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Mini Review

Concerns regarding infectious disease prevention: An issue for maritime management

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Abstract

A frequent issue in medicine is infectious disease. It is feasible for infectious diseases to spread to other locations. A prospective breakout of an infectious disease among seafarers on board must be addressed carefully for the sake of maritime safety. The authors of this article provide a summary of infectious disease prevention. In this mini review, relevant reports are summarized and discussed.

1. Introduction

Medical care for seafarers- those who operate in the merchant marines, on offshore oil platforms, in commercial fishing fleets, and in the cruise-related industry, the latter of which is the one most of us are familiar with- is referred to as maritime medicine. Additionally, care is given through pre-employment and seafarer consultation facilities located on land. These numerous nautical medical specialties offer quite distinct alternatives to office-based care. There are many challenges in maritime health care, especially for specific situations on marine trips. The most distinctive challenge for the shipboard doctor is determining a diagnostic and treatment plan for a patient's issue in a setting with occasionally very few resources. Any care must be simple, primary, and of emergency response.

Like any population, seafarers are susceptible to illness, and infections are a regular issue. The pathophysiological process of infections in seafarers is the same as that in the overall population. However, the location's special limitations and the ship's cramped quarters frequently make it challenging to diagnose and treat problems. There are typically few diagnostic tools available to use for diagnosis. Diagnosis is typically made after a quick history-taking process and a physical examination. Simple laboratory tests might be available on a large ship, but they are typically not available at all on a small ship. Consequently, diagnosis is typically speculative. As a result, it is frequently difficult to make early diagnosis of an infection. Additionally, diagnosis is frequently an indefinite and presumptive. Fever is a frequent clinical symptom of many infections, making differential diagnosis difficult in the absence of a laboratory test. For instance, a lung infection, gastrointestinal infection, or vector-borne disease may manifest as an acute febrile

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sickness. Initial clinical therapy without a specific diagnosis is typically symptomatic and supportive. In order to receive additional accurate diagnosis and management in an emergency situation, it is typically done on shore. There may be instances where a ship is without a doctor. The current state of advanced IT technology allows telemedicine to play an auxiliary role (Horneland, 2009; McKay, 2007).

If there are diseases or accidents on board, the ship's captain is in breach if telemedical communication does not provide an alert or notification (Ricci et al., 2014; Schlaich, 2009). Like in a typical patient-doctor relationship, the doctor who is consulted via telecommunications networks is also in charge of the patient's diagnosis and course of treatment. However, there are definite distinctions between telemedicine and the cornerstones of conventional medicine (Ricci et al., 2014). As a result, it might be difficult to provide medical care to seafarers onboard ships (Norum et al., 2002; Ricci et al., 2014).

At the moment, infectious diseases are a major global concern. There are new developing and re-emerging threats, some of which pose a global hazard. There are various pathogens that might cause sickness. An infectious disease may develop when the trinity of a vulnerable host, a pathogen, and an adequate environment all coexist at the same time and location. Regarding maritime jobs, employees may also be at risk for contracting an illness. Since marine workers must put in a lot of effort in a small space, especially while on a voyage, infectious diseases could become a serious issue. Possible infectious disease outbreaks during a maritime excursion are mostly caused by crowding and the challenge of managing cleanliness. In the management of maritime health, infectious disease prevention and management are key concerns.

This minireview's goal is to summarize a basic concept for infectious disease prevention that can be applied to maritime activity. The literature cited in international databases such as SCOPUS and PubMed is reviewed and summarized. The main focus of the review is on introducing concepts to readers who may be unfamiliar with medicine, rather than summarizing specific infectious diseases, which is a specific issue in biomedicine.

2. Outbreak of disease on ship

The epidemiological trio can be effectively employed to explain illness among seafarers. To start, pathogens are crucial elements. A ship may contain pathogens, which may be moved from the ground to the ship. The infection might enter the environment of the ship by a human, animal, or insect vector. The disease can quickly spread throughout the entire region of a narrow ship's limited environment. In addition, seawater contains harmful microbes (Pougnnet et al., 2018). In the environment of the ship, the pathogen may begin the development of a disease. Seafarers are the main focus of the host's attention. In general, seamen are sturdy, which can point to a strong immune system.

