SUMMARY

The fear of an invisible enemy, as bacteria and viruses often disrupt or take away health, has accompanied humanity for thousands of years. The article presents cases of illness caused by biological factor among passengers and crew members on board ships. Incidents that have occurred in the past have been mentioned. The Author's leading considerations focused on the current situation (Pandemic COVID-19) of biological hazard on vessels.

Keywords:
coronavirus, infectious disease, pandemic, ship, crew, passengers

INTRODUCTION

In 2002, a British government report stated that "at the beginning of the 21st century, infectious diseases remain a serious global threat to human health, prosperity, social stability and security."327 Concerns were raised by the fact that 41% of all diseases in the world were infectious diseases, which claimed millions of lives328. If we look back, we will see a simple truth: all wars in human history have not taken as many victims as infectious diseases have consumed. At the moment, we are in an unusual, very undesirable situation, because each of us

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328 Ibidem.
fears infection with a new coronavirus. On 11.03.2020, the WHO announced the COVID-2019 pandemic.

The author will limit his considerations to analyzing the situation where carriers of viral infection appear on the vessel. Particular attention will be paid to the cases of ships affected by the most modern virus, i.e. COVID-19.

**INFECTIOUS DISEASE ON BOARD**

Infectious diseases have decimated humanity since the dawn of time. History remembers that they were equally willingly used to fight, and over the years the deliberate spread of diseases has reached the status of one of the greatest threats to health and life. Infectious diseases are also wreaking havoc nowadays – more than 17 million people (or 50,000 people a day) die every year at the hands of "invisible killers".

An infectious disease that has been caused by a biological pathogen is defined, i.e. “cellular micro-organisms, or products produced by them, external, and internal human parasites, or products produced by them, non-cellular particles capable of replicating, or transferring genetic material.

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329 Coronaviruses (family Coronaviridae) are RNA viruses, i.e. those whose genome is ribonucleic acid (they have one of the largest genomes in the group of RNA viruses infecting humans). "There are numerous thick stick-like protrusions protruding from their casing, which in electron microscopy photos look as if they are forming a kind of crown or halo, resembling a solar corona (the name of coronaviruses comes from the Latin word for wreath or crown)." Quote from: E. Krawczyk *Koronawirus. Wszystko co musisz wiedzieć żeby się zabezpieczyć*, Pascal, Bielsko-Biała 2020, p. 28

"The first records of human coronaviruses date back to the 1960s, when two pathogens - HCoV-229E and HCoV-OC43 were isolated and described. Coronaviruses have been out of the way of mainstream research in virology and medicine for years, as these two species cause a mild cold that resolves without intervention within a few days. It was not until the beginning of the 21st century that the world experienced an epidemic of a disease caused by a previously unknown, highly infectious species of the SARS coronavirus (...) In 2012, 10 years after the SARS-CoV epidemic, there were cases of a new, severe and often fatal respiratory disease caused by the MERS coronavirus." Quote from: K. Pyrć, *Ludzkie koronawirusy*, Postępy Nauk Medycznych 2015, Volume XXVIII, no. 4B, p. 48

330 On 02/11/2020, the Director General of the World Health Organization (WHO), Tedros Adhanom Ghebreyesus, announced that the Wuhan coronavirus, temporarily named 2019-nCoV, was officially named COVID-19

331 Their strains are officially stored for scientific purposes at the Centers for Disease Control and Prevention (CDC) in Atlanta, USA, and in a secret Russian government laboratory near Novosibirsk.

332 The Act of 5 December 2008 on the prevention and combating of infections and infectious diseases in humans (Dz.U. z 2020 r. poz. 284, 322, 374), art. 2 point 3.
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including genetically modified cell cultures, or products produced by them”.

The vast majority of all diseases referred to as infectious diseases are caused by viruses. Modern taxonomy includes several thousand pathogenic viruses for humans, animals, and plants. For many viruses, man is a natural host, for many others the natural hosts are animals, but man is also a link in the circulation of the virus.

An infectious disease is associated with the term 'epidemic', i.e. 'the occurrence in a given area [or a given time] of infections, or infectious diseases in a number significantly higher than in the previous period, or the occurrence of infections, or infectious diseases not yet occurring'. If the epidemic covers large areas around the world, spreading to many countries, and its concomitant feature is high population incidence, then it is referred to as a pandemic. On 11.03.2020, the Director-General of the World Health Organization (WHO), Tedros Adhanom Ghebreyesus, announced the COVID-19 Pandemic, thus recognising that the epidemic of the new coronavirus, which began in November 2019 in Wuhan, China, had undergone a global SARS-CoV-2 coronavirus pandemic.

