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Infection prevention on cruise ships

PROJECT THESIS

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ABSTRACT

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The recently ended COVID-19 pandemic made the world to turn back to infectious diseases, their control and prevention. Almost all industries and spheres of daily living have been greatly affected, but tourism was one of the couple industries that suffered the most due to the closed borders and months'- long restrictions. As Finland is a maritime country with multiple ports, cruise ship travelling between the neighbouring countries is essential part of daily living for many.

The aim of this project thesis was to create an evidence-based digital booklet about infection prevention on cruise ships for the crews working on board, so the risk of infectious disease outbreak would be minimized. The digital- booklet contains summarized information from different research papers about infection outbreaks on cruise ships and from guidelines provided by WHO, IMO, CDC and European Centre for Disease Prevention and Control.

The theoretical basis of the project thesis contains detailed information not only about infectious diseases and their prevention but as well about the cruise ship industry in Finland and why the infection prevention needs to be implemented in this specific maritime industry. The project was written by using the hybrid methodology, which consisted of agile and waterfall methods.

Keywords: infection prevention, infectious disease, COVID-19, cruise ship travelling.

FOREWORD

This thesis represents the culmination of a year-long writing process that involved extensive research, late nights, and countless cups of coffee. As we stand on the brink of presenting this project report, our hearts are filled with gratitude, excitement, and above all, relief.

The path to presenting this thesis was not without its fair share of obstacles and challenges. Both authors encountered setbacks in the research process and scheduling conflicts. However, we were determined to overcome these hurdles and adapt to the challenges that came our way. Our shared determination to complete this report on time and to the best of our abilities fueled our journey.

This thesis is the product of a collaborative effort, enriched by the guidance and insights of our mentors, teachers, and colleagues. Their valuable input played an essential role in shaping this report.

We owe a profound debt of gratitude to our families and friends for their unwavering support throughout this process. Their understanding, encouragement, and unwavering belief in our capabilities sustained us during trying times. We are grateful for their patience and faith in our success.

Within this thesis, we have compiled research-based knowledge on a topic of great significance within our field of work. We hope that our research will offer valuable insights and inspire future colleagues and scholars to expand the boundaries of knowledge in this area.

Lastly, we extend our heartfelt appreciation to all the readers and reviewers of this thesis. We value your feedback and analysis and encourage you to engage in constructive discussions about our work, including critique and new ideas.

We, the authors, now present this academic thesis to you, our readers, colleagues, and scholars, with immense gratitude. We hope that this work imparts valuable knowledge and serves as a foundation for further exploration of this vital topic.

We thank you for joining us on this journey.

CONTENTS

1 INTRODUCTION

The recent COVID-19 pandemic and the fast prevalence of the virus has shed a light on the lack of knowledge about infection prevention not only in our daily lives but especially in confined places such as cruise ships, where a big number of people spend their time, engage in different activities, and live together for a specific amount of time so different viruses can be caught and spread at a fast pace. According to the meta-analysis "*Transmission risks of respiratory infectious diseases in various confined spaces: A meta-analysis for future pandemics*" written by Moon, J. and Ryu B. H. in the year of 2021, it was discovered that the transmission of viruses is three times higher in confined spaces than in open air.

Finland is a maritime country with many seaports of which some (such as Helsinki's and Turku's ports) serve passenger ships. Nevertheless the fact that cruises are short-haul and mostly serve the purpose of weekend getaways and moving between the neighbouring countries, according to the statistics provided by the Port of Helsinki, during the year 2022, the number of passengers on cruise ships from January to December collectively was 7 951 241 (Port of Helsinki, 2023) telling us that the cruise traffic at the ports is high and that the prevalence of the viruses in the ships and ports might be high as well.

So far, there has been little research done about infection prevention in cruise ships, as the topic is relatively new and the goal of this project thesis is to create an evidence- based and up-to-date digital booklet about infection prevention in cruise ships, which could be used and shared by the cruise ship crew, so the possibility of outbreaks of infectious diseases and their spread on the cruise ships could be minimized. As well, the main objective of this thesis goes hand- in- hand with the purpose- to increase the cruise ship's crews' knowledge about infection prevention in cruise ships.

The cooperation partner of this project thesis is the Maritime Logistic Research Center (SAMK). The Maritime Logistic Research Center (SAMK) is located in the city of Rauma and is responsible for bachelor's degree of maritime logistics/ sea captain and master's degrees of maritime management and maritime logistics management. (SAMK, 2022.)

2 THEORETICAL BASIS OF THE PROJECT

2.1 Infectious disease

Finnish Institute for health and welfare describes infectious diseases or communicable diseases as pathogens (or agents) known as bacteria, parasites, viruses and fungi that spread and are transmittable from one organism to another organism either directly or indirectly. (Finnish Institute for Health and Welfare, 2023.) Currently, additional group of agents (although rare), which can cause an infection and is being mentioned in different sources, is TSEs or transmissible spongiform encephalothies, also known as prions (Cleveland, 2022).

All five groups of the infectious agents share the same six characteristics- infectivity (ability to enter the body of a host and multiply in it); pathogenicity (producing a specific reaction); virulence (producing harmful reactions); toxicity (producing of a poisonous reaction in the host); invasiveness (penetration of the tissue and spreading within the infected tissues and further); and antigenicity (stimulation of infected body's immunological response). (Walden University, n.d.) During the last 30 years, over 30 new infectious agents have emerged and are already affecting the human population. To this day, infectious diseases are one of the leading causes of mortality and disability and

puts a significant strain not only on the public health but as well on the economies and different societies across the globe. (Nii- Trebi, 2017).

