	1.3%	3.6%

*$p < 0.05$ significant differences between groups. ME — Marine Engineering; MTE — Marine Transportation Engineering

Table 3. Answers to food safety related knowledge questions

Questions	Correct answers	Wrong answers	'Do not know'
Do you think that diseases can be transmitted through food? *(yes*, no)*	**98%**	2%	–
Does refrigeration kill all the pathogens that may be present in food? *(no, but it preserves the food so that germs cannot multiply*; it just kills the germs that are vulnerable to low temperatures; yes, it kills all the germs; no, on the contrary, it facilitates their growth)*	**64.9%**	27.1%	8.0%
Which is a common symptom of food poisoning? *(headache, diarrhoea*, rash, constipation, do not know)*	**64.5%**	27.1%	8.4%
At body heat (37°C) what will food poisoning bacteria do? *(die, do not grow, grow quickly*, grow slowly)*	**51.8%**	17.5%	30.7%
Which foods are most favourable to micro-organism multiplication? *(those with the highest water content*, those with the lowest water content, very salty foods)*	**41.4%**	30.3%	28.3%
Is it appropriate to refreeze thawed food? *(not more than once, not more than 3 times, no never*, yes as many times as you'd like)*	**25.5%**	56.2%	18.3%
Hot food must be kept above which temperature? *(22°C, 47°C, 63°C*, 77°C)*	**22.3%**	30.7%	47.0%
Which of the following is most likely to cause food poisoning? *(prawn crackers, cooked rice*, plain naan bread, cheese and tomato pizza)*	**21.5%**	78.5%	0.0%
If food is contaminated with food poisoning bacteria, you can normally tell by? *(tasting, looking at, smelling, none of these*)*	**3.2%**	85.6%	11.2%

*Correct answers

-risk food when presented with other options. In addition to that, most of the students struggled with proper storage procedures for frozen foods (74.5%) and temperature control (78.5%).

Table 4 lists the questions and answers for food hygiene awareness and knowledge. Participants were asked general questions related to food hygiene such as high-risk activities that favour germ development and food contamination. In response to these; 74.5% responded that leaving the food at room temperature for a long time will favour germ development. In the opinion of 59.8% putting cooked food in contact with raw food did not lead to germ development. Personal and environmental hygiene was determined to be the main concern in all groups. Hence, hands handling the food (71.3%), personal hygiene (65.7%) and environmental hygiene (57.4%) were the most common answers. A significant difference between the MTE and ME students was observed regarding environmental hygiene. ME students thought the hygiene of the surroundings were less of a concern in food contamination ($p < 0.05$). Other significant differences were on the prevention of food contamination. ME students, as well as novice students, significantly favoured the effectiveness of freezing and cooking foods to avoid contamination ($p < 0.05$).

In addition to these questions, participants were asked to assess the main risk factors on merchant vessels regarding the foodborne diseases. It is revealed that 63.3% perceive the improper storage temperature of the foods as the main risk factor for disease transmission on board. Oddly enough, participants did not consider cross-contamination as a high-risk factor. Only 32.7% and 36.7%, respectively, believed the contamination of cooked food with raw food and contaminated utensils may create a disease risk. This ratio was significantly lower in ME students when it is compared with MTE students ($p < 0.05$). Instead, 48.2% of the participants considered poor hygiene of the food handler a greater risk. However, only 32.7% thought catering personnel carrying pathogens could factor a high-risk of disease transmission. Poor hygiene conditions of food handler were observed to be more concerning both for the MTE department and inexperienced students compared to ME department and experienced students ($p < 0.05$).

DISCUSSION

This study shows that the most important factor in food choice was the costs of the food and the economic status of the individual. Similar results were obtained in various studies regarding the food selection [8, 9]. However, a study conducted by Alpuguz et al. [21] found that these criteria (cost/economic condition) were the least important factors among the undergraduate students which contradict with our findings. The same study determined that the individual's own preferences were the most influencing factor in food choice. Own preference response is lower in our study compared to these findings. Regarding food selection, most of the participants indicated that they prefer packaged

Table 4. Distribution of food safety awareness and knowledge answers

Survey questions	Class		Department		Total
	Freshmen and sophomore	Junior and senior	MTE	ME	
	Yes	Yes	Yes	Yes	
In your opinion, which of the following activities favour the development of germs in food?					
Leaving the food at room temperature for a long time	78.6%	67.4%	**78.3%***	**65.8%***	74.5%
Putting cooked food in contact with raw food	43.4%	34.8%	41.1%	38.2%	40.2%
Reheating food at high temperatures	22.0%	20.7%	21.7%	21.1%	21.5%
Refrigerating food in large pots	20.8%	20.7%	19.4%	23.7%	20.7%
Consuming food immediately after cooking it	11.3%	9.8%	10.3%	11.8%	11.2%
Food get contaminated with microorganisms mainly through					
Hands handling food	75.5%	64.1%	73.1%	67.1%	71.3%
Food containers	56.6%	51.1%	57.1%	48.7%	54.6%
Air	57.2%	44.6%	56.0%	44.7%	52.6%
How can food contamination be avoided?					
Personal hygiene	69.2%	59.8%	68.6%	59.2%	65.7%
Environmental hygiene	59.7%	53.3%	**62.9%***	**44.7%***	57.4%
Separating cooked from uncooked foods	**56.6%***	**40.2%***	52.6%	46.1%	50.6%
Separating meat from vegetables	44.0%	34.8%	**47.4%***	**25.0%***	40.6%
Refrigeration	**48.4%***	**30.4%***	**47.4%***	**28.9%***	41.8%
Freezing	**47.2%***	**26.1%***	**45.7%***	**25.0%***	39.4%
Cooking	41.5%	29.3%	40.6%	28.9%	37.1%
In your opinion, what are the main risk factors for disease transmission through food on board?					
Improper storage temperature	64.8%	60.9%	65.1%	59.2%	63.3%
Poor hygiene of the person preparing/distributing food	**54.1%***	**38.0%***	**53.7%***	**35.5%***	48.2%
Improper cooking process;	46.5%	45.7%	45.1%	48.7%	46.2%
Uncertain origin of food	37.1%	34.8%	38.3%	31.6%	35.1%
Excessive time between the preparation and consumption of food	**42.8%***	**28.3%***	40.0%	31.6%	37.5%
Contaminated utensils	40.3%	29.3%	**41.7%***	**23.7%***	36.7%
Contamination of cooked food by raw food	36.5%	25.0%	35.4%	25.0%	32.7%
Pathogen-carrying catering personnel	35.8%	26.1%	34.9%	26.3%	32.7%

*$p < 0.05$ significant differences between groups. ME — Marine Engineering; MTE — Marine Transportation Engineering

foods. This finding is in line with the findings of Alpuguz et al. [21]. It should also be noted that elements individuals pay attention in food selection differ a lot. In the works of McArthur et al. [10] condition of the food package had a high rate of answer, yet in our study package condition observed to be less of a concern. We also found that some individuals do not distinguish packaged and unpackaged foods when selecting. Instead, it is revealed that undergraduate maritime students pay a great attention to the expiration date and package conditions of foods. This result is consistent and in line with other studies in the literature. Since our findings on food selection criteria seem to be both alike and different with several studies, it should be considered that there could be unsought factors (age, nationality, etc.) affecting the food selection of individuals. So these findings should be interpreted as circumstantial.

Most of our participants have knowledge that diseases can be transmitted through food. The correct response rate for this question is higher in this study than the study of Grappasonni et al. [4] where the correct answers rate was 76.5%. The rate of knowledge on the symptoms of foodborne diseases is very similar to findings of Low et al. [12]. However, this does not mean that seafarers possess the knowledge of foodborne diseases. In fact, Türkistanli and Sevgili [22] found that most of the seafarers were indeed aware of the foodborne diseases yet they often failed to

identify the characteristics and symptoms of these diseases. Probably the most worrisome finding is that participant's inability to tell the correct way to identify contaminated food. Most of them believed it is possible to tell if a food is contaminated by smelling it. However, it is not possible to tell whether a food is contaminated with for example *E. coli*. These findings on foodborne diseases are also supported with the fact of participant's incapability to identify high-risk foods. Such as, individuals lack knowledge that high-water content foods, such as cooked rice, are favourable to micro-organism multiplication. Similarly, participants lacked knowledge on the temperature control of the foods. It is also proved by other studies that temperature control and high-risk food groups are more known by food handlers [4, 20]. This should be accepted as reasonable since these students won't take roles as food handlers on board. Even so, knowledge about the high-risk food groups should be common knowledge for all individuals.

There are also few noteworthy findings on the knowledge of food storage processes. Correct answer rate for the effects of refrigeration process on pathogens is slightly higher in our study than the observed rates in the study of Grappasonni et al. [4]. On the contrary, seafarers and ashore personnel in the study of Grappasonni et al. [4] had higher correct answers for the micro-organism multiplication and thawed food questions. These findings compared; it can be said that our participants' knowledge of food storing conditions is below average.

Regarding the risky behaviours on board considering food hygiene, our findings show that maritime students have knowledge and awareness deficiencies. For instance, most students know that leaving foods at room temperature for a long time is a risky behaviour but most of them failed to notice that hot food refrigerated in large pots may possess a similar risk. It is determined that most of our participants were concerned with personal hygiene and environmental hygiene in food contamination. In addition, they believe the food handler's hygiene is more important than food storage and preparation process. A notable finding shows that our participants mostly ignore other factors that might result in food contamination, such as cross-contamination. Diseases like Salmonellosis are mostly transmitted from raw foods to cooked foods. So cross-contamination and food preparation are as much important as the hygiene of the food handler.

In general, foodborne outbreaks on board ships are caused by inadequate food temperature control, infected food handlers, contaminated raw ingredients and cross-contamination [6]. Even though the digestive and gastroenteral diseases constitute a small percentage of the causes of death among seafarers, it is important to keep these diseases under control to improve overall well-being of seafarers [23, 24]. For this reason, training in food hygiene during the education process of maritime students can be very beneficial which is also proposed by several other studies [10, 12, 15–17, 19].

CONCLUSIONS

Food hygiene appears to be an underrated problem on board, yet it is one of the major problems in the maritime industry threatening the health of seafarers. Food hygiene-related problems affect seafarers' health and overall well-being. Ways to treat food-related diseases are limited while the ship is underway without medical professionals on board. It is important to create an environment that favours avoidance and prevention from such diseases. Promoting food safety culture with food hygiene knowledge and awareness in maritime students could be a key factor towards this goal. We must aim to eliminate risky behaviours regarding food hygiene on board. This study highlights the shortcomings of maritime students regarding food safety. Further studies should consider examining maritime companies' rules and attitudes toward food hygiene on board. We believe the way to eliminate the food contaminations on merchant vessels can be achieved by training the whole crew. Development of standardised health and disease training for seafarers should also be considered.

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Acute respiratory tract infection symptoms and the uptake of dual influenza and pneumococcal vaccines among Hajj pilgrims

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ABSTRACT

Background: *Hajj pilgrims are encouraged to take influenza and pneumococcal vaccines prior to their travel to safeguard against acute respiratory tract infections (ARTIs). It is unclear whether dual immunisation with influenza and pneumococcal vaccines have had any impact on ARTI symptoms. To this end, we have examined the data of the last several years to assess whether combined influenza and pneumococcal vaccination has affected the rate of ARTI symptoms among Hajj pilgrims.*

Materials and methods: *Hajj pilgrims from United Kingdom, Australia, Saudi Arabia and Qatar who attended the congregation between 2005 and 2015 were included in this study. Data from surveillance studies or clinical trials involving Hajj pilgrims were used. In this analysis we have made use of the raw data to construct a trend line graph with the prevalence of combined cough and fever (as a proxy for ARTI) against the uptake of combined influenza and pneumococcal vaccines, and to estimate the relative risk (RR) of ARTI with 95% confidence interval (95% CI).*

Results: *Data of a pooled sample of 9350 pilgrims, aged 0.5–90 years with a male to female ratio of 1.1, were analysed. Although vaccination uptake did not rise significantly over the years, there was also no observed meaningful benefit of combined vaccination (RR = 1.1; 95% CI 0.8–1.4), the rates of ARTI symptoms demonstrated a decline over the last several years. The findings of this analysis highlight that the prevalence of 'cough and fever' among Hajj pilgrims is on decline but the uptake of combined influenza and pneumococcal vaccines remains unchanged over years, and the decline can not be attributed to dual influenza and pneumococcal vaccination.*

Conclusions: *Acute respiratory tract infections among Hajj pilgrims are decreasing, it is unclear if the reduction is due to vaccine uptake, but the data and analysis have some limitations.*

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Key words: acute respiratory tract infection, Hajj, influenza vaccine, mass gathering, pneumococcal vaccine

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INTRODUCTION

Hajj is the largest annual religious mass gathering (MG) in which 2 to 3 million people assemble from different parts of the world in Makkah, the holiest city of Islam in the Kingdom of Saudi Arabia [1]. This event is spiritually significant for Muslims, being one of the five basic tenets of Islam and is found to increase belief in the quality and harmony among ethnic groups [2]. For over fourteen centuries, following the tradition of patriarch Abraham, Muslims from all corners of the world have been congregating in Makkah on specific dates of the 'Hajj month', the last month of the Arabic calendar [3]. Adult Muslims who are capable, both financially and physically, consider it a mandatory part of their religious duty to perform Hajj at least once in lifetime.

