



## IMHA Conference and Workshop

### Infection on board Ship in the 21<sup>st</sup> Century

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#### Introduction

Infectious diseases are still an important cause of ill health in seafarers, despite preventive measures. These illnesses are also a matter of concern for port and public health authorities. The workshop was held to review current knowledge of infectious diseases, especially new and emerging ones, relevant to the maritime sector. It brought together a wide range of expertise in infectious disease and in maritime health and identified some of the successes and challenges in prevention and treatment of infections in seafarers.

The first part of this report is a summary of the key points discussed, emphasising where further action would bring benefits. The summary notes the special features of infectious disease in the maritime setting; the scale and nature of the risks and the data available on them; the scope for improved intervention, and the framework of communication needed for effective management of infections and for improving responses in future. The second part of the report gives information on individual presentations and on the discussion that took place. Presentations that provide examples to support the first part of the report are referenced at the appropriate place.

#### Context

Global travel and transport have been linked for centuries to the spread of infection, leading to the development of international sanitary agreements. The WHO International Health Regulations 2005 address health requirements for ship operations and construction. These are global standards for ship and port sanitation and disease surveillance, as well as for response to infectious diseases. Guidance is given on provision of safe water and food, on vector and rodent control, and on waste disposal. However currently there is no continuing international disease surveillance specifically related to shipping.

Under the International Health Regulations shipmasters are required to notify Port Health Authorities about *“any cases of illness indicative of a disease of an infectious nature or evidence of a public health risk on board.”* Port and public health surveillance arrangements differ substantially between nations and do not—with a few exceptions—result in any systematic evaluation or publication of data. Hence it is not possible to use national data to build up a picture of the pattern of infections in the maritime sector.

A ship provides an environment in which the spread of communicable disease is favoured: crew members with different susceptibilities to infection share living quarters, common food and water supplies, sanitation, and air-conditioning systems. Outbreak reports and systematic studies mainly focus on disease on cruise ships. The transferability of study results from cruise line to merchant seafaring is limited.

On cruise ships a large number of passengers from many countries and of all ages, many of them with other medical conditions, and a large crew gather on a ship for a relatively short period of time. Often they consume potentially high-risk food in on board restaurants and have access to local food markets and restaurants in ports. Common recreational facilities are used. Cruise ships have medical facilities and perform routine surveillance of disease and other preventative activities. Most cruise companies also require crew to provide evidence of immunity against vaccine-preventable diseases before embarking.

In contrast, on a cargo ship a multicultural crew of 30 or less persons is living in a common space for months. Regular statutory medical examinations reduce the frequency of chronic diseases. There are only

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limited opportunities for such seafarers to visit local food markets or restaurants and for person-to-person contact in port cities. Medical care is usually a responsibility of the second officer who has limited training. When needed, medical advice is obtained from radiomedical services. No routine disease surveillance is in place and food hygiene is highly variable.

There is now increasing recognition that to respond to emerging epidemics effectively migrants and mobile populations, including seafarers, must be included in national and regional policies for prevention and disease management. While migration does not necessarily contribute to increased risk of infection, some migrants and mobile populations do face increased risk of infectious diseases. Mobile workers may face increased risks of infection in so-called “spaces of vulnerability” such as ports.

## Part1: Overview of Conference Themes

### Seafarers and infectious disease

There are important aspects of risk and intervention that are different for infectious disease in the maritime sector and for similar conditions arising on shore. The pattern of contact with infections is different:

- Between voyages seafarers are in their home communities and exposed to a similar pattern of infection to their families and friends.
- While at sea their exposure is largely limited to infections carried by other crewmembers and to any present in contaminated food or water.
- The crew may come from locations where the pattern of infection is markedly different and so there may be scope for spread of conditions to others who have little resistance to unfamiliar pathogens (presentations A4, A6, A8).
- When infection becomes apparent at sea the diagnostic and treatment facilities are very limited.
- On international voyages contact with land may bring exposure to new infections. This may be by contact with local populations, from food or water, as a result of sexual encounters or from transmission by insect or other vectors (presentations A3, A9, B2).
- Seafarers may be under suspicion as carriers of infection when they arrive in a port in another country.
- On return to their home country they may carry exotic infections that pose diagnostic and treatment problems. If these are unrecognized they may both endanger their health and that of others in their community.

Infectious diseases also have different consequences in seafarers and in the on shore population:

- Seafarers are selected for employment and medical aspects of this process may look for and aim to reduce infection risks. This can pose ethical and legal problems.
- While at sea, especially on a ship with a crew that is just sufficient to operate it, infection in one or more seafarers can adversely affect the safe functioning of the vessel and place strains on the reduced crew who have to cover for, and possibly nurse, ill colleagues.
- Historically seafarers have been a major means of international dispersal of infectious diseases, although now air travel dominates (presentation E1). This still leads to suspicion of infection and to formal clearance procedures in port. Inappropriate or corrupt decisions about clearance can have a major adverse effect on ship schedules (presentation E2).
- Individual seafarers who develop an infectious disease may be treated at sea, often with advice from radiomedical centres (presentation D1) but if they have to be landed this may be at a location with limited medical facilities and they then require repatriation on recovery. Because of the perceived risks of disease transmission both these processes can be lengthy and costly.

Because of these complex consequences from infection at sea it is important to maximise risk reduction by means of appropriate preventative measures.

The pattern of risks and their consequences vary in different maritime sectors. In fishing there are few or no resources for management of infection (presentation C1). By contrast the fixed offshore sector (presentation

C2) and the cruise industry have extensive provisions in place. In the case of the latter these need to include passengers as well as crewmembers. There may be additional issues here as passengers are not selected and often come from groups with a high risk of complications if infection occurs. They also have expectations of a holiday rather than a period of illness and possible isolation.

### The Scale and nature of infection risks

Quantitative information on infectious disease in seafarers is limited. Potential sources include:

- Records of treatment at sea: medication use, medical logs (a little exploited source)
- Radiomedical contacts (valuable source of information: presentation D1)
- Seafarers landed for treatment or repatriated. (some company and state based studies. Insurer/ P and I Club data are potential sources but there may be barriers of commercial secrecy that prevent access)
- Decisions on fitness to work at sea (company and state sources of information)
- Disease ashore (as part of general population studies that include occupational data, or through social insurance schemes for seafarers.)
- Planned studies of patterns of illness in defined groups of seafarers (A high cost approach. Scope for obtaining good quality information on risk and on the effectiveness of intervention.)

