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A SARS-CoV-2 Omicron outbreak among crew members on a cruise ship in Germany in early 2022

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ABSTRACT

Background: *Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreaks on cruise ships have rarely been investigated. In early 2022, we were informed about a SARS-CoV-2 outbreak on a cruise ship calling Port of Hamburg after 10 infections among crew members were detected. We conducted an outbreak investigation in collaboration between ship owners, the ship physician and Hamburg's Institute for Hygiene and Environment, to identify risk factors and to achieve containment. The aim was to identify risk factors for SARS-CoV-2 infection and SARS-CoV-2 variants in a cohort of 165 crew members.*

Materials and methods: *For this purpose, we collected data on age, sex, nationality, boarding-time, cabin use (single/shared), work place, and vaccination status of the study participants. Cases were defined as individuals who tested SARS-CoV-2 positive at least once in daily screenings during the outbreak period (10 days) by polymerase chain reaction or antigen test. We investigated risk factors for infection by descriptive, univariable and multivariable analysis. We performed whole genome sequencing to identify SARS-CoV-2 variants.*

Results: *We verified 103 SARS-CoV-2 positive cases (attack rate [AR] 62.4%); 39/41 sequenced samples were BA.2.3 Omicron subtype, one BA.1 and one BA.1.1. Among boostered crew members, AR was 38% vs. 65% among those vaccinated once or twice. Among those who stayed < 30 days on board, AR was 31% vs. 72% among those staying on board longer. Among Europeans, the AR was 53% vs. 71% in non-Europeans. Adjusting for age and sex, cases were more likely to have received no booster vaccine (odds ratio [OR]: 2.66, 95% confidence interval [CI]: 0.99–7.13), to have spent more time on board (≥ 30 days, OR: 6.36, 95% CI: 2.81–14.40 vs. < 30 days) and to have a non-European nationality (OR: 2.14, 95% CI: 1.08–4.27). The outbreak stopped shortly after offboard isolation of cases.*

Conclusions: *This investigation confirms the importance of a booster vaccine against COVID-19. Longer stays onboard could facilitate social mixing. Further studies could investigate the impact of social, cultural/behavioural patterns and public health access on the infection risk. Physical distancing together with screening and isolation can contain SARS-CoV-2 outbreaks on cruise ships.*

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Keywords: crew, cruise ship, Omicron, outbreak, SARS-CoV-2

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INTRODUCTION

In the wake of the coronavirus disease 2019 (COVID-19) pandemic, cruise calls were shut down. In summer 2021, industry representatives, politicians, port authorities, municipal and local public health authorities agreed on common guidelines for cruises. As a result, cruise operations reopened stepwise.

The setting on board can be favourable for outbreaks of communicable diseases. Various factors contribute to this circumstance: limited space, gathering and mixing of people from different regions and countries, particular ventilation systems, limited diagnostic resources and isolation/quarantine capabilities on board, to name a few [1, 2]. Influenza-like illness beside gastrointestinal diseases have been the most commonly documented causes for outbreak situations on board of ships, followed by vaccine-preventable diseases such as chickenpox. Bacterial infections caused by *Escherichia coli*, *Salmonella*, or *Legionella* species have also been reported [3–6]. Infectious disease outbreaks on ships often require immediate medical and public health assessment and response. The investigations as well as the communication between all involved people on board and ashore are extremely time- and resource-demanding, and require a high degree of coordination.

Previous outbreak events on cruise ships, such as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak on board of the Diamond Princess in February 2020, underline the importance of conducting early outbreak investigation and public health response [7]. SARS-CoV-2 outbreaks on cruise ships have rarely been investigated [1, 8]. We assume that the absolute number and dimensions of such events are largely underreported. Coordinated scientific research, however, is scarce since public health services are confronted with several challenges [9–11]:

- the pandemic has overstressed the capacity of public health institutions and often did not allow outbreak investigations in selected settings;
- connection and communication barriers between different stakeholders and competent authorities in different areas of responsibility and jurisdiction at a national and international level leave limited possibilities for outbreak investigations;
- as passengers and crew members usually travel to their respective homes, they are often difficult to follow-up after disembarkation.

Those difficulties are illustrated in a study by Gravningen et al. [10]. Four crew members of a Norwegian expedition cruise ship were tested positive for SARS-CoV-2 after the voyage. The majority of the passengers had already disembarked and the public health authorities had difficulties reaching out to the passengers afterwards [10].

We conducted an outbreak investigation among crew members in the Port of Hamburg in collaboration with ship owners, the ship's physician and Hamburg's Institute for Hygiene and Environment (HU), to identify risk factors for infection and to contribute to a better understanding of outbreak situations and containment strategies on board of a cruise ship.

We used epidemiological methods and genome sequencing to map transmission chains and the dynamics of the outbreak. We determined risk factors and their constellations that increase the infectious hazard by statistical methods.

No exact cruise dates can be mentioned in this manuscript as these would make the cruise ship identifiable.

OUTBREAK SITUATION

Early 2022 a cruise ship left the Port of Hamburg to a 14-day voyage along the Norwegian coast with 165 crew members and 175 passengers on board. A rapid antigen test was negative in all passengers prior to boarding. Serial antigen tests of crew members were conducted on a weekly basis, according to the company's regulations. In addition, on day 1 of the voyage, SARS-CoV-2 antigen tests were conducted for all crew members and passengers as it was required by Norwegian entry regulations. All tests were negative.

On day 3 of the journey the ship was informed about positive SARS-CoV-2 tests in two crew members, who had left the ship prior to the ship's departure from Hamburg. As a consequence, all crew members were screened for infection by antigen test on the same day. The results showed 10 positive cases that were further confirmed using an onboard polymerase chain reaction (PCR) device. In the evening, the Hamburg Port Health Centre (HPHC) at the HU was informed about the outbreak. The HPHC is the competent authority for Public Health events on points of entry in Hamburg, Germany, according to International Health Regulations [11]. At this moment the vessel was located in the Norwegian Sea. The ship discontinued its journey and returned to Hamburg.

All positively tested persons were immediately isolated in individual cabins. Furthermore, a total of 7 close contacts to the positive cases were identified by the ship's physician and these were also isolated in individual cabins. For casual contacts, a 'working-quarantine' was ordered which included consistently wearing FFP2-masks (KN95), eating meals separately from others, and daily antigen testing. The number of isolation cabins on board was sufficient at the time of the initial notification.

MATERIALS AND METHODS

OUTBREAK INVESTIGATION

The outbreak was investigated in collaboration between ship owners, the ship's physician and Hamburg's Institute

for Hygiene and Environment, including its HPHC, the Division of Hygiene and Infectious Diseases, the Division of Microbiology and the Next-Generation Sequencing (NGS) Laboratory. We collected data on age, sex, nationality, boarding time, cabin use (single/shared), work place, and vaccination status in a cohort of 165 crew members.

Definition of cases

Cases were defined as individuals who tested SARS-CoV-2 positive at least once during daily screenings during the outbreak period (days 1 to 10) by a PCR or antigen test.

Definition of vaccination status

Following the recommendations of the Robert Koch Institute valid at the time [12], crew members were categorised as having received one SARS-CoV-2-vaccination if they had received one dose of an mRNA- or vector-based vaccine. Vaccines without licensure in the European Union were not considered. The term "fully vaccinated" was further defined as having received two doses of an mRNA- or vector-based vaccine (incl. 1 dose Janssen® plus 1 dose mRNA vaccine). A "boostered" person was defined as someone having received two vaccine doses plus an mRNA-based vaccine dose. Shortly before departure and in the early days of the trip (day 0 and day 3), vaccination events were conducted for crew members. The vaccinations administered during these events were excluded from being categorised as "fully vaccinated" or "boostered" due to the short time span between the time of this vaccination and the detection of the outbreak under the presumption that immunisation was not yet achieved [13].

Statistical analysis

We calculated the SARS-CoV-2 attack rates among crew members for different risk factors and compared them by chi-squared test, Fisher's Exact test, or Mann-Whitney U test, as applicable. Logistic regression was used for univariable and multivariable analysis. Three separate multivariable regression models were built for three variables to adjust for age and sex. The three variables were chosen based on their a) statistical significance associated with becoming SARS-CoV-2 positive in the descriptive analysis and in the univariable model; and b) on their epidemiologically most plausible cause for becoming infected. Due to strong collinearity, it was not possible to include all potential risk factors in one final model. Analyses were carried out using Stata/IC 17.0 (Stata Corp, Texas, USA).

Sequencing

For whole-genome sequencing of SARS-CoV-2, only samples with a cycling threshold (Ct) ≤ 25 were chosen. RNA and DNA concentration of 45 samples were tested before and after a DNase digestion. The samples were prepared for sequencing following the Illumina® RNA Prep with Enrichment, (L) Tagmentation kit (Illumina, Inc., San Diego, CA, USA) according to the manufacturer's instructions. The sequencing was performed on an Illumina MiSeq with a reading length of 150 bp (paired-end).

The raw paired sequencing reads were quality checked, with a minimum base quality of 30, and aligned with bwa v0.7 [14]. Sorting, duplication and indel realignment were performed by using Samtools v.1.6 [15] and Picard v.2.27.4 [16]. Consensus sequences were built using bcftools v1.15.1. Pangolin v4.1.2 was used for lineage [17]. To detect transmission chains, the resulting consensus sequences were used as input for further analysis with Snippy v4.4.3 and Snippy-snake v1.0.0 [18, 19]. All sequences were uploaded on GISAID (www.gisaid.org, access date 12/2022) and are available under the accession numbers EPI_ISL_16188009 - EPI_ISL_16188049.

ACTIONS AND MEASUREMENTS

SARS-CoV-2 testing

Tests on board were performed by the medical staff (ship's physician and nurses). Two types of antigen test were used: SARS-CoV-2 rapid antigen test by Roche and MEDsan. The use of the onboard PCR device was abandoned with an increasing number of cases. As the PCR device turned out to show contradictory results, it was questionable whether it was suitable for use at sea. Furthermore, the device was not purchased for use in large quantities. After the return to the Port of Hamburg, all passengers were tested before disembarkation via SARS-CoV-2 rapid antigen test (MEDsan) in collaboration with the ship's medical staff and the Hamburg Port Health Authority. Serial swab tests and PCR analyses of the entire crew were carried out upon arrival by a shore-based laboratory.

Isolation and quarantine

All passengers disembarked on the return day (day 5) and were tested by rapid antigen test ashore. Crew members who were not essentially needed for the ship's safety on board also disembarked (84 persons in total) on the day of return and were isolated/quarantined in a hotel ashore. In accordance to the German recommendations valid at the time, quarantine and isolation measures were ended for persons remaining asymptomatic, after at least 7 days subject to a negative test result [20].

RESULTS

OUTBREAK MANAGEMENT

On the day of arrival in Hamburg (day 5), 41 of the 165 crew members tested positive cumulatively by antigen test on board; there were no reports of infections among the 175 passengers. In the serial swab of all crew members

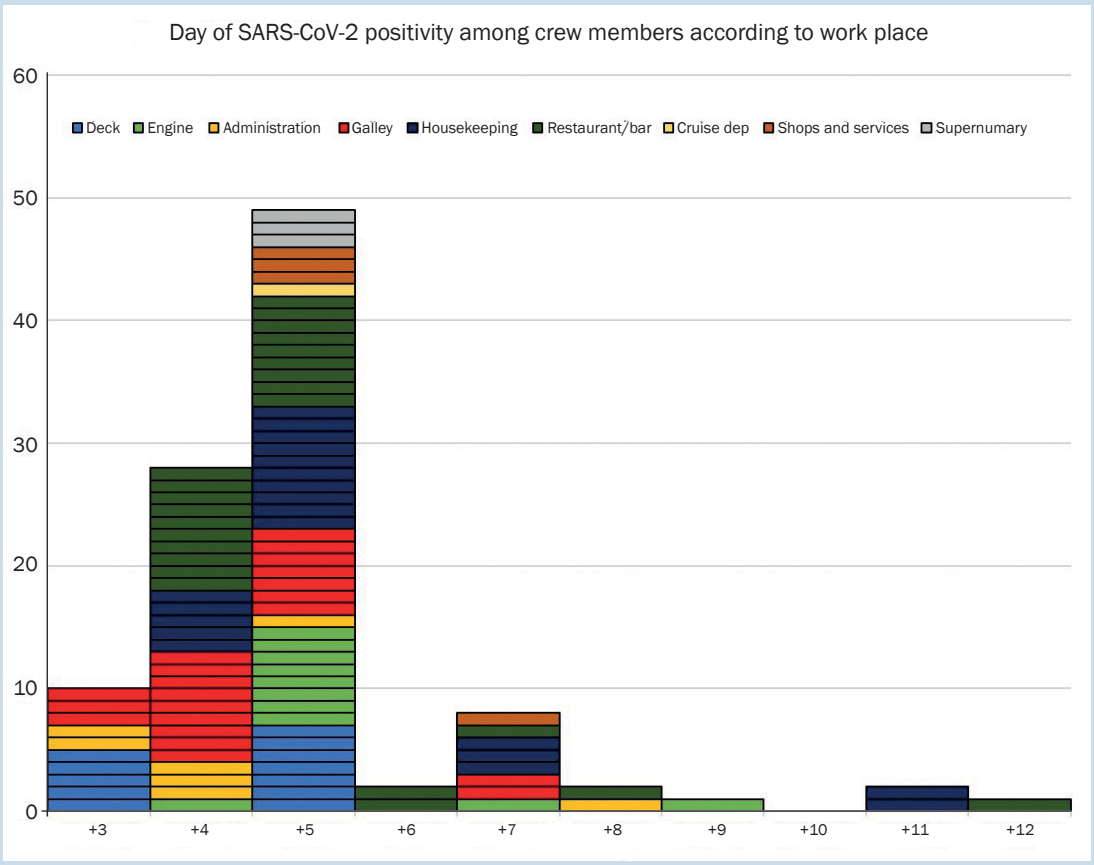


Figure 1. Timeline and number of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) positive tests among crew members by days and according to workplace during a SARS-CoV-2 outbreak among crew members on a cruise ship in early 2022. Exact dates are not shown for data protection reasons. Antigen-testing of all crew members on day +3 and +4. On arrival at Port of Hamburg (day +5) PCR tests were conducted on all crew members

performed on arrival, 82 of 165 PCR tests were found to be positive for SARS-CoV-2.

After the quarantine/isolation off-board, the number of new cases decreased considerably (Fig. 1). In total, the outbreak among crew members included 103 cases and lasted 10 days.

All passenger tests were negative and the passengers were able to continue their journey home after they were advised to monitor themselves for symptoms and report them to their regional public health administration.

OUTBREAK INVESTIGATION

Statistical analysis

One hundred and three SARS-CoV-2 cases among crew members were identified over a course of 10 days (attack rate [AR] 62.4%; Table 1). The majority (n = 87) of cases tested positive on 3 consecutive days: 3 to 5 of the journey (Fig. 1). Day 5 was the day of return to the Port of Hamburg, and represents the shore-side laboratory PCR test results. The median age was comparable in SARS-CoV-2 positive and SARS-CoV-2 negative crew members (36 vs. 38 years, p = 0.45; Table 1). The AR did not differ significantly between males and females (65.3% vs. 53.7%, p = 0.18).

Among crew members who had received a vaccine booster dose, the AR was 38% vs. 66% among those who had only been vaccinated once or twice (p = 0.014). Among those with a stay of less than 30 days on board, the AR was 31% vs. 72% among those staying on board 30 days or longer (p < 0.001). The AR was 53% in Europeans vs. 71% in non-Europeans (p = 0.016). Between work places, the AR differed significantly (p = 0.003), with a notably low AR in the cruise department (9%). In univariable analysis, the risk of infection was only significantly lower in the cruise department compared to working on deck, which was defined as the reference category (odds ratio [OR]: 0.06, 95% confidence interval [CI]: 0.01–0.56, p = 0.014; Table 2). There was no significant difference for all other work places (Table 2). Crew members working in the cruise department also had high coverage of vaccine booster doses, they were all European and predominantly stayed less than 30 days on board (data not shown).

Table 1. Baseline characteristics in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) positive and SARS-CoV-2 negative crew members in a SARS-CoV-2 outbreak on a cruise ship in early 2022

Characteristics		N	SARS-CoV-2 positive	SARS-CoV-2 negative	Attack rate (%)	P value
Crew members overall		165	103	62	62.4	
Sex	Male	124	81	43	65.3	0.18*
	Female	41	22	19	53.7	
Age median (range)		NA	36 (23–61)	38 (20–66)	NA	0.45#
Nationality	Europe	76	40	36	52.6	0.016§
	Other	89	63	26	70.8	
Work place	Deck	19	12	7	63.2	0.003§
	Engine	20	11	9	55.0	
	Administration	9	7	2	77.8	
	Galley	27	21	6	77.8	
	Housekeeping	26	20	6	76.9	
	Restaurant/bar	38	24	14	63.2	
	Cruise department	11	1	10	9.1	
	Shops and services	6	4	2	66.7	
	Supernumerary	9	3	6	33.3	
Cabin use	Alone	55	29	26	52.7	0.069*
	With a cabin mate	110	74	36	67.3	
Vaccination status	One or two doses**	144	95	49	66.0	0.014*
	Booster**	21	8	13	38.1	
Time on board in categories	< 30 days	39	12	27	30.8	< 0.001
	≥ 30 days	126	91	35	72.2	

#Mann Whitney U test; §Fisher Exact test; *Chi-squared test; **One dose: one dose of any mRNA or vector-based vaccine, two doses: two doses of any mRNA or vector--based vaccine (incl. 1 dose Janssen plus 1 dose mRNA vaccine), booster (two doses plus an mRNA-based vaccine). Vaccines without licensure in the EU (e.g. Sinovac) were not considered; NA — not available

There was some evidence that the AR was higher in crew members sharing a cabin than in those with a cabin of their own (67% vs. 53%, p = 0.069). Also, among those sharing a cabin, 95% had not received a booster vaccine dose, 73% had a non-European nationality, and 83% stayed 30 or more days on board.

Adjusting for age and sex, cases were more likely to have received no booster vaccine (OR: 2.66, 95% CI: 0.99–7.13), to have spent more time on board (≥ 30 days, OR: 6.36, 95% CI: 2.81–14.40 vs. < 30 days) and to have a non-European nationality (OR: 2.14, 95% CI: 1.08–4.27).

Laboratory analysis

A shore-based laboratory performed SARS-CoV-2 PCR analysis of the 165 swab samples taken from the crew members after the arrival in Hamburg. The extracted nucleic acids of 82 SARS-CoV-2 positive tested samples were sent to the NGS Laboratory (Institute for Hygiene and Environment, Hamburg, Germany) to identify SARS-CoV-2 variants and possible transmission chains by sequencing. Hence, 45 samples were sequenced and only 41 samples showed high quality reads which then were further analysed. The Pangolin classification revealed that 39 consensus sequences are related to Omicron subtype BA.2.3, one sequence to BA.1.1 and one sequence to BA.1.18. The BA.2.3-related sequences show a high similarity in a single nucleotide polymorphism analysis (Fig. 2).

DISSCUSION

OUTBREAK INVESTIGATION

The majority of cases on board were related to a larger Omicron subtype BA.2.3 outbreak. However, other smaller outbreaks cannot be ruled out (as two sequences were classified as subtypes of BA.1). However, BA.1 is less transmissible compared to BA.2.3, which might have an effect on the outbreak situation on the ship [21].

Due to the possibility to analyse only half of the positive samples by sequencing, transmission chains and sources cannot be completely verified.

Table 2. Association of different risk factors with becoming severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) positive during a SARS-CoV-2 outbreak among crew members on a cruise ship in early 2022

Characteristics		Odds ratio (95% CI)	P value
Sex	Male	1.63 (0.79–3.33)	0.18
	Female	Baseline	
Age [years]		0.98 (0.95–1.01)	0.26
Nationality	Europe	Baseline	
	Other	2.18 (1.15–4.14)	0.017
Work place	Deck	Baseline	
	Engine	0.71 (0.20–2.57)	0.61
	Administration	2.04 (0.33–12.69)	0.44
	Galley	2.04 (0.56–7.50)	0.28
	Housekeeping	1.94 (0.53–7.17)	0.32
	Restaurant/bar	1 (0.32–3.13)	0.99
	Cruise department	0.06 (0.01–0.56)	0.014
	Shops and services	1.17 (0.17–8.09)	0.88
	Supernumerary	0.29 (0.06–1.55)	0.15
Cabin use	Alone	Baseline	
	With a cabin mate	1.84 (0.95–3.57)	0.070
Vaccination status	One or two doses*	Baseline	
	Booster*	0.32 (0.12–0.82)	0.017
Time on board in categories	< 30 days	Baseline	
	≥ 30 days	5.85 (2.67–12.81)	< 0.001

Univariate analysis — logistic regression; *One dose: one dose of any mRNA or vector-based vaccine, two doses: two doses of any mRNA or vector–based vaccine (incl. 1 dose Janssen plus 1 dose mRNA vaccine), booster (two doses plus an mRNA-based vaccine). Vaccines without licensure in the EU (e.g. Sinovac) were not considered; CI — confidence interval

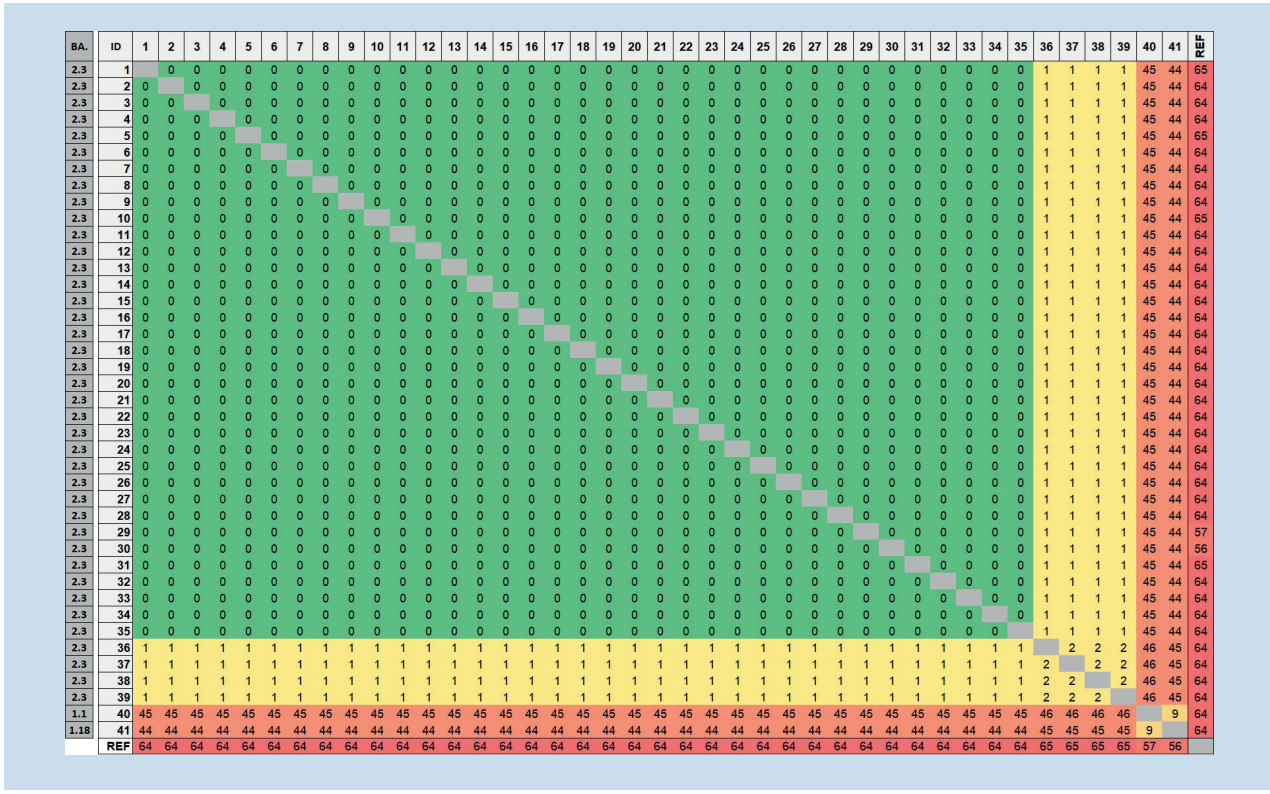
Our investigation shows that not receiving a COVID-19 vaccine booster dose, longer stays on board and a non-European nationality were associated with a higher risk of SARS-CoV-2 infection during an Omicron outbreak among crew members of a cruise ship. A longer stay on board could be an indicator for more social contacts and therefore mixing on board.

Although working in the cruise department appears to be associated with a lower risk of infection in the univariable analysis — and one may hypothesize that this group worked and socialised separately from the other groups — we could not confirm this theory in interviews. It was reported that social mixing occurred between crew members working in different places. Furthermore, the low infection risk in the cruise department group could also be explained by the high booster vaccine coverage, all members of the crew department being European and their short stays on board. We therefore believe that different work places were not an independent risk factor for SARS-CoV-2 infection on this cruise ship.

Why would non-Europeans have a higher risk of SARS-CoV-2 infection? We found statistical correlations between the nationality, boarding-time, cabin use (single/shared), work place, and vaccination status, which may all influence the risk of an infection but also have an influence on each other.

The vaccination rate with a booster dose (which was 2% among non-European vs. 25% among European crew), for example, could be a reason for a higher risk of an infection among the non-European crew members. It is unknown whether social, cultural and behavioural patterns or a limited access to relevant public health information may be associated with different infection risks in Europeans and non-Europeans.