In this annual MG of more than two million people, the risk of communicable diseases is high [4]. Several large intercontinental outbreaks of infectious diseases have been linked to Hajj attendance [3–5]. Vaccinations against certain infections are routinely recommended for Hajj pilgrims, tour group officials, volunteers, healthcare workers, para-troops and seasonal workers [6]. Vaccination against four meningococcal serogroups (A, C, W, and Y) is mandatory for all Hajj pilgrims and the local residents of pilgrimage sites [7]. Following the vaccination policy, the incidence of the laboratory-confirmed meningococcal disease has declined significantly not only among pilgrims but also among residents [8]. Acute respiratory tract infections (ARTIs) can be caused by bacteria (e.g., *Streptococcus pneumoniae*), viruses (e.g., influenza) and other microbes. Children, elderly and individuals with lung and heart diseases, or other pre-existing medical conditions are at a higher risk of suffering from ARTIs. The risk of ARTIs, viral or bacterial, amplifies several times at Hajj [9]. In fact ARTIs are the leading causes of hospital attendance and admission among Hajj pilgrims [10]. Influenza and pneumococcal vaccines are viewed as the key preventive measures against these potentially serious diseases [11, 12]. The role of seasonal influenza vaccination in Hajj pilgrims is established [13, 14], but the role of combined influenza and pneumococcal vaccination in reducing ARTIs has not been assessed in a sufficiently large sample. To this end, we have examined the data of the last several Hajj years to assess whether dual influenza and pneumococcal vaccination has had any effect on the rate of ARTI among Hajj pilgrims.

Thus, the objectives of this study are to examine the frequency of ARTI symptoms and the uptake of influenza and pneumococcal vaccines among Hajj pilgrims, and to evaluate the effect of dual influenza and pneumococcal vaccination on ARTIs among Hajj pilgrims.

MATERIALS AND METHODS

DATA SYNTHESIS

The dataset used here comes from a database held by the senior authors of this publication at the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, The Children's Hospital at Westmead, New South Wales, Australia). The database contains data from various surveys, surveillance studies and clinical trials involving Hajj pilgrims from Qatar, Saudi Arabia, Australia and United Kingdom conducted between 2005 and 2017. In the database, data for some years were incomplete or absent for this analysis. For instance, no, or only partial data (for this analysis) were available for the years 2006, 2008–2010, 2016 and 2017. For the pandemic year (2009), the data were retrieved from a published study [15], which provided data on participant demographics, uptake rate of influenza and pneumococcal vaccines, and prevalence of cough and fever symptoms. The study types, participant nationalities and Hajj years of the studies from where data have been used for this analysis are summarised in Figure 1.

Individual subject data for the included years 2005, 2007 and 2011–2015 were imported and combined in

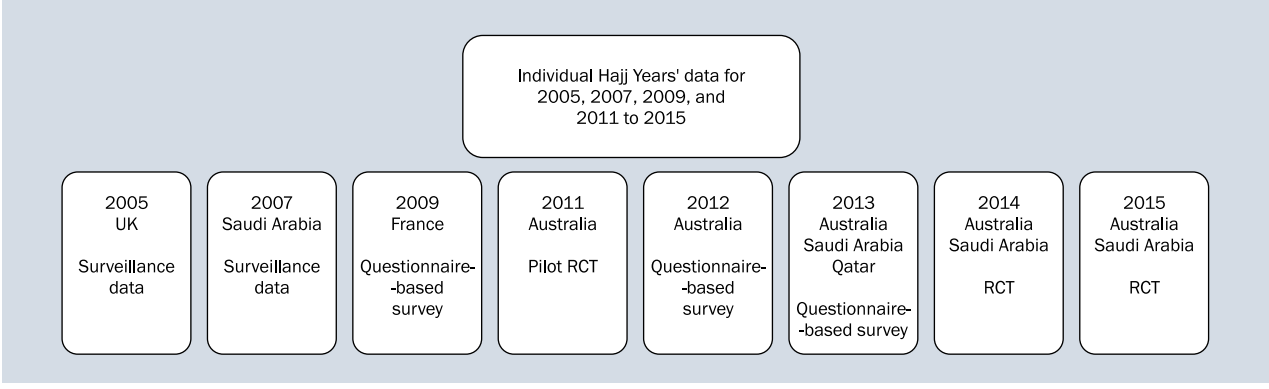

Figure 1. Studies from where individual subject data were collected for this analysis; RCT — randomised controlled trial

a MS Excel sheet for analysis. ARTI was defined as a combination of 'cough and fever'; such a definition was chosen because it contains a symptom of the lower respiratory tract (i.e., cough) and a constitutional symptom (i.e., fever) and covers two of the key symptoms produced by both influenza and pneumococcus. The rates of combined cough and fever (as proxy for ARTI) were plotted against the uptake rates of combined influenza and pneumococcal vaccines to construct a trend line graph. The relative risk (RR) of acquisition of ARTI among vaccinated versus unvaccinated pilgrims was estimated for each year with 95% confidence interval (95% CI) and finally for the pooled data. 'At risk' pilgrims were defined as those who were aged ≥ 65 years and/or had pre-existing medical conditions including heart, lung, kidney, liver, and neurological conditions and persons who were immunocompromised, including those with HIV infection, malignancy, functional or anatomical asplenia (which includes sickle cell disease, other haemoglobinopathies, congenital or acquired asplenia, splenic dysfunction), or chronic steroid users.

ETHICS APPROVAL

Ethical approval for the years 2013–2015 was obtained in Saudi Arabia from the Institutional Review Board (IRB) of King Abdullah Medical City, Makkah, (IRB Reference No: 15-205), in Australia from the Hunter New England Human Research Ethics Committee (HNEHREC Reference No: 13/07/17/3.04), and in Qatar from the Joint Institutional Review Board of Hamad Medical Corporation/Weill Cornell Medical College (JIRB Reference No: 13-00039). Ethics approvals for the other years were obtained from appropriate authorities in the UK (Reference No: MREC 02/2/12), Saudi Arabia (Reference No: KACST: H-01-R-012) and Australia (HREC Reference No: 11/SCHN/162).

RESULTS

The pooled sample size was 9350; in individual years or studies, the sample size varied considerably from 164 to 4428 (Table 1). The pilgrims' age ranged between 0.5 years and 95 years with comparable age range across the studies. Median ages across individual studies fell within the age band of 34–49 years. In the pooled sample male to female ratio was 1.1, but the ratio varied considerably across the years: males outnumbered females in the years 2005, 2007, 2012, and 2013, whereas in the remaining years females outnumbered males (Table 1). Overall, 19.2% of pilgrims were 'at risk', but this proportion varied from 12.8% in 2013 to 27.8% in 2005.

The uptake of combined influenza and pneumococcal vaccines ranged from 0.32% in 2007 to 24.4% in 2012, with the mean of 13.8% in the pooled sample with no significant trend of change (R^2 = 0.5), but the rate of ARTI (i.e., combined cough and fever) ranged from 2.2% in 2014 and 2.9% in 2015 to 46.3% in 2005 with the mean rate of 5.3% in the pooled sample and showed an overall declining trend (R^2 = 0.8) (Fig. 2). However, when the prevalence of ARTIs was computed against the uptake of vaccination, the RR showed a high variability from being ineffective in 2011 (RR 1.9, 95% CI 1.1–3.17) and 2014 (HR 2.2, 95% CI 1.1–4.5) to being effective in 2009 (RR 0.2, 95% CI 0.06–0.73), in the other years no significant effectiveness (or ineffectiveness) of vaccination was observed, and in the pooled sample vaccination was not effective (RR 1.1, 95% CI 0.8–1.4) (Table 1).

DISCUSSION

The findings of this analysis highlight that the prevalence of 'cough and fever' among Hajj pilgrims is on decline but the uptake of combined influenza and pneumococcal vaccines remains unchanged over years (Fig. 2), and the decline can not be attributed to dual vaccination (RR = 1.1, 95% CI 0.8–1.4).

The decline in the prevalence of cough and fever symptoms could be purely because of influenza vaccination as was seen in previous analyses, including a meta-analysis of six studies (RR 0.56, 95% CI 0.41–0.75, $p < 0.001$) [13, 14, 16], or because of overall improvement in infection control programmes [17], or because of change in Hajj seasons from colder months a decade ago to warmer months in recent years, or it just could be an inexplicable chance finding.

Although no protective effect of dual influenza and pneumococcal vaccination was observed in this analysis, benefit of dual vaccination was noted in a cohort study involving 295 Iranian pilgrims during the Hajj 2005 when a significant reduction in the duration of cough, by almost 6 days, was noticed compared to no vaccination ($p < 0.01$) [18]. Beneficial effect was also noted in the French study included in this synthesis where fever was less frequently reported in pilgrims who were vaccinated against pneumococcal disease (plus influenza) (8.3% vs. 14.6%; RR = 0.22, 95% CI 0.06–0.73) [15].

Lack of apparent benefit of dual influenza and pneumococcal vaccination against ARTI may have stemmed from several reasons: a) in our analysis 'cough' and 'fever' have been used a proxy for ARTIs but those two symptoms may represent an array of respiratory and non-respiratory conditions not just influenza and pneumonia; b) only a small proportion of pilgrims (13.8%) received both vaccines, this small vaccination rate may not have a discernible impact on two common respiratory symptoms; c) the pneumococcal vaccine used here is a 23-valent polysaccharide vaccine which is primarily used to protect against invasive pneumococcal disease not necessarily pneumococcal pneumonia [19]. Systematic reviews of studies involving non-Hajj settings consistently showed that dual influenza

Table 1. Summary of the included raw data

	Hajj year								
	2005	**2007**	**2009**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
1st day of Hajj	19th January	18th December	25th November	4th November	24th October	13th October	3rd October	22nd October	
Country	United Kingdom	Saudi Arabia	France	Australia	Australia	Australia, Saudi Arabia and Qatar	Australia and Saudi Arabia	Australia and Saudi Arabia	All included countries
Sample size	205	312	274	164	553	1180	2234	4428	9350
Male Female	9.3 1	1.3 1	1.1 1	1 1.3	1.8 1	1.9 1	1 1.4	1 1	1.1 1
Age range [years] (median)	01–83 (43)	0.5–90 (45.25)	23–83 (mean 58)	17–80 (48.9)	12–82 (47.4)	18–95 (36)	18–95 (34)	18–88 (36)	0.5–95
At risk pilgrims	57 (27.8%)	50 (16%)	135 (49.3%)	36 (22%)	103 (18.6%)	151 (12.8%)	353 (15.8%)	948 (21.4%)	2151 (23%)
Flu vaccine uptake	56 (27.3%)	22 (7.1%)	267 (97.4%)	111 (67.7%)	488 (88.3%)	242 (20.5%)	936 (41.9%)	2638 (59.6%)	4760 (51.2%)
Pneumococcal vaccine uptake	10 (4.9%)	1 (0.3%)	86 (31.4%)	46 (28.1%)	149 (26.9%)	67 (5.7%)	275 (12.3%)	535 (12.1%)	1169 (15.2%)
Flu and pneumococcal vaccine uptake	7 (3.4%)	1 (0.3%)	86 (31.4%)#	40 (24.4%)	135 (24.4%)	37 (3.1%)	203 (9.1%)	411 (9.3%)	920 (13.8%)
Fever*	8	132	30	57	57	N/A	N/A	N/A	284
Cough*	51	175	133	78	191	N/A	N/A	N/A	637
ARTI	95 (46.3%)	78 (25%)	30 (10.9%)†	44 (26.8%)	41 (7.4%)	35 (3%)	49 (2.2%)	124 (2.8%)	496 (5.3%)
RR (95% CI)	0.6 (0.1–2.0)	0.9 (0.1–11.0)	0.2 (0.06–0.73)	1.9 (1.1–3.17)	0.8 (0.4–1.7)	0.9 (0.1–6.4)	2.2 (1.1–4.5)	0.9 (0.5–1.7)	1.1 (0.8–1.4)