At present analyses of infectious disease in seafarers are limited in coverage. They do not provide a sound basis for decision-taking and often data from other population groups has to be extrapolated to the maritime sector. Resources are required to collect and analyse seafarer health information, which forms the most valid basis for policy development and for planning programmes of prevention and care.

Anecdotal and 'experience-based' information on infection problems forms the basis for most current maritime health practice. This may often be combined with extrapolations from the results of studies on other populations to form a picture of the likely situation as a basis for deciding on preventative and treatment needs (presentations A1, A6, A7, A8, B3, B5, B6, C1, C2.). This pragmatic approach does not satisfy the criteria of formal evidence-based medicine and so may not be accepted by some policy-making organisations such as WHO.

### Intervention to manage infectious diseases

Prevention of infections may be by environmental control of sources such as water or food, contacts with potential sources of infection (presentations A6, B2), and vector control (presentation A3). Clinical preventive methods include screening and selection for work at sea (presentation A8) and the use of immunisation/vaccination or prophylactic medication (presentations B3, B4). Health education is a further important facet of prevention, provided that the seafarer is then empowered to take the steps needed to reduce risk (presentations B1, B2).

Effective procedures for managing outbreaks of infection are essential, and these need to be designed for the conditions on board a ship. The cruise industry has considerable experience and has formalised this into operational policies and protocols (presentation E2. See also International Maritime Health 2010; 61 issue 2: State of the art: public health and passenger ships). Onshore experience may provide useful frameworks (presentation A5). Similar protocols have only been developed for the smaller crew numbers on cargo ships very recently for emerging strains of influenza. These could be models for other conditions.

Access to professional medical skills on board is limited to large passenger vessels, now almost exclusively cruise ships, where the diagnosis of illness and its treatment can follow onshore approaches. Medical expertise also contributes to ensuring that measures to prevent and control infections are in place. Officer training and the provision of medical guides aim to remedy this lack for ships with smaller crews. However there are limitations to the currently available training programmes: better ship medical guides and improved training have the potential to enhance disease management (presentations A1, B1, B5).

Treatment protocols, where the observed signs and symptoms are used to determine requirements using decision trees could be a valid way of improving care. Treatment options are limited to the antibiotics and

other treatments carried in the ship's medicine chest. These need to be under continuing review to take account of changing patterns of resistance in pathogenic organisms (presentation B6). Lack of regular review of the medication requirements can be a problem when there are major new infection risks such as pandemic influenza, for which medication has been considered to be a useful means of preventing infection, shortening the duration of incapacitating symptoms and reducing transmission (presentation A2).

Screening and selection of seafarers prior to embarkation has the potential to reduce some infection risks. The screening programme needs to be adapted to the pattern of infection in the population being engaged (presentation A8). However screening can be a delusion if the infection concerned is not transmitted under working and living conditions at sea (presentation B2). The availability of screening methods should not be taken as the sole reason for using them. Judgements on their benefits, costs and ethics all need to be made before deciding to introduce them (presentation A4).

### Communication and collaboration

The management of infectious disease in seafarers needs effective communication between several of groups who have responsibilities for or an interest in cases and outbreaks. It is not just a clinical matter. Communication in the event of an outbreak is much more successful if it has been planned in advance (presentations A5, E2). Preventive measures also need collaboration between different groups. One problem in securing good outbreak management in the absence of prior planning is the level of concern and pressure from external interests. By contrast the barriers to collaboration on prevention are usually those of indifference and an unwillingness to commit resources to what are seen as routine tasks preparing for events that may never arise.

All those who have a stake in the control of infectious disease in seafarers need to be aware of the basis on which decisions have to be taken. The development of better information on the risks of infection at sea as well as on the effectiveness of prevention is needed to underpin long-term improvements in the control of infections and to audit the success of the measures taken. Until this is achieved a pragmatic approach based on a mix of extrapolated data, experience and expertise will need to form the basis for action. Despite its limits this mix has been shown to be an effective basis for infection management on offshore oil and gas platforms as well as on cruise ships (presentations A1, C2, E2). There is scope for its further development to meet the needs of cargo vessels and fishing (presentation C1). Those responsible for control need to be aware of the sources of maritime health expertise from which such pragmatic appraisals can be obtained and of their strengths and limitations.

In developing strategies for the management of infections at sea those with expertise in maritime health need to recognise and work with other organisations to whom these concerns may only be a peripheral part of their work or who may see them from a different perspective (presentation E3). At the same time these other organisations need to recognise the realities of infection management at sea (presentations B5, B6).

### Action points

1. Model protocols for prevention, immunisation and treatment of common infections are needed, in addition to those available for influenza. These should be flexible to take account of the needs of different sections of the maritime industry and the pattern of illness and immunity in different groups of seafarers. They should be able to be modified rapidly to reflect changes in disease understanding and treatment.
2. Experience with programmes for disease prevention by health education for specific infections, such as HIV, need to be used as models to develop similar approaches for other conditions. Training about the management of infectious disease at an early stage of seafarers' careers should be introduced.
3. Lessons on outbreak management from ashore and from sectors such as the cruise and offshore oil and gas industries need to be made available to other maritime sectors, adapted as needed.

4. The place of pre-embarkation interventions such as immunisation/vaccination, screening for latent infection and advice on hygiene needs to be evaluated. In particular the risk levels at which it is and is not justified need to be determined.
5. The advice on the management of infections in ship medical guides should be reviewed and the best means of presentation considered, taking account of options such as the use of decision trees. Recommendations on medication and other aspects of treatment need to remain up to date and be presented in a way that makes them easy to follow.
6. International case reporting systems for infectious disease cases and outbreaks in seafarers, along the lines of those developed by travel health clinics, have the potential to provide early information on patterns of illness and their spread.
7. Quantitative studies of infection risks and on the effectiveness of intervention to prevent and treat infections at sea are needed. These could use existing sources of data where these are available but they may need to be based on prospective studies of well-characterised groups of seafarers.
8. Maritime health professionals need to have a better understanding of the goals and motivations of the other groups who have responsibilities for infection management ashore and at sea to aid communications. They also need a good understanding of the international dimensions and how to work with those from diverse cultural backgrounds.
9. The International Maritime Health Association has a continuing part to play securing action on all the above items.