Infectious diseases can spread and cause outbreaks in multiple ways- through person-to-person, animal-to-person contact, or from the environment. Microbes are usually being transmitted by droplets (for example coughing or sneezing), by aerosol particles and by faeces. Additionally, multiple factors increase the transmission of the disease including the lack of safe and clean water, inadequate excreta disposal, poor hygiene, poor living conditions and unsafe food. Yet, infectious diseases are categorized not only by the way they are being spread or by their agents, but as well by the mortality they cause. Currently there are three different categories: diseases, which can cause high mortality; diseases, which can place heavy disability burdens on a population; and diseases, which can spread rapidly and are of unexpected nature. (World Health Organization, n.d.). Needless to mention, that different infectious agents cause different symptoms. Usually, the first symptoms of an infection in a body include fever, cough, shortness of breath, fatigue, diarrhoea, vomiting and stiffness of the muscles. (The Center for Disease Control and Prevention, 2023).

The last major outbreak of an infectious disease which has turned into a 3-year long pandemic and has put a lot of pressure on the health care systems and economies, was the COVID-19 pandemic. Usual on set symptoms of COV-19 are cough, shortness of breath, fatigue, muscle aches, nausea, diarrhoea and loss of smell and taste (The Center for Disease Control and Prevention, 2023).

According to Duodecim (2022), infectious and communicable diseases can cause and have caused epidemics on board of the cruise liners. These diseases often include stomach flu caused by norovirus, respiratory infections such as seasonal influenza and pneumonia caused by legionella bacteria. There have also been reported cases of measles among unvaccinated passengers. (Duodecim Terveyskirjasto, 2022).

As this thesis project is aimed at the cruise ship companies working in Finland, the authors of the thesis decided to collect the information about infectious diseases in Finland to understand better which ones are being transmitted the most. The report was based on the data collected by the National Infectious Diseases Register and published annually, in the springtime. The last publication was released in the year of 2021. Until the year of 2017, the reports were published in three different languages- Finnish, Swedish and English, but from 2018 the reports are only accessible in Finnish and Swedish (Terveyden ja hyvinvoinnin laitos, 2023). In the reports, information about the cases of respiratory, gastrointestinal, hepatitis, sexual transmitted, antibiotic-resistant, tuberculosis and local foreigner diseases such as Malaria, diseases can be found.

Every year, around 140 000 cases of infections of different kind are registered in Finland. According to the report published in the year of 2021, the number of respiratory infections, especially of influenza, was considerably smaller than in the years prior and it might be due to the COVID-19 pandemic. (Terveyden ja hyvinvoinnin laitos, 2021). Influenza, and the variations of it, is one of the main infectious diseases that both, Finnish and the whole European populations suffer from every winter. The symptoms of influenza include mild to high fever, fatigue, muscle aches, cough, sore throat, sneezing and headaches. During the period from October of the year 2021 to the June of 2022, 6942 cases of Influenza- A and 94 cases of Influenza- B were registered in Finland (Terveyden ja hyvinvoinnin laitos, 2023), while during the whole COVID-19 pandemic from the March of 2020 to May of 2023, 1 484 052 cases of COV-19 were registered only in Finland (Terveyden ja hyvinvoinnin laitos, 2023).

Infectious disease, which cases grew drastically in Finland during the last years, was norovirus. Norovirus is a human virus, which causes diarrhoea, abdominal pain, fever, vomiting and in Finland is the most common acute intestinal infectious disease. (Duodecim Terveyskirjasto, 2020.) According to statistics provided on the site of Terveyden ja hyvinvoinnin laitos (later in the text shortened as THL), in the year of 2022, 3747 cases of the virus were

registered, while in 2021 951 cases were documented, and in in 2020 only 865 (Terveyden ja hyvinvoinnin laitos, 2023).

Together with the respiratory and gastrointestinal diseases, sexually transmitted and hepatitis are being mentioned. Yet, the numbers of sexually transmitted diseases are rather stable and do not change through the years much, as well as the cases of new hepatitis infections. (Terveyden ja hyvinvoinnin laitos , 2021.)

2.2 Infection prevention

According to WHO (World Health Organization) infection prevention is the foundation to providing efficient health care, so the ability to deliver clean quality care is crucial. WHO states that taking precautions to avoid the spread of infection is possible in different ways. Standard precautions are used to protect the public and the healthcare professionals to control and prevent infections from occurring. These basic standard precautions include proper hand hygiene, proper coughing and sneezing etiquette, aseptic working technique, protective equipment such as uniforms, masks, face shields and gloves, patient hospitalization if it is needed for the safety of the person and its surroundings, risk assessment, injury prevention and safe injection technique, waste management, decontamination of equipment, and patient care items. (WHO, 2022.)

Correct sneezing and coughing technique is one the main ways to limit the spreading of the diseases. A big number of bacteria and viruses are being spread by droplets and air transmission, for example a cough releases approximately 3,000 droplets and a single sneeze about 40,000 droplets. (Dhad & Li, 2020). The hazard of the air transmitted droplets is not only in their high number, but also in their possibility to stay on different surfaces for a long time. In the experimental study, in which the liveability of the SARS- CoV-2 virus droplets on different surfaces were tested showed, that the virus has lasted four

hours on the copper, 23 hours on the cardboard and more than two days on the plastic, stainless steel and other less porous materials. (van Doremalen et al, 2020). Although correct sneezing and coughing etiquette would not fully eliminate the spread of the infectious diseases, it still minimizes the transmission of the droplets. Effective etiquette includes sneezing into the bent elbow (but never to the palm) or covering of the mouth and nose with the tissue paper, which has to be put to the trash immediately after the usage, then washing the hands with warm water and soap and using hand rub with no less than 60% of alcohol after. (THL, 2023).