Infectious diseases spread in different environments. The cases of illness among passengers, or crew members on board should therefore not come as a surprise. However, in the wake of K. Kubiak, it is worth noting that "otherwise (...) the situation develops on land, or on a ship where there are several thousand people in confined space". Cruise ships, which are a kind of clusters of the population, are a particularly vulnerable object. "It should be remembered that modern passenger ships are able to accommodate several thousand people. The largest of these, MS Harmony of the Seas, holds up to 8,880 passengers – 6,780 passengers, and 2,100 crew members. In such a situation, the appearance of...

333 Ibidem, point 2.
334 In the sample quarter-century 1975-2000, infectious diseases of viral etiology accounted for 49,973,000. (93.8%) of all acute infectious diseases, i.e. 53,370,000. More: M. Kańtoch, Człowiek a wirusy, access: alergia.org.pl/pacjent/inne/człowiek.htm (17.03.2020).
335 Ibidem.
336 The act on preventing and combating infections and infectious diseases in humans ..., pkt 9.
337 A factor that differentiates a pandemic from an endemic should be mentioned here – the latter applies to a situation where a specific infectious disease persists in a specific area for many years at a similar level, e.g. the Ebola epidemic in West Africa in 2014.
even one carrier of the virus immediately results in an epidemic.\cite{341} Mastering mass contagion on such a unit is a huge challenge. And while we are aware of plans for all sorts of threats, we know how often assumptions about dealing with a potential danger are nothing more than a real threat to life and health.

**Diseases on cruise ships due to biological factor**

In 2019, it was estimated that around 30 million passengers had crossed 272 cruise ships worldwide.\cite{342} Cruise ships are a common place of outbreak of infectious diseases due to the hermetic environment, and contact between people from different parts of the world.

In mid-November 2006, *Carnival Liberty*\cite{343} passengers were affected by a viral infection of the gastrointestinal tract. During a voyage from the Mediterranean to the Caribbean on a luxury cruise ship, a massive illness caused by the Norwalk virus infection was reported.\cite{344} Symptoms of the disease were detected in 536 of the 2,804 passengers, and 143 of the 1,166 crew members. The same situation occurred in December 2006 on board one of the largest passenger ships – *Freedom of the Seas* (see Photo. 1). Symptoms of norovirus infection were found in 338 of the 3,823 passengers, and 46 of the 1,402 crew members on a Caribbean cruise.\cite{348}

\begin{footnotesize}
\begin{enumerate}
\item \cite{341} K. Kubiak, *Przemoc na oceanach...*, op. cit. p. 106.
\item \cite{343} The ship is 290.2 m long and 35.4 m wide, with 13 decks; it accommodates 2,974 passengers and 1,160 crew members. See: https://www.carnival.com/cruise-ships/carnival-liberty.aspx (13.03.2020).
\item \cite{344} Norovirus, which causes gastroenteritis (viruses like them are called gastrointestinal disease, acute non-bacterial gastroenteritis, food poisoning, or food infection). http://www.cdc.gov/nceh/vsp/surv/outbreak/2006/nov13carnivalliberty.htm (13.03.2020).
\item \cite{345} The ship is 339 m long and 56 m wide, has 18 decks and 1,800 cabins; it accommodates 4,375 passengers, and 1,360 crew members. See: http://www.royalcaribbean.com/ (19.05.2015).
\item \cite{346} "They are a very common cause of food infections. Symptoms of the disease generally begin 12-48 hours after exposure to the virus, and usually last from 1 to 3 days, sometimes may last longer. The main symptoms are abdominal pain, vomiting, and diarrhea. The source of infection is sick people who excrete a huge number of viral particles. It should be remembered, that viruses are excreted from the body even after the symptoms of the disease have resolved, and they are still a source of infection. Infection can occur through direct contact with a sick person or contact with objects on which the patient "left" viruses. As the name of the disease suggests, infection occurs through the ingestion (contaminated hands, food)". Quote from: Norowirusy, access: https://www.pzh.gov.pl/norowirusy/ (09.04.2020).
\end{enumerate}
\end{footnotesize}
In both cases, larum was raised due to the suspicion that biological agents were used against the population. However, these were not individual cases (see Table 2), but the scale of the phenomenon raised relevant assumptions, and concerns.