## **Part 2: Summary of Conference Proceedings**

### **A. Types of infectious disease**

The presentations on specific types of infection reflected the theme of the conference by emphasising changes and trends in well-established risks (wound infection, hepatitis, dengue, respiratory infections including TB, STIs) as well as in ever-changing and emerging risks (influenza, SARS, chickenpox on cruise ships).

#### **A1: Wound infections: pathogens and treatment (Eilif Dahl, Norwegian Centre for Maritime Medicine)**

Injuries are common in seafarers but there is little information about the pathogens present aboard. There are no diagnostic facilities to determine the best treatment and only a limited range of antibiotics, so prevention of injuries and early treatment to reduce the likelihood of infection is needed. One essential preventive measure is tetanus immunisation before embarkation to avoid this rare but serious infection. Antibiotics are not always the solution: abscesses are best treated by incision and drainage. Wounds are the commonest reason for seeking treatment after an accident: on cruise ships c 40% of total, but infection is rare<sup>1</sup>. By contrast radiomedical data indicate that c 70% of skin disorders on which advice is sought are infectious and the majority of these are abscesses and cellulitis<sup>2</sup>. Methicillin resistant Staphylococcus aureus (MRSA) is increasing in frequency, however some national medical chest requirements include few agents suitable for treating MRSA<sup>3</sup>. Most MRSA infection comes from human carriers but, given the frequency of carriage, pre-embarkation screening and exclusion or treatment are not practicable options. The cause of a wound that becomes infected and the features of the infection may be a guide to treatment: cellulitis from a fish hook or knife – Amoxicillin + clavulanate; Shell or fish spine – ciprofloxacin; sea or estuary water with trauma and tissue infection e.g. propeller – all of the above plus

<sup>1</sup> Dahl E. Internat Marit Health 2005; 56 (1-4): 115-128. Dahl E et al. Internat Marit Health 2008; 59 (1-4): 19-33

<sup>2</sup> Lucas R et al. Int Marit Health 2010; 61: 9-12

<sup>3</sup> LaMar JE et al. Military Med 2003; 168: 135-8



doxycycline. Bites frequently become infected with multiple pathogens, the risk is highest with cats who commonly carry *Pasteurella*. Human bites arising in fights may contain fragments of tooth. Rabies is a rare but potentially fatal complication of dog bites ashore and vaccine treatment must be obtained. All bites need careful cleansing. Bites should not normally be sutured. Amoxicillin + Clavulanate are the preferred antibiotics. Suturing all other clean, non-contaminated cuts reduces infection rates, if infection arises then a suture should be removed to enable drainage.

### **A2: Avian, swine and seasonal influenza: zoonotic risks and maritime health (Poh Lian Lim. Tan Tock Seng Hospital, Singapore.)**

Influenza outbreaks have been studied on cruise ships and their spread has been traced.<sup>4</sup> Comparable studies on cargo ships are rare.<sup>5</sup> The exposure routes, infectivity and severity vary with the type of influenza:

- H5N1 (Avian) is usually caught from close contact with poultry, but person to person transmission has been reported. Other animal species can also become infected. The mortality rate is high and human cases continue to arise. Treatment with Oseltamivir can be effective, but drug resistant strains have developed in some fatal cases. Vaccines have been developed.
- H1N1 (Swine, pandemic of 2009). A localised epidemic became global with mainly person to person spread. As it spread infectivity and severity were less than anticipated from the early outbreaks. Masks can reduce transmission and Oseltamivir both reduces symptoms and shortens the period of virus shedding. Drug resistance may develop. H1N1 is now moving to be a seasonal strain.
- Seasonal influenza is ubiquitous with winter peaks in northern and southern hemispheres and a steadier pattern in the tropics. Vaccine is modified to keep pace with emergent strains.

Mass gatherings of people with different infective and immune status in close proximity provide ideal conditions for spread.<sup>6</sup> Some outbreaks on cruise ships have been linked to the mixing of passengers from different parts of the world. The scope spread in this way during the Hajj pilgrimage to Mecca has been a major concern<sup>7</sup>.

Thermal scanner experience at Singapore airport indicated a low detection rate for cases. However those found could be isolated more quickly<sup>8</sup>.

To minimise risks at sea up to date knowledge on the status of each strain is needed. Influenza vaccination for cruise ship crew is recommended. Masks and antiviral treatment for passengers and crew who are ill will reduce onboard transmission.

Note: both WHO and IMHA have produced guidance on H1N1 influenza in the maritime sector<sup>9</sup>.

### **A3: Geographical expansion of dengue. (Annelies Wilder-Smith. Infectious diseases specialist, Singapore)**

Dengue is increasing in frequency worldwide within a belt that can be defined by winter temperatures of  $>10^{\circ}$  C. The proportion of febrile returning travellers with dengue has risen from 2% in 1990 to 16% in 2005. There are four distinct serotypes of the virus. The severity of the disease varies markedly, depending on strain virulence, secondary versus primary infection, personal and epidemiological risk factors. The most severe cases are often characterized by plasma leakage leading to shock; some cases are associated with bleeding. The main vector is *Aedes aegypti* which is day active and lives close to habitations, with the ability to breed in any kind of water container. Climate change, urbanisation with poverty and increased travel have all contributed to the geographic expansion of dengue. Some other *Aedes* species such as *A. albopictus* can act as vectors and may be found outside the range of *A. aegypti*.

Vaccines are under development and have reached clinical trials. For the time being, the mainstay for the control of dengue remains stringent vector control and personal protective measures.

<sup>4</sup> MMWR 2001; 50: 137. Brotherton. Epidemiol. Infect. 2003;130: 263. Miller. CID 2000; 3 1: 433.

<sup>5</sup> Schlaich. JTM 2009; 16: 402

<sup>6</sup> Blyth. EID 2010; 16: 809

<sup>7</sup> Haworth. Lancet ID 208; 8: 526

<sup>8</sup> Mukherjee, Lim et al. EID 2010; 16: 21

<sup>9</sup> WHO interim technical advice for case management of pandemic (H1N1) 2009 on ships. 13 November 2009. IMHA Interim guidance regarding Influenza A (H1N1) for the maritime community. [www.imha.net](http://www.imha.net)



#### **A4: Risks of viral hepatitis to fitness and its prognosis in seafarers. (Lim Seng Gee. National University Hospital, Singapore)**

Hepatitis may present as an acute illness, as an illness in the course of chronic hepatitis or as complications from chronic hepatitis<sup>10</sup>. Evaluation needs to include a history of medical contacts, travel and lifestyle as well as examination for symptoms and signs of liver disease.