A reason for the differences in vaccination rates might be different access to COVID-19 vaccines for those crew members staying on board for a longer period (non-European crew members usually have longer contracts compared



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2.3	5	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	65
2.3	6	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	7	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	8	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	9	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	10	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	65
2.3	11	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	12	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	13	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	14	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	45	44	64
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2.3	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	45	44	64
2.3	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	1	45	44	57
2.3	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1	1	45	44	56
2.3	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	1	1	1	45	44	65
2.3	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	1	1	1	1	45	44	64
2.3	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1	1	1	1	45	44	64
2.3	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	1	1	1	45	44	64
2.3	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	1	45	44	64
2.3	36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		2	2	2	46	45	64
2.3	37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		2	2	46	45	64
2.3	38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2		2	46	45	64
2.3	39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2		46	45	64
1.1	40	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	46	46	46	46		9	64
1.18	41	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	45	45	45	45	9		64
	REF	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	65	65	65	65	57	56	

Figure 2. Single nucleotide polymorphism (SNP) matrix of the sequenced samples during a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak among crew members on a cruise ship in early 2022. Consensus sequences were used as input for further analysis with Snippy v4.4.3 and Snippy-snake v1.0.0 with default settings. Each sample is compared to every sample and reference sequence (NC_045512) concluding in a matrix with SNPs differences. Colours were depicted by the authors describing sequences with 0 SNP differences (green), with low SNP differences (yellow) and high SNP differences (orange, red). Pangolin lineage declaration is shown for each sample.

to European crew members) and for those coming from non-European countries (mRNA vaccines were not available in all countries).

There is an inconsistent international definition of the term "fully vaccinated", which results in an incongruent vaccination status of the crew on board. The company's regulations define the receipt of a single Janssen vaccine dose as being "fully vaccinated". This practice reflects the broad routine in the maritime sector. However, German requirements based on the Robert Koch Institute recommendations specify an additional mRNA vaccine for completion of the vaccination protection.

This investigation indicates that the number of vaccinations may affect the individual risk of infection. One important intervention to avoid future SARS-CoV-2 outbreaks among crew members could be to make sure that all crew members are up-to-date with their vaccination status well before starting their contract.

OUTBREAK MANAGEMENT

After the sudden emergence of 10 positive cases, the ship's master decided to interrupt the voyage and return to the Port of Hamburg. Even though immediate actions were taken by the ship's physician (isolation of positive cases, quarantine of close contacts) a sharp increase of new cases within the following 48 hours was observed.

In the morning of day 5 on board, antigen testing revealed 41 crew members positive for SARS-CoV-2. Series swab tests and PCR analysis carried out by a shore-based laboratory on the same day after the arrival uncovered a total number of 82 out of 165 crew members positive for SARS-CoV-2. The considerable discrepancy of the results underlines that serial PCR testing is superior to antigen testing. However, PCR devices, since they are sensitive for vibration and shock, are in general not validated and therefore not unrestrictedly applicable for the use on ocean-going vessels.

After disembarkation and isolation of positive cases and contacts in a shore side facility, only a small number of further cases occurred and the outbreak was soon declared over. Consistent surveillance and consequent separation of positive and suspected cases from others are crucial for an outbreak control.

In addition to the already cramped conditions on board of a ship, space and resources (i.e. treatment rooms, quarantine or isolation cabins, medical personnel, testing capacity, etc.) are also limited. These factors can promote spreading of diseases.

CONCLUSIONS

This investigation confirms the importance of a booster vaccine against COVID-19 for crew members on cruise ships. Longer stays on board could facilitate social mixing and thus the risk for SARS-CoV-2 infections. Non-Europeans appear to be at higher risk for SARS-CoV-2 infections. Further studies could investigate the impact of social, cultural and behavioural patterns as well as access to relevant public health information on the individual infection risk. For containing outbreaks of airborne diseases on cruise ships, physical distancing together with screening and isolation are crucial.

The results and lessons learned from this investigation are also relevant for other respiratory infections and future pandemic situations. They are not limited to the maritime sector or to cruise ship settings. We are convinced that our evaluation of the outbreak situation allows transferable conclusions for informed public health and disease preventing measures in similar settings of cohorts in confined environments.

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Conflict of interest: None declared

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Trends in the medical repatriation of Filipino seafarers: a ten-year study of a Philippine maritime shipping company (OSM Maritime)

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ABSTRACT

Background: *Seafarers, confronted with unique health challenges, occasionally necessitate medical repatriation. This study examines the trends in medical repatriation cases among Filipino seafarers employed by OSM Maritime shipping company over a 10-year period from 2013 to 2022.*

Materials and methods: *Medical records of OSM Maritime seafarers were reviewed, obtaining causes for and dates of medical repatriation. International Classification of Diseases (ICD-11) was utilised to classify repatriation cases. Proportion of repatriation cases were calculated and their annual trends were analysed.*

Results: *Our findings reveal that the majority of repatriation cases are attributed to injury/trauma (19.91%), musculoskeletal (18.40%), gastrointestinal (16.56%), cardiovascular (8.77%), infectious (6.82%), and genitourinary conditions (5.30%). Significantly, the study identifies a declining trend in the proportion of cardiovascular, gastrointestinal, and genitourinary conditions in annual repatriation cases, particularly in ischaemic heart conditions, cholelithiasis, cholecystitis, and urinary calculus.*

Conclusions: *These results emphasize the critical need for multisectoral collaboration to enhance seafarers' health and well-being. Prioritizing comprehensive care programmes, ensuring safe working conditions, and exploring holistic healthcare initiatives are essential steps to enhance seafarers' occupational health.*

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Keywords: medical repatriation rates, Filipino seafarers, maritime industry, holistic care programme, occupational health

INTRODUCTION

The maritime industry plays a crucial role in global trade, with seafarers serving as the backbone of this industry [1]. However, the nature of their work exposes seafarers to unique health risks and challenges, which sometimes lead to medical repatriation — the process of returning seafarers to their home country for medically-related reasons [2, 3]. Medical repatriation may disrupt the seafarers' employment and career progression and may impose significant financial and emotional burdens on both the individuals and the maritime shipping companies [4]. Moreover, repatriation adds additional load to the remaining crew onboard, and disrupts the operation and planning of the ship which usually takes several weeks and months to create. Operationally, this will also pose challenges to the shore employees as it gives rise to an urgent hiring to replace the post of the repatriated sea-

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farers, and may lead to changes in route or ports and delay in the delivery of goods and services. Thus, understanding the trends and factors influencing medical repatriation rates is essential for enhancing the well-being of seafarers and improving the overall sustainability of the maritime industry [4].

The Philippines has long been recognized as a major supplier of seafarers globally, accounting for around 20% of the global workforce [5, 6]. OSM Maritime, one of the largest maritime shipping companies in the Philippines, serves as an important case study for investigating the medical repatriation patterns and evaluating the effectiveness of interventions aimed at reducing medical repatriation rates [7]. Holistic health care programme, introduced by the company in 2018, provides an opportunity to evaluate impact of such initiative on medical repatriation rates.

In this study, we focus on examining the repatriation cases among Filipino seafarers employed by OSM Maritime shipping company over a 10-year period, from 2013 to 2022. A comprehensive understanding of the causes and patterns of repatriation cases can provide valuable insights into the health concerns and challenges faced by seafarers, thereby guiding the development of targeted interventions and support systems.

MATERIALS AND METHODS

STUDY POPULATION

This study analysed medical repatriation cases among seafarers employed by OSM Maritime shipping company from 2013 to 2022. To safeguard the privacy and confidentiality of the seafarers, a thorough de-identification process was carried out on the records before analysis.

DATA COLLECTION

Extensive reviews of medical records of OSM Maritime seafarers were conducted. Information related to medical repatriation cases, including the dates of repatriation, was extracted from these records. The causes leading to medical repatriation were categorised in accordance with the International Classification of Diseases, 11th edition (ICD-11) [8]. Subsequently, the collected data was organized based on organ systems to facilitate further analysis.

DATA ANALYSIS

Descriptive analysis was employed to examine the medical repatriation cases in this research. Percentages were calculated to determine the proportion of cases within specific organ systems and disease categories. The dynamics of repatriation cases were also explored by analysing the annual trends. Linear regression was performed to analyse the trends of proportion of repatriation cases for each year. Microsoft Excel (365) was utilised for data management, and Graph Pad Prism 8.0 (Boston, Massachusetts, USA) was employed for constructing figures to illustrate the findings.

RESULTS

To investigate the trends in medical repatriation rates among Filipino seafarers, we conducted an extensive analysis of medical repatriation cases involving seafarers employed by OSM Maritime shipping company over a 10-year period, spanning from 2013 to 2022. There are a total of 924 repatriation cases in this 10-year period.

DISTRIBUTION OF REPATRIATION CASES BY ORGAN SYSTEM

Figure 1 illustrates the distribution of cases categorised by organ systems, following the ICD-11 codes. Within this dataset, injuries constituted the highest proportion of cases, accounting for 184 out of 924 (19.91%), with musculoskeletal conditions ranking closely behind at 170 (18.40%) cases. Additionally, other organ systems with noteworthy proportions of cases include gastrointestinal (153/924, 16.56%), cardiovascular (81/924, 8.77%), infectious (63/924, 6.82%), genitourinary (49/924, 5.30%), and dermatological (48/924, 5.19%) conditions.

DISTRIBUTION OF REPATRIATION CASES IN EACH ORGAN SYSTEM

We determined the number of cases in each organ system. Among injury or trauma cases (Fig. 2), the highest proportion are those with hand injury (n = 52/184, 28.27%), followed by smoke inhalation (n = 13/184, 7.07%). There were also high proportion of cases with burn injury (10/184, 5.43%), knee injury (10/184, 5.43%), head injury (9/184. 4.89%), and shoulder injury (9/184, 4.89%).

Within musculoskeletal conditions (Fig. 3), low back pain emerged as the most prevalent, with 51 cases out of 170 (30.00%), followed by joint pains (29/170, 17.06%). Additional significant conditions included gout (12/170, 7.06%), limb pains (11/170, 6.47%), joint effusion (10/170, 5.88%), and soft tissue disorders (9/170, 5.29%).

Among gastrointestinal conditions (Fig. 4), acute appendicitis was the most commonly reported case, accounting for 27 out of 153 cases (17.65%), followed by abdominal or pelvic pain (24/153, 15.69%). Other notable gastrointestinal cases included haemorrhoids (16/153, 10.46%), hernias (13/153, 8.50%), cholelithiasis/cholecystitis (10/153, 6.54%), and melena (7/153, 4.58%).

Turning to cardiovascular disease (Fig. 5), hypertension emerged as the leading cause of repatriation, constituting 34 out of 81 cases (41.98%), followed by chest pain (14/81, 17.28%), and coronary artery disease (10/81, 12.35%). The remaining cases encompassed varicose veins and other lymphatic diseases.

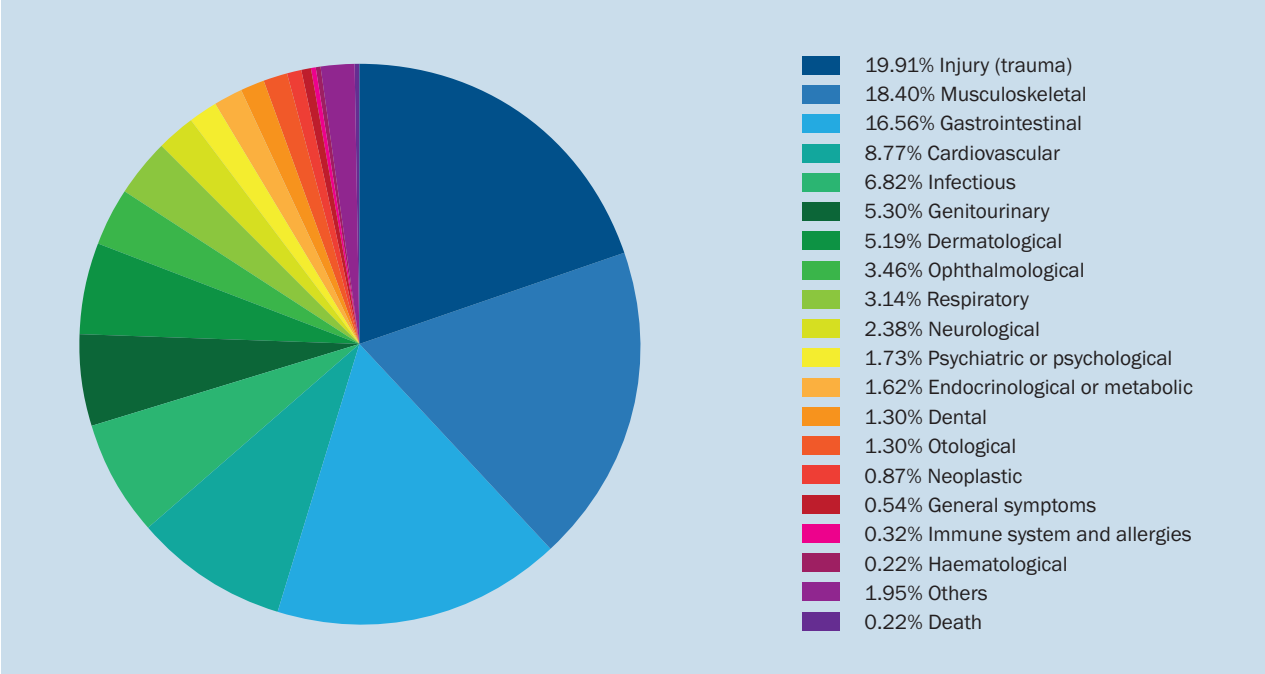

Figure 1. Percentage of each organ system in the total repatriation cases from 2013 to 2022 (total = 924)

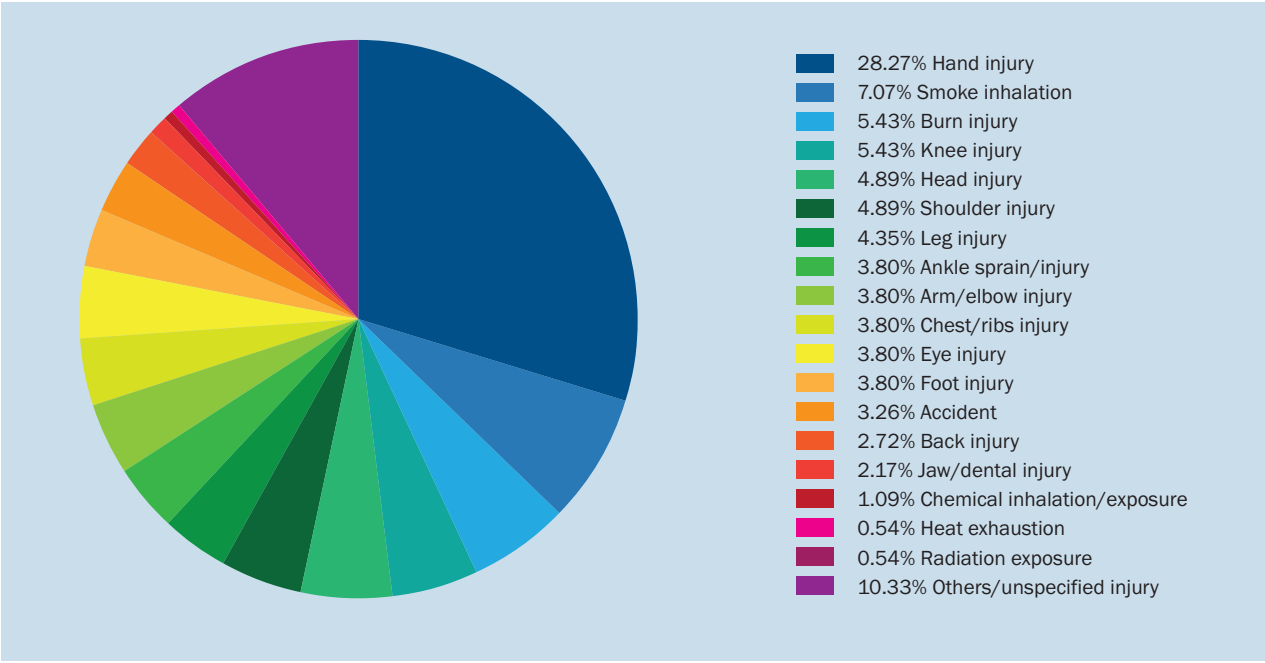

Figure 2. Characteristics of injury or trauma cases among repatriated OSM seafarers from 2013 to 2022 (total = 184)

Within infectious repatriation cases (Fig. 6), deep folliculitis or pyogenic abscess of the skin was the most prevalent, accounting for 20.63% of cases. Notably, coronavirus disease 2019 (COVID-19) emerged as a significant factor, comprising 14.29% of cases, although this infection only surfaced in 2020. Other infectious diseases included dengue (11.11%), malaria (9.52%), tuberculosis (9.52%), and varicella (9.52%).

In the realm of genitourinary conditions (Fig. 7), calculus or urinary tract were the most prevalent with 16 out of 49 cases (32.66%). Another common condition included urinary tract infection (5/49, 10.20%), followed by haematuria (3/49, 6.12%), orchitis/epididymitis (2/49, 4.08%), and testicular pain (2/49, 4.08%).

The remainder of repatriation cases are presented in Supplementary Table 1 (see journal website). Notable cases within

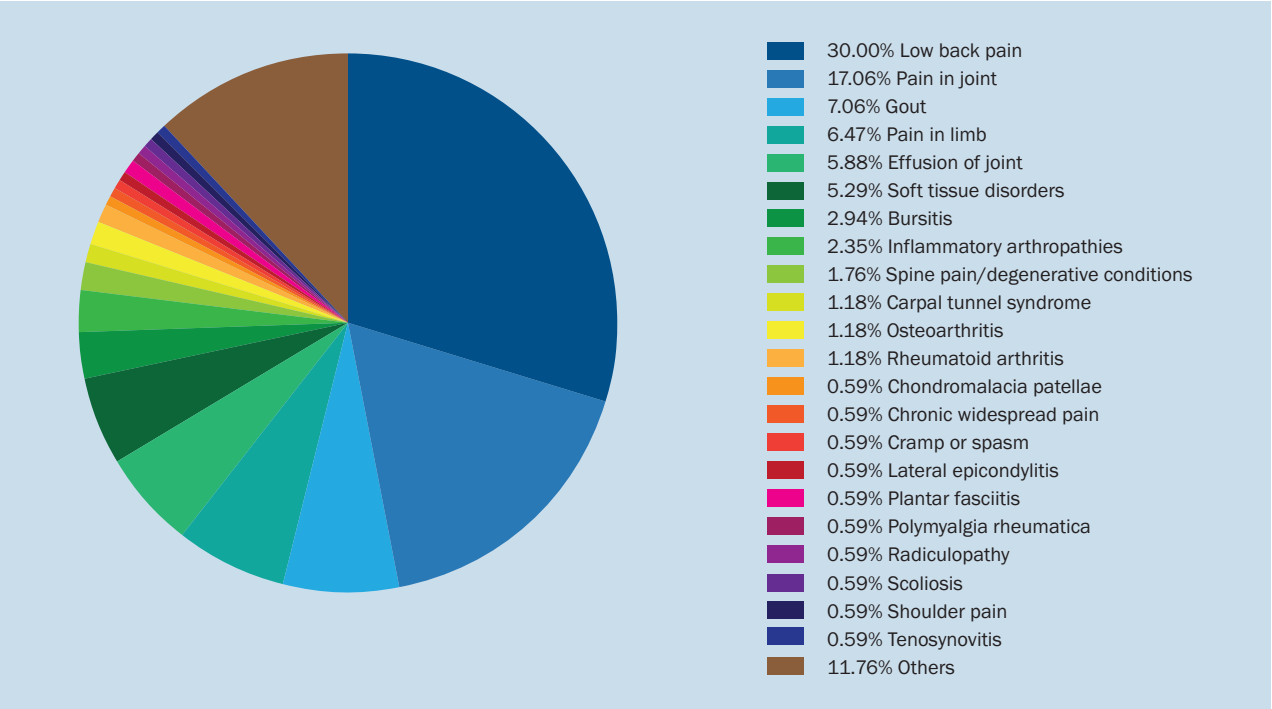

Figure 3. Characteristics of musculoskeletal cases among repatriated OSM seafarers from 2013 to 2022 (total = 170)

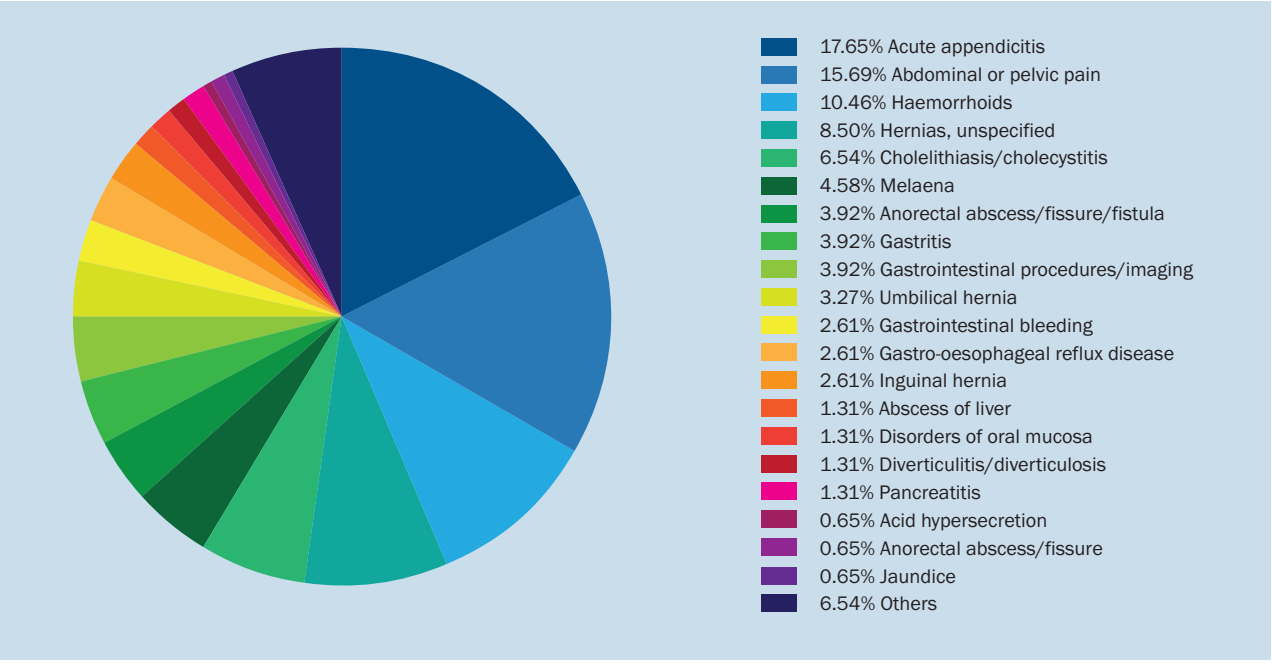

Figure 4. Characteristics of gastrointestinal cases among repatriated OSM seafarers from 2013 to 2022 (total = 153)

dermatological conditions (48 cases in total) encompassed subcutaneous masses or swellings (14/48, 29.17%), contact dermatitis (8/48, 16.67%), and eczema (8/48, 16.67%). The most common ophthalmological cases (32 in total) included pterygium (5/32, 15.63%), blurred vision (2/32, 6.25%), and cataract (2/32, 6.25%). Respiratory cases (29 in total) were predominantly represented by pneumonia (6/29, 20.69%), dyspnoea (3/29, 10.34%), and acute upper respiratory infections (6/29, 10.34%). Neurological cases (22 in total) primarily included cerebral strokes (5/22, 22.73%), epilepsy/seizures (3/22, 13.64%), and headaches (3/22, 13.64%). Psychiatric or psychological conditions (16 in total) consisted mainly of acute and transient psychotic disorders (6/16, 37.50%), anxiety/fear disorders (2/16, 12.50%), and adjustment dis-

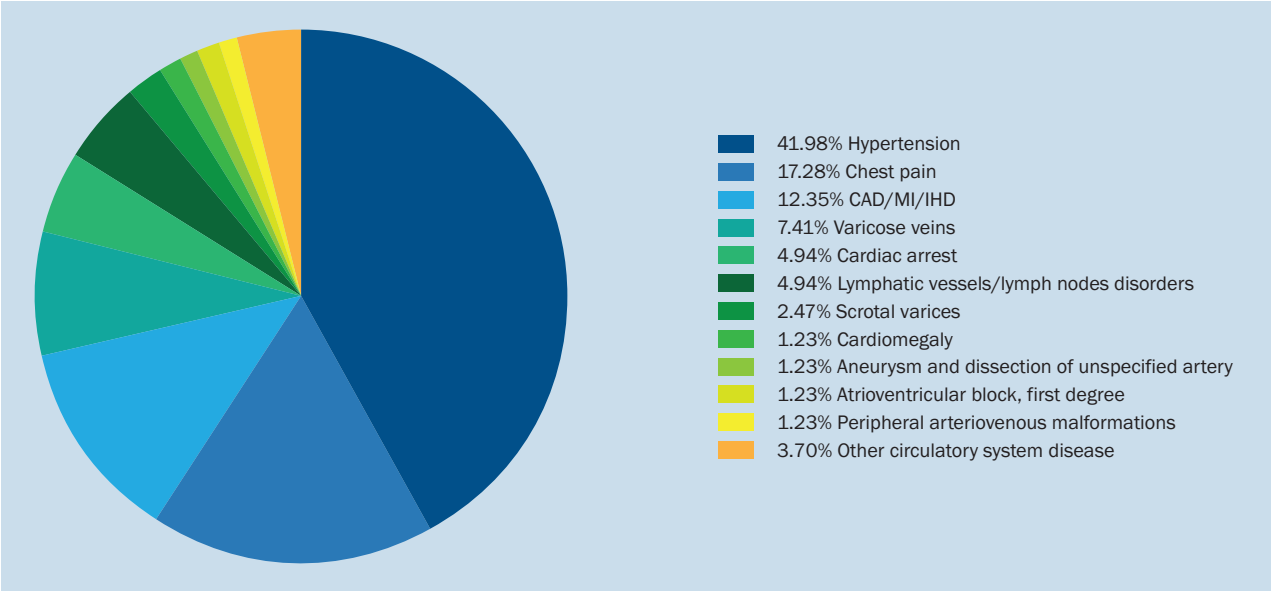

Figure 5. Characteristics of cardiovascular cases among repatriated OSM seafarers from 2013 to 2022 (total = 81); CAD/MI/IHD — coronary artery disease/myocardial infarction/ischaemic heart disease

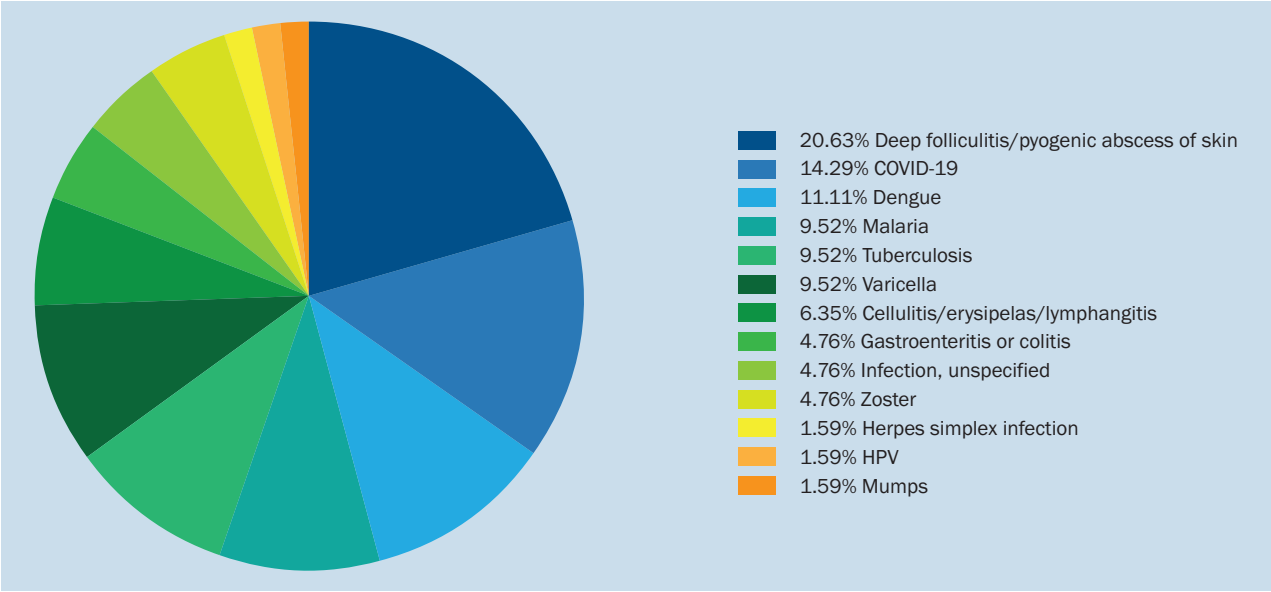

Figure 6. Characteristics of infectious cases among repatriated OSM seafarers from 2013 to 2022 (total = 63); COVID-19 — coronavirus disease 2019; HPV — human papilloma virus

orders (2/16, 12.50%). Among endocrinological or metabolic disorders (15 in total), the most common were nontoxic goitre (5/15, 33.33%), diabetes mellitus (4/15, 26.67%), and hypokalaemia (4/15, 13.33%). Otoological conditions (12 in total) were primarily represented by hearing impairment disorders (4/12, 33.33%) and otitis media (2/12, 16.67%).