On January 21, 2014, she sailed on a 10-day *Explorer of the Seas*\(^{349}\) cruise, where there was also an epidemic of viral gastrointestinal infection. The disease statistics were as follows: 634 out of 3071 passengers, and 55 of the 1166 crew members\(^{350}\). In the last year, the highest number of cases due to norovirus occurred during the cruise, which took place on 6-13 January 2019. At that time, 561 passengers, and 31 *Oasis of the Seas* crew members\(^{351}\).

Table 1. Cases of morbidity caused by a biological agent among passengers, and crew members of cruise ships

<table>
<thead>
<tr>
<th>Year</th>
<th>Cruises</th>
<th>Sickness (passengers)</th>
<th>Sickness (crew)</th>
<th>Sickness (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>32</td>
<td>2643</td>
<td>479</td>
<td>3122</td>
</tr>
<tr>
<td>2005</td>
<td>17</td>
<td>1982</td>
<td>294</td>
<td>2276</td>
</tr>
<tr>
<td>2006</td>
<td>34</td>
<td>4507</td>
<td>561</td>
<td>5068</td>
</tr>
</tbody>
</table>

\(^{349}\) The ship is 311 m long and 38.6 m wide, with 15 decks; accommodates 3,114 passengers and 1,180 crew members. See: https://www.royalcaribbeancruises.pl/statki/klasa-voyager/explorer-of-the-seas/ (19.03.2020).


\(^{351}\) The ship is 362 m long, and 47 m wide, with 16 decks; it accommodates 6,630 passengers and 2,160 crew members. See: http://www.royalcaribbeancruises.pl/statki/klasa-oasis/oasis-of-the-seas/ (19.03.2020).
An analysis of the cases indicated in Table 1 indicates that it is not uncommon for ships to become infected with a viral infection (in 98% of cases with noroviruses).

However, it is not only norovirus that poses a potential, and real threat to ship crews and passengers. The COVID-19 virus, which attacked on November 17 in the small Chinese town of Wuhan (Hubei Province, central China), and spread to other cities, neighbouring countries until it finally reached more continents, also hit the seas and oceans.

The first cruise ship to have an outbreak of coronavirus was the *Diamond Princess* 352 (see Photo. 2). This occurred shortly after the outbreak in China. Diamond Princess sailed from Yokohama on 20.01.2020. Along the way, 2,666 passengers from more than 50 countries around the world were to visit Kagoshima, Hong Kong, Vietnam, Taiwan, and Okinawa before returning to Yokohama port.

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352 The ship is 290 m long and 37.5 m wide, with 18 decks; it can accommodate 2,670 passengers and 1,100 crew members. At the beginning (launched in 2004) it was cruising the Pacific Ocean between Asia and Australia, since 2018 it also takes passengers on trips around the world. More: https://www.princess.com/ships-and-experience/ships/di-diamond-princess/ (09.04.2020).

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After a few days of sailing, an 80-year-old Chinese national had symptoms indicating coronavirus infection. The man was left in medical care in the port of Hong Kong on 25.01., as it turned out – 01.02. tested positive for COVID-19 infection. While still in Hong Kong, the shipowner decided to send the ship to Yokohama's final port, and carry out medical examinations of the entire state of the cruise ship. The Japanese authorities have decided that the ship will remain in port, without passengers and crew members being able to dissuade. From 03-4.02. the state of health of all persons was checked by the relevant services by means of a questionnaire, samples were taken for the coronavirus test. The following day (05.02) the case of COVID-19 was confirmed, which influenced the decision of the Ministry of Health, Labour and Social Welfare (Kosei Rhodes) to quarantine 3711 people\textsuperscript{353} on board at the time (2666

\textsuperscript{353} Among them, three Poles (one crew member, and two passengers) whose test for the presence of coronavirus turned out to be negative.
passengers, and 1045 crew members)\textsuperscript{354}. Protection of the population on land was cited as a basis for such a security measure, not another, by preventing the spread of the virus, regardless of the consequences it would have on those on board. It should be borne in mind that vessels are obliged by international treaties to comply with port rules and protocols. In this case, \textit{Diamond Princess} had to follow the instructions of the Japanese Health Organization working closely with the U.S. Centers for Disease Control and Prevention (CDC).