Acute disease varies but usually starts with prodromal symptoms, then pre-jaundice illness, followed by jaundice and resolution, a small proportion of infections progress to acute liver failure or to chronic disease. Hepatitis A and E are spread by infected faeces. B, C, D by body fluids. Precautionary measures are well established and immunisation is effective in A and B.

Adult hepatitis A is a feature of travellers going from low risk areas to high risk ones. Inhabitants of high-risk areas are usually infected in childhood. Chronicity does not occur in A (or E, although the acute form of E has a high fatality rate in pregnant women). Hepatitis B may have a less marked acute stage but chronicity occurs, especially if infection is as a child. Continuing presence of the antigen indicates a chronic infection and a continuing risk of transmission. Hepatitis C has features in common with B but has a more limited distribution with the highest rate in Egypt. Persistent infection is the norm. Hepatitis D only occurs as a co-infection with B.

Chronic hepatitis is characterised by liver inflammation leading to cirrhosis, decompensation, hepatocellular cancer and death.

Screening is available for assessment of fitness in seafarers. Screening is available for the presence of virus, for immune responses and for liver disease. Immunisation should be considered. The need for screening will be determined by prevalence rates and immune status. It would be prudent to vaccinate against available hepatitis viruses – hepatitis A and B - before going on board ship. If hepatitis arises on board diagnostic facilities will be needed to determine the type and likely risks to other crewmembers. Urgent transfer ashore is indicated if there is rapidly worsening disease, particularly if conscious state deteriorates, there is confusion, high fever, vomiting or passing blood.

#### **A5: Management of SARS – the Singapore perspective (Poh Lian Lim. Tan Tock Seng Hospital, Singapore.)**

SARS was the first pandemic of the 21<sup>st</sup> century. It had a major economic impact (c.4% Hong Kong GDP). The challenges with a novel pathogen are to maintain surveillance for the unexpected and to take steps identify the pathogen as soon as possible. Transmission needs to be slowed to reduce spread and gain time as prevention and treatment measures may not be immediately available. Tracing chains of transmission is important in order to understand the outbreak and to put measures in place to reduce transmission. Early isolation was found to reduce the number of secondary cases arising from each index case. Access to hospitals may need to be restricted and protective clothing worn. Rapid triage is needed following agreed but provisional criteria. SARS posed ethical challenges: use of unproved therapies, need for rigorous information collection, breach of confidentiality in contact tracing, use of scarce medical resources, freedom of movement and travel, autopsy and burial. Health care staff were at high risk and their concerns needed careful consideration.

Border controls are complex. Infection may occur on a flight.<sup>11</sup> Thermal scanning will not pick up recent contacts.

There are advantages if outline protocols for management of acute pandemics are prepared in advance, but they must be flexible. Rapid response teams need to be designated in advance and trained.

Communications and management aspect need to be addressed. WHO has now set up a global outbreak

<sup>10</sup> Viral Hepatitis A to E: An Update in 2010. Proceedings from the 6th Korea-Japan Liver Symposium, July 18-19, 2009, Kyongju, Korea. Intervirology. 2010; 53(1):1-82.  
CDC website: <http://www.cdc.gov/hepatitis/>

<sup>11</sup> Olsen. NEJM 2003; 349: 2416



and response network to assist countries where major acute outbreaks occur to carry out investigations, assess risks as well as to support national preparedness.

Maritime trade and transport was affected and will be affected by any similar events in future.

Note: Singapore produced sound port health guidelines rapidly. These guidelines were adopted by the International Maritime Organisation.

## **A6: Chickenpox on board ship. (Kate Bunyan. Medical Director, Carnival UK)**

Chickenpox spreads readily among those without immunity. In tropical and subtropical regions infection and immunity develops later than in the temperate zone. The severity of infection is higher in adults, during pregnancy and in those who are immuno-suppressed. Oral Acyclovir reduces the risk of complications. Isolation, with care only provided by those who are immune, reduces spread. Varicella vaccine is effective both for primary prevention and immediate post-exposure prophylaxis. Varicella zoster immunoglobulin may be indicated if there is a high risk of complications.

17% of 121 Indian cruise ship employees were found to be IgG negative for varicella; identification and treatment in this group cost \$US 7000<sup>12</sup>. An outbreak at sea may be much more costly. Thus vaccination of IgG negative crewmembers might be a useful preventative method. The use of this vaccination for crew members has analogies with the administration of rubella vaccine to prevent risks to pregnant passengers. Responsibility for the costs of vaccination needs to be resolved, especially as the justification for vaccination is an operational benefit and not a benefit to the individual.

Bernd-Fred Schepers (BG See, Germany) presented a case report of a person who was thought to possibly have smallpox from the description in the German ship medical guide but was diagnosed by the radiomedical service – based on digital photographs – as a case of chickenpox.

## **A7: Respiratory tract infections – port clinic perspective (Rob Verbist. Maritime physician. Mediport Clinic, Belgium)**

Respiratory diseases are common at a port clinic: (12%) of attendances. Rhinitis and rhinosinusitis are the most frequent upper respiratory conditions, with influenza presenting at a variable frequency. Exacerbations of chronic obstructive pulmonary disease are the most frequent lower respiratory conditions – usually associated with smoking. Infection commonly provokes exacerbations but antibiotic therapy is normally only justified in serious cases. Milder ones respond to inhaled bronchodilators and steroids. Acute bronchitis and pneumonia are seen, as is pulmonary tuberculosis. A wide range of less common respiratory conditions have led to diagnostic challenges, for instance, mesothelioma and Wegener's granulomatosis. Legionnaires disease also needs to be borne in mind when atypical pneumonia is present.

## **A8: Tuberculosis: pre-sea screening and case management. (Kenneth Miller. Seafarers International Union, USA)**

TB is a major cause of illness and death, mainly in developing countries and among those who are immuno-compromised or who have other co-morbidities. Multiple and extensively drug resistant TB has increased in frequency. Spread of resistant strains is a major world public health problem. Seafarers can be a vector for spread, although the risk of transmission on board is relatively low<sup>13</sup>. Data on seafarers is very limited, but the relative risk compared with the general population is elevated<sup>14</sup>. Tuberculin skin testing (TST) is rarely a part of medical examinations. Early detection and chemoprophylaxis can both benefit individuals and reduce the risks of transmission. A screening and surveillance programme has been in operation since 1992 for

<sup>12</sup> N Idnani. Int Marit Health 2010; 61: 32-35.