THL has put in place clear instructions on proper coughing and sneezing etiquette, and they have also put out instructions on the correct hand-washing technique. According to THL the proper hand washing to prevent the spread of infections includes washing hands in warm water with soap for 20 seconds, then drying off carefully. Hands should be washed every time after using the bathroom, before handling food or medication items, when the person came from the outside, after being in contact with the animals, the person has sneezed or coughed and did not use the correct etiquette, and as well when the hands are visibly dirty. If there is no possibility to wash hands with soap, then it is recommended to use a hand sanitizer, which contains at least 60% of rubbing alcohol in water, instead. Instructions for soap washing and hand sanitizing can be found on the THL website in detailed pictures and instructions in Finnish, Swedish and English languages. (THL, 2023). Yet, once the person gets in a contact with bacteria or virus such as Salmonella, Norovirus, Staphylococcus aureus or E.coli, hand rub is not enough and the person must wash hands with running water and soap as hand sanitizers do not eliminate the bacteria or the virus. The reason behind this, is that the hand sanitizers are simply not strong enough to kill the bacteria or the virus. The only effective hand rubs against these bacteria and virus contained more 90% of rubbing alcohol. (Muleba et al, 2022.)

Although the correct sneezing and coughing etiquette together with the hand washing are one of the best ways to prevent the spread of infectious diseases, vaccinations are as important. According to the Finnish Institute for Health and

Welfare (2023), vaccinating the population from various diseases is still best and the most efficient way to battle illnesses. It is important to understand, that vaccinations protect not only the one who is receiving the vaccination, but also the ones with the weak immune system. Currently, in Finland there are two national vaccination programmes- one for children and one for adults. Vaccination programme includes 16 vaccinations, from such diseases as polio, diphtheria, tetanus, measles, pneumococcus, hepatitis, influenza, varicella, human papillomavirus and more (Finnish Institute for Health and Welfare, 2020). Although the vaccinations in Finland are not mandatory and the person or family has the right of choice, the population is being heavily encouraged to follow the national vaccination programmes and get their shots done, as infectious diseases, such as polio, which have been erased from the population with the help of mass vaccination could make their comeback once the immunisation of the nation declines. (Finnish Institute for Health and Welfare,2023).

According to the Finnish Institute for Health and Welfare (2020) good hand hygiene together with the vaccinations not only supports the herd immunity in Finland, meaning that the population of the country is massively protected from the bigger outbreaks of different diseases, but also prevents the spread of the antibiotic resistant bacteria such as methicillin-resistant Staphylococcus aureus known as MRSA. Although in Finland there are no crisis regarding the antibiotic resistant bacteria, the situation is being closely monitored, as it is a global problem which keeps on growing. (Finnish Institute for Health and Welfare, 2020).

2.3 Coronavirus pandemic

Suomen Punainen Risti (2022) state that the word pandemic comes from the Greek words *pan* meaning *everyone* and *demos* meaning the *people/public*. The World Health Organization can declare a pandemic when an epidemic outbreak spreads across all continents and can cause a significant threat to the people's health and threatening the capacity of healthcare services for the consumers. Some past pandemics include the plague in the Middle Ages, the

Spanish flu after the World War I and Swine flu in the 2000´s. The most recent and recently ended pandemic is the Covid-19 pandemic that started in December of 2019 and ended in the spring of 2023. (Suomen Punainen Risti, 2022.)

Coronaviruses are being described as a large family of viruses that are transmitted in both animals and humans through droplets and cause mild to moderate upper-respiratory tract illnesses in human population. Although, COVID-19 pandemic is the most known to the public, there were two other coronaviruses, that were fatal to humans: SARS coronavirus (SARS- CoV) that has emerged in November of the year 2002 and MERS coronavirus (MERS- CoV), which emerged in year 2012. Coronavirus, which has appeared in year 2019 and has caused the COVID-19 pandemic, a mutation of previously mentioned SARS virus, is named SARS-CoV-2. The COVID-19 pandemic started in the city of Wuhan in China in December of 2019. To this day, although the COVID-19 pandemic has been declared as ended, the different variants of the virus which have developed over the past three years, are still around and making people ill (Centers for Disease Control and Prevention, 2022.)

As the coronavirus developed over time and kept evolving it sprung out different variants of the disease. One variant of concern also known as VOC, that at this present time is still currently circulating, is the Omicron variant. The earliest documents of this variant are from November of 2021 in multiple countries. The Omicron variant being the most mutated with an increased transmissibility and increased virulence was holding significance to the public health. (World Health Organization, 2023.)

The Ministry of Social Affairs and Health, along with the Finnish government declared that the COVID-19 will be classified as a monitored communicable disease, this was starting from the beginning of July of 2023. Simultaneously the mutation of the SARS-CoV-2 virus, is no longer listed as a generally hazardous communicable disease. The World Health Organization stated that since May 5th of 2023 the COVID-19 virus is no more considered a concern or a threat to the public health on an international level. (Ministry of Social Affairs and Health, 2023.)

Precautionary measures, to maximize infection prevention on cruise ships, has been taken in the wake of the Coronavirus pandemic happening throughout the recent years, for example, on their website, cruise ship company Viking Line assures that they have modified and modulated their clean-up and clear-out routines on board and in terminals. They have also provided travellers with hand disinfection stations throughout their terminals and all the cruise ships (Viking line, n.d.). Yet, to understand the infection prevention guidelines used in the cruise ship liners, directions from different organizations must be collected, grouped and analysed.