A very virulent infection, though, may be able to infect seafarers and make them sick. As previously said, the environment on board a ship is restricted, making it simple for infections and hosts to come into contact, and for the required period to be reached, because a maritime journey normally lasts a long time. In terms of sanitation, a small area poses a danger for contamination, and the inability to properly dispose of trash could contribute to the spread of pathogens. Consequently, onboard sanitation management is crucial (Cancellotti, 1995). Perhaps a ship cleaning operation is required. Surfaces can become infected by animal excreted bacteria, viruses, fungi, and parasites, which are protected by organic materials (Cancellotti, 1995). If done properly, cleaning may destroy more than 90 % of bacteria, making it a key step in the sanitizing process (Cancellotti, 1995). Chemical disinfectants must be safe for both people and animals, and work with the cleaning methods, equipment, and supplies currently in use (Cancellotti, 1995). Seafarers may contract a virus if the epidemiological triad's three conditions are met.

As a result, infectious disease may be a problem that seafarers encounter frequently. However, it is important to remember that not every infection experienced by seafarers is brought

on by voyages. During their time on land, seafarers are susceptible to infection, and common illnesses that affect the broader populace can manifest in them. For instance, it has been observed that seafarers are carriers of a number of prevalent silent infections. Examples of diseases affecting seafarers include HIV, hepatitis B, and sexually transmitted infections (Muli et al., 2010; Pougnet et al., 2020; Rokicki et al., 2022). There are numerous different types of infections, with a particular emphasis on events that first happen onboard ships (**Table 1**). An infectious disease outbreak could happen in a particular circumstance. We will now go over the significant infectious disease outbreak types in more detail.

Table 1 Summarizing potential outbreaks during a maritime voyage.

Kinds of common outbreak	Details
Respiratory infection	Respiratory infectious disease spreads quickly. Disease can easily spread within the confines of a ship's limited space. Outbreaks on ships are seen sporadically. The best example is that of a COVID-19 outbreak on an international cruise.
Gastrointestinal infection	A lack of fresh water is a common issue on a maritime trip. Sanitation of food, hands, and toilets is critical. If contamination occurs, it can lead to an outbreak of gastrointestinal infection on a ship.

2.1 Outbreaks of gastrointestinal infection

Outbreaks of gastrointestinal disease is sporadically reported on ships. Rooney et al. (2004) retrospectively analyzed incidents of outbreaks of foodborne disease associated with passenger ships. According to Rooney et al. (2004), almost 6,400 people were impacted by the bulk of recorded outbreaks, which were linked to passenger ships. On ships, there have been waterborne epidemics of *Giardia lamblia*, noroviruses, *Salmonella spp.*, *Shigella spp.*, *Cryptosporidium spp.*, and Enterotoxigenic *Escherichia coli* (Rooney et al., 2004). *E. coli* with enterotoxin was the pathogen most frequently linked to outbreaks (Rooney et al., 2004). According to Rooney et al. (2004), waterborne illness epidemics on ships are preventable. The causes of outbreaks stress the necessity for hygienic handling of water along the supply chain from source to consumption, according to Rooney et al. (2004).

2.2 Outbreaks of respiratory tract infectious disease

On a ship, an outbreak of a respiratory infection is possible, much like with gastrointestinal illness. The commonly recognized scenario is influenza on ships (Young & Wilder-Smith, 2018). The influenza outbreak on a Brazilian cruise ship was a well-documented incident in the literature (Fernandes et al., 2014). In February 2012, there was an influenza B outbreak on a cruise ship. The outbreak resulted in 104 ARI cases, including 54 (51.9 %) crew members and 50 (49 %), passengers (Fernandes et al., 2014). Lower cabin locations and younger age groups were factors related to influenza-like illness in crew members (Fernandes et al., 2014). There have also been reports of influenza A and B outbreaks in South America and Europe (CDC, 2001; Brotherton et al., 2003).

3. Disease prevention

The means to encourage infection prevention must be included in the effort to promote seafarers' well-being. The fundamental idea is to reduce risk. One possibility is to use the preventative medicine principle. Three layers of preventives exist. For the prevention of infectious

diseases, the three levels of prevention- primary, secondary, and tertiary- are crucial. These three levels of prevention are necessary for success in maritime health management (**Table 2**). Prevention coverage must include both the land and maritime sectors (**Table 3**). First, primary prevention, basic prevention, entails immunization and health education. For seafarers, routine vaccinations are necessary. Additionally, several particular vaccinations are advised for seafarers.