<sup>13</sup> Hansen HL et. al. Scand J Infect Dis 1996; 28(2): 107-10. Hansen HL et al. Scand J Infect Dis. 2006; 38(10): 882-7.

<sup>14</sup> Wickramatillake, HD. Infectious Diseases Among Seafarers. June 1998; Seafarers International Research Center Report. Cardiff University, UK.





USA Seafarers' International Union members. This uses TST and showed a reduction in positive results from c.15% in 1994 to c. 4% in 1998. Rates are associated with place of birth, ethnic group and work department. Higher prevalence was found in deep-sea seafarers and those working on cruise ships. There are benefits in an active surveillance programme and this may contribute to reducing the spread of drug resistant strains. Improved immunological and molecular methods for detection of infection may provide scope for more rapid and reliable assessment.

## **A9: Sexually transmitted infection (STI) and seafarers – treatment. (Roy Chan. National Skin Centre, Singapore)**

The common symptoms requiring assessment and management are ulcers and discharges. Any form of ulcerative or non-ulcerative genital STI increases the risk of acquiring HIV. Not all genital ulcers are STIs. Genital herpes is the commonest cause of ulcers, with syphilis second. Other conditions are becoming rare in most parts of the world. Blood tests should be done to confirm the diagnosis and exclude other pathogens. Genital herpes is a chronic infection, recurrent attacks will require episodic treatment with acyclovir or related medications and very frequent attacks may require long-term suppression. The treatment of choice for syphilis is intramuscular penicillin. After treatment syphilis requires repeat tests to confirm elimination of the pathogen. Contact tracing should be undertaken.

Chlamydia and gonorrhoea are the usual causes of genital discharges. 50% females with gonorrhoea and 80% with chlamydia are asymptomatic. There are a number of other common causes of a discharge in females due to vaginal infections. Treatment of gonorrhoea should always be accompanied by treatment for chlamydia. Gonorrhoea can be treated with intramuscular ceftriaxone 250mg, and chlamydia with oral doxycycline 100mg bid for one week or oral azithromycin 1 gram as a single dose. Treatment of recent partners for both gonorrhoea and chlamydia should be undertaken when they are traced<sup>15</sup>.

Advice on safe sexual behaviour should be an integral part of treatment. Now that HIV can be suppressed if treated early there are even better arguments for making HIV testing more easily available, in particular it should be offered to all persons with high risk behaviours as well as to those with an STI.

## **B. Prevention and treatment**

In addition to disease specific measures several presentations covered more general principles of prevention (health education, international campaigns, vaccination) and treatment (use of medical guides, antibiotics).

## **B1: Health education of seafarers – SHIP teaching modules. (Rob Verbist. Maritime physician. Mediport Clinic, Belgium)**

Male health problems are often neglected in health education and seafarers largely represent a sub-set of this group. The Seafarers' Health Information Programme was set up to meet their particular needs with messages aimed at hearts and minds and focussing on lifestyle. Several parts of the programme included prevention of infectious disease<sup>16</sup>. The programme was designed to be delivered by ship visitors and other port staff concerned with welfare. As the programme developed several large shipping organisations adopted it as one of their corporate social responsibility initiatives. Infection risks were integrated with other aspects of advice in modules on food safety, safe travel, malaria, STI HIV/AIDS, dental and skin care. Material was produced to advise companies on how to organise campaigns, for instance on safe travel. Material for the programme is also suitable for incorporation in IMO specified courses on medical care and into the general curriculum of maritime training schools.

## **B2: AIDS prophylaxis – achievements due to appropriate strategies (Nebojsa Nikolic. Maritime and travel physician, Croatia)**

Seafarers perform a risky job and often also have a high-risk lifestyle. High-risk sexual activity, including engaging in transactional sex, concurrent sexual partnerships, and inconsistent condom use, increases the

<sup>15</sup> CDC Treatment Guidelines for STI. <http://www.cdc.gov/std/treatment/>

<sup>16</sup> [www.seafarershealth.org](http://www.seafarershealth.org)



risk of infection with HIV and other sexually transmitted infections (STI). Geographical mobility and separation from intimate partners in a setting where social control differs from that in the home location is common to seafarers and other mobile workers. Many of these groups have an increased rate of HIV infection. This has been found in several studies on seafarers.

HIV infection does not pose public health risks to fellow workers as it cannot be transmitted by normal social contact<sup>17</sup>. Hence testing for and stopping HIV positive seafarers from working is not justified and will do nothing to reduce its spread: changed behaviour will. Current findings suggest that HIV and STI prevention programs must extend beyond providing information and testing and treatment facilities, towards implementing strategies that encourage and support safer sexual behaviours amongst seafarers and their partners, in particular transactional sex partners.

Validated behaviour change programmes in migrant work populations have been developed in Croatia as an International Organisation on Migration project. Such programmes are now being extended to seafarers globally<sup>18</sup>. This is being done through a global partnership of UN agencies, IOM and maritime sector bodies.

The facets of the programme are:

- Development of an evidence base on which to build initiatives
- Assessment of knowledge, attitudes and practices of seafarers
- Access to high quality HIV information and services
- HIV counselling and testing during recruitment
- Sustained impact on key stakeholders.

The aim is to reduce new cases of HIV and seafarers will encounter activities that form parts of the programme as they move from place to place. The initial study group will be 1,500 seafarers from the Philippines.

Project-specific objectives are:

1. Improve interventions in the future (create a model approach suitable for wider use) – led by IOM Secretariat / Programme Coordination
2. Reduce high-risk behaviours among seafarers – led by ITF
3. Increase access to HIV information and services – led by IOM
4. Increase use of HIV counselling and testing best practice during seafarer health assessment, PME – led by IMHA
5. Increase high-level commitment to reduce HIV among seafarers – led by ILO

### **B3: Vaccinations in seafarers: actual and optimal? (Annelies Wilder-Smith, Infectious diseases specialist, Singapore)**

There are important differences between the needs of general travellers and seafarers as the latter live aboard and only make short visits to harbour areas or inland. However they have periods distant from medical care and accumulate risk with repeated shore contacts. Yellow fever is the one currently required immunisation with a statutory international certificate. This is justified both for individual protection and to prevent the spread of the disease. There is a finite but small risk of complications from immunisation. Hepatitis A is the commonest travellers' disease with an effective vaccine, this vaccine may be combined with that for hepatitis B. There are both oral and parenteral typhoid vaccines – the later preferred for travellers. Rabies remains a small but severe risk in Asia, with the prevalence highest in India. Pre-exposure vaccination is justified only for high-risk areas/activities and the vaccine may be given immediately post exposure with immunoglobulin. In the event of a bite wound, cleansing is very important. Vaccination would not normally be justified in seafarers.