YEARLY PERCENTAGE OF ORGAN SYSTEM REPATRIATION CASES

To understand the dynamics of medical repatriation, we explored trends in repatriation rates within each organ system over the 10-year study period. To achieve this, we took the cases for each organ system. We calculated their contribution to the total repatriation cases for each year, thereby determining the percentage of yearly cases for each organ system. Subsequently, we compared these percentages across the organ systems. This comprehensive analysis is presented in Figure 8, which illustrates the annual distribution of repatriation cases at the organ system level. Additionally, Figure 9 sheds light on the fluctuations in these yearly percentages for the primary organ system causes of repatriation. More comprehensive data on the dynamics

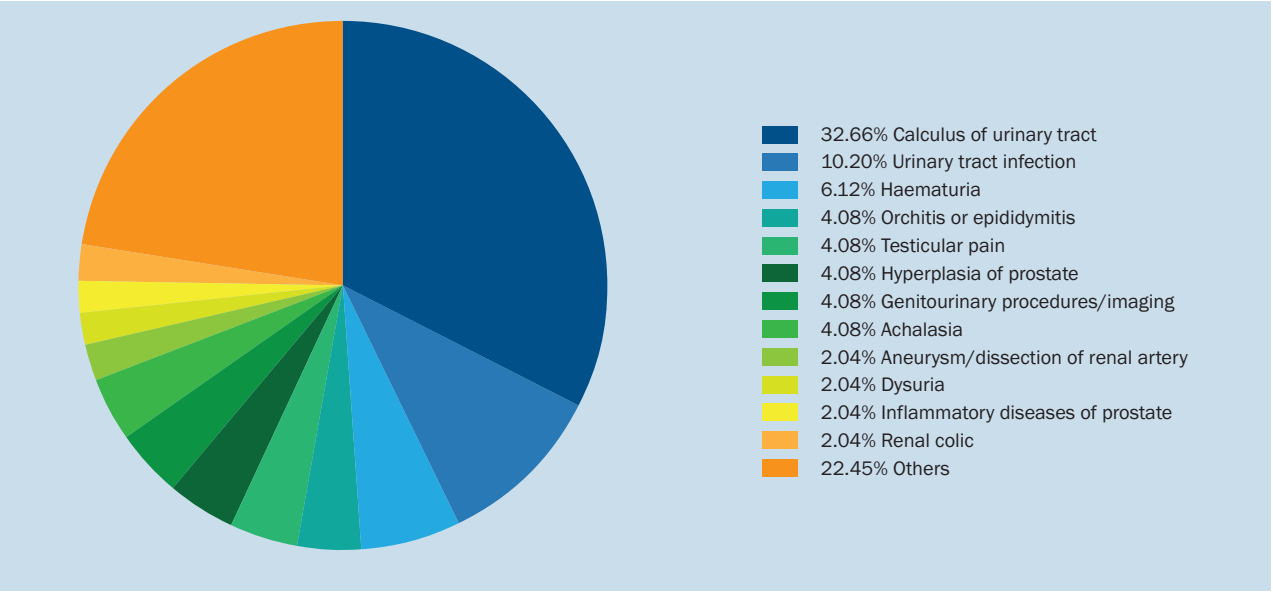

Figure 7. Characteristics of genitourinary cases among repatriated OSM seafarers from 2013 to 2022 (total = 49)

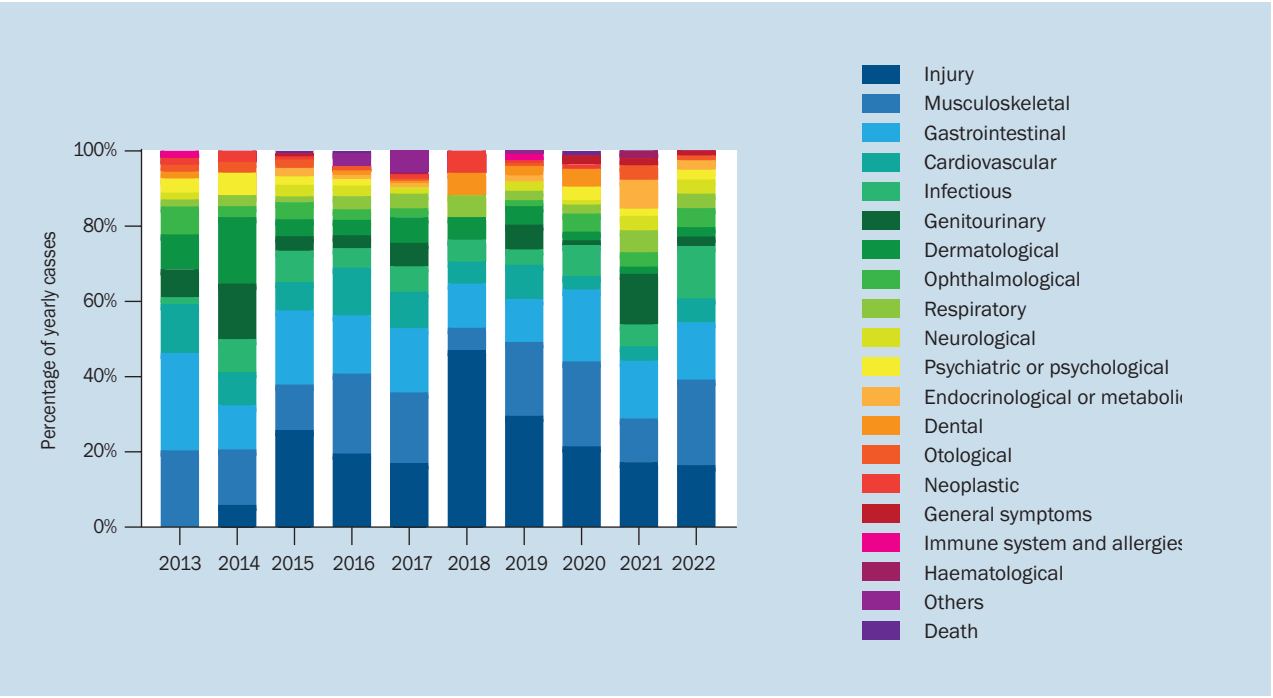

Figure 8. The proportion of repatriation cases for each year per organ system

of organ system is presented in Supplementary Table 2 (see journal website).

Notably, a consistent decline in medical repatriation rates within the cardiovascular and gastrointestinal organ systems became evident over the years, spanning from 2013 to 2022. Conversely, we observed an increasing trend in infectious disease cases. Furthermore, there was an upward trajectory in injury (trauma) cases from 2013 to 2018, followed by a declining trend from 2019 to 2022. Linear regression was performed in the yearly percentages for the primary organ system causes of repatriation to ascertain which of these trends are significant (Fig. 9). Among the organ systems presented, the cardiovascular system showed significant trend results (Slope: –0.7827; 95% confidence interval: –1.381 to –0.1849; p value: 0.0166).

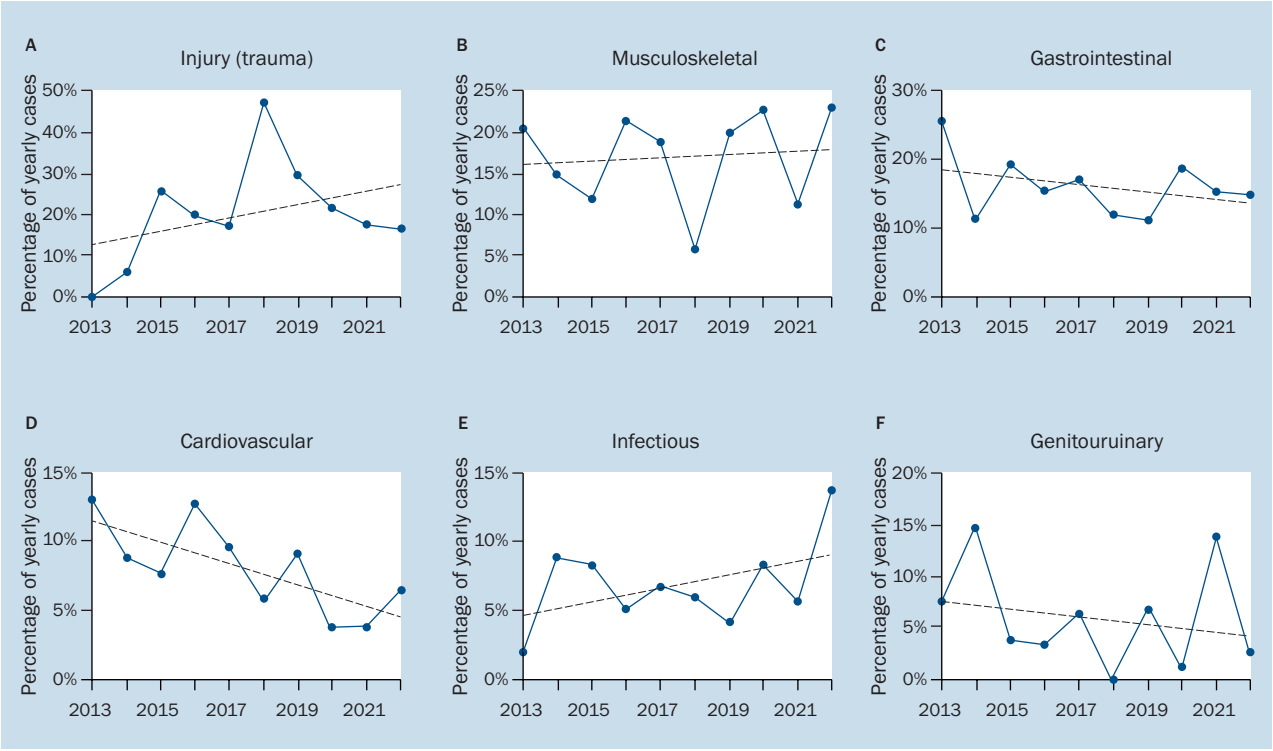

Figure 9. Proportion of repatriation cases for each year for injury (trauma) (**A**), musculoskeletal (**B**), gastrointestinal (**C**), cardiovascular (**D**), infectious (**E**), genitourinary (**F**). The broken lines represent the trend line for the 10 year period

YEARLY PERCENTAGE OF REPATRIATION CASES BY INDIVIDUAL DISEASES

To have a more granular understanding, we delved into the annual trends in repatriation cases for individual diseases spanning 2013 to 2022. We calculated each disease's share of the total repatriation cases for each year, thereby revealing the percentage of yearly cases attributed to specific diseases. These insights are graphically depicted in Figure 10, presented as a heatmap.

Within the realm of cardiovascular diseases, a consistent decline in the percentage of cases associated with chest pain, coronary artery disease, myocardial infarction, and ischaemic heart disease was observed over the study period (Fig. 10D). Turning to gastrointestinal cases, there was a reduction in the proportion of cholelithiasis/cholecystitis and haemorrhoids among the yearly repatriation cases. Conversely, there was an increase in the percentage of cases related to abdominal or pelvic pain (Fig. 10E). In the musculoskeletal category, we noted a decrease in the percentage of cases involving gout, accompanied by a rise in the percentage of cases associated with low back pain within the yearly repatriation statistics (Fig. 10B). Notably, the infectious disease category saw a visible surge in the proportion of COVID-19 cases among the yearly repatriation figures starting in 2020 (Fig. 10E). For genitourinary cases, the yearly repatriation data observed a significant decrease in the percentage of cases attributed to calculus of the urinary tract (Fig. 10F). Further details on other cases can be found in Supplementary Table 3 (see journal website).

DISCUSSION

The present study focused on analysing the repatriation cases among Filipino seafarers employed by OSM Maritime shipping company over a 10-year period (from 2013 to 2022). Our findings revealed that injuries/trauma, musculoskeletal, gastrointestinal, cardiovascular, infectious, and genitourinary conditions were the most common causes of repatriation. There is evidence for the decrease in the proportion of gastrointestinal, cardiovascular, and genitourinary conditions in yearly repatriation cases.

This study underscored the prominence of injuries and musculoskeletal conditions among repatriation cases. These conditions collectively accounted for over a third of the total repatriation cases, emphasizing their substantial impact on the seafaring community. Our findings agree with previous reports that injuries contribute a significant proportion to repatriation cases [9, 10]. Most of the injuries or musculoskeletal cases in this study were hand injuries, low back pain, and joint pains, which may signify occupational-related causes. Equally concerning were injuries stemming from smoke inhalation, burns, and radiation. This

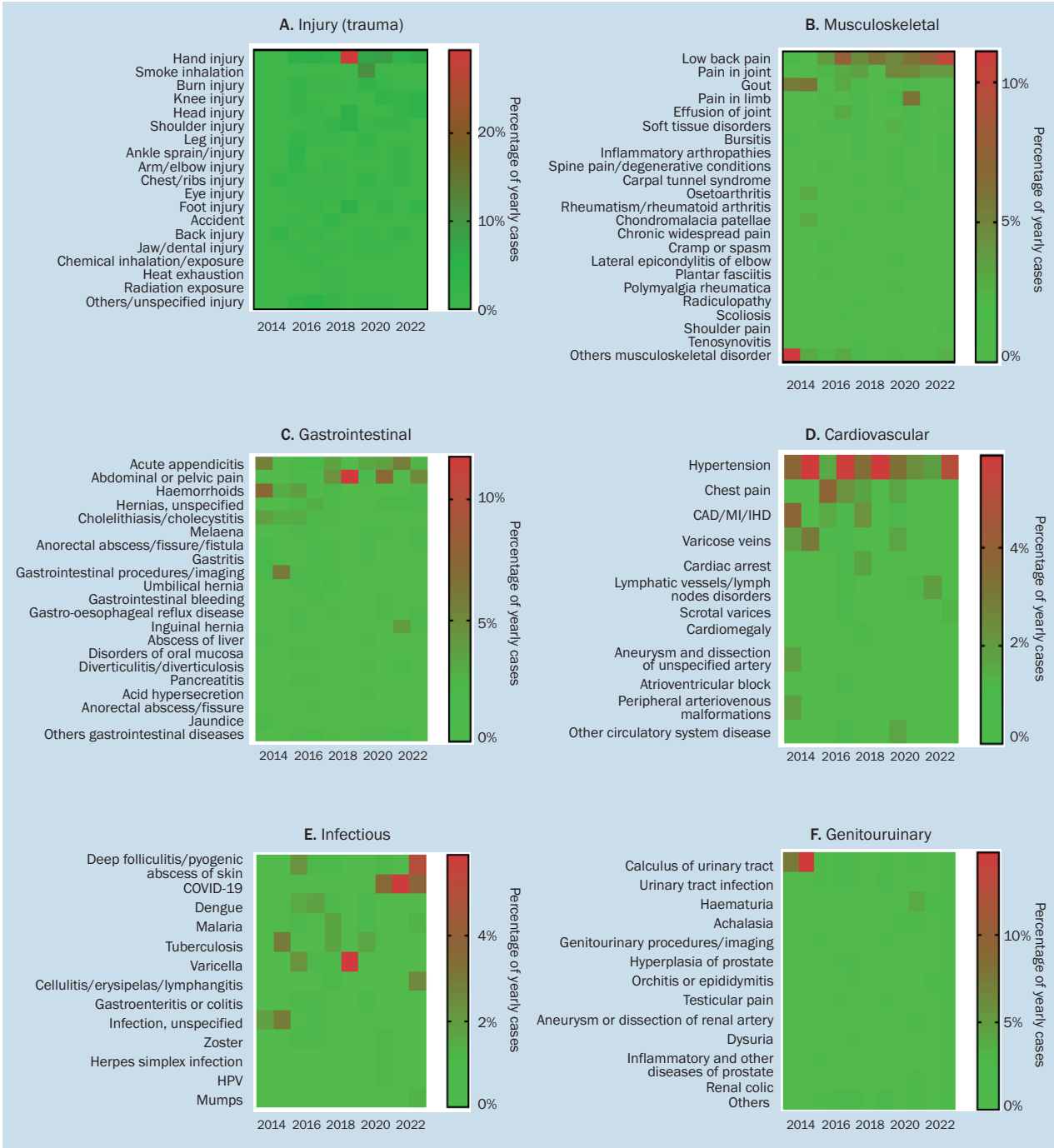

Figure 10. Heatmap depicting the percentage of specific diseases in the yearly repatriation cases. The colour represents the percentage in the yearly repatriation cases, with red representing a higher percentage and green a lower percentage; **A.** Injury; **B.** Musculoskeletal; **C.** Gastrointestinal; **D.** Cardiovascular; **E.** Infectious; **F.** Genitourinary; CAD/MI/IHD — coronary artery disease/myocardial infarction/ischaemic heart disease; COVID-19 — coronavirus disease 2019; HPV — human papilloma virus

observation underscores the need to prioritise establishing a safe and secure working environment for seafarers. Measures such as stringent safety protocols, ergonomic improvements, and comprehensive training programmes may help reduce the incidence of injuries and musculoskeletal disorders, ultimately safeguarding the physical well-being of seafaring personnel [11].

COVID-19 cases constituted a significant share of infectious disease cases, reflecting the profound impact of this global public health emergency. The World Health Organization officially declared COVID-19 a pandemic in March 2020, triggering far-reaching consequences across various industries, with the maritime and shipping sectors bearing substantial challenges and disruptions

[12]. While effective public health measures, including quarantines and extensive vaccination efforts, have successfully contained the spread of COVID-19, it remains imperative to maintain a high level of vigilance [13, 14]. This ongoing vigilance involves continuously monitoring individuals presenting symptoms suggestive of COVID-19, use of face masks when appropriate, and updating vaccination of personnels [15]. These measures continue to be relevant in preventing the transmission not just of COVID-19, but other infectious diseases as well. The study's results also revealed many skin infections among seafarers, implying the need to improve hygiene conditions in their working environment [16].

The results showed evidence for decreased proportion of cardiovascular condition, gastrointestinal diseases, and genitourinary conditions in the yearly repatriation cases. Upon closer examination, this decrease was particularly evident in ischaemic heart conditions, cholelithiasis, cholecystitis, and calculus of the urinary tract. Several factors could be attributed to this decline. Notably, these conditions are significantly influenced by lifestyle factors and dietary habits and are preventable through proper disease screening [17–19]. Consequently, proactive health measures hold the potential to mitigate these conditions. The implementation of a holistic healthcare programme by the Nordic Medical Clinic (NMC) emerges as a potential contributing factor to this observed trend.

The NMC is a pre-employment clinic that caters to the seafarers of OSM Maritime Shipping Company in the Philippines. In 2018, NMC initiated a holistic health initiative for its seafarers. Holistic health the comprehensive patient care that considers interdisciplinary or multidimensional aspects of wellness [20]. This concept encourages looking at people as a whole, not merely focusing on physical well-being or the absence of disease.

In this regard, NMC implemented the following measures in order to provide holistic care to its seafarer clients:

- Holistic health app — a free-access online application shared to all seafarers upon booking of appointment for pre-employment medical examination (PEME). This consists of 9 modules covering the following: mindfulness, sleep, hydration, activities, reproductive health, safety, mental health, spiritual health, power morning drink;
- Feedback call from NMC doctor — 1 on 1 discussion with NMC doctor regarding PEME medical results and how to improve overall health, especially if with borderline findings (e.g. HbA1c on prediabetes level);
- Holistic health booklet for seafarers — self-explanatory educational material touching on the basics of health, common findings among seafarers, guide on better nutrition, exercise regimen, losing weight, getting quality sleep, and managing stress. A last few pages of the hollistic health booklet have been allotted to encourage seafarers to track their wellbeing and condition. This promotes the behaviour that seafarers can be active participants in health decisions and their healing process;
- Company health talks — monthly or quarterly health talks for partner companies of NMC tackling topics like seasonal diseases, stress management, trimming obesity, and many more. Additionally, NMC physicians participate in the Pre-Departure Orientation Seminar (PDOS) of seafarers emphasizing the role and importance of health on safety on board;
- Vessel visits by NMC employees — learning about seafarers' everyday routines and working conditions at sea provides NMC perspective on how to improve the health care approach for seafarers;
- Comprehensive testing — inclusion of electrocardiogram, lipid profile, ultrasound, treadmill stress test based on clinical assessment for necessity in order to check the most commonly incurred lifestyle-related conditions. This aids to provide early recognition, control and management through medications and assertion of dietary or lifestyle changes prior to being deemed fit for sea duty

Moreover, NMC also implemented risk-based assessment that properly guides the screening and treatment of seafarers [21]. While the decrease in the proportion of cardiovascular cases and screenable gastrointestinal and genitourinary conditions may be attributed to the holistic care implemented by NMC, further research is required to confirm the effectiveness of NMC's holistic care approach.

CONCLUSIONS

This comprehensive analysis of medical repatriation cases among Filipino seafarers employed by OSM shipping company from 2013 to 2022 has highlighted the predominant causes of repatriation, with injuries/trauma and musculoskeletal conditions emerging as the most prevalent factors. Gastrointestinal, cardiovascular, infectious, and genitourinary conditions also constituted a significant proportion of the cases. Notably, our results indicate a declining trend in the proportion of cardiovascular, gastrointestinal, and genitourinary conditions in the annual repatriation cases.

Our study underscores the imperative for multisectoral collaboration to enhance the health and well-being of seafarers. Policymakers, maritime shipping companies, medical clinics, and other stakeholders should prioritize implementing comprehensive care programmes for seafarers, ensuring safe and clean working conditions to prevent injuries, and reduce the incidence of diseases. Holistic care programmes, such as those employed by the NMC, hold promise and should be further explored for their potential to enhance seafarers' health. Additionally, continuous monitoring and evaluation of repatriation cases and fur-

ther research into effective interventions, timely actions, and program implementations are essential to improving seafarers' occupational health and overall well-being. By investing in the health and welfare of seafarers, we can bolster the maritime industry's sustainability and resilience while safeguarding its workforce's holistic well-being.