2.4 Cruise ships

Dowling and Weeden (2017) define the meaning of a cruise as taking a trip by a sea liner for pleasure, often calling at multiple ports. A cruise ship is a large vessel transporting masses of people. According to these authors the cruise ship tourism is popular among senior citizens, and this field of tourism is constantly increasing with next generation of population. (R. Dowling & C. Weeden, 2017.)

Cruise shipping industry provides their passengers with voyages for pleasure and enjoyment. Part of the cruise line brand is to offer activities and provide experiences that are exceptional to everyday living. Often also offering passengers enrichment and activity at the calling ports. With cruise shipping the objective is not to offer transportation from one port to another often the cruise ships depart and return to the same port and the purpose is to provide a getaway experience on board for the duration. (K. Wang, S. Wang, Zhen & Qu, 2016.) In this project thesis the authors are focusing only on the short- distance cruise ships, which are operating in Finland and serve the purpose of weekend getaways and short- distance transportation for traveling between the neighbouring countries such as Sweden and Estonia.

In Finland there are four cruise line companies of which two are large cruise line companies, Viking Line and Tallink Silja Oy. Viking Line and Tallink offer not only transportation between countries like Finnlines or Eckerö line, but also entertainment and weekend getaways. Currently Viking Line has five ships that are sailing regularly: Gabriella, Viking Grace, Viking XPRS, Cinderella and their newest addition Viking Glory. The maximum capacity of a vessel is 2,800 passengers at the time. On these ships the passenger is provided with different activities and packages according to their travel plan. The ships have restaurants, spa-departments, shopping opportunities and special performances and different kinds of entertainment throughout the trip. All ships are suited for families with children and offer activities for youngsters as well. (Laivat. Viking line, n.d.)

Tallink Silja Oy or more specifically known as Silja Line, is a company now owned by Estonian AS Tallink Group. Silja Line provides cruises in the Baltic Sea between Helsinki-Mariehamn-Stockholm and Turku-Mariehamn/Långnäs-Stocholm. Tallink Silja currently has eight regularly sailing ships: Silja Serenade, Silja Symphony, MS MyStar, MS Megastar, Silja Europa, Baltic Princess, MS Star and Silja Galaxy. The maximum capacity of the passengers in the vessel is very similar to the vessels of Viking Line- 2,500 passengers at the time. All the ships provide passengers with catering services and on-board restaurants, entertainment and possibility to go shopping while being ashore. (Tallink Siljan laivat, 2023)

According to Viking Lines website, they have followed official Nordic guidelines in cases of suspecting passengers with Covid-19. The suspected individual will be isolated in their cabin until arrival to port and the staff will notify national health authorities and will also notify the local infectious disease emergency services. The individual will depart from the ship through a different exit point than rest of the passengers. The isolation cabin will be disinfected following prevailing instructions. (Koronavirus ja laivamatkustaminen, n.d.). Yet, Tallink Silja Oy has no information on their website about Coronavirus, only the links of THL recommendations and the website itself has been updated latest at the summer of year 2022. (Tallink, 2022.)

To understand the significance of sea travelling in Finland, and why the topic of infection prevention in cruise is important, the statics of main ports in Helsinki and Turku have to be taken in consideration. According to the statistics provided by the Port of Helsinki (Port of Helsinki, 2023), during the year of 2022, the number of passengers on cruise ships from January to December collectively was 7 951 241. The Port of Turku declares the number of passengers in 2022 from January to October is 2 309 518 (Port of Turku, 2022). The Port of Helsinki is Finland's biggest port and leads the statistics on passengers and maritime transport.

The impact and importance of cruise ships and passenger volume can be seen from the statistics of passenger logs from all the ports harbouring cruise ships. The authors of this project thesis found it important to include these statistics into the report to showcase the numbers, and to allow the reader context and concrete evidence on the amount of people traveling with cruise ships. This is needed when discussing about the spread of the COVID-19 virus and possible other diseases as masses of travellers are in close contact with each other.

While analysing data sourced from Helsinki port's website, the authors of the project thesis have observed noteworthy fluctuations in passenger traffic volume. A distinct pattern emerged when comparing pre-COVID-19 years, the pandemic period, and the post-pandemic phase, indicating the impact of restrictions. Notably, contrasting data from December 2020 and 2021 with that of 2018 demonstrated a considerable decrease in passenger volume during the pandemic years. In 2018, the port of Helsinki reported 11,558,745 passengers for the year and 953,999 for December, without any indication of the upcoming pandemic. In 2020, during the height of the pandemic, passenger numbers plummeted, with the port recording 4,756,685 passengers for the year and 202,859 for December. This decline was primarily attributed to COVID-19. The trend continued in 2021, with passenger figures even lower. The port registered 3,738,480 passengers for the year and 447,186 for December. By 2022, as travel restrictions eased and precautions were lifted, passenger

numbers saw a notable rise, with 7,951,241 passengers for the year and 701,790 for December. The 2022 volume surpassed 2021's count by a significant 112.7%. With restrictions fully lifted in 2023, passenger figures began to resemble pre-pandemic levels. However, as this report was completed in August, data for the entire year was unavailable, so figures were limited to July. For the period spanning January to July 2023, Helsinki port recorded 5,324,509 passengers, with 1,335,508 for July alone. When concluding and gathering this information, given the five months remaining in the year, authors speculate passenger numbers to reach somewhere between 9 and 10 million by the end of the year. (Port of Helsinki, 2023.)