In addition routine vaccinations need to be maintained in seafarers, including chickenpox in some groups.

Outbreaks of influenza on cruise ships may justify immunisation of crew members.

Continuing surveillance to detect new patterns of infection in travellers, including seafarers, is essential.

Surveillance systems such as 'Geosentinel', the system based on a world-wide network of travel medicine clinics, can provide important information on the priorities for vaccination. A range of sources give recommendations on vaccination schedules but there is little information on the risk of vaccine preventable

<sup>17</sup> Joint IMHA/ITF statement on HIV/AIDS at sea. ICAAP, Sri Lanka, 19-23 August 2007 [www.imha.net](http://www.imha.net)

<sup>18</sup> Nikolic. Int Mar Health in press



diseases in seafarers. Important issues are: who pays? Which strategies increase vaccine uptake? Is pre-screening prior to employment indicated? How can vaccinations be regularly updated? In discussion the problem of corrupt authorities requiring additional vaccinations for financial gain was raised but not resolved.

#### **B4: Vaccine economics: is it worth the shot? (Antonio Abaya, Maritime physician, Philippines)**

Vaccination delivers potential economic benefits for the individual (no costs from disease or loss of earnings/opportunity) and for society (fewer care costs as a result of herd immunity). These benefits have been quantified in onshore populations and the results published. The benefits are particularly great in the developing world where infections are commoner and immunisation ranks second only to the provision of clean drinking water as means of improving health<sup>19</sup>.

Studies on travellers also indicate clear economic benefits<sup>20</sup>. There are, however, some low frequency infections where proof may be elusive. Benefits have also been identified for working populations<sup>21</sup>. The only economic evaluation on seafarers identified relates to chickenpox<sup>22</sup>. However cruise lines may have been motivated to require rubella immunisation in crewmembers because of concerns that a severe case of congenital rubella in a passenger's child could cost \$100m. Thus there is good general evidence of benefit that could be expected to be relevant to seafarers but this has not yet been demonstrated.

#### **B5: The International Medical Guide for Ships (3<sup>rd</sup> Edition) and infectious diseases. (Alf Magne Horneland. Norwegian Centre for Maritime Medicine)**

The Guide serves several functions: an emergency manual, a source of reference at sea, a training handbook.<sup>23</sup> It aims to provide practical advice to help with disease and injury management and health protection at sea. In doing so it supports a range of international conventions. The current text has certain limitations because it tries to meet all these requirements in a single book. In common with other such guides it does not cover all relevant infections and includes some that are very rare. As an emergency manual its contents and format are particularly limited. The focus on diagnosis as a step needed before deciding on treatment, rather than basing treatment on the observed pattern of symptoms and signs may need re-thinking. Important symptoms such as 'fever' and procedures such as 'vaccination' are not indexed and the well-validated approach of utilising decision trees as aids to emergency treatment is not adopted. The list of medicines lacks quantities and some important preventative and treatment agents for infectious diseases are missing. This gap has had to be filled by other publications.<sup>24</sup>

Teaching materials, emergency treatment regimens and background reference material about infection could be published as three separate documents. Each would be designed for its prime purpose but would be compatible with the others. It is suggested that this approach should be adopted in future.

#### **B6: On board epidemiology and antibiotics (Corinne Idnani. Maritime physician, India)**

The observed pattern of infections should determine the antibiotics to be carried by ships. The evidence base is weak but it is apparent that respiratory, STIs and other urogenital, gastro intestinal, skin and ear infections, as well as infections secondary to injuries regularly occur.

The following antibiotics are normally carried: Amoxycillin+clavulanic acid, azithromycin, ceftriaxone, ciprofloxacin, doxycycline, and tetracycline as an eye ointment. These can be expected to provide therapy for the majority of infections encountered but there is no sound data on their use and effectiveness in maritime populations. Other fourth generation cephalosporins are potent and can widen the range of

<sup>19</sup> WHO IVB State of the World's Vaccines and Immunization. 3<sup>rd</sup> Edition, 2009.

<sup>20</sup> Van Doorslaer et al. J Med Virol 1994; 44: 463-469. Papadimitropoulos V et al. Clin Microbiol Infect 2004; 10: 681-683.

<sup>21</sup> Nichol KL. Vaccine 1999; 17: S67-S73.

<sup>22</sup> Idnani N. Int Marit Health 2010; 61: 32-35.

<sup>23</sup> International Medical Guide for Ships. 3<sup>rd</sup> Edition. WHO 2007

<sup>24</sup> Schlaich et al. Int Marit Health, 2009; 60: 51-66

pathogens that can be covered. Chloramphenicol as drops may be a valid substitute for tetracycline eye ointment and will also be useful in the treatment of external ear infections. The appropriate use of antibiotics at sea often requires advice from a radiomedical service.

### **C. Maritime sectors**

There were two presentations about contrasting sectors: fishing and offshore oil and gas. Cruise ships, because of the large populations of seafarers and passengers aboard and the presence of medical services, were seen as an important source of information on outbreaks as well as on good practice for prevention and outbreak management. Cruise ship experience does need to be extrapolated with care as the populations at risk and the patterns of medical care differ from other sectors of the industry. Fishing, by contrast, is a sector characterised by very little formal access to health expertise and by informal working methods that make data collection very difficult

#### **C1: Infectious occupational disease in fishing (Ilona Denisenko, Maritime Physician, Russia)**

Information on infectious disease in fishing crews is hard to collect as they are tight knit groups of workers with their own cultures and value systems<sup>25</sup>. HIV has received considerable attention as fishermen frequently have a higher prevalence of infection than other workers<sup>26</sup>. Other STIs also have raised incidences and there may be inadequate self-treatment with antibiotics. Infection risks arise because of the nature of fish catching, especially the frequency of skin trauma. Infected wounds are common and these may be with resistant organisms. Tetanus incidence is often raised. Rare marine pathogens including *Mycobacterium marinum* and *Vibrio vulnificus*, both of which cause serious and sometimes fatal illness, have been reported<sup>27</sup>. These may cause outbreaks from the handling of contaminated material but are not contagious. Diagnostic problems can occur: both with these rare infections and also with symptoms of skin and lung disease, where infectious causes have to be separated from irritancy and from the frequent allergenic causes that arise from exposure to living organisms from the sea. Anti-microbial skin hygiene precautions and appropriate protective clothing can reduce risks, but are usually only available in fishing communities in developed countries.