*For the Hajj 2013, 2014 and 2015, the data have been derived from a cluster randomised controlled trial; data on individual symptom (e.g., cough and fever) were not available, but data on combined 'fever and cough' were.
#In this study 97.4% were vaccinated against seasonal flu plus 5.8% against A(H1N1)pdm09, and 31.4% against pneumococcus. It was not mentioned precisely how many received both flu and pneumococcal vaccines. So we considered that all (100%) received flu vaccine, and the uptake of combined flu and pneumococcal vaccine was estimated to be 31.4%.
†It was estimated that of all those who complained of subjective fever, 10.9% had also cough, and 8% had a triad of cough, sore throat and fever.
ARTI — acute respiratory tract infections; N/A — not available; RR — relative risk

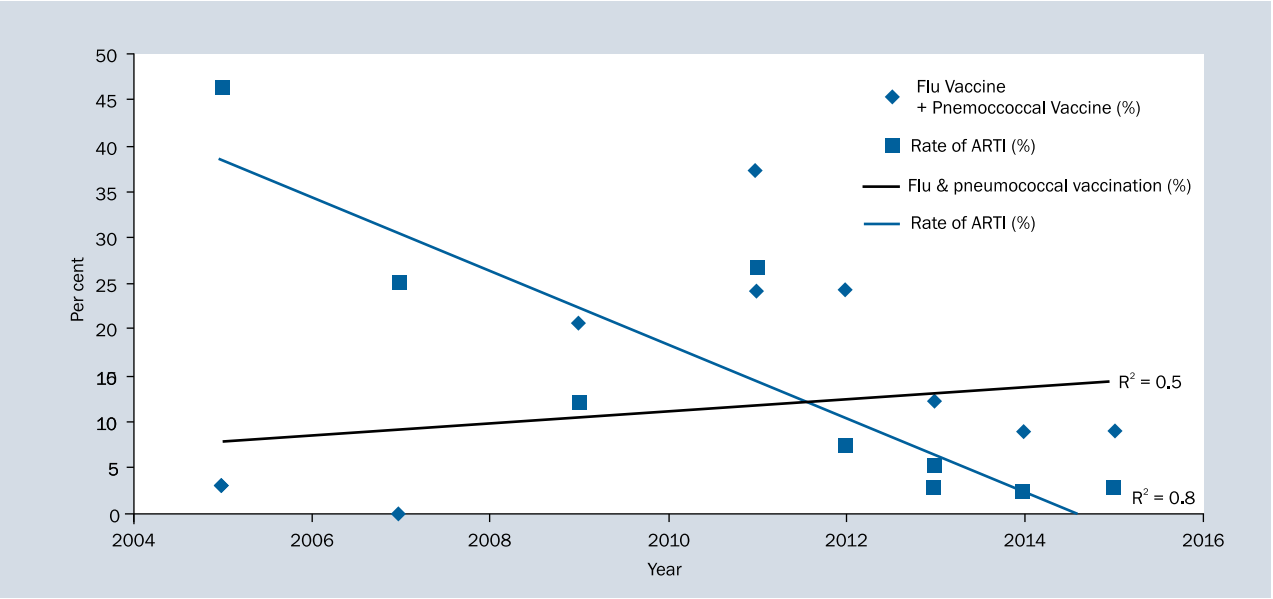

Figure 2. Line diagram showing the prevalence of cough and fever (proxy for acute respiratory tract infections [ARTIs]) against the uptake of combined influenza and pneumococcal vaccines among Hajj pilgrims (the vaccination rate did not increase significantly, however, the prevalence of cough and fever decreased)

and pneumococcal vaccination is associated with a significantly lower pneumonia rate and significantly lower pneumonia-associated mortality than influenza vaccination alone [20, 21]. No apparent effect of combined influenza and pneumonia vaccines among Hajj pilgrims observed in this analysis, compared to significant effect of influenza vaccine alone observed in other analyses, brings this synthesis into question. Despite this non-conclusive finding vaccinations are highly desirable. Serious epidemics such as the outbreaks of meningococcal group A in 1987 and then group W in 2000–2001 have been brought under control by mandatory vaccinations [5, 22], actually the effect was so sustained that the mean annual meningococcal disease rates decreased from 0.20 cases/100,000 in pre-epidemic era to 0.06 cases/100,000 in post-epidemic period and mean numbers of Hajj-related cases from 13 to 2 cases/year ($p < 0.01$) [8].

In this analysis the uptake of combined influenza and pneumococcal vaccines among Hajj pilgrims was poor. Recommendation of these vaccines for pilgrims also varies while the routine use of influenza vaccination is considered very important (even mandatory by some authorities) [11], pneumococcal vaccine is primarily considered for 'at risk' pilgrims [12, 23]. Hence individually, even though influenza vaccination rate has increased over the years in pilgrims from resource-rich countries [13, 24, 25], the uptake of pneumococcal vaccine remains suboptimal [26, 27]. Lack of awareness about the availability of the vaccines was the main reason for non-receipt of pneumococcal vaccine [28].

It is surprisingly disappointing to note that in 2 years (2011 and 2014), receipt of influenza and pneumococcal vaccines was associated with a significant risk of ARTIs (Table 1). The reason for this paradoxical finding is unclear but the analysis has major limitations. First: smaller sample sizes in some years (e.g., in 2011 and 2005) are significant limitations. Data are unavailable for the years 2006, 2008, 2009, 2010, 2016 and 2017, and the 2009 data have been obtained from a published study where the definition of ARTI has deviated slightly from the rest of the analysis [15]. The constructed trend line, therefore, would not represent the real effect of vaccinations on ARTI. Furthermore, some data generated from clinical trials that examined the effect of an intervention (e.g., facemask) [29, 30], so the observed effect (decline in ARTI prevalence) could also be attributed to the effect of those interventions.

Second: there are variations in the participants' gender in the studied sample; it was skewed towards male gender in some years (2005, 2007, 2012, and 2013) and towards female in the other years. However, this variation was buffered in the pooled sample where female to male ratio was close to one.

Third: although pneumococcal vaccine is mostly recommended for Hajj pilgrims aged ≥ 65 years and individuals with pre-existing medical conditions [12], this analysis encompassed individuals of all age groups and irrespective of risk conditions; therefore, does not indicate a true relationship between pneumococcal vaccination and ARTI.

Fourth: ARTI was defined by a presence of cough and subjective fever. These symptoms could be caused by

viruses and bacterial infections besides influenza and pneumococci; sensitivity and specificity of this definition may not be optimum.

Fifth: vaccination data are subject to recall bias since the data were obtained by asking pilgrims about their vaccination history, not from their medical or vaccination records. This affects the validity of the data.

Sixth: the original studies from where these data were obtained differed widely in their designs (i.e., surveillance data, questionnaire-based survey, pilot clinical trial, and randomised controlled trial). This variation may have affected the quality of the aggregated data.

Seventh: the last 2 years (2014, 2015) disproportionately represented a large proportion (73.4%) of the pooled data skewing the results.

Finally, the studies were conducted in different seasons involving varying populations with varying health behaviours, nutritional status, immunity and background pre-existing illnesses compromising the homogeneity of the data and quality of the synthesis.

Despite these limitations, there are a couple of unique strengths of this study. This is the first ever analysis of dual influenza and pneumococcal vaccination among Hajj pilgrims with a relatively large sample of over 9000 pilgrims, and a large part of the data have been taken from meticulously conducted clinical trials (2013–2015, and 2011).

The pneumococcal vaccine studied here is a 23-valent polysaccharide vaccine, currently conjugate pneumococcal vaccines of different valencies covering 7, 10 and 13 serotypes are available [31]. The effectiveness of the newer conjugate vaccines against ARTI among Hajj pilgrims remains unclear at this stage but the significant burden of pneumococcal disease at Hajj means that such vaccines will make a difference [32].

CONCLUSIONS

The risk of ARTI against the uptake of influenza and pneumococcal vaccines among Hajj pilgrims is still unclear. The coverage of these vaccines together is very low, but the prevalence of 'cough and fever' seems to have declined in the last several years. The data and their synthesis have limitations, so it is not known whether the decline in prevalence is due to slight (non-significant) increase in vaccine coverage or because of other factors. Further studies with more validated and homogenous data are needed to dispel the myth.

CONFLICT OF INTEREST

Harunor Rashid has received fees from Pfizer, Sanofi and Novartis for consulting or serving on an advisory board. The other authors have no competing interests to declare.

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The older traveller

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ABSTRACT

All over the world there has been a sudden increase in the number of international travels, mostly for touristic purposes. According to the World Tourism Organisation, the number of international journeys exceeded 1.323 billion in 2017 and it continues to grow. Of the growing number of travellers more and more are the elderly (> 65 years), this fact can be attributed to longer life expectancy and a better quality of life, especially in the developed countries. The article lists the main destinations chosen by senior tourists and their reasons for travel, it also discusses physiological changes in organs and systems affecting the elderly, which are the result of travelling across time zones and to areas with different environment. The article looks at various groups of patients affected by chronic diseases and examines health-related consequences of travel, including the most common complications. The general health prevention measures, with emphasis on vaccinations and antimalarial chemoprophylaxis, have also been discussed.

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Key words: older traveller, travel-related disease, health prevention

INTRODUCTION

The number of travelling older adults (> 65 years) is increasing every year, in keeping with growing numbers of travellers at all ages. According to the World Tourism Organisation [1], the number of international tourist arrivals reached 1.323 billion in 2017 and continues to grow. It is widely known that the population worldwide is getting older. Indeed, 8.7% of the world population is 65 and above [2]. One of the reasons for this is that in high-income countries live expectancy has been steadily increasing for decades [3]. According to European Commission statistics, live expectancy at birth in the European Union is estimated at 83.6 years for women and 78.2 for men [4]. In the study performed by Kontis et al. [3], projections show continued increases in longevity in 35 industrialised countries. The number of elderly travellers is constantly growing not only because of the increased live expectancy, but also due to the improvement of the quality of life and of medical technology, significantly higher income, relatively few obligations and a longer time spent in retirement [5–7]. Normal aging is associated with physiological changes affecting all systems, especially the cardiovascular, respiratory, gastrointestinal, dermal, renal, endocrine, and musculoskeletal [8]. Therefore, elderly people are at an increased risk of negative effects associated with their underlying medical conditions and medications they receive [9]. Concomitantly, physiological changes put older travellers at a much higher risk of travel-associated infections and complications compared with younger patients [10]. For this reason, the effects of aging and physiological changes associated with this process are particularly important while discussing travel-related diseases. As international travels have become increasingly available to larger groups of travellers, elderly individuals now represent an increasing proportion of patients with travel-associated diseases [11]. Furthermore, as the number of elderly travellers is constantly growing, there may be an increase in the number of elderly patients who seek pre-travel counselling [10].

EPIDEMIOLOGY

It is estimated that 15–30% of the total number of international travellers are people aged 60 years or more [11]. According to European Commission statistics, 48.8% of European Union citizens aged 65 and over took part in international and domestic travels in 2015. The number

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of elderly travellers differed between European countries and ranged between 83.7% in Denmark and only 11.0% in Bulgaria [12]. In the study performed by Gautret et al. [11], 49.1% of tourists aged 60 years and over were from Europe, 36.4% from North America and 6.7% from Asia. Destinations chosen by senior travellers are also important; travel to developing countries has become increasingly popular. In the study by Gautret et al. [11], 47.1% of elderly travellers have chosen Asia as their travel destination, 21.9% went to Africa, 16.5% to Latin America and only 7.7% to Europe and 2.4% to North America. In another study performed by Alon et al. [13], 53.1% of elderly travellers went to East Asia, 30.3% to South America and 14.6% to Africa. In comparison, in the Swiss study [5] the main destination were the tropical countries in South America. The other important issues to consider are the travel mode and conditions. The majority of senior travellers opted for organised tours (61.4%); however, 10.4% of them backpacked [13]. According to Jaeger et al. [5], 8.1% travelled on a low budget. Regardless of age, visiting South-East Asia and travel under basic conditions is associated with a higher risk of acquiring travel-related diseases [13]. What is more, there is a relationship between nationality and the travel destination choice. For elderly European travellers security is the priority, for Americans — it is comfort, for Canadians — entertainment and for Japanese seniors — health and safety [6]. The median travel duration is generally shorter in the elderly compared to younger travellers [11]. The group of older patients complied better with malaria chemoprophylaxis and dietary restrictions. Drinking and eating habits were also different between younger and older tourists. Only 16.2% of elderly travellers ate food from street vendors, compared to 37.9% of the younger travellers. No more than 8% of elderly travellers admitted drinking tap water, while among the younger travellers the figures were 35% [13]. In the study performed by Gautret et al. [11], the main reason for journey for 66.3% of 7034 travellers aged 60 years and older was tourism. Other common reasons for travel in this group were: business (16.7%), missionary, volunteer, research or aid work (8.5%), and visiting friends and relatives (8.0%). In the study carried out by Jaeger et al. [5], the main reasons included: tourism (87%), visiting friends and relatives (7.3%), and business (3.1%). The most popular activities among senior travellers during their trips are: going on city tours, visiting historic places, eating out and shopping, while they are generally not interested in water sports, sunbathing, camping or hiking [6]. Some of the elderly travellers perceive retirement as an opportunity to travel without any pressure. They can spend more time at a given destination and get to know it better [7]. Contrary to other age groups, 48% of elderly people indicated health as one of the main reasons not to travel [14]. According to Sundling et al. [15], health was the main obstacle to railway travel only for patients with low functional ability, whereas older travellers with high functional ability put costs and poor punctuality as the main obstacle to travelling more often. On the other hand, some elderly people who used to travel a lot as part of their job perceive retirement as an opportunity to travel less [7].