Table 2 Three levels of prevention necessary for maritime health management.

Levels of prevention	Details
Primary prevention	Health education is critical. Workers should be given up-to-date information and knowledge. Vaccination, which is an effective infection prevention method, should also be provided to workers.
Secondary prevention	Infection must be diagnosed and treated as soon as possible. Some basic diagnostic tools, such as self-diagnostic tests, should be available, as should some basic drugs for symptomatic treatment.
Tertiary prevention	Any workers who have been exposed to an infectious disease should have access to rehabilitation programs. Basic rehabilitation tool should be available, at the very least.

Table 3 Describing prevention activities for “on land” and “on ship” measures.

Prevention	Details
On land	Knowledge education and up-to-date information on emerging/resurfacing diseases should be provided. A program for routine health check-ups should be available. Workers must be given routine vaccinations. Vaccinations for infection prevention should be provided in accordance with the recommendations for specific destinations (such as yellow fever vaccination). Chemoprophylaxis, such as antimalarial drugs, should be provided in accordance with a destination’s recommendations.
On ship	Self-diagnostic tests or point-of-care analyzers are examples of basic diagnostic tools, and should be readily available Basic medications for symptomatic and supportive care should be available. Telemedicine for medical consultations is required. There must be a plan in place for evacuation and referral.

3.1 Tetanus vaccine

For instance, tetanus vaccine is advised for any traveler who handles items (Tomaszun et al., 1986). Because of the sea environment, sailors commonly suffer wounds that are easily infected. Most wounds must be treated as contaminated, and only sterile dressings should be applied to them after cleaning (Dahl, 2011). This is why the tetanus vaccine has been shown to be effective.

3.2 Varicella vaccine

Varicella vaccination is another shot that is advised. Idnani (2010) makes the recommendation that testing for varicella IgG and IgM antibodies be a required part of the pre-employment medical examination for seafarers, followed by vaccinations, when necessary, as these

are affordable ways to prevent expensive epidemics in the semi-confined environments of cruise ships.

3.3 COVID-19 vaccine

COVID-19 vaccine is the vaccine that is most frequently addressed in the current COVID-19 situation. The underserved seafarer community did not have access to the vaccine, even after COVID-19 vaccinations were made available (Taylor et al., 2022). Seamen occasionally could not leave their ships for months after their initial contracts, because they could not acquire the COVID-19 vaccine (Taylor et al., 2022). Giving sailors the option to get vaccinated while their ships are in port is advised (Schlaich et al., 2021). The earliest feasible vaccination of seafarers safeguards their health and helps stop the international spread of COVID-19 virus strains through maritime trade (Schlaich et al., 2021). Concerning COVID-19 immunization in shipping, and related legal issues, the International Chamber of Shipping has produced extensive guidance (<https://www.ics-shipping.org>).

Second, early diagnosis and prompt treatment are the core concepts for secondary prevention in preventative medicine. The seafarer should get routine health examinations as part of this. If it is practicable, pre- and post-trip examinations might be used. This is how potential infectious disease importation is detected early. Any infected case must also receive rehabilitation as the tertiary preventative. This is helpful for limiting disabilities and may hasten the seafarer's return to normal health.

Third, tertiary prevention and rehabilitation should not be overlooked. A long-term problem or sequelae may exist after an infection attack, necessitating a proper rehabilitation program. The most notable example is the long-COVID-19 problem, which occurs following a COVID-19 illness. A good rehabilitation program must be established for any seafarer who becomes ill with COVID-19 and develops a long-COVID problem.

4. Conclusions

A common medical problem that seriously endangers seafarers is infection. There have been reports of infectious disease outbreaks among mariners. Taking preventative measures for seafarers is a broad notion. Health education, vaccines, and checkups should be offered as part of the welfare of seafarers. A ship's environmental sanitation control must also be given a lot of thought. The current article can provide the general reader with broad ideas on important knowledge. It also provides some new knowledge, such as information about the new COVID-19 situation. The review can show that, while it is perceived that the topic of maritime health management and infection control/management during maritime trips is a widely discussed issue, there may still be no effective measurement. The unsuccessful management of a COVID 19 outbreak on a ship is a lesson in the need for additional quality improvement. As a solution, a good knowledge collection and international consensus are required to seek a solution and specific management guidelines. Because updating is required, the activities should be collaborative and the measures should be adjusted to correspond to the changing situation over time.

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