The event was not only a surprise, an unexpected, and unwanted situation on board, but also an unprecedented one – the quarantine on the \textit{Diamond Princess} cruise ship lasted more than two weeks. Prof. Kentaro Iwata, infection control specialist\textsuperscript{355} at Kobe University Hospital (Infectious Diseases at Kobe University), strongly criticized the management of the situation during the COVID-19 infection incident on the \textit{Diamond Princess} cruise ship. He made his comments available to the public by posting videos on the youtube.com\textsuperscript{356}. There, he pointed to the prevailing chaos, the lack of a quick, and adequate response required by the situation, and the profession of doctor, epidemiologist, expert on difficult situations, prepared to work under stress, and in difficult conditions. In his speech, he also used the statement that, through the actions taken, "the \textit{Diamond Princess} ship has become a mill for COVID-19"\textsuperscript{357}. He pointed, among others, the lack of separation of green, infection-free zones, and red zones where infection may have occurred, and the failure of health and safety officials who left the ship, and returned to land in a crowd of healthy people\textsuperscript{358}.

For many days, the number of people infected was growing rapidly – from 5 to 22.02. increased from 25 to 634 cases\textsuperscript{359}. The justified spike in the


\textsuperscript{355} He conducted research, and participated, inter alia, in work during the Ebola epidemic in Africa, and SARS in China. He was also summoned aboard the Diamond Princess; after two people working on the ship on behalf of the government contracted the coronavirus, After leaving the unit, prof. Iwata submitted to a 14-day quarantine.

\textsuperscript{356} The films were removed by the author (investigating the causes is not important from the point of view of the issue discussed in this article), nevertheless, materials circulate in the worldwide network, e.g. \textit{Professor Kentaro Iwata Kobe University, on Covid-19/SARS-CoV-2 Diamond Princes}, access: https://www.youtube.com/watch?v=v.jksM-NTWM (11.04.2020) or material from the press conference on February 20, 2020., See: K. Iwato, \textit{Aboard the Diamond Princess}, access: https://www.youtube.com/watch?v=V29eNY_0kWQ (11.04.2020).

\textsuperscript{357} \textit{Professor Kentaro Iwata Kobe University, on Covid-19/SARS-CoV-2 Diamond Princes}, access: https://www.youtube.com/watch?v=v.jksM-NTWM (11.04.2020).

\textsuperscript{358} Ibidem.

\textsuperscript{359} 10.02. of 99; 11.02 of 88.

This is very well illustrated by the graph in the article by Chinese scientists, where additionally there is a comparison with the Covid-19 incidence curve in Wuhan. See: J.-W. Xu,
number of cases was due to the gradual testing of the number of passengers on board the *Diamond Princess*. Finally, 712 (567 passengers, and 145 crew members) tested positive for the virus, of which 331 were asymptomatic at the time of the tests and 13 died.\(^{360}\)

The public (not only within Japan) criticized the authorities for the misuse of quarantine measures on the virus infected cruise ship. There have been voices about the need to establish a cell along the lines of the US CDC\(^{361}\). Although Japan already has a certain equivalent of the *National Institute of Infectious Diseases* (NIID), experts point out that the institute lacks autonomy from state authorities\(^{362}\). The media even christened *Diamond Princess* as "Floating Prison." This was facilitated by social media. Thanks to them, the participants of the cruise were able to maintain communication with the world, and the world could see the dramatic appeals sent by passengers, and crew members through videos, records, and photographs of the ship, on board which hung banners with a tragic cry for help. Michael Mina, a physician and professor of epidemiology, and immunology at Harvard School of Public Health & Harvard Med School, described the quarantine ordered on the *Diamond Princess* as uneasy, and completely inappropriate, pointing out that most likely the infection had moved between individuals, putting everyone at great risk of getting sick, and even, dying.\(^{363}\)

Researchers from Sweden's Umeå University (Umeå Universitet) believe that quarantine on the *Diamond Princess* has led to more passengers, and crew being infected\(^{364}\). An in-depth analysis by scientists\(^{365}\) led by epidemiologist X.-Y Wang, Z. Qin, H.L. Song, H. Wang, H.-Y. Luo, L. Ye, Z.-H. Feng, *Deep thought of COVID-19 based on Diamond Princess’s quarantine and home quarantine*, "European Review for Medical and Pharmacological Sciences" 2020, 24, p. 4028.


\(^{363}\) https://twitter.com/michaelmina_lab/status/12270313528143872 (08.04.2020).