Conflict of interest: None declared

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Characteristics of Polish travellers: six-month experience from the University Centre of Maritime and Tropical Medicine in Gdynia, Poland

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ABSTRACT

Background: *The number of international travels has grown substantially over the last decade, both globally and in Poland. Thousands of Poles travel to tropical or subtropical countries in Asia, Africa or South America each year. The aim of this paper was to discuss the characteristics of Polish travellers seeking pre-travel consultation at the largest diagnostic and treatment travel medicine clinic in Poland.*

Materials and methods: *This retrospective study was based on the analysis of medical records of 1291 patients seeking pre-travel advice at the University Centre of Maritime and Tropical Medicine in Gdynia, Poland, between 1 July and 31 December 2022. The study comprised the analysis of the following patient variables: age, sex, travel details (purpose and length of travel, continents and countries to be visited, activities planned). The study also aimed to evaluate the range of prevention measures which were recommended/administered (preventive vaccinations, chemoprophylaxis). In addition, it assessed the health status of the patients presenting at the travel medicine clinic.*

Results: *Patients who sought pre-travel advice were mostly people aged 18–35 years old (50.1%), travelling for tourism (72.2%), for a maximum period of 4 weeks (85.0%), travelling in December (24.3%) or in November (22.2%). Most of the Polish travellers consulted at the clinic travelled to Asia (56.2%), mainly to Thailand (27.3%), Vietnam (10.8%) or India (8.7%). Most travellers were planning a beach holiday (56.4%). As regards extreme activities, scuba diving was the most popular among the patients involved in the study (22.5%). The most frequently administered immunoprophylaxis were vaccines against typhoid fever (76.3%) and hepatitis A (56.2%). Other commonly recommended/prescribed prevention measures included: probiotics (75.9%), repellents (73.6%), antimalarial drugs (60.9%), and antidiarrheal antibiotics (51.9%). The analysis of patient interviews demonstrated that 42.4% of Polish travellers consulted at the clinic complained of no medical problems while 36.0% were taking chronic medications, mainly for allergies (17.1%) or thyroid disorders (12.2%).*

Conclusions: *A growing number of people from Poland travel to destinations where the risk of infectious disease exposure or transmission is high. Providing a patient with appropriate advice during a pre-travel consultation will help protect the traveller against travel-associated risks at their intended destinations.*

(Int Marit Health 2023; 74, 4: 253–258)

Keywords: Polish travellers, international travel, risk assessment, prophylaxis

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INTRODUCTION

The number of international travels has grown substantially over the last decade, both globally and in Poland. The unprecedented growth in the number of international travels was possible due to the development of international air transport. In the pre-pandemic period, international tourist arrivals were projected to reach 1.8 billion by 2030, and each region of the world reported an annual increase in international tourist arrivals [1]. However, the coronavirus disease 2019 (COVID-19) pandemic, which broke out in 2020, brought the global travel sector to a standstill, and earlier projections were no longer applicable. The global lockdown had a major impact on individuals and their behaviours. People, unaccustomed to the new situation of being 'locked down,' eagerly awaited the opportunity to be able to travel again [2]. Once the COVID-19 restrictions had been lifted, many people resumed travelling. The question that arises is whether people have learned any lessons from the pandemic. Will travellers become more aware of how important it is to comply with the basic prevention measures (e.g. immunoprophylaxis and chemoprophylaxis), to minimize the risk of exposure to travel-associated hazards, or to have a pre-travel consultation before travelling to areas where infectious diseases are endemic or epidemic. In 2019, Polish people made over 12.7 million international trips, mostly to the Mediterranean coast but also to tropical or subtropical countries in Asia, Africa or South America [3]. Until mid-2022, the number of Polish tourists travelling internationally has grown substantially compared to the previous year. Owing to the increasing number of international travels, there are now more patients who report to travel medicine clinics for a pre-travel consultation. This creates new challenges for health care providers, namely the provision of optimal pre-travel counselling and prophylaxis, the evaluation of the patients' health status after taking their medical history, the collection of information on the most popular travel destinations and activities planned (including high-risk behaviours), the assessment of the epidemiological situation at the destinations to be visited and post-travel health assessment. The aim of this paper was to discuss the characteristics of Polish travellers based on the information obtained from a 6-month analysis of the profiles of the patients seeking pre-travel consultation at the largest diagnostic and treatment travel medicine clinic in Poland.

MATERIALS AND METHODS

STUDY POPULATION

All patients (n = 1291) who sought pre-travel consultation at the Clinic of Travel Medicine, Tropical Diseases and Occupational Medicine at the University Centre of Maritime and Tropical Medicine (UCMTM) in Gdynia, between 1 July and 31 December 2022 were enrolled in the present study. Patients' demographics (age, sex), travel details (purpose of travel, length of travel, departure date/month, continents and countries to be visited, activities planned) as well as preventive measures taken (pre-travel vaccinations, chemoprophylaxis, other) were recorded and analysed. In addition, the study assessed the health status of the patients presenting at the travel medicine clinic; health assessments were based on patient interviews.

DATA COLLECTION

Patients were requested to fill in a pre-travel questionnaire prior to the consultation. They needed to provide the following information: their personal details, travel details, activities planned, past and present medical history (e.g. chronic diseases, medications). During a visit, a consulting physician completed the remaining sections of the questionnaire with the information on the current health status of the patient, vaccinations taken before the visit or recommended to the patient during the visit, and any other prevention measures suggested to the patient.

ETHICAL CONSIDERATION

For this non-interventional cross-sectional study, a decision of Bioethics Committee was not required.

RESULTS

TRAVELLERS' AND TRAVEL CHARACTERISTICS

Of the total number of 1291 travellers included in the present study, 670 (51.9%) were men, and 621 (48.1%) were women. Patients who sought pre-travel advice were mostly individuals aged 18–35 years old (50.1%), travelling for tourism (72.2%), for a maximum period of 4 weeks (85.0%), who were travelling in December (24.3%) or in November (22.2%). It is important to emphasize that the Clinic of Travel Medicine, Tropical Diseases and Occupational Medicine at the University Centre of Maritime and Tropical Medicine in Gdynia does not provide medical consultations for children or adolescents below 18 years old. As regards the type of holiday activities, most patients consulted at the clinic were planning a beach holiday (56.4%), scuba diving was found to be the most popular (22.5%) extreme sport among Polish travellers (Table 1).

MEDICAL HISTORY

The analysis of the information collected in the patient interviews showed that 42.2% of Polish travellers enrolled in the study did not complain of any medical problems, while 36.0% were taking chronic medications, mainly for allergies (17.1%) or thyroid disorders (12.2%) (Table 2).

Table 1. Characteristics of Polish travellers consulted at the University Centre of Maritime and Tropical Medicine in Gdynia between July and December 2022 (n = 1291)

Travellers and travel characteristics	All travellers
Sex	
Male	670 (51.9%)
Female	621 (48.1%)
Age [years]	
< 18	0 (0.0%)
18–35	647 (50.1%)
36–65	595 (46.1%)
> 65	49 (3.8%)
Reason of travel	
Tourism	932 (72.2%)
Business	296 (22.9%)
Others	63 (4.9%)
Length of travel	
< 4 weeks	1098 (85.0%)
> 4 weeks	193 (15.0%)
Month of travel	
December	314 (24.3%)
November	287 (22.2%)
Activities planned	
A beach holiday	728 (56.4%)
Scuba diving	291 (22.5%)
Safari	268 (20.7%)
Mountain trekking	261 (20.2%)

TRAVEL DESTINATIONS

The data generated in the study showed that Asia was the most popular travel destination among Polish travellers (56.2%), with Thailand (27.3%), Vietnam (10.8%) and India (8.7%) being the top three most visited countries (Table 3).

VACCINES AND RECOMMENDED CHEMIOPROPHYLAXIS

As regards immunoprophylaxis, the most frequently administered vaccines were the typhoid fever vaccine (76.3%) and the hepatitis A vaccine (56.2%). Other commonly recommended or prescribed prevention measures included: probiotics (75.9%), repellents (73.6%), antimalarial drugs (60.9%), and antidiarrheal antibiotics (51.9%) (Table 4).

Table 2. Medical history of Polish travellers consulted at the University Centre of Maritime and Tropical Medicine in Gdynia between July and December 2022 (n = 1291)

Patients' medical history	All travellers
No abnormalities	548 (42.4%)
Patients taking chronic medications	465 (36.0%)
Allergies	221 (17.1%)
Thyroid disorders	158 (12.2%)
Cardiovascular conditions	95 (7.4%)
Mental illnesses/disorders	69 (5.3%)
Respiratory illnesses	54 (4.2%)
Gastrointestinal illnesses	47 (3.6%)
Diabetes mellitus	32 (2.5%)
Neoplasms	27 (2.1%)
CNS conditions	25 (1.9%)
Urogenital disorders	20 (1.5%)
Skin diseases	16 (1.2%)
Pregnancy	8 (0.6%)

CNS — central nervous system

Table 3. The most visited continents and countries by Polish travellers consulted at the University Centre of Maritime and Tropical Medicine in Gdynia between July and December 2022 (n = 1291)

Destinations	All travellers
Continents	
Asia	725 (56.2%)
Africa	321 (24.9%)
South America	98 (7.6%)
North and Central America	91 (7.0%)
Several continents	28 (2.2%)
Europe	19 (1.5%)
Australia and Oceania	8 (0.6%)
Countries	
Thailand	352 (27.3%)
Vietnam	139 (10.8%)
India	113 (8.7%)
Tanzania/Zanzibar	87 (6.7%)
Kenya	80 (6.2%)
Indonesia/Bali	76 (5.9%)
Cambodia	63 (4.9%)

Table 4. The most common vaccines and chemioprophylaxis prescribed to Polish travellers consulted at the University Centre of Maritime and Tropical Medicine in Gdynia between July and December 2022 (n = 1291)

Vaccines and chemioprophylaxis	All travellers
Vaccines against	
Typhoid fever	985 (76.3%)
Hepatitis A	725 (56.2%)
Tetanus, Diphtheria, Pertussis, Polio	544 (42.1%)
Rabies	485 (37.6%)
Cholera	271 (21.0%)
Hepatitis A+B	261 (20.2%)
Yellow fever	250 (19.4%)
Japanese encephalitis	93 (7.2%)
Chemioprophylaxis	
Probiotics	980 (75.9%)
Repellents	950 (73.6%)
Antimalarial drugs	786 (60.9%)
Antidiarrheal antibiotics	670 (51.9%)
Sun protection	542 (42.0%)
Antithrombotic	115 (8.9%)
Altitude sickness	45 (3.5%)

DISCUSSION

Travel medicine is one of the fastest growing medical fields. The growth of travel medicine as a separate specialty is linked to an increase in the number of international and intercontinental travels. Only a few decades ago, travellers from temperate climates mainly travelled to the tropics for business purposes. However, with the growing popularity of air travel, the number of people travelling internationally has surged in recent year. Currently, millions of tourists from all over the world travel to developing countries in Asia, Africa or South America each year. Surveys of American travellers visiting countries in Asia, Africa and Central or South America showed that between 15% and 70% of the travellers have experienced a travel-related health problem. Most travel-related illnesses are mild, but 1–5% of travellers become ill enough to seek medical care during travel [4]. A study conducted by travel medicine specialists demonstrated that of 100,000 travellers from developed countries who visit developing countries for a period shorter or equal to 1 month: 50% will develop a travel-related illness (manifesting with mild symptoms normally); 8% of travellers will seek medical care while abroad; 1100 travellers will be unfit for work after return; 300 travellers will need to be hospitalized during travel or after return; 50 travellers will require medical evacuation; and 1 person will die of an illness or an injury [5]. The study by Freedman et al. [6] shows that the most common travel-related health problems of international travellers include acute and chronic gastrointestinal disorders (10%), skin lesions (8%), respiratory tract infections (5–13%), and fevers of unknown origin (3%). Pre-travel consultation is therefore essential for those travelling internationally. It helps identify travel-associated risk factors as well as offers education on how to avoid or minimize those risks, thus enabling the patient to travel safely. During a pre-travel consultation, a patient should receive all the necessary information on how to prepare for a trip and how to behave in a new, unfamiliar environment. Patients should also receive counselling regarding the most common human and animal-borne diseases which are prevalent at the intended destinations; the indications/contraindications to the use of mandatory and recommended pre-travel vaccinations, antimalarial chemoprophylaxis, and antidiarrheal drugs; strategies for risk avoidance; and finally education on how to prepare the travel first aid kit. In recent years, travel medicine clinics have witnessed a rise in the number of patients with underlying health conditions. The group of high-risk travellers comprise the elderly, patients with chronic illnesses and individuals who are immunocompromised. It is particularly important that high-risk travellers receive optimal counselling (based on the results of the physical examination, past and present medical history and laboratory tests results) and are offered individually tailored prevention measures [7–9]. A health care provider offering pre-travel counselling needs a high level of knowledge of the global epidemiological situation and of the latest guidelines and strategies for infection control proposed by the World Health Organization and Centres for Disease Control and Prevention [1].

The present study was based on the 6-month analysis of medical records of 1291 patients-international travellers who sought pre-travel advice at the UCMTM in Gdynia. Patients' demographics, their past and present medical history, preventive measures taken (vaccinations, chemoprophylaxis), and travel characteristics (countries and continents to be visited, activities planned) were recorded and analysed. The findings of the present study were compared to the data obtained from the studies conducted at the travel medicine clinic at the Academic Medical Centre in Amsterdam (the Netherlands) [10] and the Communicable Disease Centre at the Hamad International Airport (Qatar) [11], which analysed the profiles of international travellers who presented at the clinics for a pre-travel consultation.

The analysis of the generated data shows that most patients who sought pre-travel advice at the Polish clinic were aged 18–35 years old (50.1%), travelling for tourism

(72.2%), for a maximum period of 4 weeks (85.0%). The data from the Dutch study, which involved 1749 patients, demonstrated that the median age of travellers was 35 years; the median length of travel was 21 days; and the main purpose of travel was tourism (53.3%) (vs. 7.3% visiting friends and relatives and 10.2% business travel) [10]. The data from travel medicine clinics in the USA [12], Singapore [13] and Spain [14] suggest that vacation/tourism is one the most common reasons for international travel, with rates ranging from 49% to 81.6%. The data from the Communicable Disease Centre in Qatar, where a total of 279 patients were consulted within a 6-month period, show that the mean age of travellers was 31 years (80% of travellers were between 18 and 59 years old), the mean travel duration was 46 days (range 3–90 days; and the most common reason for travel was tourism — 57.3% (vs. 12.9% pilgrimage, 12.2% business travel) [11].

The analysis of the medical records of the Polish patients shows that 36.0% of travellers were taking chronic medications, mainly for allergies (17.1%) or thyroid disorders (12.2%). In comparison, 31.1% of travellers consulted at the Dutch clinic reported the use of chronic medications, mainly for cardiovascular diseases (7.5%), such as hypertension, hypercholesterolaemia [10]. The findings are consistent with the data reported by travel medicine clinics in the United States [12] and in France [15], where cardiovascular diseases have been described as one of the most frequent chronic conditions among international travellers presenting for a pre-travel consultation. The results of the study conducted at the Qatari centre found that 21% of travellers who participated in the study had pre-existing medical conditions and were taking chronic medications, mostly for cardiovascular diseases and diabetes mellitus [11].

The present study found that Asia (56.2%) was the most popular travel destination for Polish travellers, with Thailand (27.3%), Vietnam (10.8%) and India (8.7%) being the top three most visited countries. The most popular travel destination among Dutch citizens was found to be South-East Asia (the top two visited countries were Thailand and Indonesia). Dutch travellers visiting friends and relatives (VFRs) mainly travelled to Surinam in South America and Ghana in Africa [10]. Tanzania, including Zanzibar (16.5%), and Kenya (15.1%) in East Africa were the most common destinations for travellers consulted at the Qatari centre [11]. As regards prevention measures, 76.3% of travellers consulted at the UCMTM in Gdynia received the typhoid fever vaccine (which was the most commonly administered vaccine in this study group) and 56.2% received the hepatitis A vaccine. Antimalarial drugs were prescribed to 60.9% of the consulted travellers. In the Dutch clinic, the most commonly administered vaccines were those against hepatitis A (88.6%) and typhoid fever (85.1%). In addition, a large number of Dutch patients required vaccination against yellow fever, as 27.3% of the travellers (mostly VFRs) intended to travel to countries in South America or Sub-Saharan Africa where yellow fever is endemic and vaccination against disease is required for all travellers. A total of 73% of Dutch patients were prescribed antimalarial drugs [10]. Similar vaccination rates were reported by travel medicine clinics in the United States [12] and in Sweden [16]; the rates of patients who received antimalarial chemoprophylaxis were similar in the United States [12] and in France [15]. At the Qatari centre, the most commonly prescribed vaccines included the typhoid fever vaccine (69%), tetanus/diphtheria/pertussis vaccine (55%) and the hepatitis A vaccine (49.3%). Antimalarial drugs were prescribed to 42.3% of the international travellers [11].

Travel medicine clinics set up in the developed countries have seen an increase in the number of patients presenting for a pre-travel consultation, counselling, health risk assessment and pre-travel immunization and chemoprophylaxis. The present study is the first of its kind to discuss the characteristics of international travellers (including their health assessment) who presented at an outpatient travel medicine clinic in Poland for a pre-travel consultation. The results of the present analysis should prompt further research into developing effective strategies for reducing travel-associated health problems in international travellers.

CONCLUSIONS

A growing number of people from Poland and other developed countries travel to destinations where the risk of infectious disease exposure or transmission is high. Providing a patient with appropriate advice during a pre-travel consultation will help protect the traveller against travel-associated risks at their intended destination.

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Cutaneous Larva Migrans as a frequent problem in travellers

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ABSTRACT

Dermatological disorders are among the most common complaints of patients seeking medical assistance after returning from trips to tropical countries. Among exotic dermatoses, one of the frequently encountered diagnoses is Cutaneous Larva Migrans (CLM), primarily caused by the nematodes Ancylostoma braziliense and A. caninum. Cats and dogs, which serve as the definitive hosts for these nematodes, excrete with their stool parasite eggs into the environment, where they transform into larvae. Human infection occurs through the invasive form of the larvae, which penetrate the skin, causing itching and the characteristic serpiginous, slightly raised, and enlarging lesion at the site of invasion. Diagnosis is made based on the highly characteristic clinical presentation, although in non-endemic countries, diagnostic errors and delays in initiating effective causal treatment are relatively common. Effective therapy includes oral albendazole and ivermectin. Prevention of CLM involves avoiding skin contact with potentially contaminated soil by wearing shoes and using towels and mats on the beach. Due to the high interest in travel and the risk of importing exotic diseases, it is important to promote knowledge of tropical medicine among healthcare professionals as well as the travellers.

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Keywords: parasitosis, pruritus, larva, Cutaneous Larva Migrans (CLM), tropic, travel

INTRODUCTION

In current times, following global travel restrictions imposed due to the coronavirus disease 2019 (COVID-19) pandemic, interest in travel has returned to the situation observed in 2019, which was record-breaking in this regard. The United Nations World Tourism Organization (UNWTO) has indicated that in the months of January to July of the current year, the number of international travels was comparable to the pre-pandemic period [1]. Due to the increasing accessibility of travel as a means of spending leisure time, ease of reaching the farthest corners of the world, and the continuous growth in the number of travellers in recent decades, even outside the pandemic period, an expansion of geographic spread of many infectious diseases has been observed [2]. The most renowned research organization dedicated to travel health is the Geosentinel Network, established in 1995 as a result of collaboration between the Centres for Disease Control and Prevention (CDC) and the International Society of Travel Medicine [3]. Based on reports from this organization and others, it is known that ill travellers most commonly report traveller's diarrhoea, febrile illnesses, and dermatological conditions, among which one can mention insect bite reactions, rash of unknown aetiology, skin and soft tissue infections, sunburn, myiasis, tungiasis, cutaneous leishmaniasis, and cutaneous larva migrans [4]. In tropical countries, skin problems

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are common due to lower levels of hygiene, humid and hot climatic conditions, difficulties in accessing medical care, and often a lack of effective medications. Many tropical diseases, including those affecting the skin, belong to neglected diseases, particularly impacting impoverished social strata [5].

Among the most frequently encountered dermatological disorders among travellers is Cutaneous Larva Migrans (CLM), also known as creeping eruption, sand worm eruption, plumber's itch, or duck hunter's itch. The disease was first described by Lee in 1874 [6]. Depending on the studied group, CLM is diagnosed in 8% to 49%, and even more, of tourists reporting skin problems [7]. Cutaneous Larva Migrans is a set of symptoms occurring in humans after infection with nematodes primarily belonging to the species *Ancylostoma braziliense* and *A. caninum*. Usually, dogs and cats serve as the definitive hosts for these parasites, excreting nematode eggs along with faeces. In damp and warm soil, the eggs transform into larvae, which invade human skin [8]. The disease induces intense itching and serpiginous skin changes. While not life-threatening, the condition is bothersome and prompts the affected individual to seek medical help. In non-endemic countries for tropical diseases, diagnostic challenges arise, and CLM is often initially misdiagnosed [9], most commonly as urticaria. Despite the fact that CLM usually dies off spontaneously about 5–6 weeks after human infection, the patient, due to intense itching, risk of bacterial superinfection, and the unpleasant awareness of a live parasite beneath the skin, requires causal treatment. This treatment is widely available and highly effective, involving the oral administration of albendazole or ivermectin. Prevention of this disease necessitates avoiding contact with potentially contaminated soil by wearing shoes on the beach, and sitting or lying on a towel or mat.

Due to the frequency of CLM occurrence among travellers and the difficulties in obtaining a correct diagnosis in non-endemic countries for the disease, it is worth disseminating knowledge about this parasitic infection among both healthcare professionals and travellers.

AETIOLOGY

The aetiological agent of CLM is the nematode, most commonly *Ancylostoma braziliense*, *A. caninum*, and *Uncinaria stenocephala*. To emphasize the role of these specific aetiological agents, the term hookworm-related CLM is also used. To differentiate, infection with the human hookworm is referred to as larva currens. On the other hand, other nematodes such as *Ancylostoma duodenale* or *Necator americanus* have a similar dermatological presentation but are capable of penetrating internal organs. In addition to the remaining species accountable for CLM, one can enumerate also *Bunostomum phlebotomum* (cattle hookworm) and in more rare cases *Ancylostoma ceylonicum*, *Strongyloides papillosus* (parasite of sheep, goats, and cattle), *Strongyloides stercoralis, Ancylostoma tubaeforme* (cat hookworm) and *Strongyloides westeri* (parasite of horses).

Cutaneous Larva Migrans represents the larval form of the disease in humans, as the parasites do not mature and produce eggs. The disease remains present only in the superficial layers of the skin. The absence of collagenase prevents penetration of the basal layer of the skin and colonization of the liver, gastrointestinal tract, or lungs [10]. The life cycle of CLM is depicted in the Figure 1 [11].

The definitive hosts for these nematodes are animals, most commonly dogs and cats, which excrete parasite eggs into the environment along with faeces. In warm and humid environments, the eggs develop into rhabditiform larvae, which then progress into filariform larvae, the infective stage capable of penetrating human skin. Humans become infected by walking barefoot on contaminated ground or by sitting directly on sand or grass. The larvae produce proteases and hyaluronidases that facilitate invasion through the human skin layers. In tropical regions, infection through clothing or bedding dried on the ground instead of on clotheslines has also been described [12].

EPIDEMIOLOGY

Cutaneous Larva Migrans is a frequently encountered parasitic condition in the tropical zone, prevalent in countries of South and Central America, the Caribbean, Africa, and Southeast Asia. Despite being primarily associated with hot climates, isolated indigenous cases have been reported in cooler regions, such as Europe [13]. In some publications, CLM appears to occur with high frequency in specific populations. For instance, in Manaus, Brazil, 18.2% of children were found to be infected. Factors that seem to favour infection include age below 15, male gender, environmental contamination with faeces of dogs and cats, walking barefoot, and poverty [14]. The exact prevalence of CLM among travellers is not precisely known, but reports of this tropical dermatosis among outbound travellers have been consistently appearing for many years [15–17].

It is worth noting that animals in tropical countries, although not exclusively, are often stray, and there is a lack of veterinary care for them. Consequently, deworming is not systematically implemented. Cats and dogs roam freely, infecting, among other places, hotel beaches where tourists often walk. Moreover, the sand collected from these beaches is used in hotel sandboxes, becoming a source of infection for children playing there [18].

Cutaneous Larva Migrans is also recognized as an occupational disease affecting carpenters, electricians, plumbers, farmers, gardeners, and pest exterminators. Individuals engaged in these professions are more susceptible

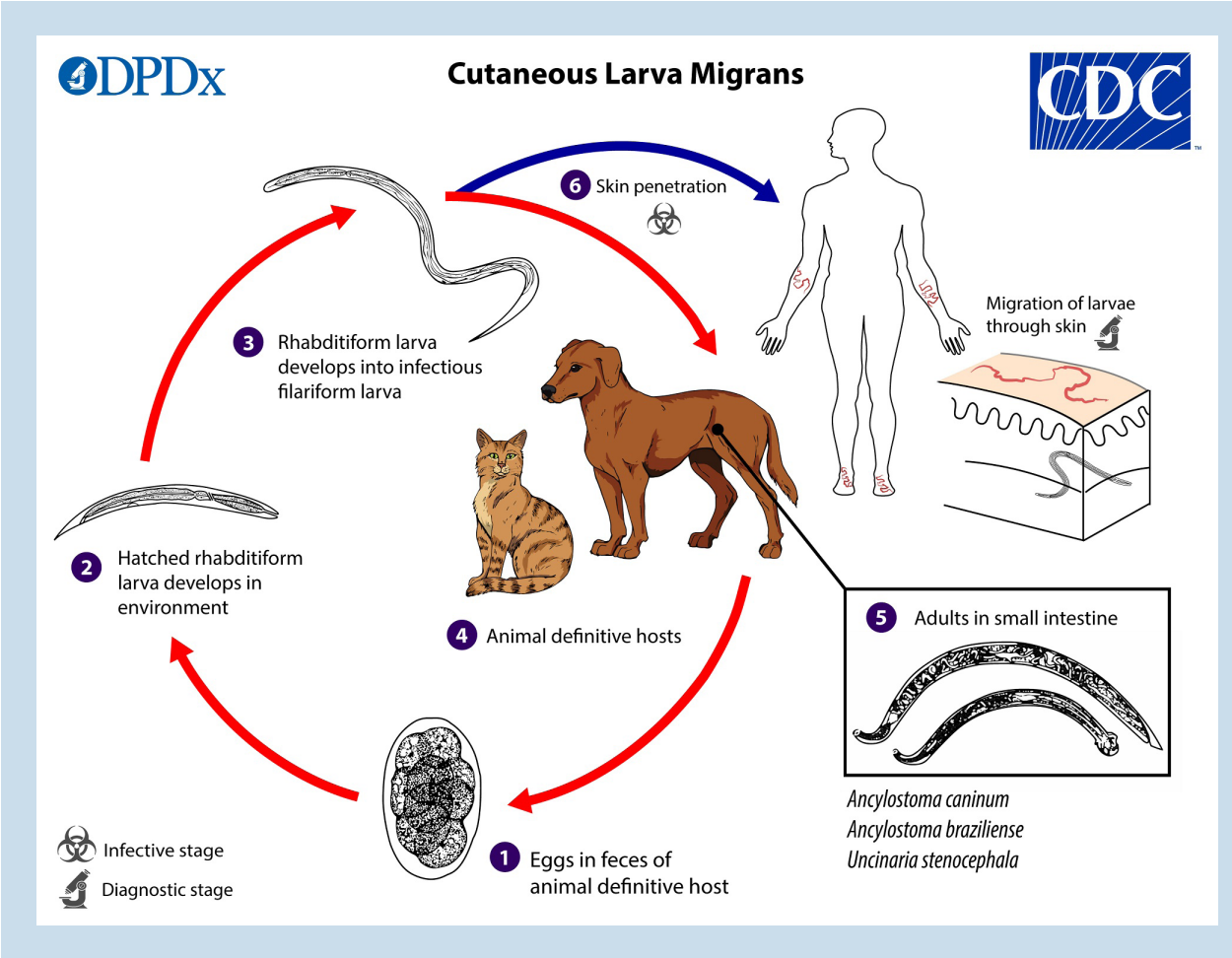

Figure 1. The life cycle of Cutaneous Larva Migrans (Source: Centres for Disease Control and Prevention)

to parasitic infestation by the mentioned nematodes due to direct contact with potentially contaminated ground.