When examining the provided data, specifically focusing on the Turku port, a marked decrease in passenger numbers is evident during 2020 and 2021, coinciding with the height of the COVID-19 pandemic and travel restrictions. In 2020, the total passenger count for the year at the Turku port was 1,094,847, with December alone accounting for 62,578 passengers. The subsequent year, 2021, saw a total of 1,407,548 passengers for the year and 135,145 for December. These figures significantly contrast with pre-pandemic times like 2018, when there were no COVID-19 concerns. In 2018, the annual passenger count reached 3,260,306, with December contributing 249,931 passengers, a considerably higher count than in 2020 and 2021. A turnaround occurred in passenger numbers during 2022 and 2023 as the COVID-19 threat receded, restrictions eased, and ultimately ceased. In 2022, the Turku port reported 2,670,555 passengers for the entire year, with December alone recording 180,911 passengers. Presently in 2023, passenger traffic has been tracked up to July. Notably, the data for the remaining months is unavailable and unnecessary for this report. For the period spanning January 1st to July 31st, 2023, the Turku port documented 1,502,286 passengers, and for July alone, the count was 386,196. These figures once again demonstrate a substantial rebound compared to the COVID-19 peak years. (Port of Turku, 2023.)

From the previously stated statistics it is evident that the amount of people travelling through the ports make up for a large portion of the country’s tourism and as a large amount of people travel along with these large vessels it

became an issue when the previously mentioned COVID-19 virus started spreading. But as mentioned earlier, the official site for Viking Line has provided instructions on traveling with them throughout the COVID-19 pandemic and continues to update its information for the safest travelling experience for their passengers with newfound knowledge and must know information. Tallink has also updated its current guidelines when travelling with them. Tallink's passengers will find from their website the precautions that have been taken to maintain hygiene and prevent spread of viruses and diseases.

2.4.1 Infection prevention on cruise ships

One of the main international organizations which is providing governmental institutions with their guidelines for maritime travelling and shipping is The International Maritime Organization (IMO later in the text), which has been created in the year of 1958 and has started working the following year. IMO is an international agency, which works under United Nations and is responsible not only for safety and security of seafaring, but as well for the prevention of marine and atmospheric pollution caused by ships. Currently, 175 countries belong to the IMO and Finland is one of them since the year of 1959. (IMO, n.d.). The International Maritime Organization as well has protocols and guidelines in place for infection prevention on cruise ships. These guidelines were created during the Coronavirus pandemic to ensure safe crew changes between ships and for safe travelling. Although, the objective of these guidelines was released by the IMO, they have been created with the cooperation with WHO and the objective of them was/is to maximize the functioning of trading and keep the global supply chains open by minimizing disruptions to these chains of motion and function. These guidelines focus largely on governmental and national recommendations by authorities in infection prevention between traveling sea crew. According to the report *"Industry recommended framework of protocols for ensuring safe ship crew changes and travel during the coronavirus (Covid-19) pandemic*" released on 22nd of April, 2021, by the IMO, it is being offered to ensure standard infection protection and control precautions such as hand-washing, usage of hand- sanitizer on the cruise ships; avoid

passengers or crew members who feel unwell; if needed to wear masks and if needed, gloves; ensure testing points and isolation rooms for the ones, who are being unwell. Additionally, it is being offered to follow the national guidelines of a country to which or in which it is travelling, and the guidelines provided by WHO.

European Centre for Disease Prevention and Control, an agency of the European Union on the 12th of May in 2021 has released a set of guidelines for cruise ship companies operating in the European Union, called "*COVID-19: EU guidance for cruise ship operations*". The guidelines mentioned in the document are very similar to the ones released by the IMO. The emphasis is on good hand hygiene, regular disinfection of the rooms and common areas with the disinfectants that contain antibacterial/ antimicrobial solutions, maintaining safe distance between the passengers, having testing points for the new passengers and the ones, who feel unwell, having additional spaces for isolation of the unwell passengers and if needed checking the vaccination documents of the passengers on board. Additionally, in the document is mentioned the good maintenance of heating, ventilation, and air conditioning systems (HVAC), as spread of small SARS-CoV-2 particles are spread by droplets through the ventilation systems as well. (European Centre for Disease Prevention and Control, 2021).

On June of 2022, Healthy GateWays, a joint action of AIRSAIN (network of national public health and civil aviation authorities, airline management and medical services across EU Member States) and SHIPSAIN (network addressing health issues in maritime transport across EU Member States), which is co-funded by the Health Programme of the European Union, has released an updated version of the infection prevention guidelines for cruise ships operating in the European Union (Healthy Gateways,n.d.). In "*Advice for cruise ship operators for preparedness and response to an outbreak of COVID-19. Version 7"* had updated guidelines about wearing masks on- board and the possible health risks of not wearing one, as well as the information vaccination passports and accepted vaccines in the European Union.

Currently, as the Covid-19 pandemic has been declared as ended and the guidelines have to be re-adapted, a new project has been issued. Healthy sailing is a three-year long research project funded by the European Commission under the Horizon Europe Framework Programme. The goal of the project is to reduce the spread of infectious diseases on passenger ships by improving health and hygiene operations. Yet, as the project was launched on the 1st of September 2022, there are no scientific and peer-reviewed articles or guidelines published. (Healthy Sailing, 2022).

Authors of this project thesis have decided to gather the information about infection prevention on cruise ships as well from The Center for Disease Control and Prevention (*CDC*, later in the text). Although CDC is a governmental institution based in the United States of America, the CDC is conducting medical based research and provides different kind of information that is being used not only in the United States of America, but as well worldwide. (CDC, 2022). CDC has widely assembled guidelines for safe traveling in The Yellow Book. However, these guidelines cover all forms of traveling, including air and water traveling, environmental risks and information for preparing to travel. The authors of this thesis project have only focused on the section 5: *Travel-Associated Infections and Diseases*, of the CDC guidelines for safe traveling as it is relevant information for the project. The CDC Yellow Book has instructions for travellers who become ill before and during voyage, and as well how to carry out the screening (a checklist) of the infected passengers for the crew. Yet, the most mentioned guidelines for infection prevention is vaccination, the right coughing etiquette, social distancing, isolation of the ill and disinfection of the confined places. (CDC, 2023).

