

Repository of Data on Epidemic Situations on Sea Vessels

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ABSTRACT: This article is an introduction to the DESSEV (DEcision Support System regarding the risk of Epidemic threats on a sea-going Vessel) project implemented as part of the Erasmus+ partnership under the leadership of the Maritime University of Szczecin. This project consists of three elements: a data repository, a rule base and a decision support system. Due to the schedule of works in the project, only the first of them was presented. The next ones will be described in subsequent publications at various international conferences. The idea of the project naturally resulted from the COVID-19 pandemic, but other infectious outbreaks may also occur on sea vessels, posing a threat to the ship's crew and passengers (passenger transport). The existing legal regulations, available knowledge or training do not sufficiently address the problem of the epidemic on the state. Therefore, it was decided to introduce a novelty - a decision support system, which is designed to facilitate taking the right steps in the event of an infectious disease on a seagoing vessel.

1 INTRODUCTION

The COVID-19 pandemic without any doubts has changed the world. Needless to say, most people did not expect this turn of events at all. Also in maritime transport, this epidemic has left its mark. This resulted, among others, an Erasmus+ project initiative. The project called DESSEV is devoted to issues related to the outbreak of an epidemic on the sea-going vessel. In practice, the vessel becomes a moving isolator with a great potential to "release" the disease over a larger area. The COVID-19 outbreak has demonstrated that in many places there are no mechanisms for dealing with disease emergencies. Although many agreements and contracts anticipated "force majeure" risks, no one was aware of the fact that this could be global. COVID-19 has shown that very often existing procedures are not adapted to the reality around us. Very often, new ones need to be developed quickly. Sometimes there is even no legal

basis to impellent and apply such procedures. Different solutions related to the coronavirus threat have been adopted in each country. Some actions turn to be right, some don't. Unfortunately, in many cases the social factor is also important (opposition to vaccination, lockdowns, etc.). Sometimes, however, we find ourselves in a situation where we cannot wait for new procedures to be developed. COVID-19 has had a negative impact on almost all areas of the economy. It can be said that this is the greatest global threat since the Second World War. The aim of DESSEV project is to build an expert system regarding the risk of epidemic threats on a sea-going vessel (not only COVID-19). Every merchant ship, pleasure craft, sailing yacht have to be equipped with appropriate communication devices associated with the area of movements. It may be radio, satellite station, mobile phone, etc. Each of them determines different way to obtain medical assistance (or advice). In addition radio operators on board of the ship must be certified

by authorized organization and familiarized with maritime radiocommunication procedures. There are couple types of radio operator certificates depends on their purpose. For example, most common is SRC (Short Range Certificate) used by sailors and GOC (General Operator's Certificate) required by STCW (Standard for Training Certification and Watchkeeping) for deck officers. The motivation of the project is to deliver an expert system which may be helpful to resolve three problems. First – how non-medical personnel can accurately access medical situation? Second – which medical facility should be contacted with? And the third – what mean of communication should be used?

The aforementioned project consists of three stages: a repository of data on epidemic situations, a knowledge base in the form of IF...THEN rules and a proper decision support system. Currently, the first phase of the project is underway, i.e. the development of the data repository, to which this article is devoted.

2 IMPACT OF COVID-19 ON THE MARITIME SECTOR IN EU

It is estimated that 90% of world trade is carried out by sea. Maritime transport is a key element of the global economy. Ensuring the supply chain during COVID-19 pandemic was extremely important. The demand for items such as food was constant. There was a high increase in the demand for all kinds of medical supplies.

European Maritime Safety Agency (EMSA) has published a report in which it estimated the impact of COVID-19 on maritime transport in the European Union. The impact of this epidemic on the European maritime economy can be considered in three dimensions [6]:

- Traffic
- Maritime trade
- Shipbuilding

2.1 Traffic

When it comes to ship traffic, the COVID-19 pandemic caused a decrease of 10.2%, which can be seen in Figure 1. Interestingly, the first quarter of 2020 was at the same level as in previous years. In the second quarter, there was a sharp drop of 26.5%. The explanation of this phenomenon is obvious. It is simply due to the course of the epidemic.