CLINICAL SYMPTOMS

Symptoms of infection typically develop 10–15 days after exposure. In the case of *Ancylostoma braziliense*, the disease can manifest within hours of infection. Initially, the patient experiences intense itching, followed by the appearance of a small bump, which then evolves into a serpiginous, enlarging redness. Symptoms most commonly occur on the feet, thighs, buttocks, and back, in areas that had contact with contaminated ground. However, any part of the body can be affected. The lesion enlarges by several to a dozen millimetres per day, measuring a few millimetres in width, and can be single or multiple in cases of extensive infestation. Patients do not typically present with systemic symptoms, and their general well-being is usually good [19]. The disease often resolves spontaneously 5–6 weeks after infection and is typically self-limiting, although in some individual cases, it can persist for several months. Humans are accidental and dead-end hosts. A typical lesion is depicted in Figure 2.

Blisters may also accompany the lesions. However, due to the distressing itching, bacterial superinfection may occur, leading to symptoms of localized inflammation, such as from *Staphylococcus pyogenes* [20].

DIAGNOSIS

Cutaneous Larva Migrans is diagnosed based on the characteristic clinical presentation and a history of exposure in a tropical country. Therefore, subjective and objective examinations are sufficient for establishing the diagnosis. Basic blood tests do not reveal specific deviations, and eosinophilia occurs in less than 40% of cases. Faecal examination does not show eggs or adult forms of parasites due to the developmental cycle in which humans are only infested by the larval forms of the nematodes. Serological testing is not useful, although there have been reports of the potential utility of non-invasive optical coherence tomography, but it is not a widely available technique [10]. Biopsy is not indicated, but if performed, it would reveal larvae in the epidermis surrounded by an eosinophilic infiltrate within a circular canal and spongiotic dermatitis with vesicles containing neutrophils and eosinophils.

Figure 2. Typical manifestation of Cutaneous Larva Migrans (Photo: R. Olszański)

A clue in the diagnostic process is the lack of response to potential treatment consisting of antibiotics, antifungal preparations, and corticosteroids.

A notable diagnostic option is the use of telemedicine, specifically teledermatology in this case. The disease often occurs in rural areas where access to a dermatologist is challenging or impossible. Additionally, in non-endemic countries, there are few specialists who are experts in tropical medicine. The CLM presentation is typical, and diagnosis becomes possible through photos and a brief description of the patient's symptoms [21].

In the differential diagnosis, it is important to consider urticaria, scabies, loiasis, myiasis, schistosomiasis, fungal skin infections, contact dermatitis, larva currens, ingrown hairs (cutaneous pili migrans), gnathostomiasis, as well as superficial thrombophlebitis, lichen striatus, phytophotodermatitis, and herpes zoster [10, 13].

ATYPICAL PRESENTATION

The course of CLM is usually highly characteristic, allowing for a clinical diagnosis. However, there are also reported cases with less typical presentations:

- unusual locations: on the scalp [22], penis, chest [23];
- massive infestation in several body areas: numerous parasitic lesions, often with accompanying redness;
- vesiculobullous lesions and oedema, or, rarely, folliculitis [19];
- chronic form of CLM, where lesions persist for months [24, 25], although typically in the course of infection, larvae die spontaneously after 1–2 months from the onset of symptoms;
- without a history of travel to a tropical area, suggesting indigenous infections, which have so far been described only in case reports;
- resistance to recommended treatment and recurrence of the disease despite no re-exposure [26].

CHILDREN

Cutaneous Larva Migrans is common in children, although it is rare to diagnose it in infants due to the developmental lack of independent mobility in the youngest children. One of the described modes of transmission in tropical countries is through clothing dried on the ground, instead of on clotheslines. In children who walk barefoot, playing directly on the ground, sitting, and lying down without a towel or blanket, direct contact with contaminated soil can lead to infection with parasite eggs. The youngest children may not report itching but they may be restless, have trouble sleeping, and show a lack of appetite.

Children may present with skin symptoms in various parts of the body, such as the back, buttocks, chest, and even the hairy scalp, depending on the region of the skin exposed to contact with the nematodes. In tropical regions, the disease is common, but it also affects travelling children who become infected after exposure during trips with their caregivers [27]. The selection of effective treatment remains a debated issue due to age-related limitations (see below).

In tropical areas, especially in regions with low levels of education and strong beliefs in magic and spells, children with CLM may be stigmatized or even believed to be under a spell due to the skin changes resembling snake bites [28]. Therefore, raising awareness about the aetiology of the disease and the availability of effective treatment options should be widely promoted to prevent children from being stigmatized.

IMMUNOSUPRESSION

In the literature, cases of CLM in patients in advanced stages of HIV infection are known. However, current data do not confirm a higher frequency of infestation with these nematodes in immunosuppressed patients. Albendazole remains the treatment of choice, as treatment failures with ivermectin have been observed in immunodeficient patients.

TREATMENT

The treatment is usually effective and involves the administration of albendazole or ivermectin. The recommend-

Table 1. The drugs recommended by the Centres for Disease Control and Prevention for treating Cutaneous Larva Migrans

Drug name	Adult dose	Paediatric dose
Albendazole (Zentel), 400 mg tablet	400 mg once daily for 3–7 days	> 2 years old: 400 mg once daily for 3 days
Ivermectin (Posela), 3 mg tablet	200 mcg/kg as a one-time dose	> 15 kg body weight: 200 mcg/kg as a one-time dose

ed standard therapeutic doses, according to CDC recommendations [19], are provided in Table 1.

In the case of CLM in pregnant women, both albendazole and ivermectin are categorized as class C in CDC guidelines. This means that these drugs can be used only if the benefits significantly outweigh the risks. In the Polish registration, albendazole is contraindicated during pregnancy. In breastfeeding women, albendazole should be recommended with caution. Ivermectin is excreted in small amounts in breast milk and can be used when the benefits of treatment for the mother outweigh the risks for the child.

Albendazole is contraindicated for children below 2 years of age, and the safety of using ivermectin in children weighing less than 15 kg has not been determined.

In the past, other forms of treatment such as freezing the lesions were used. However, due to the high effectiveness of albendazole and ivermectin, difficulties in locating live larvae, the painfulness of the procedure, and the low effectiveness of cryotherapy, it should be discontinued [10]. An alternative option is local treatment with a solution or ointment containing 10–15% thiabendazole, applied 3 times a day for 15 days. The effectiveness is limited in the case of multiple lesions and folliculitis [29]. Another option for local treatment is preparations containing ivermectin (e.g. Soolantra). Local treatment may be an attractive option for CLM in pregnant and breastfeeding women as well as in young children.

SUMMARY

Dermatological disorders are one of the three main reasons for illness after a stay in tropical regions, and one of the most common manifestations is cutaneous larva migrans. Currently, there is no effective vaccine or chemoprophylaxis for this disease, and the recognized method of prevention is protecting the skin from contact with contaminated soil, and in the broader context of public health, regular deworming of animals. Despite the very characteristic clinical picture in most patients, CLM is often an unrecognized disease entity, and patients seek effective treatment from successive specialists. It is worth promoting knowledge about CLM due to the intense tourist movement, including to tropical regions, and the potential risk of introducing exotic diseases into non-endemic areas. Treatment for CLM is effective, but it is crucial to first establish the correct diagnosis.

Conflict of interest: None declared

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Results of acute cerebral infarction treatment with hyperbaric oxygen therapy, 2020–2022

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ABSTRACT

Background: *Cerebral stroke is the third leading cause of death after cardiovascular disease, cancer and the leading cause of disability for patients. Hyperbaric oxygen is a non-drug treatment that has the potential to improve brain function for patients with ischaemic stroke. The objective of this study was to evaluate the results of treatment of acute cerebral infarction with hyperbaric oxygen therapy (HBOT).*

Materials and methods: *This was a case-control study. One hundred ninety-five patients diagnosed with cerebral infarction, with signs of onset within 24 hours, were treated at the Centre for Underwater Medicine and Hyperbaric Oxygen of Vietnam National Institute of Maritime Medicine during the period from January 2020 to December 2022. Study group included 100 patients with acute cerebral infarction treated with a combination of HBOT and medication and reference group included 95 patients treated by medication only (antiplatelets drugs, statins, control of associated risks factors)*

Results: *After 7 days of treatment with hyperbaric oxygen (HBO), symptoms such as headache, dizziness, nausea, sensory disturbances, and Glasgow score of the study group improved better than that of the reference group ($p < 0.01$). Movement recovery in the study group was better than the reference group: the percentage of patients with mild and moderate paralysis in the study group increased higher than that of the reference group (86.0% and 68.4%), the degree of complete paralysis of the study group decreased more than that of the reference group (14.0% and 31.6%). The degree of independence in daily activities in the study group was better than the reference group. In the study group, the percentage of patients with complete independence in daily life increased from 27.0% to 84.0%. In the reference group, the rate of patients who were independent in their daily activities increased from 37.9% to 51.6%. The average number of treatment days of the study group was 10.32 ± 2.41 days and it the reference group 14.51 ± 3.24 days.*

Conclusions: *Hyperbaric oxygen therapy is a non-drug treatment with many good effects in the treatment of cerebral infarction, especially acute cerebral infarction. HBOT reduces and improves functional symptoms, improves mobility, and reduces treatment time for patients.*

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Keywords: acute cerebral infarction, hyperbaric oxygen therapy (HBOT), VINIMAM regimen

INTRODUCTION

Acute ischaemic stroke, also known as ischaemic stroke, is a sudden loss of blood flow to an area of the brain due to blockage of a blood vessel by a thrombus or atherosclerotic plaque in a cerebral artery, rendering an area of the brain deprived of oxygen and nutrients, leading to a corresponding

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loss of neurological function [1]. Stroke is the third leading cause of death after cardiovascular disease and cancer, and is the most common cause of disability among adults in developed countries. In the United States, every year about 800,000 people have a stroke, of which 82–92% are cerebral infarction. Stroke is one of the top 5 causes of death and disability in adults, costing more than $72 billion annually [2].

Currently, there are a number of treatment methods for cerebral infarction such as: medical treatment (using antiplatelet drugs, statin drugs, controlling risk factors...). Methods of revascularization in the acute phase include: intravenous fibrinolysis (within 4.5 hours of stroke onset), this method has been confirmed but has some time limitations, and for large vessels, it provides only about 15–20% of recanalization [3], transarterial mechanical thrombectomy is indicated in large embolism (< 6 hours from stroke onset).

Hyperbaric oxygen (HBO) is a treatment method that has been shown by some authors to be effective for patients with acute ischaemic stroke [4–6]. It has a role in promoting the repair of damaged blood vessels while enhancing the development of the neovascular system, restoring the permeability of vessel walls and cell membranes by increasing the synthesis of ATP, ATPase, fighting brain oedema and especially neutralizing the aetiology of free radicals. In 2019, the Vietnam Ministry of Health officially issued Decision 2539/QD-BYT on Guidelines for the technical process of hyperbaric oxygen therapy (HBOT), with 48 diseases indicated for treatment with HBO, including cerebral infarction [7]. In order to evaluate the effect of HBO in the treatment of cerebral infarction, especially acute cerebral infarction, the research team conducted this study with the following objective: To evaluate the results of treatment of acute cerebral infarction with HBOT at VINIMAM from 2020 to 2022.

MATERIALS AND METHODS

MATERIALS

The study included 100 patients with acute brain infarction treated with HBOT combined with medical treatment at Vietnam National Institute of Marine Medicine during the period from January 2020 to December 2022 including two groups of subjects:

Study group: Study group included 100 patients with acute brain infarction treated with HBOT combined with medical treatment, who were selected based on the following criteria:

— cerebrovascular accident diagnosed according to the 1989 World Health Organization criteria (clinical criteria);
— computed tomography image showing hypodense lesions in the brain parenchyma corresponding to clinical symptoms (subclinical criteria);
— the time from symptom onset to receiving HBOT is within 24 hours;
— the following patients were excluded from the study: patients with paralysis without cerebral infarction; patients with cerebral infarction who had indications for treatment with fibrinolytic therapy, thrombectomy and thrombectomy with mechanical instruments, when indicated; patients without cerebral infarction lesions on computed tomography; patients with contraindications to HBO treatment; and patients who refused to participate in the study (exclusion criteria).

Reference group. Reference group included 95 patients with acute brain ischaemic stroke who received only medical treatment.

METHODS

Study design. This was a case-control study.

Sample size, method to choose sample size. To obtain a sufficient sample size, we enrolled all eligible patients in the study over a 3-year period. Ultimately, the size of the groups was as follows: the study group consisted of 100 patients; the reference group included 95 patients.

Criteria for evaluating research results. All patients with signs of cerebral infarction were subject to clinical examination including: assessment for headache, vomiting, nausea, dizziness, sensory disturbances, paralysis, as well as assessment of cognitive status using the Glasgow scale. The restoration of motor function according to Henry's scale and the degree of independence in daily living according to Barthel scale were also assessed.

All patients underwent computed tomography of the brain; the scans showed hypodense changes in the brain parenchyma.

TREATMENTS

Study group. Patients in the study group received treatment for the underlying disease, using antiplatelet drugs, drugs to increase cerebral circulation, drugs to treat blood lipids disorder in combination with HBOT.

Reference group. Patients in the reference group received treatment for underlying disease, antiplatelet drugs, drugs to increase cerebral circulation, drugs to treat blood lipids disorder.

Intermittent HBOT was used according to the VINIMAM 3 treatment regimen (Fig. 1) for the first treatment, and then VINIMAM 1 until discharge (Fig. 2).

Time of assessment. Patients were assessed before treatment and 7 days after treatment.

Methods of assessment before and after treatment included:

— assessment of the change of consciousness according to the Glasgow scale (mild: G ≥ 13 points; moderate: 9 ≤ G ≤ 12 points; severe: G ≤ 8 points) [8];

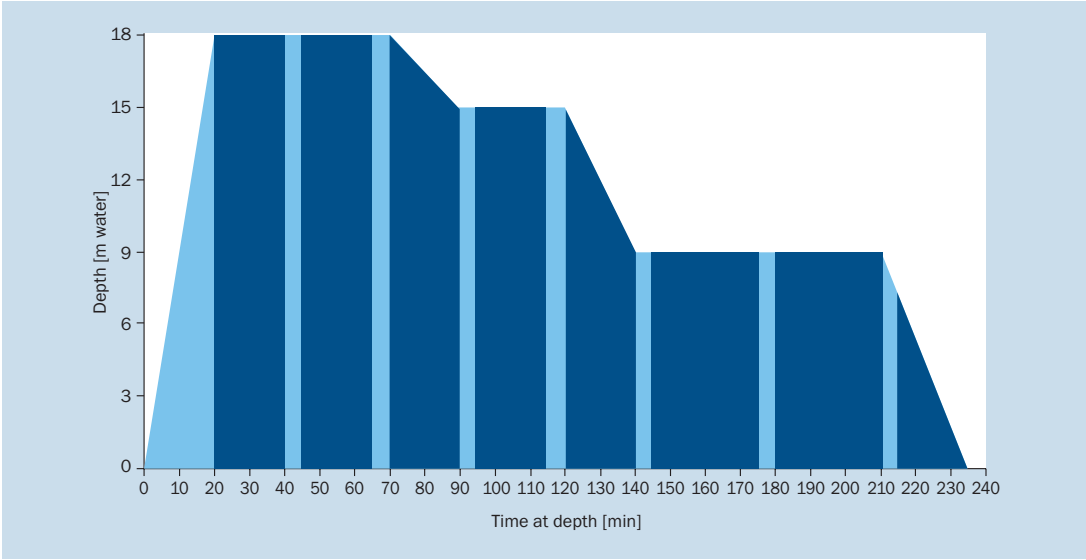

Figure 1. VINIMAM regimen 3. Treating pressure: 2.8 absolute atmospheric pressure; Total treatment time: 235 minutes; Total oxygen breathing time: 180 minutes: 20 minutes × 5 + 30 minutes × 2 + 20 minutes breathe and ascent; Between oxygen breaths rest: 5 minutes; Breathing flow: free

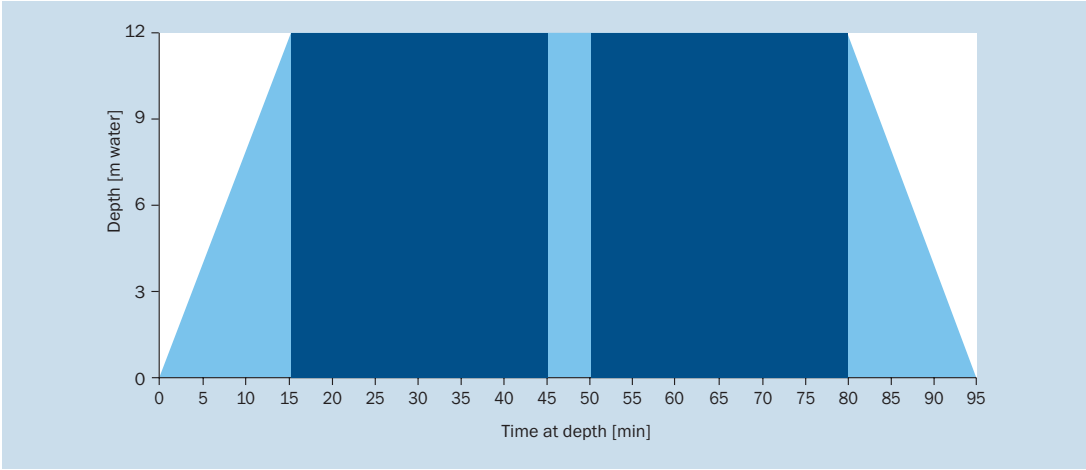

Figure 2. VINIMAM regimen 1. Treating pressure: 2.2 absolute atmospheric pressure; Total treatment time: 95 minutes; Total oxygen breathing time: 30 minutes × 2 = 60 minutes; Between 2 oxygen breaths rest: 5 minutes; Breathing flow: free

— results of recovery of independence in daily activities according to Barthel independent: 95–100 points; slightly dependent: 65–94 points; highly dependent: 30–64 points; fully dependent: 0–29 points) [9];
— results of motor recovery according to Henry: mild paralysis (reduced muscle force, motor function still present); moderate paralysis (can lift arms and legs off the bed); severe paralysis (can still stretch limbs when there is pressure point); very severe paralysis (only slight muscle contractions); completely paralyzed (no movement at all) [10].

DATA PROCESSING

Data were entered and processed by the statistical software SPSS 20.0.

ETHICS IN RESEARCH

The research topic was approved by the research ethics committee of the Vietnam National Institute of Marine Medicine before conducting the research. Participation in the study was completely voluntary.

RESULTS

The study results (Table 1) showed that there was no difference between the study group and the reference group ($p > 0.05$). The highest age of both group with cerebral infarction is 60–69 years old (37.0% and 40.0%).

Before treatment, the functional symptoms of the two groups did not differ. After 7 days of treatment, 100% of the study group had no symptoms of headache, dizzi-

Table 1. Distribution of study subjects by sex and age

Research variable		Study group (n = 100)		Reference group (n = 95)		P
		N	%	N	%	
Sex	Men	52	52.0	51	53.7	> 0.05
	Women	48	48.0	44	46.3	> 0.05
Age group [year]	< 50	5	5.0	6	6.3	> 0.05
	50–59	21	21.0	19	20.0	> 0.05
	60–69	37	37.0	38	40.0	> 0.05
	70–79	29	29.0	27	28.4	> 0.05
	≥ 80	8	8.0	5	5.3	> 0.05

Table 2. Functional symptoms (n = 100)

Research variable	Before treatment			After 7 days of treatment		
	Study group (n = 100)	Reference group (n = 95)	P	Study group (n = 100)	Reference group (n = 95)	P
Headache (%)	74 (74.0%)	69 (72.6%)	> 0.05	0 (0.0%)	11 (11.6%)	< 0.001
Dizziness	79 (79.0%)	77 (81.1%)	> 0.05	0 (0.00%)	18 (18.90%)	< 0.001
Nausea, vomiting	23 (23.0%)	18 (18.9%)	> 0.05	0 (0.00%)	3 (3.10%)	< 0.05
Sensory disturbances	58 (58.0%)	59 (62.1%)	> 0.05	9 (9.00%)	22 (23.10%)	0.002

Table 3. Result of awareness change according to Glasgow scale before and after treatment

Glasgow score	Study group (n = 100)			Reference group (n = 95)		
	Before treatment	After 7 days of treatment	P	Before treatment	After 7 days of treatment	P
≤ 8 score	0 (0.0%)	0 (0.0%)	1	0 (0.0%)	0 (0.0%)	1
9–12 score	12 (12.0%)	4 (4.0%)	< 0.05	12 (12.6%)	10 (10.5%)	0.45
13–15 score	88 (88.0%)	96 (96.0%)	< 0.05	83 (87.4%)	85 (89.5%)	0.47

ness, and nausea. Meanwhile, in the reference group, some patients experienced headache (11.8%), dizziness (19.4%) and nausea or vomiting (2.2%). This difference is statistically significant ($p < 0.05$) (Table 2).

After 7 days of treatment, the rate of patients treated with HBOT with a Glasgow score of 9–12 points decreased from 11.63% to 4.21%. The group with Glasgow score from 13 to 15 increased from 89.47% to 96.84%, $p = 0.04$. In the reference group, the rate of patients with Glasgow score of 9–12 decreased slightly from 12.9% to 9.7%. The proportion of patients with Glasgow score of 13–15 increased from 87.1% to 90.3%, $p = 0.48$ (Table 3).

Before treatment, there was no difference in the degree of paralysis between the two study groups. After 7 days of treatment, in the study group, the proportion of patients with mild paralysis plus moderate paralysis was 86.0%, and the rate of patients with complete paralysis was 14% (Table 4).

In the reference group, the rate of mild paralysis plus moderate paralysis was 68.4% and the rate of complete paralysis was 31.6%. The difference was statistically significant with $p < 0.05$.

Thus, the progression in the group treated with HBO was much better than that of the reference group.

In the study group, the rate of patients who were independent in daily life increased from 37.0% to 77.0%. The proportion of patients who were highly dependent in daily life decreased from 33.0% to 9.0%, $p < 0.05$ (Table 5).

In the reference group, the proportion of patients independent in daily life increased from 38.0% to 51.6%. The proportion of patients who required help in daily activities decreased from 31.5% to 26.3%, $p > 0.05$.

The average number of treatment days of the study group was 10.32 ± 2.41 days, and it was lower than that of the reference group (14.51 ± 3.24, $p < 0.001$) (Table 6).

Table 4. Restoration of motor function according to Henry's scale

Research variable	Before treatment			After treatment		
	Study group (n = 100)	Reference group (n = 95)	P	Study group (n = 100)	Reference group (n = 95)	P
Mild + moderate paralysis	64 (64.0%)	61 (64.2%)	0.98	86 (86.0%)	65 (68.4%)	< 0.05
Complete paralysis	36 (36.0%)	34 (35.8%)	0.98	14 (14.0%)	30 (31.6%)	< 0.05

Table 5. Level of independence in daily activities according to the Barthel scale

Research variable (Barthel scale)	Study group (n = 100)			Reference group (n = 95)		
	Before treatment	After treatment	P	Before treatment	After treatment	P
Completely dependent	8 (8.0%)	2 (2.0%)	< 0.05	4 (4.2%)	4 (4.2%)	1
Highly dependent	35 (35.0%)	9 (9.0%)	< 0.01	30 (31.6%)	25 (26.3%)	0.62
Slightly	30 (30.0%)	5 (7.0%)	< 0.01	25 (26.3%)	17 (17.9%)	0.08
Independent	27 (27.0%)	84 (84.0%)	< 0.01	36 (37.9%)	49 (51.6%)	0.056

Table 6. Average number of treatment days of study subjects

Research variable	Study group (n = 100)	Reference group (n = 95)	P
Number of treatment days ($\bar{X} \pm$ SD)	10.32 ± 2.41	14.51 ± 3.24	< 0.001
Minimum (day)	7	10	
Maximum (day)	15	20	

SD — standard deviation

DISCUSSION

Stroke is the third leading cause of death after ischaemic heart disease and cancer worldwide. In Vietnam, an estimated 200,000 people have a stroke every year, which is the leading cause of death and disability. The incidence and prevalence of stroke are 161 and 415 per 100,000 people, respectively [11]. Currently, there are many advances in the treatment of ischaemic stroke, including the method of using intravenous fibrinolysis and the method of removing thrombus with mechanical instruments. However, many patients do not have access to treatment by this method because they usually arrive at the hospital late, beyond the golden time for treatment. Intravenous fibrinolytics should be used within 4.5 hours of stroke onset, whereas transarterial mechanical thrombectomy is indicated in large emboli (< 6 hours from stroke onset) [3, 12, 13]. Hyperbaric oxygen is one of the treatment methods for cerebral infarction, which has initially been proven effective and can be applied to treat various stages of cerebral infarction, especially acute cerebral infarction [14–16].

In this study 100 patients with cerebral infarction treated with HBO in combination with medical therapy (antiplatelet drugs, statins, risk factors control) were compared with 95 patients in the reference group who received medical therapy alone. Research results show that after 7 days of treatment, 100% of the study group no longer had headaches, dizziness, nausea, whereas in the reference group some patients reported headache (11.6%), dizziness (18.9%), nausea, vomiting (3.1%), $p < 0.05$ (Table 2).

The assessment of consciousness change after treatment of the study group showed that the rate of patients with Glasgow score of 13–15 increased from 89.47% to 96.84%, $p = 0.04$. In the reference group, the proportion of patients with Glasgow score of 13–15 points increased from 87.4% to 89.5%, $p = 0.47$ (Table 3).

When assessing motor recovery according to Henry's scale, the results showed that after 7 days of treatment, the proportion of patients with mild and moderate paralysis in the study group increased more than that of the reference group (86.0% and 68.4%, $p < 0.05$). The proportion of patients with complete paralysis of the study group also decreased more compared with the reference group (14.0% and 31.6%, $p < 0.05$; Table 4).