Additionally, to the different agencies and their published guidelines, to understand how the new guidelines are being implemented and what is being offered by the scientists in the topic of infection prevention, some of the scientific and peer- reviewed articles were analysed. In "*Transmission of SARS-CoV-2 Associated with Cruise Ship Travel: A Systematic Review*" written by Rosca et al. and published in the *Tropical Medicine and Infectious Disease* journal on the 22nd of October, 2022, it is being discussed how after conducting a systematic

review the researchers have spotted a correlation between the spread rate of an infectious disease and shared rooms in the cruise ships. In an article "*What the Diamond Princess taught the world about Covid-19*" written by Baraniuk Chris and published in the British Medical Journal (BMJ) in the year 2020 it is being written how diseases which can be transmitted in aerosol are spread more easily in confined spaces such as cruise ships and what could be done to minimize the possible spread. Additionally, in the article "*COVID-19 outbreak on the Diamond Princess Cruise Ship in February 2020*" written by Tokuda et al, in the year of 2020 and published in the Journal of General and Family Medicine, the importance of safety precautions such as protective clothing and the early isolation of the ill is being discussed. As well, in the article is being mentioned the need simulations of similar events in the future, so the crew would be prepared to react efficiently as soon as possible to prevent massive outbreaks of infectious diseases. Another relevant article to the topic is "*Cruise Ship Travel in the Era of Coronavirus Disease 2019 (COVID-19): A Summary of Outbreaks and a Model of Public Health Interventions*" written by Guagliardo et al. and published in the journal of Clinical Infectious Diseases on February of the year 2022 it is being offered to minimize the number of passengers on cruise ships and to test them regularly to avoid any outbreaks of diseases that are transmitted the form of aerosol.

Summarizing the currently released scientific articles and international guidelines, the precautions that are needed to prevent outbreaks of infectious diseases on such confined place as cruise ship are good hygiene of the passengers, minimization of the passengers on board, proper disinfection of both, rooms and common spaces. As well, the crew working on board should take good care of the air ventilating systems and be able to provide the passengers with hand disinfection, masks if needed, isolation and testing rooms for the ones feeling unwell. Although, vaccinations play an important role in preventing the outbreaks of different diseases, the working crew is not asked anymore to check the vaccination passports of the passengers.

2.5 Digital booklet

The key concept “digital booklet” consists of two terms: digital and booklet. The word “digital” in the online dictionary of Cambridge is explained as something that is showing information in the form of an electronic, computerized image (Cambridge Dictionary, n.d.). The word “booklet” according to the online dictionary of Cambridge, is described as a small book with a small number of pages which’s purpose is to give information about a particular topic (Cambridge Dictionary, n.d.).

There are many internet sites which are offering tips on how to booklet, but there are a couple of points that stand out in every single article about the booklet making. A good and high- quality booklet has to have a clear target and well- defined purpose, the provided information has to be written understandably, in short sentences or/and paragraphs. Additionally, visual information, such as pictures can be added. (Publuu, 2023.)

Authors agreed upon creating the digital booklet for this project thesis to be made with Microsoft Sway. This application was sufficient for creating this product as it was easily accessible and shareable with others as well as creating and modifying the content to the liking of the authors.

3 THE PURPOSE AND OBJECTIVES OF THE PROJECT

The purpose of this project thesis was to create an evidence- based and up-to-date informational digital booklet about infection prevention for the crew of cruise ships. This digital booklet is available to use in by the cruise ship lines operating in Finland and will serve the purpose of guiding the staff on how to prevent the outbreaks of infectious diseases in confined spaces, in this case, cruise ships.

The main objective of this project thesis was to increase the cruise ship crew's knowledge about infection prevention in cruise ships. Increasing the staff's knowledge in this specific area may potentially help to prevent the outbreaks of infectious diseases at the cruise ships or at least the working members of the crew will be better prepared in the future for possible virus outbreaks.

4 IMPLEMENTATION OF THE PROJECT

4.1 Project methodology

Methodology used in this project thesis was the hybrid method, combining two methodologies together- waterfall and agile. The waterfall method follows a linear path in its approach to the project, it means each phase of the project was completed thoroughly before moving onto the next phase- methodology is well structured and closely follows timetables. (Hoory & Bottorff, 2022.) Opposing the waterfall method, the agile methodology has a more flexible approach. The authors were able to move between phases quicker as the agile method is more iterative and adaptive form of methodology. The agile methodology allows writers more freedom because it does not strictly focus on stages or requirements. (Davis, 2022.)

As the authors of the project thesis have created a timetable with specific deadlines for each stage of the project, but were not sure if it will be followed thoroughly due to different external and internal factors, such as personal schedules, work, studies and motivation, so hybrid methodology, a combination of waterfall and agile methodologies, was the most suitable with very flexible and supportive structure for the work. The decision for the hybrid methodology approach for this project was quick and authors were able to agree on the matter right away without conflict.