Figure 1 Traffic disruption and normalisation [6]

2.2 Maritime trade

In the case of trade (exports, imports and internal trade in the EU, Figure 3), a decrease in turnover of 9.3% was observed. This is a very high value of the indicator because it corresponds to 226 million tons of goods. The highest decrease was noted in imports – 12.1%. Domestic, internal trade fell by 7.1% and exports by 4.3%. All values in 2020 are presented relative to 2019.

It is also worth looking at the individual categories of goods. We can clearly see a decline in oil, gas and car trade. Trade in chemicals, dry bulk or reefer cargoes increased slightly.

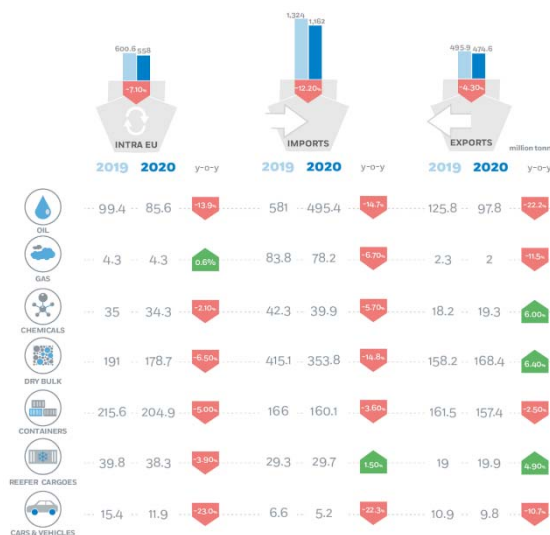


Figure 2. Maritime trade in the EU [6]

2.3 Impact on shipbuilding

Globally, orders for new ships fell by 30% (Figure 3). Nevertheless, the level of production compared to 2019 was maintained in 85%. However, the shipbuilding industry in the EU has been severely affected by the COVID-19 pandemic. In Europe, the focus was on building cruise ships. In this case, compared to 2019, the number of new orders decreased by as much as 98% (34% globally).

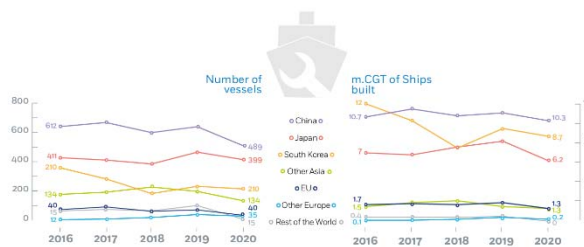


Figure 3. Impact of the COVID-19 pandemic on the shipbuilding industry [6]

3 DEALING WITH EPIDEMIC ON SHIP

Dealing with an epidemic on ship is a challenging task, but with proper planning and execution, it can be managed effectively [5, 11]. The following steps can help in controlling the spread of epidemic:

- Early Detection: The first step in dealing with an epidemic on a ship is to identify the disease as early as possible. This can be done by monitoring the health of passengers and crew members, and reporting any signs of illness to the ship's medical team. The ship's medical team should be equipped with diagnostic tools and medications to quickly identify and treat any cases of illness.
- Isolation: Once a case of illness is identified, the affected person should be isolated to prevent the disease from spreading to others. The ship's medical team should have a plan in place for isolating and treating sick passengers and crew members. Isolation areas should be well-ventilated and equipped with medical supplies.
- Sanitation: Maintaining good hygiene and sanitation practices is critical in preventing the spread of disease on a ship. All common areas, cabins, and restrooms should be regularly cleaned and disinfected. Hand hygiene practices should be emphasized, and passengers and crew members should be encouraged to wash their hands frequently.
- Contact Tracing: In the event of an outbreak, contact tracing can help to identify individuals who may have been exposed to the disease. The ship's medical team should have a plan in place for contact tracing and should work closely with public health officials on shore to identify any potential sources of infection.
- Communication: Open and transparent communication is essential in managing an epidemic on a ship. Passengers and crew members should be informed of any cases of illness and what measures are being taken to control the outbreak. Regular updates should be provided to all individuals on board, and clear instructions should be given on how to prevent the spread of the disease.