The mean treatment time of the study group was also lower than that of the reference group (10.32 ± 2.41 and 14.51 ± 3.24, p < 0.001; Table 6).

Thus, the study results showed that the treatment effect of HBO in the study group compared with the reference group was clearly better, which was reflected in a greater improvement in the functional symptoms of the disease (headache, dizziness, nausea, sensory disturbances); improved mobility and shorter average number of days of treatment. To explain this, we and some authors believe that the problem of lack of oxygen supply to the brain has been considered as the main cause of brain cell damage after stroke. Treatment with HBO increases the partial pressure of oxygen in blood (10 to 13 times higher than normal), thereby increasing the oxygen supply to brain tissue. Moreover, HBO can stabilize blood-brain barrier and reduce cerebral oedema, increase brain microcirculation development and improve brain cell metabolism to generate enough energy for brain tissue to function, maintain homeostasis, reduce intracranial pressure through regulation of cerebral blood flow and reduce cerebral oedema. Hyperbaric oxygen alleviates post-stroke neuroinflammation and inhibits post-stroke cell death and necrosis reactions. It also improves microcirculation in the ischaemic area and reduces cerebral ischaemia. Appropriate and timely HBOT will alleviate oxidative stress and prevent ischaemic brain damage [17–20].

A retrospective study was performed on 22 patients with ischaemic stroke treated with HBO (13 of them received HBO therapy within the first 5 hours after a stroke). Logistic regression analysis was performed to examine the effect of time after stroke, time in the chamber and dose of HBO. Treatment pressure ranged from 2.02 to 3.04 absolute atmospheric pressure (ATA). The results showed that the time after a stroke had a significant effect on recovery, with each passing hour reducing the chance of recovery by at least 62% (odds ratio: 0.38, 95% confidence interval: 0.15–0.95, p = 0.039). In the group of 13 patients from one to 5 hours, 9 recovered well. Patients treated after 6 hours recovered more slowly [15].

Nighoghossian et al. [16] studied 34 patients with mid-cerebral artery occlusive cerebral stroke, examined within 24 hours of onset (17 patients treated with HBO; 17 patients treated with isobaric oxygen). The study results showed that the mean score of motor recovery in the study group was higher than that of the reference group (p < 0.02) [19]. Bennett et al. [4] synthesized 11 randomized controlled trials in 705 stroke patients treated with HBO. The study results showed that the degree of disability and motor function were significantly improved after HBOT (p = 0.02–0.04).

A retrospective analysis of 162 patients (75.3% male with mean age 0.75 ± 12.91) treated with HBO for chronic cerebral stroke (> 3 months) during the 2008–2018 according to the following schedule: from 40 to 60 treatments, 5 days per week, each time 90 minutes of 100% oxygen at 2 ATA. The study results showed that HBOT improved the patient's cognitive function (p < 0.05); 86% of stroke patients had clinically significant improvement (p < 0.05) [21].

Thus, the results of our study as well as that of some international authors have the same conclusion that HBOT is clearly effective for the treatment of acute cerebral infarction.

CONCLUSIONS

Through the study of 195 patients with acute cerebral infarction, divided into two groups: study and reference groups, after 7 days of treatment, we draw the following conclusions:

- all functional symptoms in patients in the study group significantly improved after HBOT compared to before treatment and to the reference group;
- the percentage of patients with a Glasgow score of 9–12 points decreased after 7 days of HBOT from 11.63% to 4.21%, and the percentage with a Glasgow score > 12 points increased from 89.47% to 96.84%;
- the functional symptoms of the study group improved better compared to reference group;
- the results of motor recovery according to Henry's scale were better in the study group than in the reference group: 85.3% had mild and moderate paralysis, only 14.7% had severe paralysis. This rates in the reference group were 66.7% and 33.3%, respectively;
- the level of independence in daily activities according to the Batel scale was higher in the study group than in the reference group: 78.9% were completely independent, 9.5% slightly dependent. This rates in the reference group were 52.7% and 16.1%, respectively;
- the average number of treatment days of the study group was lower than that of the reference group. In the study group it was 10.32 ± 2.41 days, in the reference group 14.51 ± 3.24 days.

Conflict of interest: None declared

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Intestinal parasite infections among internal war refugees and inhabitants of the Ternopil region, Western Ukraine

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ABSTRACT

Background: *The armed aggression of the Russian Federation against Ukraine resulted in the destruction of the country's infrastructure and a decline in the standard of living for many citizens (e.g. shortages of electricity and safe drinking water, limited access to healthcare, living in unsuitable cold basements). A lot of Ukrainians living in the eastern, southern and central parts of the country were forced to flee their homes. The aim of this study was to assess the prevalence of intestinal parasite infections among internal war refugees and residents of Ternopil, a city in Western Ukraine, in response to the worsening of the epidemiological situation in the country.*

Materials and methods: *Parasitological diagnostics was carried out in June 2023 and involved 127 adult Ukrainian citizens aged 19–80 years old, including 80 internal war refugees (most of the participants came from Donetsk, Luhansk, Dnipro, Kherson regions) and 47 residents of Ternopil region, Western Ukraine. Surveys and parasitological examination of stool samples by three different light microscopy testing methods (direct smear, decantation, flotation) were performed. The samples were then tested for the presence of Giardia intestinalis intestinal protozoa by molecular tests (reverse transcription polymerase chain reaction [RT-PCR]) and immunochromatographic rapid diagnostic tests (RDTs).*

Results: *All RT-PCR and RDT tests to detect Giardia intestinalis were found to be negative. The examination of faecal samples taken from 127 patients showed no infections with nematodes, cestodes or trematodes. The examinations only revealed infections with potentially pathogenic Blastocystis spp.: 18/80 infections in the population of internal war refugees (22.5%) and 7/47 infections among residents of the Ternopil region (14.9%). Survey results demonstrated frequent use of antibiotics and antiparasitic drugs without physician advise or prescription: 43.9% of the study participants (n = 127) were taking antibiotics, and 25.2% were taking antiparasitic drugs during the period of 3 months prior to the study.*

Conclusions: *An absence of intestinal parasite pathogens was detected in the studied population. The authors may explain it by the fact, that many Ukrainian patients have unlimited access to antimicrobial drugs (drugs sold without a valid prescription and taken without consultation with a physician), which could have contributed to the low incidence of intestinal parasite infections.*

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Keywords: intestinal parasites, internal war refugees, antimicrobial drugs, Ukraine

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Table 1. Selected gastrointestinal infections reported in Ukraine, 2022 vs. 2021

Diseases	2022		2021	
	No.	Incidence	No.	Incidence
Salmonellosis	3,195	7.71	3,350	8.03
Shigellosis	223	0.54	222	0.53
Other intestinal infections:				
Total	18,484	44.6	17,119	41.0
Campylobacter infection	109	0.26	189	0.45
Yersinia enterocolitica infection	48	0.12	47	0.11
Intestinal protozoan infections:				
Total	3,868	9.34	4,617	11.06
Giardiasis	3,480	8.40	4,105	9.84
Cryptosporidiosis	10	0.03	11	0.03
Viral hepatitis type A	281	0.68	398	0.95

Source: Ministry of Health of Ukraine.

Available at: https://phc.org.ua/kontrol-zakhvoryuvan/inshi-infekciyni-zakhvoryuvannya/infekciyna-zakhvoryuvanist-naselennya-ukraini. Accessed: 27 July 2023

INTRODUCTION

The armed aggression of the Russian Federation against Ukraine resulted in the destruction of the country's infrastructure and a decline in the standard of living for many of the country's citizens (shortages of electricity and safe drinking water, limited access to healthcare). For this reason, a lot of Ukrainians living in the eastern, southern and central parts of the country were forced to flee their homes. According to the European Centre for Disease Prevention and Control the epidemiological situation of infectious diseases in Ukraine is one of the worst in Europe [1]. Apart from numerous cases of childhood diseases (e.g. measles), tuberculosis, sexually transmitted diseases (HIV/AIDS, syphilis, gonorrhoea) and infections caused by multidrug resistant bacteria (*Acinetobacter baumannii* and *Klebsiella pneumoniae*) [2–4], Ukrainian medical services also report a high number of gastrointestinal infections (Table 1). We assume that due to limited diagnostic capacity of the laboratories operating in Ukraine (which is one of the consequences of the war with Russia), the number of gastrointestinal infections is largely underreported.

The aim of this study was to assess the prevalence of intestinal parasite infections among internal war refugees and residents of Ternopil, a city in Western Ukraine in response to the worsening of the epidemiological situation in the country.

MATERIALS AND METHODS

Surveys and faecal samples were collected from 127 Ukrainian adults, aged 19–80 years old. The study population involved 80 internal war refugees (mostly from the Donetsk, Luhansk, Dnipro, and Kherson regions; recruitment for the study took place in hospitals in Ternopil and Lviv, Western Ukraine and in centres for refugees in Ternopil) and 47 permanent residents from the Ternopil region. The parasitological diagnostics was performed in June 2023. The samples were first tested for intestinal parasites by three different light microscopy methods (direct smear in Lugol's solution, preparation from decantation in distilled water, preparation from Fülleborn's flotation) [5, 6] at the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine – National Research Institute (MIM-NRI) in Poland. Next, the samples were screened for *Giardia intestinalis* protozoa using molecular tests and immunochromatographic rapid diagnostic tests. Reverse transcription polymerase chain reaction (RT-PCR) assays were performed at MIM-NRI, and the rapid diagnostic tests (RDTs) at the Department of Infectious Diseases and Epidemiology, Dermatology and Venereology, I. Horbachevsky National Medical University in Ternopil, Ukraine.

STATISTICS

All statistical analyses were carried out using StatSoft Inc. (2014) STATISTICA (data analysis software system) version 12.0 www.statsoft.com and an Excell spreadsheet. Quantitative variables were characterized as an arithmetic mean, standard deviation, median, minimum and maximum values (range), and a 95% confidence interval. Qualitative variables were presented as frequencies and percentages (proportion). Values $p = 0.05$ were considered statistically significant.

Table 2. Intestinal parasite infections in internal war refugees from eastern, central, and southern Ukraine (n = 80)

Internal war refugees		Gastrointestinal symptoms	
		Yes	No
	N (%)	N (%)	N (%)
Total	80 (100.0%)	38 (47.5%)	42 (52.5%)
Negative (–)	62 (77.5%)	31 (38.75%)	31 (38.75%)
Blastocystis spp.	18 (22.5%)	7 (8.75%)	11 (13.75%)
Nematodes	–	–	–
Cestodes	–	–	–
Trematodes	–	–	–

Table 3. Intestinal parasite infections in inhabitants of the Ternopil region, western Ukraine (n = 47)

Inhabitants of Ternopil region		Gastrointestinal symptoms	
		Yes	No
	N (%)	N (%)	N (%)
Total	47 (100.0%)	29 (61.7%)	18 (38.3%)
Negative (–)	40 (85.1%)	26 (55.3%)	14 (29.8%)
Blastocystis spp.	7 (14.9%)	3 (6.4%)	4 (8.5%)
Nematodes	–	–	–
Cestodes	–	–	–
Trematodes	–	–	–

ETHICAL CONSIDERATIONS

The research project titled "Intestinal parasite infections among internal war refugees and inhabitants of Ternopil, western Ukraine" was approved by the Committee on Bioethics at the I. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine (Protocol No. 73/2023 of 28 June 2023). Researches conducting the present study took appropriate measures to ensure the safety of all patients and their right to dignity; they observed all moral and ethical standards as defined by the provisions of the European Convention on Human Rights and Biomedicine (4 April 1997), the World Medical Association Declaration of Helsinki on ethical principles for medical research involving human subjects (1964–2000 and 2001), the Order of the Ministry of Health of Ukraine No. 281 (1 November 2000), and the Ukrainian Ethical Code of Scientist (2009).

RESULTS

The study found that all RT-PCR and RDT tests for *Giardia intestinalis* were negative. The examination of the faecal samples taken from 127 patients showed no infections with nematodes, cestodes or trematodes. The examinations revealed infections with potentially pathogenic *Blastocystis* spp. only (what may explain the lack of helminth and protozoan infections in connection with the use of antiparasitic drugs, which are often ineffective in the treatment of *Blastocystis* infections). The infections were seen in both study arms: 18/80 cases in the population of internal war refugees (22.5%) and 7/47 cases among residents of Ternopil (14.9%). The study showed no statistically significant differences in rate of *Blastocystis* infections in both groups. Gastrointestinal symptoms (abdominal pain, loose stools, constipation, nausea, vomiting, weight loss) were reported by 7 infected and 31 non-infected war refugees, and by 3 infected and 26 non-infected residents of the Ternopil region (Tables 2, 3). The study showed no statistically significant differences between infected vs. non-infected patients in terms of the presence of gastrointestinal symptoms. The study was conducted in a group of adults aged 19–80 years old (mean 40.5); 36.2% of the group were women and 63.8% were men. It is worth pointing out that 43.9% of the study participants (n = 127) were taking antibiotics (without providing the name of the drugs in the survey), and 25.2% were taking antiparasitic drugs (metronidazole, tinidazole, ornidazole, albendazole) over a period of 3 months prior to entering the study (Table 4).

Table 4. Study group variables, including sex, age, and the use of antiparasitic drugs and antibiotics (n = 127)

Study group variables	Light microscopy (–) (n = 102)	Light microscopy (+) (n = 25)	Total (n = 127)
Sex:			
Female	40 (39.2%)	6 (24.0%)	46 (36.2%)
Male	62 (60.8%)	19 (76.0%)	81 (63.8%)
Age:			
Mean (SD)	41.6 (14.9)	36,3 (7.9)	40.5 (13.9)
Range	19,0–80,0	21.0–47.0	19.0–80.0
Median (IQR)	39.0 (22.0)	37.0 (10,0)	39.0 (20.0)
95% CI	[38.6; 44.5]	[33.0; 39.6]	[38.1; 43.0]
Receiving antiparasitic drugs during the previous 3 months:			
No	73 (74.5%)	19 (76.0%)	92 (74.8%)
Yes	25 (25.5%)	6 (24.0%)	31 (25.2%)
Receiving antibiotics during the previous 3 months:			
No	57 (58.2%)	12 (48.0%)	69 (56.1%)
Yes	41 (41.8%)	13 (52.0%)	54 (43.9%)

CI – confidence interval; IQR – interquartile range; SD – standard deviation

DISCUSSION

Because of a poor epidemiological surveillance system and due to the war, there is little data available on of the prevalence of intestinal parasitic infections in Ukraine. Currently, giardiasis and cryptosporidiosis are the only notifiable intestinal diseases in the country. In 2022, a total of 3,480 cases of giardiasis and 10 cases of cryptosporidiosis were reported in Ukraine (Table 1). However, it should be emphasized that the epidemiological situation of most parasitic infections is not known. According to World Health Organization report "Antimicrobial resistance surveillance in Europe 2023–2021" published in April 2023, we observe extended microbial resistance in many countries of Europe. Higher levels were reported in the southern and eastern parts of the Europe. It is a serious threat to health, and many countries have limited treatment options for patients with infections caused by these pathogens.

Irrational and excessive consumption of antibiotics and antiparasitic medications is one of the major public health issues in Ukraine [7]. A survey which was conducted in a group of pharmacists working in Ukraine showed that as much as 90.7% of the respondents admitted to the sales of antimicrobial drugs without a valid prescription (only in August 2022 the electronic prescription forms were provided in the country and it means that patients can buy antibiotics only with a doctor's prescription, but the military full scale Russian invasion led to a lack of respect for this regulation). There are two major reasons which may explain this situation. On the one hand, the sale of drugs without a prescription increases the profits of pharmacies, on the other, a lot of patients are not aware of the risks associated with self-medication or simply do not have money to consult a specialist [8]. In 2019, the Ministry of Health of Ukraine implemented a series of measures to fight antibiotic resistance by limiting the use of antimicrobial drugs but, widespread corruption in the health sector slows down the process [9]. In addition, the newly imposed restrictions do not apply to pharmacies located in a war-zone or territories occupied by the Russian Federation. In those places pharmacies are authorized to sell drugs without a valid prescription. Also, voluntary associations and charities have been given permission to purchase antibiotics directly from distributors (without a prescription) whenever they get such a request from any military unit or a medical facility [10].

In 2020, when the COVID-19 pandemic was declared, the use of antimicrobial drugs in Ukraine increased by 50.5% compared to 2019 [11]. Only 2 years later, the Russian Federation waged a full-scale military operation against Ukraine, which hit the country's healthcare system even harder. The medical infrastructure was partly destroyed and thus the authorities were forced to transform some hospitals into bomb shelters or to move hospital wards to the basements of hospital buildings. In addition, a considerable number of doctors were moved to the frontline. The evidence from the studies conducted during the military operations in Iraq and Afghanistan [12] shows that people working or serving in areas affected by a war are exposed to high levels of emotional stress. Since emotional stress is one of the major factors contributing to an increased consumption of drugs (especially broad-spectrum antimicrobials) it could explain

why the use of drugs in Ukraine has grown so much in recent years. The present study revealed that as much as 43.9% of the participants were taking antibiotics and 25.2% were taking antiparasitic drugs within 3 months prior to entering the study. Antimicrobial therapies (e.g. drugs used to treat giardiasis, such as metronidazole or tinidazole) can have a significant impact on the susceptibility of a host to parasitic infections [13] and could be the reason why all the tests for *Giardia intestinalis* in the present study were negative. Iakovlieva et al. [14] analysed the use of antiparasitic medications in the period from 2018 to 2020. The study showed that the consumption of this type of drugs in Ukraine was 1.4-fold higher than in Lithuania, 3-fold higher than in Estonia and 4-fold higher than in Norway. The study also found that the most common antiparasitic drugs in Ukraine included: mebendazole, albendazole, pyrantel and praziquantel.

The present study found no infections with protozoa, nematodes, cestodes or trematodes, which might be explained by the fact that a high proportion of the study participants were taking antiparasitic medications prior to the enrolment in the study. Examinations performed as part of this study have only revealed infections with potentially pathogenic *Blastocystis* spp. The infection rate was slightly higher among internal war refuges than among residents of the Ternopil region, which might be linked to poor sanitation in areas affected by the war. Shortages of safe drinking water and poor access to sanitation and hygiene contribute to the spread of gastrointestinal infections, including parasitic infections [15]. The present study showed low rates of infections caused by intestinal parasites even though many Ukrainians are now living under poor sanitary conditions. Easy access to antimicrobial drugs (which are often sold without a valid prescription and taken without any consultation with a physician) may have impacted the results of the study. Experts from the European Centre for Disease Prevention and Control have pointed to a growing risk of infections caused by multi-drug resistant bacteria in Ukraine. According to the data reported to CAESAR (Central Asian and European Surveillance of Antimicrobial Resistance network) by Ukrainian healthcare providers, 53% of *Escherichia coli* isolates from Ukrainian patients were resistant to cephalosporins, 54% *Klebsiella pneumoniae* isolates were resistant to carbapenems, 77% *Acinetobacter* spp. isolates were resistant to carbapenems, and 18% *Staphylococcus aureus* isolates were resistant to methicillin (MRSA) [16].

CONCLUSIONS

Many Ukrainian patients have unlimited access to antimicrobial drugs (which are sold without a valid prescription and taken without a consultation with a physician), which could have contributed to a low prevalence of intestinal parasite infections in the studied population. It is important to point out that the misuse of antimicrobial drugs leads to an increase in the number of cases caused by multidrug resistant organisms.

Conflict of interest: None declared

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LETTER TO THE EDITOR

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"COVID-19 on board a cruise ship: medical management" — correspondence

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We found that the article on "COVID-19 on board a cruise ship: medical management" [1] is interesting. In order to help the ship doctor foresee the length and significance of the contaminations, Beust et al. [1] studied the dynamics of a COVID-19 cluster on a cruise ship. Beust et al. [1] sought to determine if the enclosed environment on board permits precise inferences about the dynamics of epidemics and appropriate preventive actions. The study found similarities in the dynamics of virus dissemination on cruise ships and in land-based outbreaks. Regular polymerase chain reaction testing of crew members, in addition to symptomatic case testing, reveals a proactive strategy to monitoring and managing the virus's spread on board. The usage of an excel spreadsheet for daily reporting to the ship's owner demonstrates a dedication to transparency and good communication regarding the pandemic situation.

Because the study only comprises one ship and its crew members, the sample size is quite limited. This small sample size may not be typical of the larger population or provide an in-depth insight of COVID-19 transmission patterns on cruise ships in general. Furthermore, the paper did not identify specific preventive actions and treatments implemented on the ship to mitigate the spread of the pathogen. Without this information, determining the effectiveness of the actions implemented and their impact on the reported epidemic dynamics is impossible. Before drawing conclusive conclusions or generalizing the findings to other contexts, it is critical to understand these limitations as well as the need for additional study and validation. Finally, we should also recognize the diagnostic ability of the diagnostic test. False positive and false negative can still occur and it is necessary to interpret the results with concerns on possibility of the false result. The quality control of all laboratory investigation on ship might be difficult but it is needed.

Conflict of interest: None declared

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Responses to the correspondence on "COVID-19 on board a cruise ship: medical management"

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First of all, thank you very much for your interest and your relevant remarks about our article "COVID-19 on board a cruise ship: medical management" [1].

We do agree with you when you write: "Because the study only comprises one ship and its crew members, the sample size is quite limited. This small sample size may not be typical of the larger population or provide an in-depth insight of COVID-19 transmission patterns on cruise ships in general." [2].

We can specify that we reported on medical management on a single ship and tried to determine whether there are benefits or not of the presence of a medical doctor on board and what can be experienced. Our findings are available for this particular situation and this kind of ship. It is important to state these limitations clearly.

Nevertheless, we think that at that time, during the evolution of the pandemic, there were no medical management strategies than non-specific preventive measures and treatments. For us, isolation in onboard cabins is quite similar to isolation in in-land rooms. And it was the principal way to limit the spread of the pathogen on board.

Moreover we reported the cases on board the Jacques Cartier in order to aggregate information on COVID-19 pandemic in the maritime sector. If the experience of one ship's contamination is not sufficient to draw general conclusions, we can refer to other publications onboard different ships. And we finally found some similarities that allowed us to conclude in the effectiveness of the measures taken onboard.

You write: "False positive and false negative can still occur and it is necessary to interpret the results with concerns on possibility of the false result. The quality control of all laboratory investigation on ship might be difficult but it is needed." [2].

We know that and we need a quality control for medical devices on board ships. And it was done in this case. We can also mention that even some false positive or false negative tests can occur, the onboard laboratory is: (i) practical; (ii) transportable, and (iii) appropriate to give quick answers to biological questions regarding many infectious diseases in patients on board, such as COVID-19.

In our cases, passengers and crew were tested by reverse transcription-polymerase chain reaction (RT-PCR) on the Biosynex© machine on board (VITA PCR Credo Diagnostics©) and all positive samples were re-tested. They were also re-run to verify the positive RT-PCR test results at the Starmetropolis© Dubai inland laboratory.

Conflict of interest: None declared

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MAGAZINE

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Editorial

Dear Colleagues,

we finish 2023 with the 4th issue of your International Maritime Health journal and magazine hoping that all of you made it through an indeed memorable year safe and sound. We wish you a happy and healthy new year whether at sea or ashore — always fair winds and following seas!

For this magazine we have once again collected a number of articles, hoping that these will support your work in the maritime environment. A focus in this issue is telemedical advice/assistance. With the establishment of its expert panel the International Maritime Health Foundation (IMHF) has gone beyond its prior role as owner and publisher of this journal. In 2021 a series of workshops were started that addressed practical issues of maritime medicine. Reports were published in this journal that offer IMHF positions on actual standards for best medical practice at sea. Find below a recently published study under aegis of International Transport Workers' Federation (ITF)-Seafarers' Trust that provides some epidemiology. Extremely helpful for our foundation's further work on pathways to manage medical incidents at sea. A report on IMHF's most recent workshop on this topic will be published in this journal early next year!

It is our pleasure to also report on the 16th International Maritime Health Symposium held in October 2023 in Athens. After the pandemic we are back to normal!

Happy reading!

Klaus Seidenstücker
Temporary magazine editor
International Maritime Health Foundation's Expert Panel

News

SEAFARERS' CHARITY — NEW FILM ISSUED

Contributed by Nebojša Nikolić

The Seafarers' Charity (formerly Seafarers United Kingdom) have been improving the lives of all seafarers and their families for over 100 years. Today, guided by the same powerful vision, they are publishing a series of films aiming to empower foreign crew members with insights into life in United Kingdom fishing fleets, legal rights, and avenues for support in case of abuse or exploitation.

In collaboration with Stella Maris and Waitrose, they have recently published: **"Working in UK Fishing — Pre Departure"**, available at: https://www.youtube.com/playlist?list=PLWglqT89t2fQAQ_B3vjFgAh-B6yAltZcE.

Particulars

NEW SECRETARY GENERAL AT IMO

Contributed by Klaus Seidenstücker

January 1st, 2024, Mr. Arsenio Dominguez from Panama will take up office as new Secretary General of the International Maritime Organization (IMO). He is to follow Mr. Kitak Lim from South Korea. Mr. Dominguez' recent position was that of Head of IMO Environmental Department.

NEW MEDICAL DIRECTOR AT THE GERMAN MARITIME MEDICAL SERVICE

Contributed by Klaus Seidenstücker

July 1st, 2023, Doctor Jörg Abel took office as head of the German Maritime Medical Service. Doctor Abel is anaesthesiologist and emergency medicine specialist. He presently holds positions in the board of directors of the International Maritime Health Association (IMHA) and the board of the German Maritime Medical Association (Deutsche Gesellschaft für Maritime Medizin, DGMM).

(Photo provided by Dienststelle Schiffssicherheit/Seeärztlicher Dienst)

PRESIDENT OF THE GERMAN SEAFARER MISSION RE-ELECTED

Contributed by Klaus Seidenstücker

Doctor Clara Schlaich was recently re-elected as president of the German Seafarer Mission (www.seemannsmission.org), a global charity for seafarer's welfare. Doctor Schlaich is a private practitioner serving especially seafarers at Hamburg harbour. She is medical consultant for a number of shipping companies.