AGE-RELATED PHYSIOLOGICAL CHANGES AND THEIR CONSEQUENCES

CARDIOVASCULAR SYSTEM

Age is the greatest risk factor for cardiovascular disease [16]. There is a general tendency for the cardiac output to decline and systolic hypertension is much more likely to occur in this group of patients. Another problem of geriatric patients is arteriosclerosis. Stiffening, fibrosis and incremental accumulation of phosphate and calcium occur during the aging process [8, 9]. Arteriosclerosis is the leading cause of coronary artery disease (CAD) [17], whereas age and hypertension are significant risk factors [8, 17]. Cardiovascular events are a common cause of in-flight medical emergencies, with exacerbations in CAD being one of the main incidences. Some diseases, e.g. mild and treated appropriately stable chronic angina and stable heart failure or controlled systemic hypertension are not contraindications to flying. What is more, it is even possible to fly 1 week after uncomplicated myocardial infarction or 5 days after uncomplicated percutaneous coronary intervention. However, patients with severe heart failure (New York Heart Association IV) or those with unstable angina are not recommended to travel by air. Individuals with moderate to severe systolic pulmonary hypertension (higher than 60) may need supplementary oxygen. Another important issue is venous thromboembolism. The hazard is higher in patients with pre-existing risk factors, e.g. older age, malignancy, obesity, recent surgeries, inherited or acquired thrombophilia, polycythaemia or oestrogen therapy [10, 18]. As pointed out by Lee et al. [10] patients at the highest risk of venous thromboembolism may benefit from well fitted medical compression stockings and subcutaneous enoxaparin administered before and 1 day after air travel if the journey lasts more than 3 hours.

RESPIRATORY SYSTEM

Aging-related changes in the respiratory system, including a decrease in vital capacity, an increase in residual volume, a reduction amount of protective mucous, impaired cough reflex, insufficient production of Ig A may all have a negative effect on elderly travellers [8, 9]. According to Guatret et al. [11], 14.6% of travellers aged 60 and over had a respiratory tract infection, ranked as the second most common complaint in this group of patients. Even

though elderly travellers present less frequently with upper respiratory tract infections, they are at a higher risk of developing lower respiratory tract infections, e.g. pneumonia and bronchitis. Therefore, preventive measures against respiratory infections are particularly important for older adults [11, 13]. Another problem is hypobaric hypoxemia induced by high altitude and a poorer ventilatory response to hypoxia compared with younger patients, which may lead to exacerbation of underlying pulmonary diseases [10, 19]. Lee et al. [10] suggest that for this reason geriatric patients with certain chronic (e.g. chronic obstructive pulmonary disease) or acute (e.g. pneumonia) medical problems should contact a clinician prior to travel to assess the risk of exacerbation. It is also essential to contact the airline before travel in the event that supplemental oxygen is required. In addition, older age may be a risk factor for developing high-altitude illness.

GASTROINTESTINAL SYSTEM

Changes in the gastrointestinal system occur with advancing age, but they are moderate and minimally impact function of organs in the elderly patients [9]. As pointed out by Grassi et al. [20], no digestive diseases are seen only in geriatric patients, but compared with younger persons the prevalence of functional disorders affecting gastrointestinal system is significantly higher in the elderly. Changes in the aging gastrointestinal tract include decreased saliva production, generalized slowing of peristalsis, reduced pepsin, bicarbonate and pancreatic enzymes (lipase, chymotrypsin, amylase) secretions, decreased biodiversity and endangered stability of the intestinal microbiota [8, 9, 21]. Some of these changes, like reduced gastric motility and a decline in bicarbonate and prostaglandin production, may raise the risk of adverse drug events. Slowed peristalsis in the small and large intestine put older people at a higher risk for constipation [9]. On the other hand, many of the elderly people have special risk factors for developing travellers' diarrhoea, e.g. diabetes and taking histamine-blockers or proton pump inhibitors, resulting in a reduction of the host defence of gastric acidity [13, 22]. There is also a higher probability of developing complications of travellers' diarrhoea in this group of patients [22].

IMMUNE SYSTEM

One of the most noticeable changes associated with the immune system ageing is thymic involution, which results in a decreased output of mature T cells. B cells immune response is also impaired due to age related changes [5, 10]. As a result, the immunity conferred through vaccinations received in the past may become impaired, a response to more recently received vaccines may be decreased and the duration of immunity is generally shorter. Also noteworthy are the changes in cytokine production, including lower level of Th1 cytokines (IL-12 and IFN-G) and an increased production of Th2 cytokines (IL-10 and TGF-B) [23]. Due to the dysfunction of the immune system elderly patients are more susceptible to infections, e.g. cosmopolitan diseases like pneumonia as well as travel-associated illnesses, e.g. malaria [5, 24].

SKIN

Changes in the skin are the most visible signs of ageing. They are especially pronounced in the uncovered parts of the body: the face, neck, upper part of the chest, hands and forearms, and result in the alteration of people's physical appearance [8, 9]. Apart from the aesthetic aspect, skin ageing may have a negative effect on skin function and therefore it is more than barely a cosmetic problem [9, 25]. The degenerative changes that occur with age include a decrease in the amount of collagen, elastin, connective tissue and fat [9, 25, 26]. Clinical presentations of age-related skin degeneration may indeed be very serious and may even manifest as basal and squamous cell carcinoma and malignant melanoma [25]. Due to a decrease in melanocytes, skin is easily damaged by exposure to the sun, and so elderly travellers become increasingly vulnerable to the UV light [9, 26]. Therefore, it is crucial for the elderly to remember about adequate skin protection, especially while travelling to sunny destinations.

MUSCULOSKELETAL SYSTEM

Ageing is associated with natural changes in body composition. Fat mass increases while muscle mass and total body water decreases. These changes are responsible for reduce muscle strength and growing muscle fatigue in elderly people [9, 27]. Another common problem of geriatric patients is osteoporosis, which may result in bone fractures [8]. All of that put elderly people at higher risk for falls, especially as travellers visit unfamiliar destinations [9, 10].

POLYPHARMACY

Another problem of the elderly is polypharmacy due to multimorbidity, as one or more medications can be used to treat single disease [28]. Although polypharmacy is not consistently defined in the literature, it is usually explained as taking 5–6 medications daily [29]. As Masnoon et al. [28] pointed out, numerical only definition is the most popular, but even the numerical definitions vary to a large extent; some define polypharmacy as the use of two or more drugs concurrently while others as the use of above 11 medications at the same time. There are also other ways to explain polypharmacy, e.g. definitions which take into account both the number of medicines taken and also the length of therapy or treatment setting, as well as descriptive definitions.

Differences in the understanding of the term 'polypharmacy' may be the reason why its prevalence varied a great deal between different studies. Kim et al. [29], in South Korea, reported that polypharmacy was found in 86.4% of elderly patients, whereas in the Finnish study performed by Jyrkkä et al. [30], polypharmacy was only seen in 33% of patients. It is important to note that the use of medications can impact morbidity and quality of life and taking multiple of drugs may have many negative consequences [31, 32]. Polypharmacy has been associated with increased risk of adverse drug events, medication non-adherence or drug-interactions [32]. According to Doan et al. [33], the risk of drug–drug interactions increase with the number of medicaments taken: when a patient is taking 5–9 drugs daily, it is estimated at 50%, and in patients taking 20 or more medications, the risk increases to 100%. It is essential to remember about potential drug interactions that may occur during travel [22]. Drug–drug interactions between antibiotics used for empiric therapy of travellers' diarrhoea, antimalarials used for chemoprophylaxis, altitude illness prevention drugs and other common medications prescribed to the elderly should be considered prior to travel [10, 22]. Another important issue is that many elderly travellers fail to take prescribed drugs, especially diuretics during travel [26], and leave their emergency or routine medications at home [19].

MOST COMMON TRAVEL-ASSOCIATED DISEASES

ARTHROPOD-BORNE DISEASES

Malaria is one of the most widespread infectious diseases in the world. It is a mosquito-borne disease caused by five species of protozoa that belong to the *Plasmodium* genus*: P. falciparum, P. vivax, P. ovale, P. malariae* and *P. knowlesi.* According to the World Health Organisation (WHO), there were 216 million registered malaria cases and 445 thousand deaths in 2016 [34]. In an observational study that analyse the trends in the prevalence of imported malaria in London [35], of a total of 15,473 cases reported between 2000 and 2004, 5.9% were seen in patients older than 60 years; between 2005 and 2009 the prevalence of malaria in this group reached 7.7% and between 2010 and 2014 — 8.7%. In the study performed by Allen et al. [36], 5.9% of the cases reported between 2002 and 2012 were found in patients aged 65 years or older. Travellers coming from non-endemic countries visiting endemic regions are at a particularly high risk for malaria acquisition, the mortality rates associated with malaria are also higher in this group of travellers [37]. What is more, because of physiological changes and multimorbidity elderly travellers are at an increased risk of serious complications of malaria and other travel-related diseases [36]. A questionnaire-based survey carried out at Amsterdam Airport Schiphol showed that travellers aged 60 and over are at a similar risk of malaria as younger persons [38]; however according to Checkley et al. [39], patients over the age of 65 are approximately 10 times more likely to die from malaria in comparison with younger patients. Also, Allen et al. [36] found that the length of hospital stay (LOS) increases with age — the median LOS was 8 days for the elderly compared to a median LOS of 3 days in younger groups. While the median time from consultation to diagnosis was 2 days and ranged between 0 and 35 days resulting in a delay of treatment initiation. It is essential to note that age, delayed diagnosis and a delay in treatment initiation are significant risk factors for fatal malaria. Therefore it is important to take patient's history very carefully, especially if a returned traveller presents with fever — this can facilitate early diagnosis, improve clinical outcomes and decrease morbidity and mortality. However, due to multiple comorbidities presenting features vary with age, so the identification of imported infection may be challenging [36].

Dengue is a disease caused by any one of the four related viruses and is transmitted by mosquitoes. According to the WHO [40], 390 million dengue infections occur every year. Dengue virus causes a wide variety of diseases from a self-limiting febrile illness — dengue fever to a severe, life-threatening diseases known as dengue haemorrhagic fever (DHF) or dengue shock syndrome (DSS). DHF and DSS usually affect children living in endemic areas and infrequently adults, especially travellers [41]. In the study performed by Rowe et al. [42], 4.4% of the 6989 cases were found in patients aged 60 or older, although in other studies the prevalence of dengue in patients older than 65 years ranged between 4.2% and 8.7% [43, 44]. Although the number of cases in the elderly is relatively low, a Taiwanese study showed that 69.9% of all patients hospitalised for dengue and 85.3% of dengue patients admitted to intensive care units were over 60 [45]. Compared with younger patients, the classical symptoms including a headache, rash, pain are less common in the elderly. Despite this fact, the time from consultation to dengue diagnosis was similar in the two groups. It is important to mention that that elderly stayed in hospital longer (5 vs. 4 days) [42]. Another example of an arthropod-borne illness is Chagas disease (CD). It is most commonly transmitted to humans by triatomine bugs and is caused by the *Trypanosoma cruzi* parasite. It is estimated that eight million people are infected, particularly in Latin America; however, more than 300,000 people with *T. cruzi* infection live in the United States [46]. In the study performed by Pereira et al. [47], of the total number of 411 patients 23.6% were older than 60 years and between 2005 and 2013 the prevalence of CD in the elderly was steadily increasing. In this group of

patients the cardiac form of CD was predominant, followed by the mixed and digestive forms [47, 48]. The elderly affected by CD show a greater number of ageing-associated diseases. What is more, the clinical interaction between CD and other age-related illnesses may increase mortality and morbidity and may reduce the quality of life. Indeed, morbidity rates among the elderly are higher in comparison with other age groups [47–49]. Pereira et al. [49] highlighted that the elderly patients with CD need special attention from healthcare providers and that further studies in this group of patients are necessary. Leishmaniasis is a disease caused by an infection with *Leishmania* parasites and is spread by the bite of phlebotomine sand flies. There are three clinical forms of leishmaniasis: visceral (VL), cutaneous and mucocutaneous. Leishmaniasis is found in the tropics, subtropics and southern Europe. However, 90% of VL cases (the most severe form of leishmaniasis) are reported from several countries only; these countries however are popular travel destinations, e.g. Brazil, India or Nepal [23, 50, 51]. According to Montalvo et al. [52] high human global mobility is one of the factors which have led to an increase in the number of cases in non-endemic regions such as Cuba. Also noteworthy is that lethality rates for VL have risen in many areas over the past 10 years, especially in patients over 50 years. A higher lethality is connected with late diagnosis, atypical presentations and multimorbidity. Despite the fact that multidrug therapy is associated with higher risk of drug interactions and cumulative toxicity, it was not found to influence the mortality rate in VL patients [23].