#### **C2: Infections and preventive policies in offshore workplaces (Arne Ulven, Norwegian Centre for Maritime Medicine)**

<sup>25</sup> Al Hamdi, Al-Malikey: Frequency of skin diseases among sea fishermen in Basrah. *The Internet Journal of Dermatology*. 2009; 7. Slaven, Pankey, Martin. Cellulitis in an Oyster Fisherman.

<http://www.medscape.com/viewarticle/410095>. David Sharp. Superbug's latest target-Maine Lobstermen. AP 10.06.2010 [http://www.msnbc.msn.com/id/39539106/ns/health-infectious\\_diseases/](http://www.msnbc.msn.com/id/39539106/ns/health-infectious_diseases/)

<sup>26</sup> Kwena, Cohen, Sang, Ng'ayo, Ochieng, Bukusi. Fishermen as a Suitable Population for HIV Trials. *AIDS Research and Treatment* 2010(2010), Article ID 865903

Entz, Prachuambh, van Griensven, Soskolne. STD history and healthcare, self-treatment behaviors among fishermen in the Gulf of Thailand and the Andaman Sea. *Sex Trans. Inf* 2001; 77:436-440

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1744414/pdf/v077p00436.pdf>

Htoo, Panza. Factors Associated with Unsafe Sex Behaviors for Prevention of HIV/AIDS transmission among Myanmar Migrant Fishermen in Ranong, Thailand. *J Health Res* 2009,23(suppl);43-47.

<http://www.cphs.chula.ac.th/J%20Health%20Res/files/FullText/23/Supplement/K%20Maler%20Htoo.pdf>

<sup>27</sup> Blake, Merson, Weaver, et al. Diseases caused by a marine *Vibrio*: clinical characteristics and epidemiology. *N Engl J Med*. 1979; 300:1-5.

Lacse, Gelfand, Kiel. *Mycobacterium Marinum*. <http://emedicine.medscape.com/article/223363-overview>

Kirby, Kim, Jaffer. *Mycobacterium Marinum* Infection of the Skin. <http://emedicine.medscape.com/article/1105126-overview>

Reboli, Farrar. *Erysipelothrix rhusiopathiae*: an Occupational Pathogen

*Clinical Microbiology Reviews*, 1989;354-359. <http://cmr.asm.org/cgi/reprint/2/4/354.pdf>

Butt, Figueroa, Martin. Ocular infection caused by three unusual marine organisms. *Clin Infect Dis*. 1997; 24: 740



Offshore oil and gas platforms differ from ships in that they have paramedical staff well supported by onshore expertise. A wide range of medical equipment and facilities are available, and evacuation arrangements are planned and predictable. Many infections follow patterns similar to those ashore. Norvirus can usually be contained but contaminated food may be a cause of other outbreaks of infection e.g. Shigella: here transfer to shore of those with the infection may not be possible because of the frequency of diarrhoea. Local spread of infection has occurred, for instance impetigo in people using the same telephone handset. Follow up after an open TB case did not find any transmission to fellow workers. Epidemic plans are developed, for instance for SARS. A major outbreak of any infection would disrupt or stop production – with major economic consequences. This has not yet happened on a Norwegian offshore installation. However risk assessment is a continuing process that needs vigilance and expertise, especially in relation to food handling and cross contamination. Multi national crewing can lead to spread of infections to susceptible people without previous exposure. Vector control is needed.

#### **D. Data collection**

Throughout the meeting and during the closing discussion the limited available data on infectious disease in the maritime sector was seen as a major gap. Radiomedical services provide one of the few sources where representative data can be obtained without setting up new and resource intensive arrangements.

#### **D1: Infections on board ship: advice given by Swedish radiomedical advice service (Karin Westlund, Radiomedical service, Sweden)**

1290 requests for advice over a ten year period were reviewed. The data are classified using the International Classification of Primary Care (ICPC-2). Most requests for advice came from Swedish vessels in all parts of the world, but predominantly from Northern European waters. 30% of requests came from ships of other flags, mostly when close to Sweden. Captains on Swedish flagged ships are obliged to obtain advice for all but minor cases and before medications that require a prescription when ashore are used. About 80% of the calls were for illness, the rest being for injuries. Antibiotics were recommended in 26% of calls, and antimalarials in 1%. Local treatments to skin/wounds and eyes, many of which were infections, made up 18%. Thus infections are a major, and probably the commonest class of disease on which advice is sought. The most common sites were respiratory system (25%), Digestive (16%), Skin (15%), Urinary (12%). 71% of infections were fully treated onboard, 6% were evacuated and 23% advised to see a physician in the next port. Digital photographs emailed from ships to the service improved the quality of diagnosis of superficial infections. These results can be used to assess the adequacy of medications carried and the training of seafarers.

#### **E. History and organisation**

Arrangements for managing infections at sea have long been in place. These featured in several of the presentations on diseases. The scope for extrapolating from onshore experience to the maritime environment needs to be critically assessed. Interfaces between ship and shore are also central to maritime disease control measures.

#### **E1: Historical perspective on infectious disease in seafarers (Tim Carter, Norwegian Centre for Maritime Medicine)**

The pattern of infectious disease in seafarers has changed markedly over time<sup>28</sup>. The meaning attached to different infections is not constant but reflects attitudes ashore: as treatment for a disease becomes available concern may be lessened, while novel and unexpected disease outbreaks lead to fear as their implications are unknown. The major source for infections is ashore and these may then be carried aboard by seafarers or insect vectors and either transmitted to other crewmembers or lead to outbreaks at locations where an infected seafarer subsequently goes ashore. Infection risk may be raised because of living or working

<sup>28</sup> Carter T. Dissertation, University of Greenwich, 2010. The Ship Captain's Medical Guide and the management of infectious disease at sea 1867-1967.



conditions aboard, exotic diseases in ports of call or because of the lifestyle of seafarers. Infections have a different significance when they arise at sea as diagnosis and treatment skills and facilities are limited, the operational efficiency of the ship may be threatened and cases may lead to quarantine or other restrictions on the ship and its crew. As a result special arrangements for management of illness have been developed comprising of training for officers, manuals on treatment, a standardised medicine chest and, more recently, access to shore based medical advice by radio. These arrangements have to be regularly updated to take account of changing patterns of illness, especially infections, and new methods of prevention, diagnosis and treatment. Arrangements have historically been specified by flag states but, with a global industry as well as global patterns of infection, shared international arrangements are now essential.