\(^{365}\) In the presented studies using the SEIR epidemiological model (Susceptible, Exposed, Infectious, Recovered = susceptible individuals, individuals with latent disease, individuals...
Professor Joackima Rocklöv shows, that the infection rate on board the *Diamond Princess* was four times higher than that of China’s most infected regions, so the presumed cause of the avalanche was the proximity between people on board\(^{366}\). Scientists argue that immediate boarding, as soon as the first case of illness is revealed would be less tragic.

*Diamond Princess* is not the only ship to have a coronavirus. From 07.03. the escalation of COVID-19 infections on cruise ships sailing near the US has increased. In the sample time, 07.03.-01.04. The U.S. Coast Guard conducted 31 rescue operations related to COVID-19 infection\(^{367}\). On the list of cruise ships on which quarantine was ordered, and/or people complaining of breathing problems were evacuated to hospitals m.in.: *Costa Smeralda, WorldDream, Grand Princess*\(^{368}\), *Braemar, Golden Princess, Ruby Princess, Zaandam, Rotterdam, Coral Princess, Lambelu, Oasis of the Seas, Symphony of the Seas, Costa Favolosa*, and *Costa Magica*.

Despite recent restrictions restricting operations, such as port closures, the introduction of quotas on the movement of people, and eventually the suspension of activities from the tourism industry, including cruises, many cruise ships are still in the waters. At the beginning of April this year, the U.S. Coast Guard reported that there were a total of 114 cruise ships in U.S. ports, anchorages, and in the waters there, totalling 93,000 crew members on board\(^{369}\). A detailed breakdown is illustrated in Figure 1.

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suffering from infections, and spreading infections, convalescent individuals); assuming a relatively homogeneous mixing of people on board), scientists presented solutions based on the assumption that the virus is transmitted from person to person, other routes of transmission, such as water infected with feces, were not taken into account.

\(^{366}\) Ibidem, p. 5.


\(^{368}\) 98 people infected, 1 fatal.

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Fig 1. The situation of American cruise lines – as of April 1, 2020


On March 14, CDC Director Robert R. Redfield issued a 'Non sail' order for cruise ships, to take effect on March 14.2020. At the same time, he praised the Cruise Lines International Association (CLIA), a leading industry trade group, for its willingness to voluntarily suspend cruise ships at U.S. ports for a period of 30 days, announced at March 13.

**Ship diseases due to biological factor**

_Diamond Princess_ is a flagship example of a cruise ship, on which the fight against the coronavirus was fought. Unfortunately, vessels in the service of the state have not been able to remain free from danger.

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370 It is worth noting that the virologist also holds the position of Administrator of the _Agency for Toxic Substances and Disease Registry – ATSDR._


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In mid-April, the rapid spread of the coronavirus was revealed aboard the French nuclear aircraft carrier *Charles de Gaulle*\(^{372}\) (see photo 3). It turned out that almost half of the 2,300 crew members of the French nuclear aircraft carrier are infected with the COVID-19 virus. The Minister of the Armed Forces of France, Florence Parly, confirmed 1081 positive cases, and indicated that a further 545 sailors had symptoms, and 24 were hospitalised. The ship was on a mission in the Atlantic Ocean, had no contact with external factors since 16 March, and was reported to be returning to the coast of France on 8 April after signs of infection were revealed. Earlier, *Charles de Gaulle* held a three-day stop in Brest in the northwest of France.

\[\text{Photo. 3. } \text*Charles de Gaulle* (R91)\]

*source: https://www.defense.gouv.fr/var/dicod/storage/images/base-de-medias/images/marine/batiments/charles-de-gaulle/charles-de-gaulle/233022-1-fre-FR/charles-de-gaulle.jpg (18.04.2020).*

\(^{372}\) Joined in French service in 2001, *Charles de Gaulle* is the showpiece of the French Navy; it is the only nuclear aircraft carrier built by a country other than the United States.
One of the sailors, who requested anonymity, told Radio France Bleu that the aircraft carrier’s commander, Guillaume Pinget, had offered to notify the superiors immediately after the Brest stop, that he needed to abort the mission, but his demands were rejected by the authorities. Initially, Minister Florence Parly – like a spokesperson for the French Navy – officially denied the sailor’s reports. Nevertheless, Parly soon announced that the information on board the Charles de Gaulle aircraft carrier was informed on April 7 by Admiral Christophe Prazuck. The Director of Service de Santé des Armées Security Administration (SSA), Marilyne Gygax Genero MD, quoted in a press release from the French Senate Committee, stressed that infection on the aircraft company is an important event and that "at the end of this crisis, there will undoubtedly be consequences"373. However, in parallel, it stated that at the moment it is not possible to test all French military units, or order the wearing of masks. In turn, the chairman of the Senate committee, Christian Cambon, announced that he would ask the Minister of the Armed Forces to systematically examine the soldiers before launching the mission. The Chairman expressed a lack of understanding of the fact that "the military does not use pre-mission tests" in both their security, and [operational] capabilities374. This is a flagship example that does not apply to just one particular country. This case shows chaos, and a lack of preparation for an unprecedented situation, but the creation of a state army would have to expect precisely preparation for the worst-case scenarios.