(Photo provided by Clara Schlaich)

Reports

Courtesy of the ITF Seafarers' Trust

TOWARDS HARMONISATION OF DATA COLLECTION: A METHODOLOGY FOR TMAS COLLABORATION — PROJECT REPORT

Contributed by Luca Tommasi

Background

Approximately 1.9 million seafarers are currently employed in international shipping[1] and subject to the particular challenges and hazards of living and working on board vessels at sea. In addition, an estimated 58.5 million people are employed in the fishing industry[2] working on board vessels for longer and shorter periods of time.

In May 2000 the International Maritime Organization (IMO) agreed guidelines on the provision of Medical Assistance at Sea highlighting the importance role of Telemedical Assistance Services (TMAS).[3] The Guidelines state that such a system is essential:

— to alleviate the isolation at sea of both the victim (the sick or injured person on board) and the captain responsible for giving treatment;
— to avoid, as far as possible, the need for evacuation, which, although sometimes essential, is by its nature dangerous and expensive; and
— to assist Rescue Coordination Centres (RCCs), which are often the first contact with the captain in difficulty, to take an appropriate decision.

They further state that 'a TMAS should be officially designated as such by the competent authority in the State concerned', but they leave the mechanisms for providing such services wide open.

In August 2013 the International Labour Organization (ILO) Maritime Labour Convention (MLC), 2006 came into force with the requirement that seafarers must have access to prompt and adequate medical care whilst working on board. Regulation 4.1 requires 'standards for measures aimed at providing seafarers with health protection and medical care as comparable as possible to that which is generally available to workers ashore.'[4] This right is applicable to all seafarers covered under the convention as agreed by the 104 signatories of the MLC covering 96.6% of world gross tonnage.[5]

Standard A4.1 para 4 (d) states that 'the competent authority shall ensure by a prearranged system that medical advice by radio or satellite communication to ships at sea, including specialist advice, is available 24 hours a day; medical advice, including the onward transmission of medical messages by radio or satellite communication between a ship and those ashore giving the advice, shall be available free of charge to all ships irrespective of the flag that they fly'.

The MLC sets out further guidance around international cooperation in the area of assistance, programmes and research in health protection and medical care — including collecting and evaluating statistics concerning occupational accidents, diseases and fatalities of seafarers and integrating and harmonizing the statistics with any existing national system of statistics on occupational accidents and diseases covering other categories of workers'.[6]

However, to date, in spite of the long existence of TMAS, there is still much room for improvement.

[1] BIMCO-ICS 2021. Seafarer Workforce Report.
[2] FAO 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. https://doi.org/10.4060/cc0461en.
[3] https://wwwcdn.imo.org/localresources/en/OurWork/Safety/Documents/MSC.1-Circ.960%20-%20Medical%20Assistance%20At%20Sea.PDF.
[4] https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:91:0::NO::P91_SECTION:MLCA_AMEND_A4.
[5] https://www.ilo.org/global/standards/maritime-labour-convention/lang--en/index.htm.
[6] ILO. Maritime Labour Convention, 2006 Guideline B4.1.4 para 1.

For more than 100 years some form of telemedicine service has been in operation. A number of national TMAS provide services internationally, but structures for coordination and formal cooperation are limited. In addition to the wide range of national services from primarily Search and Rescue (SAR) operations, to TMAS departments in hospitals and fully-manned 24/7 dedicated services, there is also a private market for companies providing supplemental medical services to companies on a commercial basis.

There are many factors which create potential obstacles for meaningful cooperation, including but not limited to variations in:

— culture and expectations of medical services;
— medical practices between countries and diagnostic systems;
— target populations — seafarers, fishers, passengers;
— languages spoken by the target population;
— organization of SAR services and integration or otherwise with TMAS;
— main means of communication;
— volume of contacts;
— training and recruitment of TMAS doctors;
— legal requirements for data protection.

The lack of standardised data collection on seafarers' conditions is a missed opportunity to better compare services and improve the overall understanding of seafarers' health issues and the ways in which they are addressed. A more systematic approach would allow for services to learn from each other, facilitate improvements to regulation and support better decision making around training of TMAS doctors and requirements for ship medical chests. It would also help stakeholders to develop informed strategies for prevention of ill health at sea.

The ITF Seafarers' Trust TMAS Project

In order to tackle the challenges of limited harmonisation of reporting, the ITF Seafarers' Trust (ITFST) together with the services from Germany, Italy, the Netherlands and Norway initiated the TMAS project.

During the first meeting in London in September 2019 a commitment was made to:

— cooperate with each other with facilitation and support of ITFST;
— share information with a view to producing an annual report on seafarers' health;
— provide a named contact to deliver agreed outputs.

Subsequent meetings have focussed on the discrepancies in data collected by the different services.

Engagement in the project has expanded and now includes participants from Denmark, Finland, Germany, Italy, the Netherlands, Norway, Poland, Sweden, Turkey and the United Kingdom.

Of the services represented, the scale of involvement in telemedicine ranges from 50 cases per year to in excess of 7,500 cases per year. Some have a truly international scope, whilst others are focussed on national shipping and search and rescue areas. Some include significant numbers of passenger vessels, others fishing vessels, or offshore support vessels, others reflect more mainstream international shipping.

Agreed aims and methodology

— To agree common definitions and record comparable anonymised data sets.
— To follow an agreed methodology from which data can be extracted rather than sharing complete databases due to the sensitivity around holding and sharing medical data.
— To develop a standardised method of data collection with a view to facilitating an annual report of selected consolidated statistics from those TMAS services included in the project.

Whilst early discussions focused on the publication of an annual report, it became apparent that before such a project could be realised, considerable work would need to be undertaken to agree and implement standard elements for data collection.

From a diagnostic perspective, some services used the ICPC-2 coding system, others used ICD-10.

Of the other factors deemed relevant: age, gender, nationality, position on board, vessel location — not all elements were collected by all services. In addition not all services held full details on actions taken once advice had been given. Where information was held, definitions varied between services.

A balance needed to be struck in collecting information essential for meaningful interpretation of diagnostic data and outcomes, and information of more statistical interest. Given the challenges of existing disparity and concerns around data

protection, the conclusion was to focus on the basics for collation with the option to include additional detail in individual reports.

Once agreement had been reached and refined on elements of data to collect along with definitions, a format for data collection was developed allowing each service to compile its complete data and submit it in disaggregated tables to ensure compliance with data protection regulations.

Agreed elements and definitions

ICPC-2 vs. ICD-10

Participating services agreed to use ICPC2 codes, recording complete codes but providing only the letter element to the ITFST report.

Age

It was agreed to group patient age as follows:

— 0–20;
— 21–40;
— 41–60;
— over 60.

Position

The agreed list for 'position/rank' was changed from a list reflecting the hierarchy of a crew list to a simplified designation more linked to the working environment.

Position	Definition
Captain	Person in charge of the vessel
Deck	Navigational officer/rating working primarily on deck
Engine	Engineer, oiler, wiper crewmember working primarily in the engine room
Galley	Cooks and crew working primarily in the galley/kitchen
Hotel	Seafarers primarily working as chamber maids, croupiers, waiters and general hospitality
Passenger	Person travelling on board, not working in any capacity on board
Fisher	Person working on board a fishing vessel or fish factory vessel
Other	Specialist categories of worker such as guest entertainers, inspectors, repair technicians
Unknown	The status of the person is unknown

Vessel type	Definition
Cargo	Bulk carrier, general cargo and container ships
Tanker	Oil and chemical tankers
Passenger	Ferries, cruise ships
Search and rescue	Vessels engaged in search and rescue activities
Fishing	Fishing vessels and fish factory vessels
Leisure	Yachts, small boats
Other	Offshore supply and support vessels, scientific research vessels, pilot boats and tugs etc.
Unknown	The type of vessel is unknown

Advice given

Following discussion it was agreed to reduce the number of options of advice given to three broad categories and to delete the category of 'advice taken' since this is not always known.

Advice given	Definition
Treatment on board only	Treatment on board with no further immediate action advised
Treatment ashore	Treatment ashore advised but without need for urgent action
Deviation/evacuation/disembarkation	Recommendation to take urgent action including vessel deviation, evacuation by helicopter or rescue boat, ship to ship transfer or other means of immediate disembarkation

Means of communication

It was agreed to retain means of communication as a data set given the significant variation between services and the recent introduction of video consultation. Where there is more than one form of communication, the most significant for the service is reported.

Means of communication	Definition
Video	Video platform primarily
Voice	Contact primarily by telephone
Written	Contact primarily by email, text message or dedicated platform

Location

The question of location was discussed with the following options noted:

— AIS position or coordinates;
— SAR area;
— coastal or deep sea;
— ocean/sea or geographic area.

This is a subject for further consideration with more work to be undertaken at the national level.

Data collected

The total number of records in the data set is 12,316.

All data is anonymous, and all elements were disaggregated to avoid data protection issues.

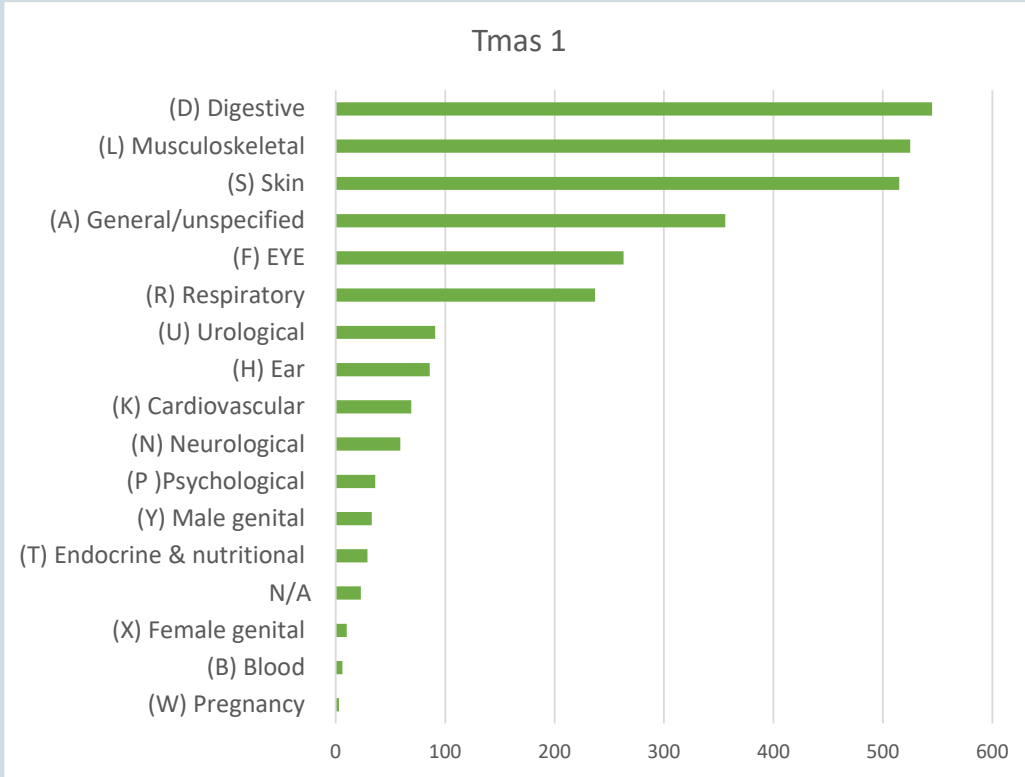
Each record represents a case handled by an individual TMAS service, not the total number of contacts.

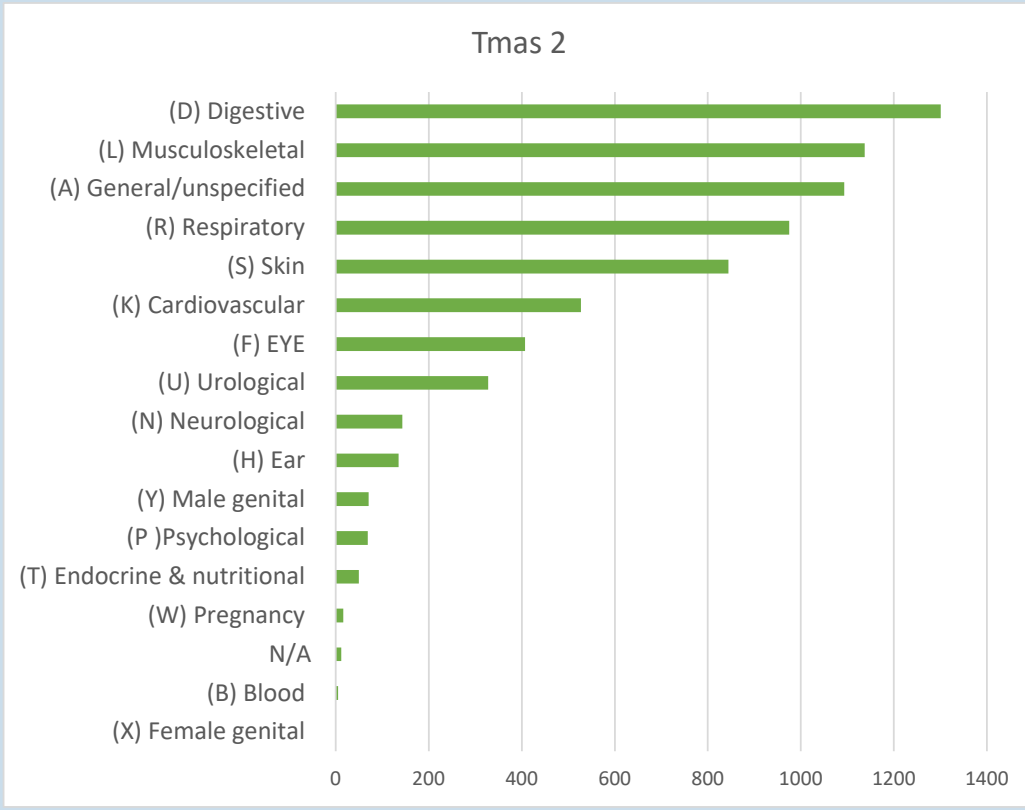
The following series of charts presents combined data from 4 TMAS services for the year 2022 covering:

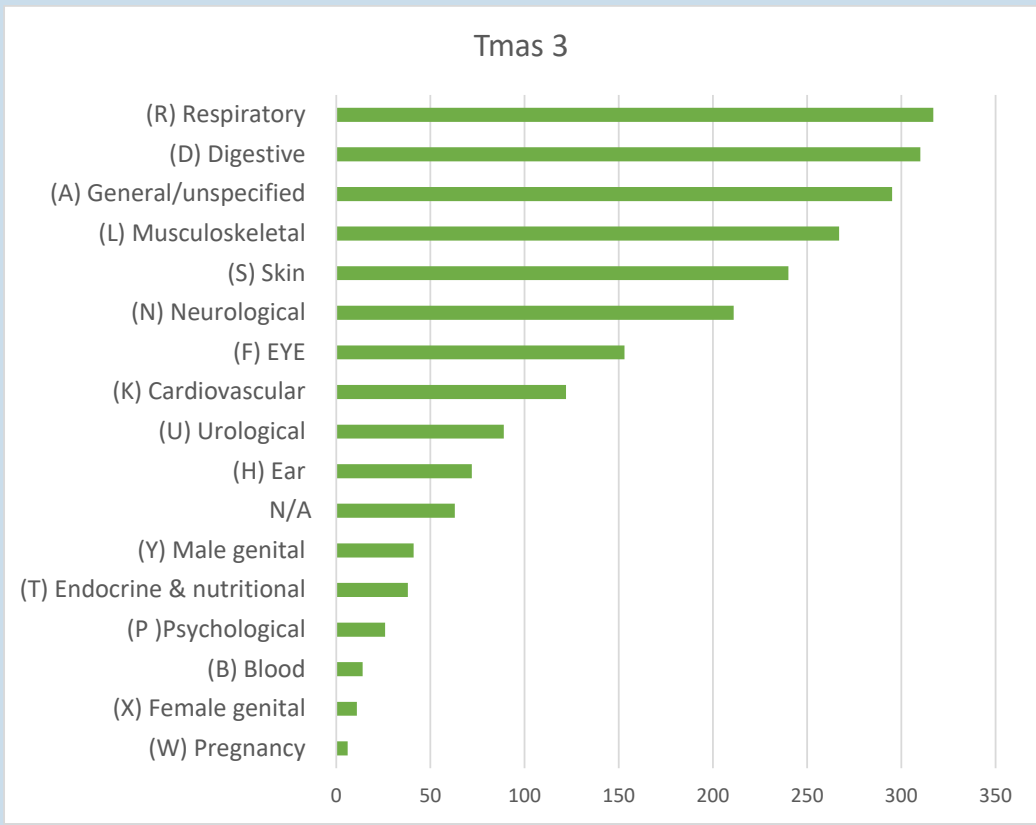
— diagnosis identified by the TMAS doctor, recorded using the ICPC-2 classification of disease;
— age groups;
— position;
— type of ship;
— medical advice given to the patient by the TMAS doctor;
— main means of communication between ship and TMAS service.

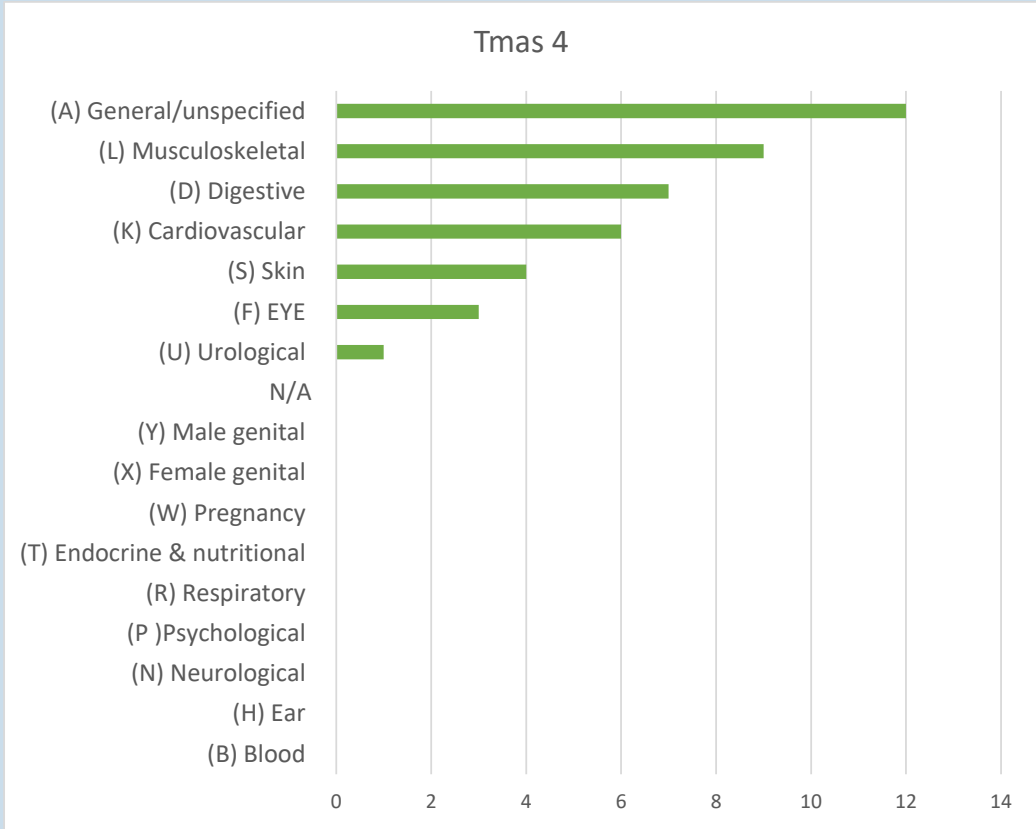
The largest category of medical condition was 'Digestive' (2,163) followed by 'Musculoskeletal' problems (1,3938). Most patients were at the lower end of the age categories: 21–40 (5,964). The majority of patients worked on 'Deck' (3,885), with 'Engine' not far behind (3,069). Vessel types were mainly cargo ships (5,503), followed by tankers (3,416). The majority of cases were treated on board (7,149) and the primary method of communication was written, either by email or within web based platforms (10,216).

Individual TMAS diagnosis recorded using ICPC-2 code

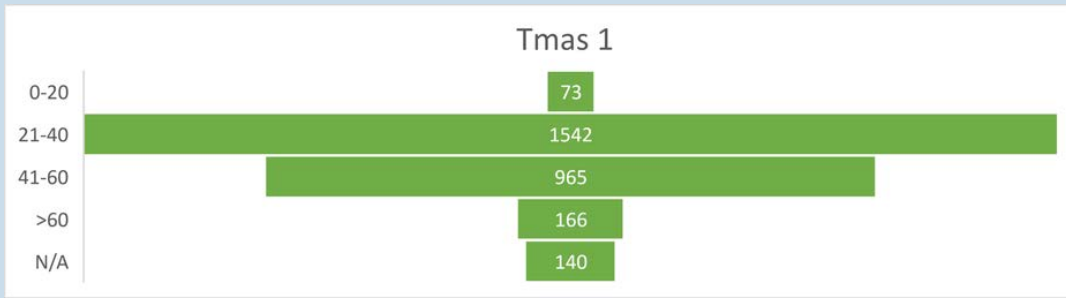


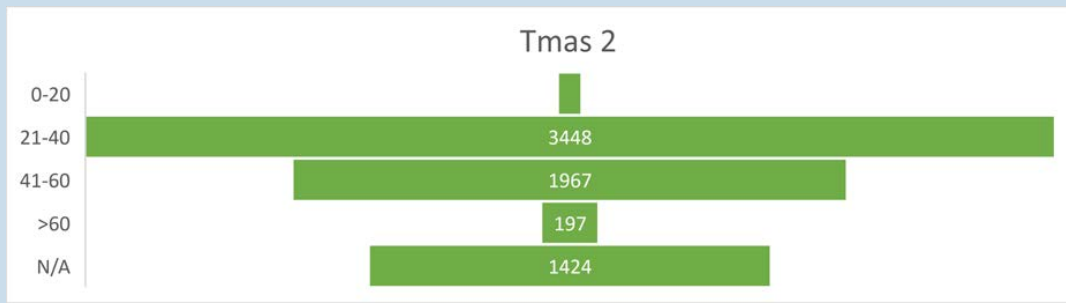


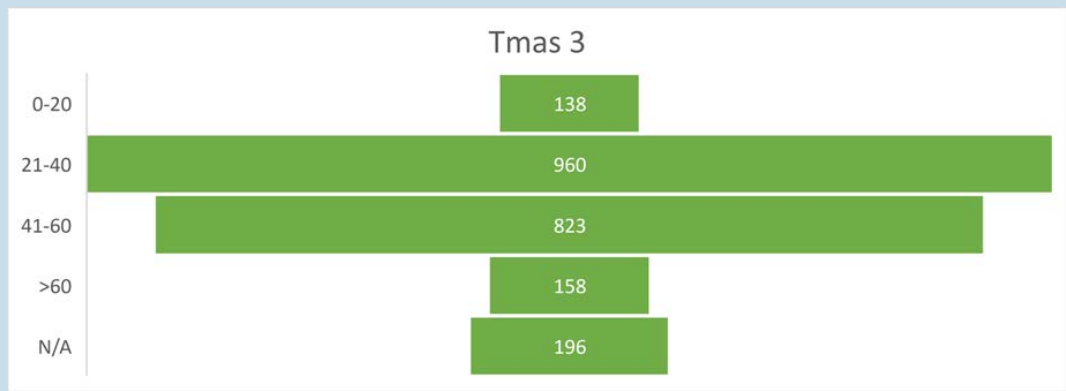

Tmas 3
(R) Respiratory
(D) Digestive
(A) General/unspecified
(L) Musculoskeletal
(S) Skin
(N) Neurological
(F) EYE
(K) Cardiovascular
(U) Urological
(H) Ear
N/A
(Y) Male genital
(T) Endocrine & nutritional
(P)Psychological
(B) Blood
(X) Female genital
(W) Pregnancy
0
50
100
150
200
250
300
350


Tmas 4
(A) General/unspecified
(L) Musculoskeletal
(D) Digestive
(K) Cardiovascular
(S) Skin
(F) EYE
(U) Urological
N/A
(Y) Male genital
(X) Female genital
(W) Pregnancy
(T) Endocrine & nutritional
(R) Respiratory
(P)Psychological
(N) Neurological
(H) Ear
(B) Blood
0
2
4
6
8
10
12
14