TRAVELLERS' DIARRHOEA

Travellers' diarrhoea (TD) is the most common travel-related health problem which affects 20–50% of international travellers [53]. It is defined as three or more loose stools occurring within 24 hours associated with one or more enteric symptom. TD is most common among people travelling to South-East Asia, Sub-Saharan Africa and Latin America. Bacterial infections cause 50–80% of TD cases. Traditionally, enterotoxigenic *Escherichia coli* is considered to be the major causative pathogen of TD. Other etiological factors include enteroaggregative *E.coli*, enteropathogenic *E.coli, Shigella, Salmonella*, and especially in South-East Asia — *Campylobacter*. Less common are viral and protozoal pathogens [53, 54]. TD is usually a mild, self-limiting disease, and it generally resolves spontaneously after 3–4 days. However, it may be the cause of activity limitation leading to loss of business or vacation days. In some cases the clinical picture of TD can be more severe — about 10% of travellers affected by TD seek medical care and hospitalisation is required in up to 3% of cases [54]. Acute TD was shown to be less frequent in the elderly compared to younger travellers [11]; however, it is important to highlight that some group of elderly patients are at a higher risk of TD sequelae. For example, travellers with age-associated diseases, e.g. heart failure or renal insufficiency are more vulnerable to dehydration and electrolyte imbalance, which can lead to the exacerbation of the underlying disease. TD can also lead to persistent gastrointestinal symptoms like post-infectious irritable bowel syndrome (PI-IBS) or other post-infectious sequelae like Guillain-Barre syndrome or reactive arthritis. Generally, older travellers are at lower risk of PI-IBS in comparison to the younger ones; nevertheless, patients with severe disease are at an increased risk of PI-IBS. What is more, medicines commonly used for travellers' diarrhoea, such as antibiotics and anti-motility agents, may impact TD's potential to develop into PI-IBS [10, 54]. Guillain-Barre syndrome, typically associated with a *Campylobacter* infection, most commonly affects young adults and the elderly and may lead to permanent disability or even death [54].

HIGH-ALTITUDE ILLNESS

In 2013, more than 100 million people travelled to areas where altitude illness is likely to occur. It is important to note that high-altitude cities, like Cusco, La Paz or Lhasa, are becoming popular tourist destinations also among elderly travellers and travellers with chronic illnesses [55]. There are three main forms of the disease: acute mountain sickness (AMS), high-altitude pulmonary oedema (HAPE) and high-altitude cerebral oedema (HACE). AMS is not life-threatening, although it may lead to more severe conditions: HAPE and HACE. Risk factors for developing high-altitude illness include quick ascent, previous history of AMS, HAPE or HACE, inadequate fluid intake and climbing up despite signs which may indicate poor tolerance of height [55, 56]. According to Gautret et al. [11], elderly people may be at higher risk of developing high-altitude illness. On the other hand, other studies showed that older travellers with no co-morbidities have no increased risk of the disease [55], although the risk of HAPE may be elevated in individuals over the age of 65 [56]. Contraindications to travel to areas located at high altitude include common age-related diseases such as severe obstructive pulmonary disease, symptomatic pulmonary hypertension, severe or uncontrolled heart failure or severe ischaemic heart disease [55, 56]. The best way to avoid AMS is primary prevention, which include appropriate physical preparation, slow gradual ascent, pre-acclimatisation, adequate fluid intake and avoiding overexertion. In the case of patients with a history of altitude illness or travellers who are not able to follow the recommendations above medications may be a useful adjunct to the prevention of high-altitude illness [55–57].

PREVENTION OF ELDERLY TRAVELLERS

PRE-TRAVEL CONSULTATION

Pre-travel counselling has become an essential part of comprehensive family medicine over the last years [58]. The aim of the pre-travel health consultation is to prepare travellers for a safe and healthy trip. A healthcare provider familiar with travel medicine should assess the risk of travel and provide proper guidance. These consultations give the opportunity not only to provide a patient with specific information but also to administer all necessary vaccinations and prescribe medications for self-treatment of diarrhoea or for malaria chemoprophylaxis. The effectiveness of a pre-travel consultation depends both on expert advice and patient compliance [10, 58–60]. Elderly people, especially with comorbidities including cardiovascular disease or diabetes mellitus are at a higher risk of travel-associated diseases, therefore they require greater attention [59]. In the study performed by Gautret et al. [11], the proportion of patients who sought pre-travel advice was 42.2% among patients aged 60 and over, and 51.7% in travellers aged 18–45 years. According to Jaeger et al. [5], almost 10% of patients who obtained pre-travel health advice were people aged 60 or above. This group of patients consulted a travel clinic earlier compared to middle-aged adults. The most common reasons for not seeking pre-travel advice included: not being aware of such a necessity, the belief that prevention measures undertaken by a patient would be sufficient, financial limitations and language barriers [61].

NON TRAVEL-RELATED VACCINES

As mentioned before, a pre-travel consultation gives an opportunity to administer routine vaccines. Immunisations are extremely important for older adults, due to their increased vulnerability to infections. Although, it must be remembered that immunogenicity and efficiency of most vaccines are decreased due to age-associated changes in the immune system and there are no alternative schedules to compensate for the immunosenescence for the majority of vaccines [10, 62]. Routine influenza vaccination is particularly recommended in the elderly as they are highly vulnerable to influenza and are at a higher risk of developing serious complications from the disease. Approximately 90% of influenza-associated deaths occur among the elderly [63]. Influenza vaccination should be considered prior to travel to tropical and subtropical countries. According to Mutsch et al. [64], influenza is the most common vaccine-preventable infection in travellers to tropical or subtropical areas and immunisation should be recommended to the traditional risk groups, e.g. senior travellers and patients with multiple comorbidities. Several studies demonstrated clinical efficacy of influenza immunisation in the elderly, resulting in a reduced number of influenza-associated hospitalisations and deaths, although generally, seroprotection rates are lower in people age 65 and older [10, 62]. In some cases it may be reasonable to prescribe elderly travellers a self-treatment course of zanamivir or oseltamivir, in case the vaccine is ineffective [10]. Community-acquired pneumonia is another major health issue affecting the elderly globally; *Streptococcus pneumoniae* being the leading cause of CAD. Most industrialised countries recommend routine vaccination to all adults age 65 and older. Both the 23-valent pneumococcal polysaccharide vaccine (PPSV23) and the 13-valent pneumococcal conjugate vaccine (PCV13) are approved for the use [65, 66]. Systematic review and meta-analysis performed by Falkenhorst et al. [66] showed that PPSV23 is indeed effective, although previous studies had demonstrated its ineffectiveness. What is more, PPSV23 should be recommended for routine vaccination, due to its broader serotype coverage compared to PCV13. As pointed out by Lee et al. [10], there is not enough information regarding the prevalence of pneumococcal pneumonia in travellers; however, a pre-travel counselling visit is a good opportunity to ensure that elderly travellers are aware of the current vaccination recommendations. It is estimated that more than 90% of adults are latently infected with varicella zoster virus (VZV) and are at risk for herpes zoster. The primary infection is especially likely to occur in children; however, due to immunosuppression or immunosenescence viral reactivation may occur at any age and may develop into herpes zoster. The disease is most frequent in adults aged 50 and over and nearly 50% of all cases affect individuals older than 85 years of age. Elderly people are also at a higher risk of developing complications from herpes zoster, such as postherpetic neuralgia. An attenuated live-vaccine has been licensed for use in adults above 50 years old and is recommended to all adults older than 60 in some countries. The vaccine reduced the incidence of herpes zoster by 51.3% and showed 66.5% efficacy against postherpetic neuralgia in patients; however, its overall efficacy decreased with age. It is important to remember that immunisation with live vaccines is contraindicated in immunosuppressed patients [62, 65, 67]. In the study performed by Lal et al. [67], the overall efficacy of a new adjuvanted herpes zoster subunit vaccine was 97.2%. Little is known about the herpes zoster prevalence among travellers; however, due to its high prevalence among the elderly it is possible that an outbreak may occur while travelling. It is reasonable to administer a full course of the vaccine to senior travellers, and if the last dose had been administered more than 8 years prior to travel, a booster dose is recommended [10]. Vaccination against tetanus, pertussis and diphtheria is advised to be given to all adults. In many countries patients are recommended to receive a booster dose every 10 years; in some

countries booster intervals are shortened for patients over the age of 65 as the response to the vaccination becomes impaired with age [62, 65]. As Lee et al. [10] pointed out, there is little information about the incidence of tetanus, diphtheria and pertussis in travellers. Due to the measles, mumps and rubella (MMR) outbreaks in the United States there has recently been a focus on immunization against MMR;, however, the MMR vaccine is not essential for the elderly travellers.

TRAVEL-RELATED VACCINES

A single dose of live-attenuated yellow fever vaccine provides lifelong immunity in the majority of patients. In the study performed by Jaeger et al. [5], it was the most often administered vaccine in the group of elderly travellers. The vaccine is highly effective; however, in some groups of patients, e.g. individuals over 60 years old, the risk of developing a reaction to the immunisation may be elevated [68]. Side effects are rare, but can be severe, including yellow fever vaccine-associated viscerotropic disease (YEL-AVD) and yellow fever vaccine-associated neurologic disease (YEL-AND) which may manifest as meningoencephalitis, disseminated encephalomyelitis or Guillain-Barre syndrome [10]. The risk of YEL-AVD or YEL-AND is approximately 0.5/100,000 administered doses. However, the risk of YEL-AVD in patients aged over 60 years is about 1.0–1.1/100,000 distributed doses, rising to 2.3–3.2/100,000 in individuals aged above 70 [5]. Another study also showed that the risk of serious systemic adverse events was significantly higher in individuals aged 65 years or older in comparison to the 25–44 age group. Additionally, a majority of deaths from YEL-AVD were seen in adults aged 45 years and above [69]. Indeed, more travellers were found to have died from YEL-AVD than yellow fever itself [10]. It is the role of a healthcare provider, in collaboration with a patient, to decide whether the benefits from vaccination outweigh the risks [10, 68]. Hepatitis A is the second most common vaccine-preventable disease among non-immune travellers [10] and international travel was identified to be the major risk factor for hepatitis A virus (HAV) acquisition [70]. The incidence rate varies between 6.0 and 30.0 cases per 100,000 months of stay in virtually all developing countries [71]. In children a majority of infections are asymptomatic; however, in adults the infection often leads to acute hepatitis that may result in prolonged incapacitation or to acute liver failure [72]. In the study performed by Mutsch et al. [71], 5.3% of all hepatitis A cases occurred in the group of patients older than 60 years. There are several effective hepatitis A vaccines with a very low risk of side effects [70]. However, due to their immunosenescence, individuals over 50 years are recommended to receive two doses of the vaccine. The seroprotective rate was found to be 65% after the first dose and 97% after receiving the booster (in the group of patients aged 18 to 45 years it was 100% after a single dose) [10]. Hepatitis A vaccine is recommended to high risk groups, e.g. all people who travel to endemic areas or those who have chronic liver disease [70]. In the study performed by Jaeger et al. [5], travellers over the age of 60 received the vaccine significantly less often compared to younger groups. Hepatitis B is one of the most common vaccine-preventable travel-associated infectious diseases. It is estimated that approximately 240 million people worldwide are infected with hepatitis B virus (HBV) and approximately 1 million people die each year from HBV-related illness [73]. The risk of acquiring HBV during the travel is relatively low (about 0.2 to 0.6 per 1000 person-months). However, elderly people are more likely to acquire travel-associated HBV infection as they require medical treatment more often than younger travellers and because medical tourism is growing in popularity [74]. About 20% of patients with hepatitis B infection need to be hospitalised and the risk is doubled in individuals 50 years and older. What is more, elderly patients with co-morbidities, such as liver or renal disease or diabetes are at a higher risk of developing complications from hepatitis B [75]. However, the risk of chronic HBV infection in people over 40 years of age is lower in comparison to young adults (6% vs. 8%) [76]. The hepatitis B vaccine is recommended to all unvaccinated travellers going to regions with intermediate to high prevalence of chronic hepatitis B; however, only 15–30% of international travellers had received a full vaccination course prior to travel [73]. The Swiss study showed that hepatitis B vaccination was administered significantly less often to senior travellers [5]. It is important to note that age is the strongest predictor of vaccine response. In the study performed by Van Der Meeren et al. [75], vaccine protection rate was above 90% in individuals aged 20–49 years and only 64.8% in those aged 65 years or more. Another study showed that only 75% of the people vaccinated after the age of 60 years develop protective antibody levels [77]. For this reason, further studies are necessary to establish if elderly patients would benefit from additional or higher doses of the hepatitis B vaccine [75]. Typhoid is one of the most commonly diagnosed vaccine-preventable illness in returned international travellers. The incidence rate of typhoid infection is estimated at 1–10 cases per 100,000 travellers to developing countries [78]. The effectiveness of typhoid vaccine has been reported to be 65% to 80% [79, 80] and no significant difference in efficiency by age group has been noticed [79]. According to Lee et al. [10], typhoid vaccine should be considered in elderly travellers to endemic regions as an effective way of preventing the disease. Rabies is a preventable fatal disease that causes 50,000–55,000 deaths worldwide each year. However, in the decade prior to the study performed by Gautret et al. [81]

only 22 cases have been confirmed in travellers. Many studies confirmed safety and immunogenicity of the rabies vaccine with the overall seroconversion rate being 94.5% in patients up to age 65 [81, 82]. WHO recommends the rabies vaccine to all travellers [10]. Other travel-related vaccines include meningococcal, polio or Japanese encephalitis vaccines. The conjugated meningococcal vaccine needs to be considered in all senior travellers. Moreover, in some settings, e.g. the Hajj pilgrimage, the vaccine is compulsory for all pilgrims. The polio vaccine should also be considered in this group of patients and may be a requirement for travellers going to endemic areas. The Japanese encephalitis vaccine should be given to senior patients that travel to endemic regions [10].