It should be noted that the aircraft carrier is an excellent place for transmission of the virus – crew members share cramped cabins, and use the same bathrooms, canteens, or workstations every day. The command has no chance of isolating all cases, as a result of which the virus has room to show off – it can spread at a much faster rate than on land375.

Unfortunately, this is not an isolated case of a unit remaining in the state navy, where the cases of COVID-19 have been revealed. Such cases, although less than discussed above, occurred on board of the San Giusto, San Giorgio, USS Theodore Roosevelt, USNS Comfort376.

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374 Ibidem.
376 Supertanker transformed by the events of September 11, 2001 into a hospital ship of the US Navy. The unit was involved in the fight against COVID-19, and was to admit patients uninfected with the virus in order to relieve New York hospitals. Unfortunately, an oversight by staff members led to five people being admitted onto the ship with suspected coronavirus.
Finally, it should be mentioned that the coronavirus has also affected merchant ships. An example would be a South African mass carrier called, *nomen omen – Corona*377.

**CONCLUSIONS**

Since the early 1990s, humanity is particularly fearful of infectious diseases, as it is plagued by deadly diseases caused by The Ebola, SARS, MERS, Marburg viruses. "Existing vaccines are often ineffective, cause side effects, or their protective properties last only a few months. For some diseases (...) there is still a lack of specific prevention"378. As Mr Krawczyk rightly points out, "Although the new SARS-CoV-2 coronavirus, which is now spreading around the world, and has been followed by uncertainty, fear and panic, is at the level of genetic material similar to the SARS virus that attacked humanity 17 years ago, it is brand new 379. Fighting it is a huge challenge, and time is inexorable here, every day there are victims affected by the virus – in the form of more infected and fatalities.

As many as two – *Diamond Princess*, and *Grand Princess* – of the many ships on which COVID-19 appeared revealed 800 laboratory confirmed cases of the disease. The limited space on board promotes an increase in infections, and thus carries the risk of an epidemic at sea. In addition, outbreaks on board pose a risk of infection spreading beyond travel – both passengers, and crew are multinational groups.

The case studies contained in this article point to the need to constant analyse past cases of illness, and the behaviour of the population (crew, passengers, shipowners, medical services, and finally state authorities) in the face of the threat, to verify and assess so that in the future the response is more adequate, more structured380. An important place in this respect is occupied by the principle of good practices in the area of learning from the experiences of others, cooperation, exchanging views, and adapting solutions. On this basis, plans, and procedures for preparing, preventing, and responding to a threat should be verified, modernized, and changed. The truth is, reality likes to verify plans. However, the implementation of safety assurance, following appropriate

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planning, remains a significant challenge. In the implementation of the above-mentioned projects, it is important to raise the awareness of the average citizen about the threats (both real, and potential), and the possibilities of protecting against them (both individual, and group).

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[34] *Professor Kentaro Iwata Kobe University, on Covid-19/SARS-CoV-2 Diamond Princes*, access: https://www.youtube.com/watch?v=v_jksM-NTWM (11.04.2020).


Strach przed niewidzialnym wrogiem, jak zwykło się określać bakterie i wirusy nieraz zaburzające lub zabierające zdrowie, towarzyszy ludzkości od tysięcy lat. W artykule przedstawiono przypadki zachorowań spowodowanych czynnikiem biologicznym wśród pasażerów i członków załóg na statkach. Wspomniano o incydentach, które miały miejsce w przeszłości. Wiodące rozważania Autora skupiły się na obecnej sytuacji (Pandemia COVID-19) zagrożenia czynnikiem biologicznym na jednostkach pływających.

Słowa kluczowe:
koronawirus, choroba zakaźna, pandemia, statek, załoga, pasażerowie