By following these steps, an epidemic on a ship can be managed effectively, and the health and safety of all individuals on board can be maintained.

In addition to the mentioned steps, there are few other factors to consider when dealing with an epidemic on a ship:

- Evacuation: In some cases, it may be necessary to evacuate passengers and crew members from the ship to prevent the spread of disease. Evacuation plans should be in place, and procedures for safely transferring individuals to shore should be established.
- Personal Protective Equipment (PPE): The ship's medical team and crew members who are in contact with potentially infected individual should be provided with appropriate PPE, such as masks, gloves and gowns. PPE should be used according to established guidelines and should be properly disposed of after use.
- Quarantine: If the ship is in a port, it may be necessary to implement a quarantine to prevent the disease from spreading to the local community.

The ship's medical team should work closely with local health authorities to determine the best course of action.

- Testing: Diagnostic testing can help to identify individuals who have been infected with the disease. The ship's medical team should follow established guidelines for testing and reporting.
- Mental Health: Dealing with an epidemic on a ship can be stressful for passengers.

The International Maritime Organization provides guidance on protecting the health of seafarers during the COVID-19 pandemic [8]. The European Centre for Disease Prevention and Control offers guidance on COVID-19 prevention and control on board ships [7]. The American Society of Travel Advisors has created a COVID-19 Cruise Ship Resource Center with helpful information for travelers and travel advisors [1].

4 EXAMPLES OF HISTORICAL AND MOST RECENT EPIDEMIC ON SHIP AND THE RESULTS

One example of a historical epidemic on a ship is the outbreak of smallpox on the HMS Britannia in 1805 which led to the deaths of several crew members and quarantining of the ship [2]. Another example is the Spanish flu outbreak on the troopship Leviathan in 1918, which resulted in over 2000 cases and 80 deaths [9]. A third example is the outbreak of cholera on the steamship Moravia in 1887, which led to the deaths of over 60 passengers and crew members [3].

One recent example of an epidemic on a ship is the COVID-19 outbreak on the Diamond Princess cruise ship in 2020, which resulted in over 700 cases and 14 deaths [10]. Another example is the outbreak of norovirus on the Royal Caribbean's Oasis of the Seas in 2019, which resulted in over 500 cases of gastrointestinal illness [4].

One of the deadliest epidemics on a ship was the outbreak of the Black Death (bubonic plague) on board the Genoese fleet in 1347. The fleet was carrying soldiers and supplies from the Crimea to Italy, and the disease spread rapidly among the crew and passengers. According to historical accounts, the disease was so severe that the sailors and soldiers on board the ships died so quickly that the fleet was left without enough crew to sail the vessels, and many of the ships drifted aimlessly until they ran aground or sank. It is estimated that up to 90% of the people on board the Genoese fleet died from the Black Death during the outbreak [12]

5 REPOSITORY PROPOSAL

The pre-developed version of the repository contains 55 documents relating directly to epidemic situations on board. The repository includes, among others, IMO recommendations, WHO recommendations, Centers for Disease Control and Prevention guides, case reports and a number of scientific articles relating in their subject matter primarily to the most recent COVID-19 outbreak. Summary statistics relative to

authors and categories of materials are shown in Figure 4 and 5.