MALARIA PREVENTION

Travellers to malaria-endemic regions should be informed about the effective methods of protection against insect bites (e.g. covering arms and legs, using insect repellents, e.g. DEET, and permethrin impregnation) [83]. Returned travellers who develop a febrile illness are recommended to seek prompt medical assistance. The recommendations concerning malaria prophylaxis refer to all travellers, regardless of age [10]. Yet, a study carried out by Alon et al. [13] revealed that travellers over the age of 60 used insect repellents significantly less often than travellers aged 20–30 years (46.6% vs. 60%). Chemoprophylaxis is likewise essential to prevent malaria and when taken properly, it is highly effective. Main options for malaria chemoprophylaxis include atovaquone/proguanil, doxycycline, mefloquine and chloroquine. It should be offered to all patients travelling to endemic areas, when an exposure to malaria is time-limited and acceptable compliance is realistic. All of these drugs are well tolerated by older patients; however, it is important to remember about possible side effects, contraindications and drug–drug interactions [10, 83]. Atovaquone/proguanil is the most frequently prescribed chemoprophylactic agent in the group of elderly travellers [13]. It has very few drug–drug interactions which is particularly important considering the fact that polypharmacy is increasingly common in elderly patients. However, travel medicine providers should be aware of potential interactions between atovaquone/proguanil and metoclopramide or warfarin. Possible side effects may include headache and abdominal pain, yet, these are very rare. There are not pharmacokinetics differences between elderly and younger patients and dosing regimens do not need to be modified, regardless of age. However, the drug cannot be used in patients with severe renal insufficiency (creatinine clearance < 30 mL/min) [10, 84]. Doxycycline may be used in the elderly for the prevention of malaria; however, it is associated with many inconvenient side effects, including oesophageal irritation, ulceration or photodermatitis. What is more, dietary and supplement restrictions may be necessary while taking doxycycline. It is also important to remember about drug–drug interactions between doxycycline and calcium salts, carbamazepine, phenytoin or warfarin. Another drug commonly used for the prevention of malaria is chloroquine, although due to high *Plasmodium* resistance to the drug, it has been used in limited settings. Moreover, long-term use of chloroquine is associated with retinopathy and macular degeneration. Interactions with amiodarone, sotalol, propranolol, metoprolol, carvedilol, fluoxetine, paroxetine, ciprofloxacin, levofloxacin, azithromycin or digoxin are likely to occur, and therefore, the drug is not recommended to the elderly [10, 83]. Mefloquine is more often recommended to younger travellers [13], especially those who travel to endemic areas for a longer period of time [83]. According to Lee et al. [10], it should not be used in elderly patients with cardiac conduction disease or neuropsychiatric disorders. However, as Hahn et al. [83] pointed out, the risk of neuropsychiatric side effects is in general overstated. Nevertheless, there are many drug–drug interactions between mefloquine and carbamazepine, phenytoin, citalopram, fluoxetine, azithromycin, verapamil, carvedilol or warfarin [10]. Main reasons for declining to take chemoprophylaxis include cost, lack of awareness and scepticism about therapy efficiency, inappropriate assessment of personal risk or failure to access drugs before travel [35]. It is essential to highlight that patients whose main reason to travel is visiting friends and relatives are less likely to take antimalarial prophylaxis [85]. Chemoprophylaxis is effective only with appropriate patient compliance [83]. In the study performed by Hill [86], 80% of travellers stated that they were fully compliant with their chemoprophylaxis regimen. Non-compliance affects all age groups; however, elderly patients generally comply better with the prescribed drug regimen According to Alon et al. [13], 60.7% of individuals at the age of 60 and above were completely compliant compared to 33.8% travellers aged 20–30 years. The main reason for not complying with recommended regimen in the group of elderly travellers was the statement that "nobody takes these drugs anyway" (19.6%). For 7.1% of the elderly the main reasons included possible side effects, 6.2% of senior travellers stated that did not believe in effectiveness of the drugs and finally, for 2.6% of them the regimen was too inconvenient.

TRAVELLERS' DIARRHOEA PREVENTION AND EARLY SELF-TREATMENT

Options for preventing travellers' diarrhoea, in travellers of all ages, include avoidance of unsafe food and drinks, frequent hand washing, vaccination, non-antibiotic and antibiotic interventions. As mentioned before, senior travellers tend to comply with travel health precautions better than

the younger ones [13, 53, 54]. The orally administered, killed whole-cell cholera vaccine has more than 90% efficiency against *Vibrio cholerae* and due to the antigenic similarity it may also reduce enterotoxigenic *Escherichia coli* TD. Effectiveness of probiotics in preventing TD is limited. Bismuth subsalicylate can provide up to 65% protection against TD; however, it is important to remember about potential drug–drug interactions, especially in elderly travellers. It may also reduce the absorption of doxycycline, used for malaria chemoprophylaxis. Frequent administration of bismuth subsalicylate may lead to decrease in the overall compliance [54]. Antibiotics are up to 90% effective in preventing TD. Antibiotic options for prevention of TD include fluoroquinolones (levofloxacin and ciprofloxacin), rifaximin and azithromycin. Despite high efficiency, antibiotic prophylaxis has a number of disadvantages which limit its usefulness, especially among elderly travellers. The disadvantages include possible side effects, cost, drug interactions, the risk of acquiring *Clostridium difficile* infection or antibiotic resistant microorganisms [53, 54, 87]. Rifaximin use is usually limited by cost. Azithromycin and levofloxacin (but not ciprofloxacin) increase the risk of ventricular arrhythmia and cardiovascular death and may lead to electrolyte imbalance in cases of severe diarrhoea. In light of the data, the above-mentioned antibiotics should be avoided in patients with QTc prolongation and are not recommended to patients with underlying heart disease [54]. What is more, azithromycin and fluoroquinolones may interact with many other drugs, e.g. citalopram, fluoxetine, escitalopram, amiodarone, dronaderone, atorvastatin, simvastatin, warfarin and multivitamins or minerals [10]. In general, antibiotic dosage regimens need to be suitably modified for use in the elderly [87]. Initial symptoms of TD should be an indication to self-treatment based on oral rehydration therapy, this is particularly important for the elderly. Although in general increasing the amount of fluid with clean water is enough, WHO-formulated oral rehydration salts are recommended, especially for moderate and severe dehydration and in vulnerable groups of patients, i.e., older travellers. In mild cases of nondysenteric TD, antimotility agents such as loperamide can be used. If TD is moderate or severe, symptoms worsen or do not subside after 24 hours of loperamide usage, a combined therapy with loperamide and antibiotics is needed. Antibiotics for early self-treatment are generally the same as these used for TD prevention [53, 54]. Patients should seek medical assistance if symptoms persist or worsen despite self-treatment, if TD is accompanied by persistent fever, chills, bloody diarrhoea, abdominal pain, intractable vomiting, or if accurate oral rehydration therapy is impossible. Senior patients with underlying diseases who develop TD are recommended to look for medical care earlier than other patients, due to increased risk of severe and complicated TD [54]. Antibiotic prophylaxis should be reserved for high risk travellers, e.g. immunocompromised patients [54]. While antibiotic treatment of TD in elderly travellers should only be limited to severe cases. There are several reasons for these recommendations. Firstly, senior travellers are at higher risk of extended spectrum beta-lactamase (ESBL) carriage and colonisation with other multi-drug resistant bacteria. ESBL carriage may, in turn, lead to complications such as the urinary tract infections or prostatitis [10]. What is more, although antibiotics and anti-motility agents are effective in the treatment of TD, their application may increase the risk of developing PI-IBS [54]. Antibiotic use during travel has also been associated with increased risk for *C. difficile* infection [88]. In light of these findings, antibiotic options may only be used for the treatment of TD when it is absolutely necessary.

ALTITUDE SICKNESS PREVENTION

The most commonly prescribed drug to prevent AMS is acetazolamide. It decreases the metabolic alkalosis, acts as a mild diuretic thus reducing oedema and it is the only one drug available which facilitates acclimatisation. Acetazolamide should be used the night before planned ascent until the beginning of descent or until a person has been at the target elevation for 2–3 days. The effectiveness of acetazolamide 250 mg daily in decreasing AMS has been demonstrated; however, it is important to remember about contraindications and drug interactions, especially in the group of elderly travellers [55, 89]. The study performed by Alon et al. [13] demonstrated that elderly travellers used acetazolamide for high-altitude illness prevention significantly more often than younger travellers (58% vs. 8.3%). Allergies, previous anaphylactic reactions, significant hepatic and renal dysfunction, severe chronic lung dysfunction are contraindications to acetazolamide. As mentioned before, common problem of elderly patients is polypharmacy and as a consequence drug–drug interactions. For example, patients on high-dose acetylsalicylic acid (325 mg daily) are at higher risk of metabolic acidosis while using acetazolamide. There is also elevated risk for metabolic acidosis and nephrolithiasis during concomitant use of acetazolamide and brinzolamide, dorzolamide, topiramate or zonisamide. Travel medicine providers should be also aware of a possible interaction between acetazolamide and loop diuretics, tramadol, oxycodone, codeine or metformin. Side effects of acetazolamide include paraesthesia, polyuria, rash and dysgeusia [10, 55, 89]. In case of contraindications or intolerance to acetazolamide, dexamethasone is a well-studied alternative. Contrary to acetazolamide it only conceals the symptoms of AMS by reducing the inflammation. Dexamethasone should not be used for more than 7 consecutive

days due to as the drug may produce Cushingoid effects or adrenal suppression. Furthermore, it may have significant side effects, e.g. insomnia, unmasking of diabetes, peptic ulceration and gastrointestinal bleeding. In recent years, the effectiveness of inhaled budesonide has been confirmed for the prevention of AMS. The drug exhibits fewer side effects compared to dexamethasone [55, 89]. Nifedipine is the first-line drug for prevention and treatment of HAPE. Side effects of this medication include AMS-like symptoms: headache, swollen ankles and constipation. Particularly noteworthy are significant interactions with drugs metabolised by the cytochrome CYP3A4 [55]. Recent studies have suggested that sumatriptan, gabapentin and ibuprofen may be effective at preventing high-altitude illness; however, further studies should be carried out [55, 89].

CONCLUSIONS

Prolonged life expectancy and improved quality of life are associated with an increase in the number of elderly travellers. Although older patients represent a relatively small proportion of international travellers, they demand greater attention because of the multimorbidity and polypharmacy which are seen in many older people. Ageing has a variable effect on common travel-related illnesses. Pre-travel counselling performed by a provider familiar with travel medicine is desirable in the group of elderly travellers and is a good opportunity to administer both non travel-related and travel-associated vaccines, bearing in mind decreased immune response in the elderly. Advanced age also affect the management of malaria prevention, travellers' diarrhoea and altitude illness. In light of these findings, every case should be considered on an individual basis.