4.2 Literature retrieval and theoretical background

Literature retrieval for the theoretical background for this project thesis was mostly done from reliable databases such as PubMed and Google Scholar. Articles that were found in Google Scholar were not used, as the articles provided by the search were not reliable or not suitable for the topic, leaving the authors of the thesis to rely mostly on the results found on PubMed. Search words such as “Cruise ships AND infection prevention”, “Diamond Princess AND infection AND crew”, “Cruise ships AND infection AND crew”, “COVID-19 outbreaks in cruise ships” were used to conduct the literature retrieval. Keywords such as “Diamond Princess” and “COVID-19” provided valuable information about infection prevention and infection outbreak control in the cruise ships, as the recent COVID-19 pandemic made the world to look back at guidelines of infection prevention and how the outbreaks of infections are being handled. Key word “Diamond Princess” was used because this exact cruise ship was one of the most covered by the news and one of the most researched cruise ships during the COVID-19 pandemic, as being one of the first liners in which the quarantine had to be issued due to the amount of the COVID-19 cases on board. (Dahl, 2020). The inclusion and exclusion of the scientific articles is provided in the Table 1.

Table 1. Inclusion and exclusion criteria for scientific articles

INCLUSION CRITERIA	EXCLUSION CRITERIA
Articles in English and Finnish	Articles in any other language
Articles no older than 5 years	Articles older than 5 years
Free of charge content	Paid content
Guidelines about infection prevention in cruise ships	Guidelines about infection prevention in any other place than cruise ships
Peer reviewed articles	Not reviewed articles

Together with the scientific articles, various guidelines about infection prevention from different local and international institutions were used. Local, meaning guidelines written by Finnish institutions and meant for Finland, were by

THL, Suomen Punainen Risti and Duodecim. International guidelines used to create the digital booklet about infection prevention on cruise ships were made by WHO, CDC, the International Maritime Organization and as well guidelines provided by the European Centre for Disease Prevention and Control.

Additionally, for stronger theoretical background, the author of thesis had gathered the information not only about the cruise ship companies operating in Finland and their vessels, but as well the statistics provided by the ports of Helsinki and Turku. This specific information was collected from the public information on the websites of Helsinki's and Turku's ports and helped the authors to understand better why proper infection prevention and control is important and needed.

4.3 The description of the target group

The target group of the project was the working crew of cruise ships which are currently operating in Finland. At this moment, there are four cruise companies which are offering cruises from and to Finland- Eckerö line, Finnlines, Tallink & Silja line, Viking line. Each of one these companies have their own routes and schedules, for example, Eckerö line is offering cruises only from Helsinki to Tallinn and from Tallinn to Helsinki (Website of Eckeröline, n.d.). Meanwhile Viking line has a wider selection of destinations- from Helsinki to Stockholm and back, Helsinki to Tallinn and back, from Turku to Stockholm and back. (Website of Viking line, n.d.)

The cruise liners are offering a day or weekend vacations to different destinations for people every single week no matter the season. Main difference between the liners themselves and the trips, is that the liners, who are offering trips to Stockholm have rooms to stay and sleep in, due to the length of travel. Other than that, the cruises are rather similar- they have different kinds of restaurants and various forms of entertainment including concerts and shopping, conveniently customers are free to look on the cruise line organizers websites

for all activities on board each vessel. (Viking line, n.d.)

4.4 Resources

Project resources can be described as factors, which are needed and help to reach the goals of the project and to successfully finish the project itself. These factors usually include human resources, materials, knowledge, time and capita (Eubanks, 2017.) For this project thesis the main resources were people, time, and knowledge. By people as resources, it means the students who were writing and preparing the project, which were two, graduating nursing students.

Time resources have been measured during the whole process of this project thesis, by how much time is needed to finish each stage of the plan and by how much time is it needed to prepare and finish the final product- a digital booklet with a shareable link about infection prevention in cruise ships. The estimated time to finish the whole project, was the autumn semester of 2023 and the authors of the project have succeeded to do so. The stakeholders were provided with the final product in the middle of October of 2023, meaning that the students needed around 13 months to prepare the thesis plan, gather the theoretical knowledge, write the final report and create the product.

Knowledge resources were measured by the amount of needed theoretical basis to create a digital, evidence- based booklet about infection prevention for the crew members of the cruise ships. The knowledge that was collected consisted of peer- reviewed articles and research papers about current guidelines of infection prevention, information about the current guidelines which are implemented in cruise ships nowadays and basic evidence- based information about the spread of the diseases, especially in confined places such as cruise ships.

For this project thesis there was no financial support being used to carry out this project and the product. The graphic designs and the digital booklet have

been done with the resources (applications) which were free of charge and the knowledge was possessed by the authors or collected from the costless sources and databases.

4.5 The formulation of the digital booklet

For this thesis project, the authors of the thesis have gathered knowledge from various, evidence- based sources about infection prevention on cruise ships and have created a digital booklet with the newest information about infection prevention on cruise ships.

To create a digital booklet about infection prevention on cruise ships, Microsoft Sway application was used. Authors looked at other possibilities for making the product but in the end found Microsoft Sway to be the key to a desired outcome of a successful product The decision and agreement on using this application for the project was quick and mutual between both authors. After first look and familiarizing with the Microsoft Sway it was evidently most beneficial for authors to use. This was due to the easy access and simple useability and navigation of the website/application. The formulation of the product was quick and simple. First authors created a simple draft based on the vision of the finished product. Then the finished product was built around the first draft. This whole period took around four weeks to complete, and authors complimented each other ideas and visions well. Needless to say, the information provided in the digital booklet was based on the previously gathered theoretical knowledge.

Pictures for the product were found online, by using Google and Bing search engines, yet all the used materials, had creative common licenses and were free of charge. Imagines were used in association for each topic on the finished product for a more pleasant reading experience. Authors first contemplated on using self-made pictures for the product but deemed it impossible due to

conflict in timetables and resources, so it was decided to use pictures with common creative licenses or pictures that were free for public use.