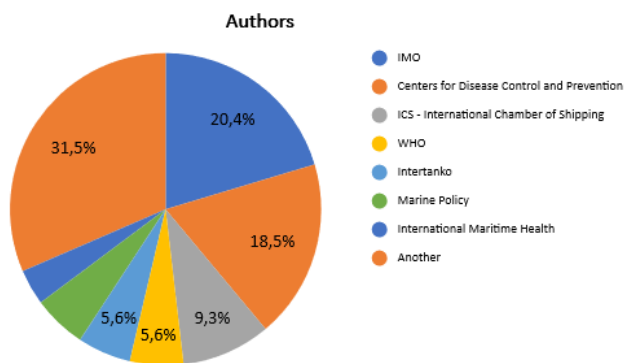


Figure 4 The repository by authors, own study

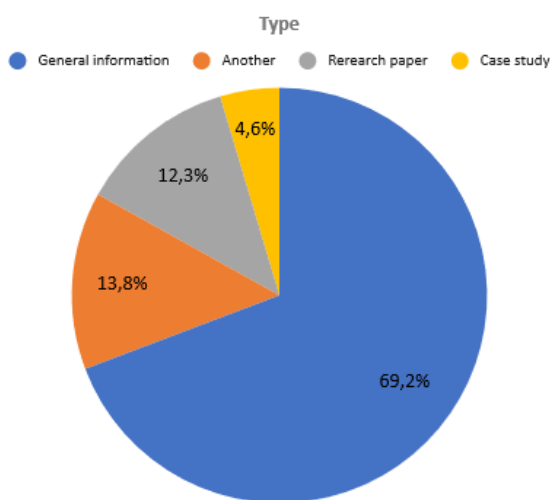


Figure 5. The repository by type, own study

In addition, the repository will also include procedures for dealing with COVID-19 made accessible by friendly shipowners and ship masters.

In the course of the search for materials and documents, several procedures were also encountered for dealing with the diagnosis of malaria, ebola or chickenpox among the ship's passengers or staff. Such procedures are available online and governed by the laws of the specific country. An example of such a procedure can be read on: <https://www.cdc.gov/quarantine/cruise/management/guidance-cruise-ships-varicella.html>.

At the time of preparing this manuscript, the repository contains materials related to the handling of an epidemic on a ship cases only. Research work is currently in progress to expand the repository with a section related to the medical aspect of epidemic detection and prevention. The two parts of the repository will be equivalent in terms of repository relevance. In addition, having a complete of both parts of the repository, a hierarchy of priority of individual documents will be established, both in the part relating directly to the situation on the board and the medical aspects.

6 CONCLUSIONS

A repository of data on epidemic situations on ships at sea proposed in DESSEV project would be useful for several reasons:

- Early detection and prevention: Having access to historical data on epidemic situations on ships can help identify trends and patterns that can be used to develop strategies for early detection and prevention of future outbreaks. This information can be used by public health authorities to develop guidelines for managing outbreaks on ships, which can help to reduce the spread of infectious diseases.
- Response planning: Historical data can also be used to develop response plans for managing outbreaks on ships. The information can be used to identify the most effective response strategies, such as quarantine measures or vaccination campaigns, and to develop protocols for communicating with ship operators and crew members.
- Research: A repository of data on epidemic situations on ships can also be a valuable resource for researchers studying infectious diseases. This information can be used to better understand the transmission dynamics of diseases on ships and to identify risk factors that contribute to outbreaks.
- Public awareness: Access to data on epidemic situations on ships can also be used to raise public awareness about risks associated with travel on ships and to promote measures to reduce the risk of infection.

Overall, a repository of data on epidemic situations on ships at sea can provide a valuable resource for public health authorities, researchers, and the public, helping to prevent the spread of infectious diseases and to promote public health and safety.

In this paper the impact of COVID-19 on European maritime economy was described. Besides the authors performed a literature review in order to propose some procedures with dealing the epidemic situation at sea. Finally, some historical cases of serious infectious diseases was described. Currently the main problem is COVID-19 but we can't deny that in the future a new serious problems may occur, including new dangerous viruses etc.

The proposed data repository is only a first stage in DESSEV project. The main reason of this proposal was to develop and implement the decision support system dealing with epidemic threats. The work on this system is carried out and the end of the project is anticipated on 30 October 2024. The results and discussion will be published during different conferences, events and in different international journals. The partners want to involve some important maritime organizations too like IMO, EMSA and many others. All the stakeholders are invited to participate in the project lifetime and the outcomes.

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