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VIA MEDICA

REVIEW ARTICLE

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Personality profiles of divers: integrating results across studies

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ABSTRACT

Background: *There are numerous reports on diver personality, spanning across five decades, across national boundaries, and using a range of measures to describe diver profiles. However, the range of reports poses challenges to interpreting new studies, particularly when having to compare findings across generations, measurements, and national/cultural contexts. This paper aimed to review and integrate diver personality descriptions, drawing on the available studies that reported trait theory based data for naval and sport divers.*

Materials and methods: *Available studies on diver personality — associated with trait theory — were tabulated and the specific traits associated with divers described. Their findings were then integrated into a synthesised description of personality traits.*

Results: *The results suggest remarkably stable military diver profiles across generations, measures, and navies, with some unique differences observed due to national-cultural variables. It was of particular interest that different measures of personality appeared to present related constructions of diver profiles. Navy divers share, among others, a propensity for adventurousness, a strong sense of self-agency, and low trait anxiety. Unsurprisingly, personality profiling could not be generalised across military-civilian diving contexts, and the same clear profile differentiation of navy divers was not visible among sport divers.*

Conclusions: *Contemporary local data — in the context of military diving — could productively be compared to the body of existing reports, at least where similar theoretical models are used.*

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Key words: personality measurement, profiling, navy divers, sport divers

INTRODUCTION

BACKGROUND

Personality — as human factor in extreme environments — remains of enduring interest. In the underwater context, personality studies have a rich history, and a survey of the available literature provides a number of psychological descriptions, in particular of navy divers, crossing generations, national borders, and certain operational contexts.

These studies can often be interpreted from a common theoretical viewpoint, as most of them are based on trait theory models. Trait theory views human nature from a perspective of consistent and enduring individual differences, and personality traits are defined as characteristic ways of behaving [1]. Using this framework, any individual could be placed somewhere on the continuum of any given trait.

In spite of some theoretical common ground between studies on the personality of divers, both the temporal and geographic range of these reports pose, among others, three challenges to the interpretation and comparison of new studies. They are the challenges of generational, measurement, and cultural equivalence.

GENERATIONAL CHALLENGES

With studies spanning five decades (± 1970–2018), the extent to which findings can be generalised across time may be questioned (e.g. can findings from different decades be compared?). For example, historical contexts (war, conscription, nationalism, etc.) may all have influenced the recruitment of navy divers in the past, even as

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socio-economic factors may do the same at present. In the recreational sphere, the popularisation of sport diving would potentially allow a wide range of personalities to participate, while the development of engineering technologies may have changed the demands on divers, potentially requiring a different personal profile to attain and maintain good psychological adaptation under water.

MEASUREMENT CHALLENGES

The measurement of personality poses two challenges to the comparison of results. This refers to the development of personality theory, and the development of measuring instruments (psychometry), over time. In this regard, earlier reports used older measures. Those studies used the prevailing theoretical models of the time. For example, Cattell's trait theory, which organised personality traits into 16 dimensions of human personality (known as the 16PF), was used extensively in the personality profiling of divers. This was supplemented by a consistent use of additional personality traits, such as Zuckerman's Sensation Seeking, or Rotter's Locus of Control, to further profile the personality of divers.

In contemporary psychology, the Five Factor Model (FFM) has emerged as the dominant framework for studying personality [2, 3]. The FFM is based on the observation that human personality traits can be reduced to five factors (sometimes referred to as the Big Five), and that all other traits fit within these five factors [4]. Recent studies have used the FFM to describe diver profiles, and as most of the instruments used to measure the Big Five were related (based on Costa and McCrae's 'International Personality Item Pool'; IPIP), their outcomes are generally comparable.

NATIONAL/CULTURAL CHALLENGES

Most of the older studies on diver personality emanated from the global north. World region has a significant effect on psychometric scale scores, for example on Big Five personality scales [5, 6], where smaller standard deviations are found in African samples (i.e. more homogenous expression of Big Five factors). Apart from region, culture further influences the development of personalities, with some culture-specific aspects corresponding to cultural syndromes such as complexity, tightness, individualism, and collectivism [7, 8]. Individualism is generally used to describe the predominant cultures of Western Europe, North America, Australia and New Zealand. In contrast, African, Middle Eastern and East Asian countries are characterised primarily by collectivism [8]. The reported differences in personality descriptions between so-called 'Western', and 'African', or 'Asian' samples open the possibility of different personality profiles between divers from different regions. Indeed, differences in country-specific navy diver samples have already been observed [9]. This leads to the challenge of generalising findings across national boundaries (e.g. can findings from studies from different navies be compared?).

AIM

The range of studies describing diver personality traits, spanning across generations, countries, and measuring instruments, raised questions about the extent to which contemporary local data (whichever the locale) can be compared to the array of existing available reports (i.e. can results be generalised across studies?). This paper therefore aims to review and integrate diver personality descriptions, drawing on the available studies that reported trait theory based data for military and sport divers.

MATERIALS AND METHODS

DATA COLLECTION

The available studies on diver personality for which sufficient data could be obtained (including full reference, sample type, psychometric measures, and main findings) were included in this analysis. Only studies associated with trait theory, and available in English, were used. All the studies were in the public domain, and came from published academic papers or chapters from books, from technical reports, or from conference posters.

As mentioned, several studies reporting comprehensive profiling of diver personalities used derivatives of Cattell's 16PF model [10–17], and results can validly be compared using the 16PF trait-letters. Where studies used measures based on different models [18], easy synthesis across reports remains elusive [19].

Other studies exploring specific individual personality traits often used the same measures, allowing for direct comparisons across studies. Examples include Rotter's Internality-externality Scale [10, 16, 20] and Zuckerman's Sensation Seeking Scale [11, 20–22].

There are also a number of studies available that reported personality functioning of navy diver samples from a mental health perspective, using the Minnesota Multiphasic Personality Inventory (MMPI) [23–28]. They all appear to report similar findings, namely a generally positive mental health profile among divers across various navies, with specific and consistent outliers across the studies [27]. MMPI studies were excluded from the current analysis.

Fewer studies used the FFM, are all more recent, and are mostly in the sport diver domain [29–31]. While they employed an array of instruments, all were based on the IPIP, and their outcomes thus comparable.

DATA ANALYSIS

The personality studies were tabulated and the specific traits associated with divers described (Table 1). This was

Table 1. Selected reports on diver personality profiling

Serial	Authors, year	Sample	Traits/factors	Psychometric measures	Summary of main findings
1	Biersner and Cameron, 1970 [23]	Navy	Comprehensive personality scale	EPPS	Higher masculinity Lesser socialisation Greater aggressiveness
			Risk taking	Betting game	Greater risk taking
2	Biersner, 1973 [32]	Navy	Behavioural history	History	More traffic violations and more arrests
3	Biersner and Larocco, 1983 [10] Biersner and Larocco, 1987 [11]	Navy	Specific traits: — locus of control — socialisation scale — trait anxiety — sensation seeking	 RIES CPI STAI SSS	 Greater internality Lesser socialisation Lower trait anxiety Seek physical adventure/ risks, rather than simply novel experiences
4	Beckman et al., 1996 [18]	Navy	Comprehensive personality scale	MIPS	Optimistic Independent Self-serving Analytical Tend towards social aggressiveness
5	Van Wijk and Waters, 2001 [17]	Navy	Comprehensive personality scale	16PF	Enthusiasm: F^+ Adventurousness: H^+ Confidence: O^- Group orientation: $Q2^-$
6	Van Wijk, 2007, 2008, 2014 [16, 22, 33]	Navy	Specific traits: — sensation seeking — locus of control — trait anxiety Comprehensive personality scale	 SSS-V RIES STPI 16PF	 High TAS, low DI and BS Greater internality Lower trait anxiety Enthusiasm: F^+ Adventurousness: H^+ Confidence: O^- Low anxiety: $Q4^-$
7	Colodro-Plaza et al., 2014, 2015 [13, 14]	Navy	Comprehensive personality scale	16PF	Emotional stability: C^+ Self-control: $Q3^+$
			Anxiety	FIA	Low: — sensitivity: I^- — apprehension: O^- — tension: $Q4^-$
8	Shopov and Vazharov, 2017 [15]	Navy	Comprehensive personality scale	16PF	Enthusiasm: F^+ Adventurousness: H^+ Confidence: O^- Group orientation: $Q2^-$
9	Van Wijk, 2018 [34]	Navy	"Big Five"	BFI-44	Agreeableness: A^+ Conscientiousness: C^+ Neuroticism: N^-
10	Martin and Myrick, 1976 [35]	Sport divers	Comprehensive personality scale	VPQ	Socially aggressive Low anxiety
11	Griffiths et al., 1978 [36]	Sport divers	Specific trait: — trait anxiety	STAI	Lower trait anxiety
12	Heyman and Rose, 1980 [20]	Sport divers	Specific traits: — locus of control — trait anxiety — sensation seeking — masculinity	 RIES STAI (T-Ax) SSS-V BSRI	Both men and women: Greater internality Lower trait anxiety More sensation seeking Higher masculinity

→

Table 1 (cont.). Selected reports on diver personality profiling

Serial	Authors, year	Sample	Traits/factors	Psychometric measures	Summary of main findings
13	Taylor et al., 2001 [21]	Sport divers	Specific trait: — sensation seeking	SSS-V	High TAS and ES, low DI (with total similar to reference group)
14	Van Wijk, 2002 [37]	Sport divers	Comprehensive personality scale	16PF	Enthusiasm: F^+ Adventurousness: H^+ Confidence: O^- Other factors were undifferentiated
15	Coetzee, 2010 [12]	Sport divers	Comprehensive personality scale	CAQ	Boldness: H^+ Self-sufficiency: $Q2^+$ Suspiciousness: L^+ Tension: $Q4^+$ Low: — warmth: A^- — emotional stability: C^- — conformity: G^- — sensitivity: I^-
16	Musa et al., 2010 [29]	Tourist divers	Big Five	NEO-FFI	Agreeableness: A^+ Conscientiousness: C^+
17	Ong and Musa, 2012 [30]	Tourist divers	Big Five	NEO-PI-R	Extraversion (NS): E^+ Agreeableness (NS): A^+ Openness to experience: $O–E^+$
18	Shopov and Vazharov, 2017 [15]	Sport divers	Comprehensive personality scale	16PF	Dominance: E^+ Other factors were undifferentiated
19	Van Wijk, 2018 [31]	Tourist divers	Big Five	BFI-44	Agreeableness (NS): A^+ Conscientious (NS): C^+

Serial 10, 11, 12, 14 were university students; EPPS — Edwards Personal Preference Schedule; RIES — Rotter's Internality-Externality Scale; CPI — California Personality Inventory; STAI — State-Trait Anxiety Inventory; SSS — Sensation Seeking Scale; MIPS — Millon Index of Personality Styles; 16PF — 16 Personality Factor Questionnaire; STPI — State-Trait Personality Inventory; FIA — Facilitating and Inhibiting Anxiety questionnaire; VPQ — Veldman Parker Questionnaire; BSRI — Bem Sex Role Inventory; CAQ — Clinical Analysis Questionnaire; NEO-FFI — NEO Five-Factor Inventory; NEO-PI-R — NEO Personality Inventory-Revised; BFI-44 — Big Five Inventory-44; NS — not significant; TAS — Thrill and Adventure Seeking; DI — Disinhibitions; BS — Boredom Susceptibility; ES — Experience Seeking

done separately for military and for sport divers. As could be expected, fewer studies were available for sport divers, possibly because the number of certified sport divers is larger and their personality profile therefore less homogenous. The table was used to develop an integrated personality description of divers.

RESULTS

Drawing on the studies collected in Table 1 (the references below are Table 1 serial numbers), there appear to be general consensus that military divers share the following traits:

(a) A propensity for sensation seeking, adventurousness, and associated risk-taking (serial 1, 2, 3, 5, 6, 8);
(b) A strong sense of self-agency (also referred to as internality, dispositional confidence) (serial 3, 4, 5, 6, 7, 8);
(c) Low trait anxiety (serial 3, 6, 7); and
(d) Enthusiasm and optimism (serial 4, 5, 6, 8).

These shared traits appear to hold stable across time (± 1970–2015) and across different navies, e.g. United States Navy (USN), South African Navy (SAN), Spanish Navy, and Bulgarian Navy.

Further, most USN studies suggest lesser socialisation (serial 1, 3, 4), although this was not found among Spanish or Bulgarian Navy divers (serial 7, 8), and even contrasted by particularly good social cooperation expressed among SAN divers (serial 5). Other differences in the reports of military divers appear to stem from methodological differences rather than referring to personality differences across samples.

The only study using FFM data with military divers reported higher scores for agreeableness and conscientiousness, and lower scores for neuroticism (serial 9). The highly differentiated and homogenised profile was particularly noteworthy.