### **E2: Pandemic planning – strategy and recommendations in the shipping industry (Kate Bunyan, Medical Director, Carnival UK)**

The requirements for a pandemic plan in shipping relate to protection of those on vessels, protection of populations at ports of call and protection of business assets and continuity. The stakeholders are the Master of the vessel and the on board medical team; shipping companies; port authorities; national public health organisations, and international organisations.

A case study was used to illustrate the problems. Port authorities took an extreme line on the risk of H1N1 spread from a cruise ship. There was no preparation for this response, no evidence was advanced to support the approach adopted and this led to a lack of trust between the two parties concerned in the absence of any established processes on the ship or ashore. Based on such experiences there is now a range of guidance<sup>29</sup>. The interest in infectious diseases on ships and in particular in the cruise sector has arisen because a ship is a large semi-closed community with travel times that extend beyond incubation periods and hence the vessel is seen as a significant vector. The well-documented surveillance programmes aboard heighten suspicion rather than being seen as a rational aspect of the management of infection. Guidance tends to follow a common pattern incorporating: pre embarkation advice and surveillance, case management aboard, recording and reporting of cases, vaccination, sanitation and public health controls. Gaps recently identified include business preparedness, communications, urgent access to essential control and treatment equipment, pre arranged medical care in port, and education of seafarers and employees.

### **E3: Inter-institutional cooperation on infectious diseases in seafarers. (Tim Carter, Norwegian Centre for Maritime Medicine)**

The special features of the maritime sector mean that infectious diseases at sea have rather different implications from the same conditions on shore. Data may be more difficult to obtain, prevention has special features aboard a ship, mobility means that infections can be different from those in the home country and be carried from place to place. As a remote working place there are also different operational and economic consequences of individual cases and outbreaks of infectious disease.

Maritime health expertise can contribute to prevention and management by collecting and disseminating information on risks and on the effectiveness of preventive measures at sea. These contributions need to gain the respect of other public health and maritime sector organisation if they are to form the basis for improvements in regulation and practice.

Cooperation at the local (port), national and international levels have different features because of relative priority given to the details of case management as distinct from policy development on prevention and treatment. These differences need to be understood by those seeking to give advice. The other groups with which maritime health professionals liaise each have their own objectives and mind-sets and effective collaboration depends on understanding these and providing the appropriate input. In international forums

<sup>29</sup> Influenza Pandemic Plan. The role of WHO and guidelines for national and regional planning. April 1999. WHO Interim technical advice for case management of pandemic (H1N1) 2009 on ships, 13 November 2009. IMHA guidance regarding Influenza A (H1N1) for the maritime community. Updated January 2010. Guidance to shipping for pandemic influenza; UK Health Protection Agency. 6 October 2009. Preparedness for the prevention and control of influenza outbreaks on passenger ships in the EU: The SHIPSAN TRAINET project communication. Eurosurveillance Vol. 14 Is 21. 28 May 2009

IMO is concerned with safety at sea and the implications of illness for this, while ILO focuses on working conditions and facilities for prevention and treatment. Both have clear maritime interests. WHO is more concerned with the global patterns of infection and its control and is the lead agency in this area. It does not have any very clear or specific expertise in the maritime sector and its special needs. WHO aims to base its advice on published and peer-reviewed studies and there are few such studies of seafarers and ship passengers. The challenge for maritime health is to work at all levels and to seek approaches that are compatible with the objectives of other parties, insofar as these relate to improved management of infectious disease. At the same time shortcomings in the responses of others need to be identified and steps taken to advise them on how they can be remedied.

## F. Concluding discussions

Several themes emerged:

1. Different patterns of infection in different countries required different approaches to management. This is clearly seen with tuberculosis and hepatitis. There are potential conflicts between the goal of internationally consistent approaches and the need to take account of local risks.
2. Well-defined protocols for the management of infectious disease at sea are needed. This was demonstrated for H1N1 influenza where the use of antivirals was not on a rational basis and where there were difficult issues about access to supplies at a time of high demand. Malaria is uncommon but serious and protocols for both prevention and treatment are needed. The International Sailing Federation has developed a number of such protocols which could be useful examples.
3. Treatment of infections at sea often needs to differ from that onshore as there are limited skills and no diagnostic support. Thus STIs and wound infections may best be treated with antibiotics that will deal with all pathogens after a single dose rather than by using multi-dose regimens tailored to a single pathogen. Port health clinics may need to use similar approaches because of the need for a seafarer to return to their ship before it sails.
4. Data collection and analysis on infectious disease in seafarers is limited and of poor quality. Use of common categories for recording is needed and the International Classification for Primary Care (ICPC2) is a suitable system as it enables symptoms as well as diagnoses to be recorded.
  - Practitioner data needs to be routinely collected and analysed. This is complicated by issues of cost and data ownership.
  - Information from medication use at sea can be misleading because of disposal of expired medicines and because of diversion of medicines to families and contacts ashore.
  - Radiomedical centre data is very valuable.
  - Information of good quality from related sectors such as offshore gas and oil production may be extrapolated.
  - Port clinics have long been a source of information and this needs better codification and analysis. The Geosentinel system for travel medicine could be a model.
  - Ideally links need to be made between pre-embarkation data, that arising during the voyage and that from port clinics. Cruise and ferry operations are useful sources for such linkage, they are not, however, representative of other types of shipping.
  - State data, notably from major crewing countries can be invaluable, for instance the Philippines Overseas Workers Administration has information on repatriated and returning seafarers.
5. There is untapped demand for training about infections and their management as part of officers' training courses. At present these concentrate on the use of medical guides to treat illness rather than on how to prevent it or on how to use information on cases and outbreaks to improve management in future.
6. Infectious disease, and especially wound infections, in fishing are a neglected area. The only information available is from radiomedical centres in developed countries.



7. The limitations of the current International Medical Guide for Ships and the associated recommendations on medical stores need to be resolved so that they reflect what is practicable at sea and present this in a clear way that forms the basis of management protocols for established infection risks.

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