Age

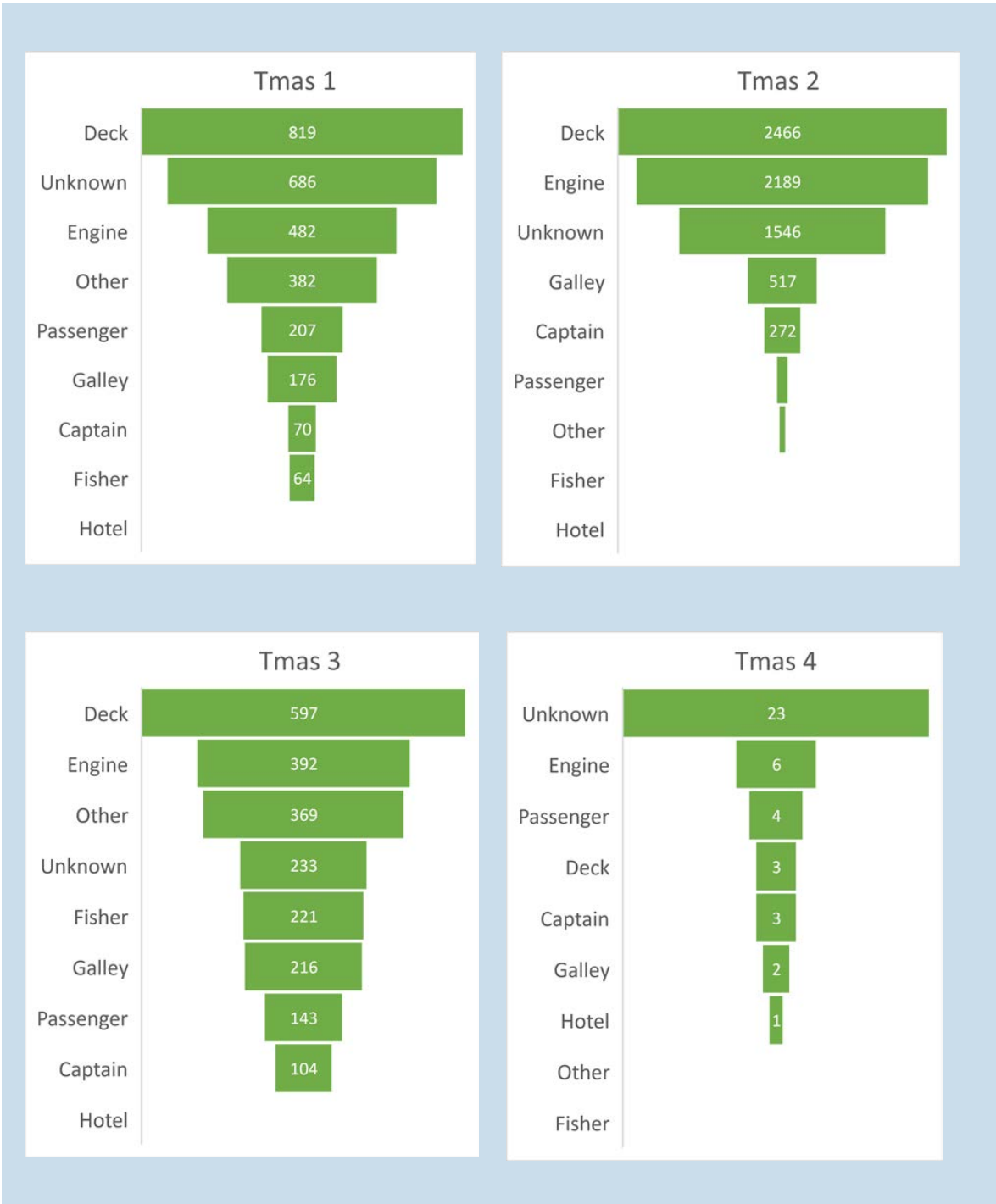

Tmas 1
0-20
21-40
41-60
>60
N/A
73
1542
965
166
140


Tmas 2
0-20
21-40
41-60
>60
N/A
3448
1967
197
1424

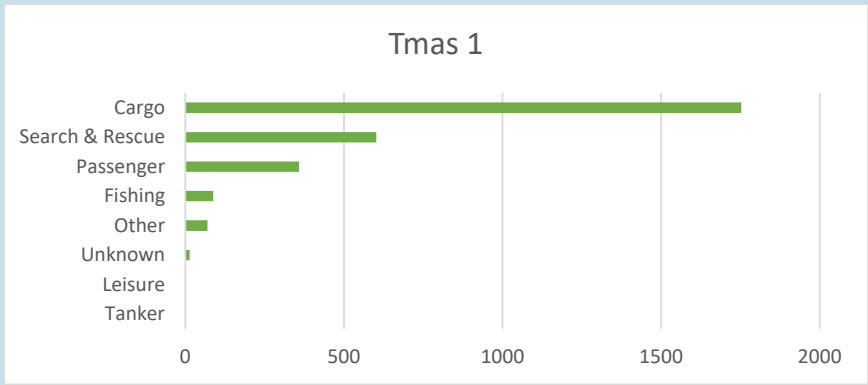

Tmas 3
0-20
21-40
41-60
>60
N/A
138
960
823
158
196

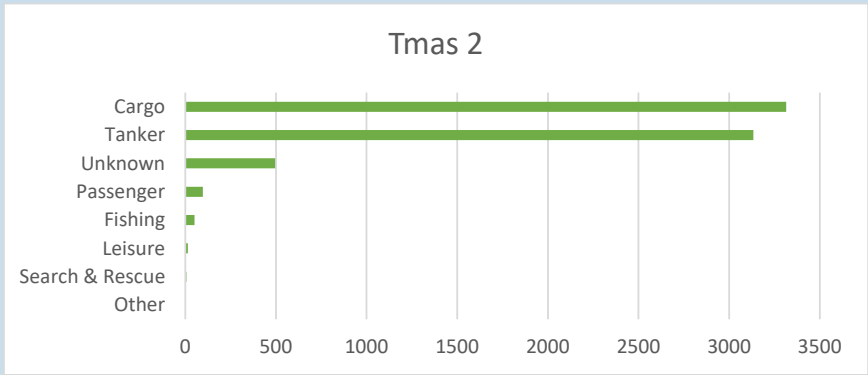

Tmas 4
0-20
21-40
41-60
>60
N/A
14
18
6
4

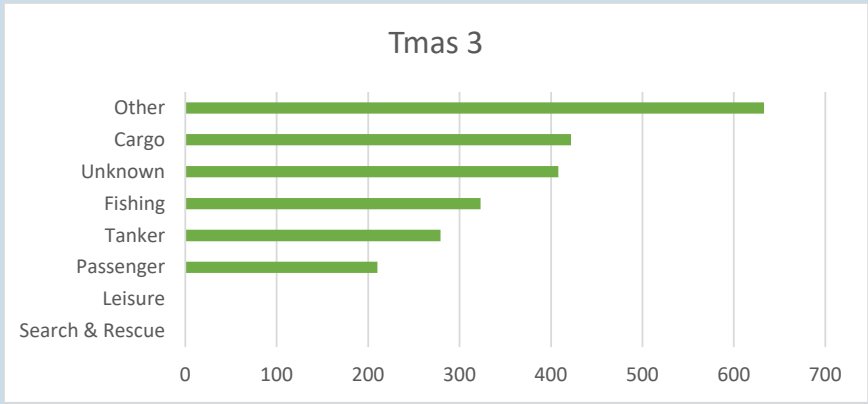
Position

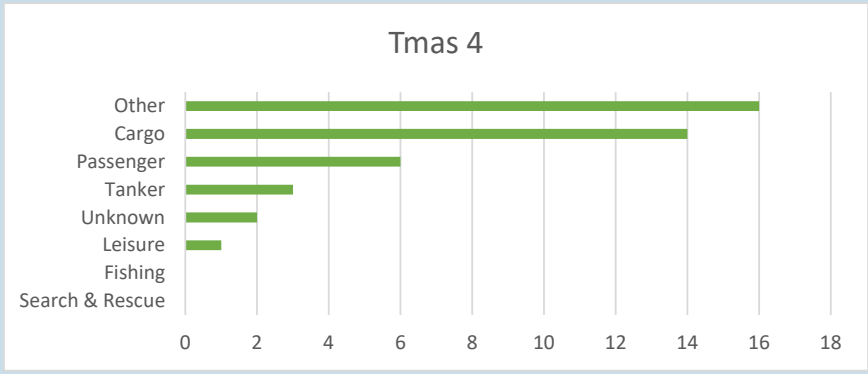

Tmas 1
Deck 819
Unknown 686
Engine 482
Other 382
Passenger 207
Galley 176
Captain 70
Fisher 64
Hotel
Tmas 2
Deck 2466
Engine 2189
Unknown 1546
Galley 517
Captain 272
Passenger
Other
Fisher
Hotel
Tmas 3
Deck 597
Engine 392
Other 369
Unknown 233
Fisher 221
Galley 216
Passenger 143
Captain 104
Hotel
Tmas 4
Unknown 23
Engine 6
Passenger 4
Deck 3
Captain 3
Galley 2
Hotel 1
Other
Fisher

Ship type


Tmas 1
Cargo
Search & Rescue
Passenger
Fishing
Other
Unknown
Leisure
Tanker
0
500
1000
1500
2000


Tmas 2
Cargo
Tanker
Unknown
Passenger
Fishing
Leisure
Search & Rescue
Other
0
500
1000
1500
2000
2500
3000
3500


Tmas 3
Other
Cargo
Unknown
Fishing
Tanker
Passenger
Leisure
Search & Rescue
0
100
200
300
400
500
600
700


Tmas 4
Other
Cargo
Passenger
Tanker
Unknown
Leisure
Fishing
Search & Rescue
0
2
4
6
8
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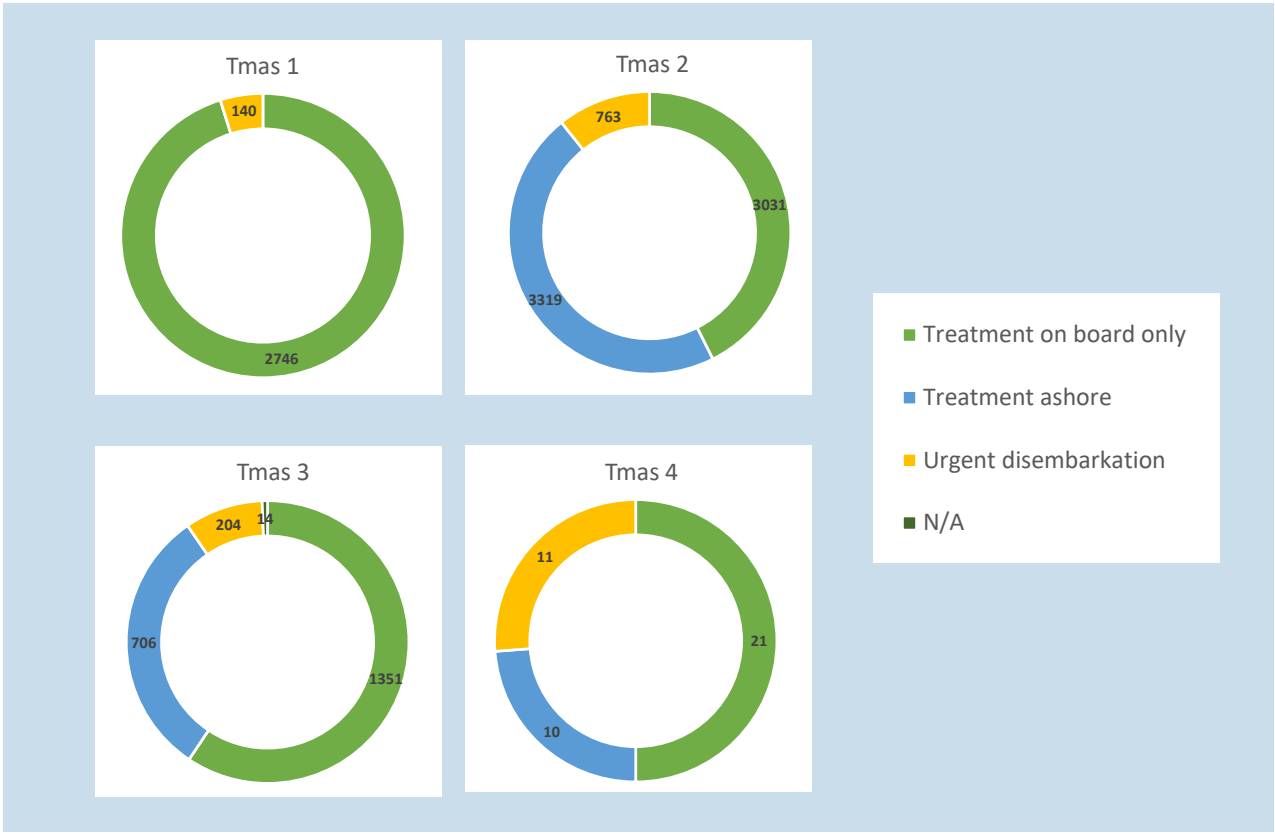
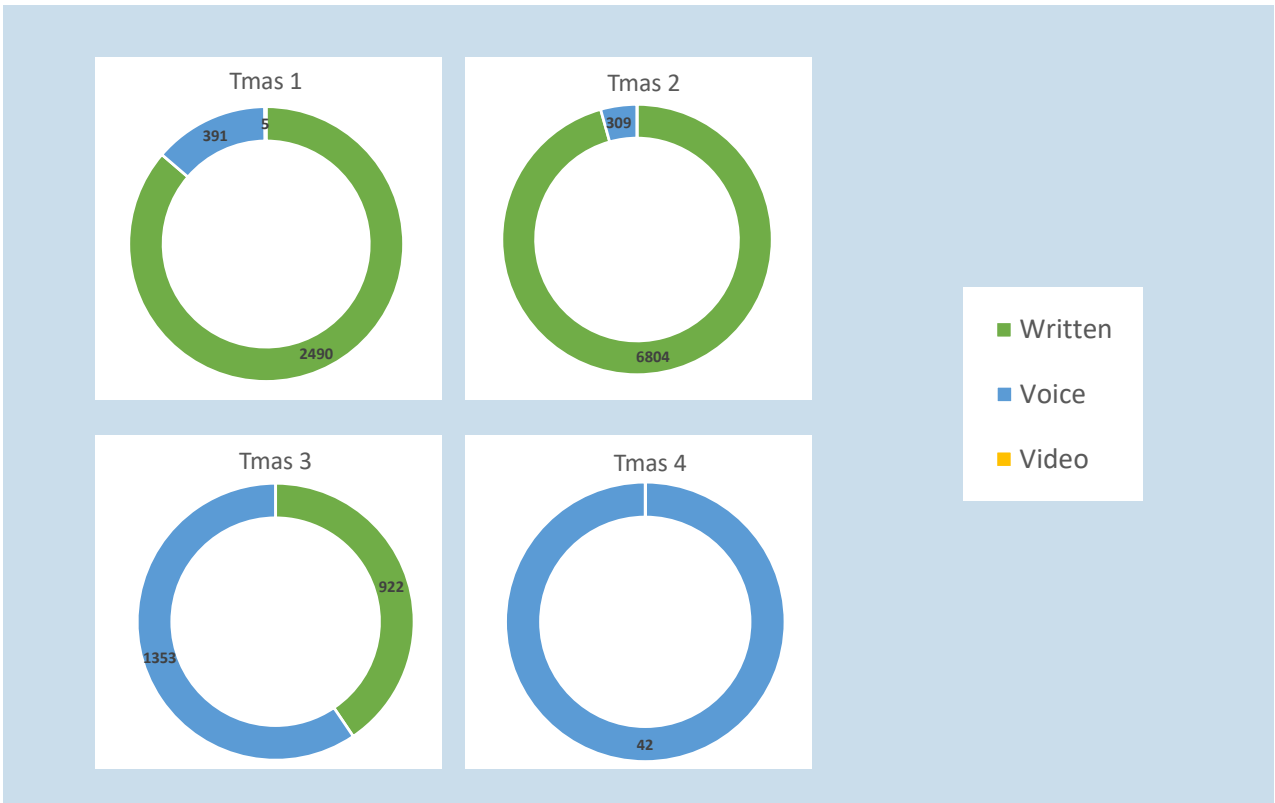
12
14
16
18

Advice given



Means of communication



Concluding remarks

The TMAS environment is complex both in terms of practical responses to seafarers and in terms of overlapping and stringent regulatory requirements. Medical data is considered sensitive data and subject to particularly strict rules. In this age of technological advances there are different options for secure transmission and storage of data but also risks that have yet to be fully understood, let alone managed and regulated in a coherent fashion.

International mechanisms for maritime governance take decades to conclude and have a tendency to accommodate the lowest common denominator. Industry initiatives can be innovative but tend to be market-based and underpinned by commercial considerations. It is hoped that this project, with its core focus on seafarers, will pave the way for some practical solutions in the constantly evolving sphere of telemedicine.

The ITF Seafarers' Trust

The ITFST is a United Kingdom registered charity funded by the Welfare Fund of the International Transport Workers' Federation. With its remit to support initiatives that promote and preserve the health and safety of seafarers with the aim of preserving life, the Trust identified an opportunity to facilitate cooperation between interested national (not-for-profit) services providers.

16TH INTERNATIONAL SYMPOSIUM ON MARITIME HEALTH — CONGRESS REPORT

Report by Ilona Denisenko and Brant Connors (IMHA)

The 16th International Symposium on Maritime Health (ISMH) was held in Athens, Greece from October 5th until the 8th in 2023, marking a significant return to in-person gatherings post-pandemic. Drawing together over 120 professionals, including port medics, telehealth providers, pharmacists, and health researchers, the symposium delved into critical discussions ranging from the latest medical research findings to the mental health and welfare of seafarers. The symposium offered a unique platform to discuss the prevalence of cancers, allergies, colour vision capacity, and the pressing need for advancements in Pre-Employment Medical Examinations (PEME).

An ISMH has traditionally been held every 2 years since the first formal ISMH in Turku, Finland in 1991. ISMH16 was originally planned for June 2021 but was unfortunately delayed due to the COVID-19 pandemic. Not surprisingly, lessons from the pandemic and effects on physical and mental health of maritime workers were recurring issues throughout the four-day symposium.

The programme began with the pre-symposium meeting, which was held at the Byzantine Museum, located at the Villa Ilissia. It started with an excursion through the museum's permanent exhibition and followed by the scientific meeting entitled Diabetes Type 2 and Hypertension Research, Educational and Prevention Plan 2023–2032. The 10-year research and educational plan constitutes a core issue for "Preventing Social Inequity in Health at Sea" as a high priority part in the MAHRE-Net programme. The content of the educational and intervention topics and research was discussed. Olaf Jensen, developer of the programme, chaired the meeting asked the participants for advance commitments to contribute with specific tasks. Luisa Canals, David Lucas, James Denham and Ilona Denisenko, the co-founders of the MAHRE.net group presented the programme. The vivid discussion of the participants expressed great interest to the topic.

The first day in Athens ended up with a get together party in the gardens of the Byzantine Museum. It is truly an oasis in the heart of Athens.

On October 5th, the official programme started at the Evgenidion Foundation. During the opening ceremony, Symposium Chair, Ilona Denisenko, set the tone for the event, expressing joy about the physical reunion and highlighting that the medical practitioners are metaphorically "a bit Greek" due to the influence of the Hippocratic oath. She promised that the 5 days would be full of conversations and scientific presentations and discussions as well as some exciting cultural programmes to show the hospitality of Greece, including Greek wine tasting, excursion to the Stavros Niarchos Foundation Cultural Centre and a visit to the Floating Naval Museum Battleship "Georgios Averof" and Olympias trireme.

Rob Verbist, International Maritime Health Association (IMHA) President, mentioned that in more than thirty years from the first symposium, it has become the most important gathering of maritime medical specialists in the world. He remarked that "Never has IMHA interacted more with the maritime industry than during COVID."

ISMH16 continued the tradition of presenting scientific research in the field of maritime health. Under the guidance of Despina Andrioti Bygvraa, the Scientific Committee evaluated more than 200 submissions of abstracts and posters for presentation. Selected research presentations during the symposium included: occupational asthma and eczema among harvesting fishermen, the psychosocial burden and stress coping strategies among seafarers, diagnosis of latent tuberculosis, prevalence of depression among maritime workers during the COVID-19 pandemic, and more.

Selected posters highlighted topics such as: disease and injuries among seafarers and fishers using TMAS in Thailand, cardiovascular risk among Polish seafarers, European Union policy impact on fishermen, and the health impact of heavy oil on board vessels.

Simon Grainge, Chief of the International Seafarers/Welfare and Assistance Network (ISWAN), noted that a lot has happened since we all came together for the Symposium in Hamburg in 2019. We've seen the industry face its biggest crisis since the Second World War and as always, seafarers demonstrated their resilience and adaptability in keeping the world's supply chains open throughout the crisis. From ISWAN's perspective, the biggest lesson is that partnership works. It works because it makes the best use of all of your talents and achieves much more than we can do alone. ISWAN has been working with IMHA since long before I began in this role, learning from each other's work and collaborating on the development of health and wellbeing resources for seafarers.

Ioannis K. Pappas, Deputy Minister of Shipping and Insular Policy, wished success to the Symposium and emphasized that Greece has a rich maritime tradition and history. Shipping and Greece are two identical concepts with a common course through the centuries.

"Above all, shipping is about its people, whether we are talking about our sailors, the women and men of the port corps or the professionals involved in maritime professions.

For all of them and for each one individually, the Ministry is planning and is going to take initiatives, so that the necessary changes can be made to protect their health. We need your cooperation and we will be in constant contact with your Association, to take the right initiatives and measures to achieve our goal, respecting the international rules."

Elpi Petraki, President of WISTA International/WISTA Hellas, expressed her gratitude to the organizers for bringing such an important event to Greece and wished for the future cooperation between both Associations.

Antonios Doumanis from the Hellenic Coast Guard and Nikolaos Psaras from the Hellenic Navy mentioned the importance of the Symposium for Greece and for the whole maritime world.

Anatoliy Gozhenko, Ukrainian Institute of the Transport Medicine, sent his welcome address from Odessa. A keynote presentation from Jan De Boer of International Maritime Organization (IMO) highlighted the many guidance documents on health and welfare of seafarers, especially the recent documents of IMO/ILO Joint Working Groups on seafarer abandonment.

Natalie Shaw and Emily Yates, representatives from the International Chamber of Shipping, underscored the importance of international cooperation in addressing seafarers' health and welfare. The launch of the International Medical Guide for Seafarers and Fishers in March 2023, with contributions from the IMHA members, highlighted the collaborative efforts in the industry.

Doctor Jason Zuidema discussed the role of seafarers' welfare centers in global COVID-19 vaccination efforts, showcasing collaborative initiatives with health professionals worldwide.

For the first time in the history of ISMH, a session was dedicated to the Fisheries Health where Cor Blonk, director of the fishing industry's safety and health platform talked about the different challenges in one of the most dangerous professions. The different problems of fishermen's health were addressed by Tarik Ghalian, Head of the Moroccan Society of Maritime Medicine, Nikolaj Granild, University of Southern Denmark/Centre of Maritime Health and Society, David Lucas, Brest University, Olaf Jensen, University of Southern Denmark and others.

A pervasive theme throughout the symposium was the Mental Health and Wellbeing of Seafarers. Industry experts Imogen Stilz, Shell International, Peter Schellenberger, Lukas Belz, Camille Jego, Alexander Dimitrevich, Joanna Szafran-Dobrowolska, Nigel Griffiths and more delved into the challenges faced by seafarers. The call for increased research and awareness emphasized the growing importance of understanding and addressing mental health in the maritime sector. Against the backdrop of Athens' cultural tapestry, impassioned discussions unfolded on strategies, support systems, and the imperative need for global collaboration to ensure the mental well-being of those navigating the seas.

Marta Gruman-Nowak and Maria Jeżewska, current and past editors of the International Maritime Health (IMH) journal, introduced the new achievements of the journal, current position, challenges and trends in publications. The IMH editorial team expects collaboration in the matter of acquiring new publications and reviewing process as a guarantee of high standards of publications. Participants of the Symposium warmly welcomed the future collaboration between IMHA and IMH.

Among the many daily highlights presented to the more than 120 participants from 30 countries were: a presentation on IMHF by Nebojša Nikolić; updates on colour vision testing by Antonello Campagna; an analysis of pre-employment clinic in Philippines by Margarita S. Huerta; maritime medicine in Thailand; a panel discussion "Solutions to medical pain points in shipping", presented by Jens Tülsner, Vivian Andria, Imogen Stilz, Christos Dimopoulos, Mina Vlachandera, Nicholas Ioannidis, Kostas Katsoulieris, with a fireside chat hosted by Peter Schellenberger; panel discussion was organized in collaboration with the Maritime Clinics and Doctors Association of the Philippines (MARCDOC), where Joseph Abesamis, Rhoel Salvador, Susanna Salvador and Margarita Huerte discussed the surviving the pandemic.

Impressive research on 20+ years of teleconsultation support was presented by Konstantin Logunov; risk factors and cancer incidence in seafaring research by Kimmo Herttua. Telemedical assistance providers (TMAS) with Emilie Dehours, Katherine Sinclaire and Paulo Alves, Tony (Anton) Schmid were a focal point of discussion, with private companies presenting data and recommendations.

As the curtains fell on the Symposium in Athens, the city had witnessed a convergence of minds dedicated to shaping a healthier maritime future. The timeless backdrop of ancient ruins and the vibrant cityscape served as a metaphorical canvas for the multifaceted themes of maritime medicine, mental health, and cruise medicine. The discussions illuminated challenges, highlighted opportunities, and fostered collaboration that will resonate in the maritime industry for years to come. As the industry continues to chart new waters, the symposium's Odyssey serves as a compass, guiding the way towards a harmonious and resilient future for those who brave the seas. The concluding remarks look forward to the next chapter in 2025 as ISMH17 sets sail for Netherlands, offering a glimpse of the continued exploration and evolution of maritime health on the horizon. Ilona Denisenko officially handed over the ISMH flag and Symposium chair bell to Walther Boon. The next International Symposium on Maritime Health ISMH17 will take place in Rotterdam in June 11–14, 2025.

Our sincere gratitude to the Organizing and Scientific Committees of the 16th International Symposium of Maritime Health, to all sponsors and partners and to all the participants, who came from all over the world to bring the maritime medicine to the next level.

Ευχαριστώ!

To

Invitees to a

IMHF Strategy Conference / Workshop 2023

Rijeka, 29th November 2023

IMHF Strategy Conference / Workshop 2023

Thanks for your commitment to the spread of scientific knowledge on maritime medicine to the world, and for your support to the IMH journal and IMH Foundation.

The IMHF Management Board in close cooperation with Editor-in-Chief and editorial staff of the IMH and the IMHF Expert Panel wish to invite you to a workshop on how to strengthen and further develop IMH, **4th-6th January 2024 in Gdynia**, at the Courtyard by Marriot hotel, with arrival on the 4th afternoon/evening and a get together dinner at 19:00, workshop starting on the 5th at 09:00, ending on Saturday the 6th at 12:00. For those who would not like to travel and be personally present, we will arrange for videoconferencing possibilities.

Background information and programme will be sent to you soon.

This Conference/Workshop is supported by The ITF Seafarers Trust's grant that will cover the costs of the workshop.

The workshop is based on pro bono work; hence we regret that we will not be able to pay for your working time. We will, however, cover the costs for travel (low fare), stay at the hotel and meals during the workshop. Any support from your employer or home organisation/institute, like covering parts of your costs, would be highly appreciated.

The workshop will produce recommendations to the IMHF Management Board on how to strengthen and further develop the IMH.

We hope you will have the possibility to participate, and ask you kindly to respond to this invitation via e-mail to: travel-medicina@ri.htnet.hr

Kind regards

Nebojša Nikolić	**Marta Grubman Nowak**	**Jon Magnus Haga**
President	Editor-in-Chief	Chair
IMHF Management Board	International Maritime Health	IMHF Expert Panel

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INFORMATION FOR AUTHORS

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

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

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

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

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

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

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

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

Only English texts will be accepted.

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

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

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

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

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

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

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

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

REFERENCES

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

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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