For sport divers, there appear to be general consensus regarding:

(a) A propensity for sensation seeking, adventurousness, and associated risk-taking (serial 12, 13, 14, 15); and
(b) Somewhat lesser socialisation (serial 10, 15).

There are further some indications of lower trait anxiety (serial 10, 11, 12), but this is not universally supported (serial 15), and there are also alternative views suggesting population normative trait anxiety among non-professional divers [38, 39]. Other differences in personality descriptions may

indicate limitations to comparisons across civilian sport diver samples, rather than actual personality differences. It is noteworthy that a number of studies using comprehensive scales reported relatively undifferentiated profiles (serial 14, 18).

Recent studies using FFM data with sport divers suggest limited consistency in profile differentiation across the factors (serial 16, 17, 19), providing support for the idea that there generally is little differentiation in their profiles. The most consistent finding is that of possibly somewhat higher Agreeableness (serial 16, 17, 19), and given that sport diving is often a group activity, is therefore not surprising.

There were only two studies that directly compared navy and sport divers [15, 37], and both found a range of significant differences on their 16PF group profiles.

DISCUSSION

The personality profiles of military divers — using trait theory — appear surprisingly consistent across both generational and cultural contexts, as well as across different (but theoretically related) measures. While there is little evidence of personality's predictive value for selection purposes [40], the consistent profile is noteworthy in that it may reflect a response to environmental demands, and could thus be seen as supportive of personality-as-coping theories [41].

Using the Big Five, the SAN profile was clearly differentiated and highly homogenised (and far more homogenous than the sport diver samples using similar measures [29–31]). Unfortunately, the data is not able to answer the question of whether this homogenisation was reflective of a) navy diver selection influences, or b) any specific personality profile associated with this specialised environment, or c) local culture, in that previous studies found African samples to express homogenised scores on FFM measures [6], or d) other socialisation or adaptation dynamics.

It is noteworthy that low trait anxiety (also referred to as generalised anxiety or neuroticism) is consistently reported in navy diver samples, which leads to the question whether this reflects environmental requirements, or whether it is a function of selection (often required for military diving training), as the same findings are present in some sport diver samples, but not in others. There is a further interesting apparent contrast between the SAN and South African sport diver samples on anxiety (serial 6, 9 vs. 15), although this may simply reflect sample composition (e.g. experienced navy divers vs. entry level sport divers).

There was no strong profile differentiation for sport divers, and efforts to profile sport divers are probably unproductive given the range of individuals who enter diving as a sport. While low trait anxiety was consistently emphasised in almost all the military diver studies, the construct appears to be of lesser importance in the sport diving environment. However, given the reported association of elevated trait anxiety with panic proneness [42], this observation from recreational diving requires further consideration.

One exception to an otherwise consistent profile across navy samples is the divergent reports on constructs of social or group orientation (also referred to as socialisation or agreeableness). USN samples suggest lesser social cooperation, whereas SAN samples report good social integration, with European samples in between. The SAN profile is not unexpected, as social components in the SAN diving context have been described previously [43]. The divergent profiles may partly be due to individual navy settings (e.g. practical contexts). For example, SAN divers not only train and work in small teams with great emphasis on social cooperation; but as the diving branch is small, they also work with the same group for their whole career. Their profile may thus be the result of the socialisation into that specific operational environment. Further to the practical context, the divergent profiles may also reflect cultural presentations. As reviewed earlier, Individualism is generally associated with the dominant cultures of North America, while African cultures are often characterised primarily by Collectivism [8]. The consistency of the reports across time suggests that this is probably not a generational issue, but rather a cultural one.

There are a number of limitations to this analysis. The geographical range of the studies were limited, and reports from elsewhere in the world, also in different languages, may need to be consulted to gain a full understanding of the consistency of reported profiles. Further, diving contexts, particularly for the military samples, were not incorporated. In this regard the type of diving (e.g. combat diving, deep sea clearance diving, rescue and recovery diving, etc.) may influence the desirability of any particular personality trait or profile.

Personality descriptions, while academically interesting, may have limited practical application. Future research needs to extend personality studies from being descriptive, to associating profiles with behavioural markers, for example safety behaviour, injury risk, and psychological adaptation, to optimise the practical value of personality assessment.

CONCLUSIONS

Military diver profiling appears remarkably stable across generations, measures, and navies, with some unique differences due to national/cultural variables. It was of particular interest that different measures of personality appeared to present related constructions of diver profiles. Unsurprisingly, personality profiling could not be generalised across military-civilian diving contexts, and the same clear profile differentiation of navy divers was not visible among sport

divers. In conclusion, the analysis suggests that contemporary local data — in the context of navy diving — could productively be compared to the body of existing reports, at least where similar theoretical models are used.

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VIA MEDICA

LETTER TO THE EDITOR

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Doctors in a hyperbaric medical unit: what is the hyperbaric exposure?

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Work in hyperbaric medical units exposes to several occupational risks. Hyperbaric oxygen therapy can be done in pressure chambers with or without the presence of an attendant. This attendant, who can be a nurse, a doctor or a technician, may provide technical support during hyperbaric chamber sessions, such as mechanical ventilation, blood gas measurement etc. [1, 2]. These hyperbaric medical unit workers are exposed to many occupational risks related to hyperbaric conditions. So a recent review of the literature showed that the decompression illness (DCI) incidence ranged from 0 to 37 per 100,000 sessions in hyperbaric chambers (SHC). Despite this low incidence, at least 2 nurses died according to the literature [3].

Moreover, caregivers are exposed to other risks related to their occupation. A French retrospective study among these workers showed that 27% of the subjects had at least one occupational accident during the study period between 2005 and 2011. In this study, there were different kinds of occupational accidents. On 30 accidents reported, there were 3 blood exposures, and 4 accidents related to patient handling [4].

However, accidents mainly concerned paramedical staff in these studies, while in French hospitals, doctors represent 1 quarter of the workforce. Several hypotheses could explain why doctors had fewer accidents. For example, they may do less SHC, or they may not do the same types of SHC, or they may report fewer accidents. This study aimed to better assess the hyperbaric exposure of physicians in a hyperbaric medical unit.

It was a retrospective study in our medical unit, including all SHC during 1 year. The SHC profiles (pressure and duration) and the indications of the session have been identified. During the study, 5 doctors and 15 non-doctors worked in the unit.

There were 665 SHC, of which 37 (6%) were done by a doctor. Doctors did 30% of the SHC which were done to treat accidents of dive; they did 50% of SHC which were done to treat CO intoxication, and 40% of SHC which were done to treat gas gangrenous. Medical presence was conditioned by the severity of the patient's condition. The 29 SHC for a major medical emergency were done by a doctor: 24 SHC for DCI and 5 SHC for other indications. So, doctors did SHC mainly for medical emergencies (Fig. 1). Consequently, the doctors were doing the longest sessions or those with the highest atmospheric pressures (Fig. 2).

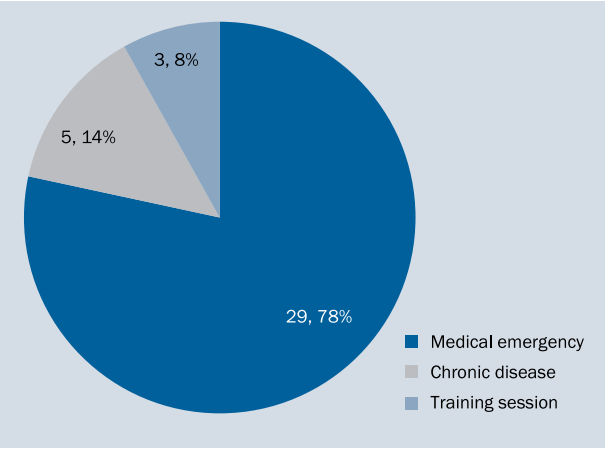

Figure 1. Medical indications of the sessions in hyperbaric chamber practiced by doctors

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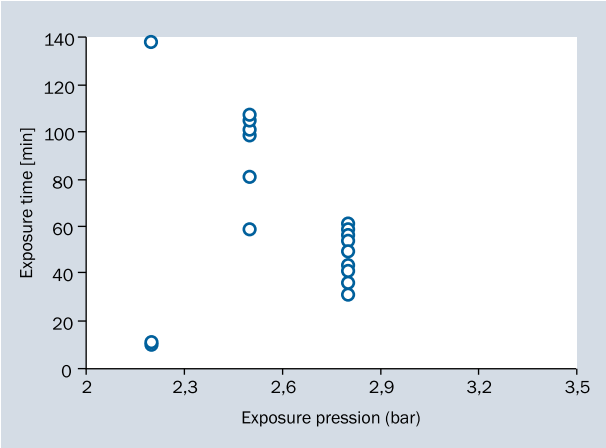

Figure 2. Profile of sessions in hyperbaric chamber practiced by doctors

This study showed that doctors practiced less SHC than paramedics. This could explain why there are fewer accidents among doctors. Yet, doctors made the most technically difficult sessions, both in terms of medical care and SHC profile. Doctors did longer or higher-pressure sessions. So, the risk of accident is not negligible for doctors. Difficult care might make it more likely to cause care-related accidents, such as body fluid exposure. The SHC profile can expose them to accidents related to hyperbaric conditions, such as otitis or DCI. It is therefore important to continue prevention for this population [5].

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ISMH 15 — Hamburg 12 to 15 June 2019

Sea, Port, Health and Environment

Announcement and call for abstracts

The upcoming 15th International Symposium on Maritime Health (ISMH15) will be held at HafenCity University Hamburg, Germany, from 12 to 15 June 2019. Six months ahead of the symposium, the preparations are well on track.

Under the auspices of the International Maritime Health Association (IMHA), ISMH15 will convene under the motto "Sea, Port, Health & Environment". Experts from the field will present the most recent scientific results from research and discuss innovative approaches in maritime health. The conference programme will include keynote lectures, invited presentations, abstract-based oral and poster sessions, panel discussions and working group meetings. Additional interdisciplinary satellite symposia, for example on offshore medicine or on health threats at points of entry, will be held to enlarge the scientific scope. The ISMH15 organizers very much welcome further initiatives and proposals for topics to be covered in thematic sessions at the symposium. If you wish to develop such a thematic session, please see the contact details below.

Hamburg is a perfect location for the biannual symposium in maritime health. Hamburg harbours the largest German seaport. The conference venue at the recently opened HafenCity University is located directly on the waterfront at the seaport's edge, within the unique architecture of transforming harbour areas. It is the ideal place to discuss results of scientific research as well as its practical implications in the context of healthy working and living at sea and port.

Registration for the conference starts by end of December 2018 on: http://www.ismh15.com

We look forward to welcoming you to Hamburg and to your contribution to ISMH15!

Volker Harth
President ISMH15

Call for abstracts

The IMHA is pleased to invite authors from around the world to submit abstracts for presentation at ISMH15. This is an opportunity to share your latest research with international colleagues dedicated to the field of maritime health. Abstracts on all aspects of health in the maritime world are welcomed and may be submitted in the following categories: Autonomous shipping; Chemical and physical hazards; Chronic diseases; Cruise medicine; E-health and shipping; Emissions and shipping; Environment and health; Ethics in maritime medicine; Fishery; Infectious diseases; Inland waterway shipping; Mental health and psychosocial factors; Miscellaneous; Musculoskeletal disorders/ergonomics; Offshore medicine; Port health; Pre-employment medical examination; Preventive medicine; Research in maritime medicine; Sea rescue; Ship sanitation; Telemedical Maritime Assistance Service (TMAS); Training/education; Travel medicine; Urban development, transforming harbour areas and health; Wellbeing, gender and culture.

There will be both oral and poster presentations at ISMH15. Oral presentations will be organized in plenary and parallel sessions, in workshop format and panel discussions. Posters will be presented during guided poster walks. Please make your choice and submit your abstract electronically via the conference website: http://www.ismh15.com

On the website you will find detailed information on abstract format and requirements. All abstracts will be evaluated by the scientific committee of ISMH15.

Abstract submission is now open and closes by **15 January 2019**.

If you want to propose and develop a thematic session, please contact: Volker.Harth@bgv.hamburg.de

We are looking forward to your contribution!

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.).

The authors' names are followed by the title of the article; the title of the journal abbreviated according to Medline; the year of publication, the volume number; and the first and last page numbers. **Please note:** References you should include DOI numbers of the cited papers (if applicable) – it will enable the references to be linked out directly to proper websites. (e.g. Redon J, Cifkova R, Laurent S et al. Mechanisms of hypertension in the cardiometabolic syndrome. J Hypertens. 2009; 27(3): 441–451, doi: 10.1097/HJH.0b013e32831e13e5.).

Reference to books should give the title, names of authors or of editors, publisher, place of publication, and the year.

Information from yet unpublished articles, papers reported at meetings, or personal communications should be cited only in the text, not in References.

For full information for authors refer to the web page: www.intmarhealth.pl.

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