During the last stage of digital booklet formulation, the authors of the thesis have decided to translate the product from English language to Finnish and have the product in two different languages. The reason behind that was that the product is meant for the Finnish speaking crews of cruise ships, and as well could be used by both Finnish and English-speaking students in nursing and sea captain studies. The translation from English to Finnish was done by one of the authors, who is a native Finnish speaker.

As the digital booklet has been created with the Microsoft Sway application, the booklet has the possibility of being shared online between the users as an online link, but as well it can be downloaded and saved to the computer, phone or tablet as a PDF file. The links of both, Finnish and English, products have been provided to the stakeholders after the products have been finalized (Appendix 1). The digital booklets as well have been moved to a newly created Microsoft Outlook account, solely dedicated to keep the products available even when the authors graduate from the university. The newly created account has no expiration date and makes the products available at any time. The products can be viewed by anyone who has the digital link to them.

4.6 The stages of the project, timetable and finances

4.6.1 Stages of the project and the timetable

There are 5 stages of project management- initiating, planning, executing, monitoring and closing. Each stage of the project has its own tasks and goals what must be accomplished during each of them. In initiating stage, the project is being started, in the planning stage the first project tasks are being done, in the executing stage the main tasks of the project are completed, in the monitoring stage the project is being progress is being supervised and feedback is

given and in the last, closing stage the project is being finished and the product presented. (Note, 2016.)

On the start of the thesis project preliminary deadlines and dates for each stage have been set. The preliminary deadlines and what has to be done in exact stage are more broadly discussed in the project table (Table 2).

Table 2. Project timetable

Initiating stage, August- November, 2022	• Meeting with the thesis partner • Choosing the topic of the project thesis • Thesis preparation assignments • Deciding on the preliminary timetable of the project thesis
Planning stage, December- February, 2023	• Writing the project thesis plan • Presentation of the thesis plan • Acceptance of the thesis plan • Signing the agreement with SAMK for the completion of the project
Executing stage, March- August, 2023	• Literature retrieval • Writing the theoretical part of the project thesis • Creating the digital booklet about infection prevention in cruise ships
Monitoring stage, September-October, 2023	• Submitting our end product and getting feedback
Closing stage, October- November, 2023	• Presenting the thesis, evaluation

Yet, during the process of writing the thesis project it was hard to meet the set deadlines due to the different external and internal factors, such as different personal schedules, work and school placements, fluctuations in motivation and a delay of the feedback from the stakeholders. Nevertheless, the thesis project, the report and the digital booklet, has been finished successfully and without any bigger delays.

4.6.2 Finances

Once starting a project, project managers define not only the project tasks but as well the financial plan. Financial plan and budgeting determine the overall budget and possible costs of resources that might be spent in regard to achieve the goals of the project. One of the main reasons why financial plan is crucial while working on the project, is to avoid unneeded overspending. As well in the financial plan the possible monetary profits and losses can be discussed. (Note, 2016.)

For this project thesis a financial plan was made, yet, at the start of the project thesis it was decided, that if finances will be needed to cover project's possible expenses, the expenses should not be big and will be covered by the personal finances of the project's authors. However, the application called "Microsoft Sway" which was used to make the digital booklet was free of charge and the scientific articles and guidelines which were used for the theoretical background of the project were free of charge as well. So, at the end the there were no costs, and the finances to finish this thesis project were not needed.

5 EVALUATION

5.1 Assessment of the thesis report

To carry out a successful assessment of a project, the goal has to be divided into smaller objectives. Once the smaller objectives are being reached it is easier to measure what additional steps need to be taken to reach the end goal (Note, 2016).

After the completion of this thesis the authors have conducted a self-evaluation. Both authors are happy with the outcome- an evidence-based and up to date thesis report on which the products, digital booklets in English and Finnish

languages about infection prevention on cruise ships, were based. Although the authors agree that the overall writing process took more time than it was expected, due to the delays of deadlines, which were caused by such external factors as busy personal schedules, work and clinical placements, the result was worthwhile. Additionally, the authors have learnt a lot not only about infection prevention in confined spaces such as cruise ships, but as well about time and project management. The writing of this project thesis was a great academical experience.

Yet the assessment of this project thesis was carried out not only by the thesis authors themselves by monitoring the process of writing, was the process smooth and if the deadlines were met, but as well by getting feedback and numeral grading 0-5 from the teachers and stakeholders.

The target group for this project thesis is the crew working on the cruise ships which are operating in Finland and the main stakeholder of this project thesis is the Maritime Logistic Research Center (SAMK), which is located in the city of Rauma and will be providing the feedback. The feedback was provided via email, by one of the project managers working in the Maritime Logistics Research Center, and it was positive. Both, the products and the report, were called as excellent and no corrections of the products were ordered.

5.2 Risks

A risk in project management is described as a factor or an event that might affect the project in a negative way and cause issues while trying to achieve the goals. The risks can be of different nature- they can be financial, such as overspending; human resource based as in lacking working force or simply time based as in having issues with time management. Risks vary from project to project, and they must be assessed at the beginning of the project by doing a risk assessment to predict the possible issues that may arise in the future.

One of the ways to assess the risks is a SWOT (Strength, Weakness, Opportunity, Threat) analysis which allows to determine and review the internal and external factors that may affect the progress of the project. (Note, 2016.)

To assess the possible risks that may arise during the project, the project authors have chosen SWOT analysis (Table 3). In the table the authors have evaluated not only what external and internal risk they might face during the project, but as well what opportunities might arise.

Table 3. SWOT analysis of this project thesis

STRENGTHS	**WEAKNESSES**
• Both authors of the thesis are interested in the topic • Both authors have studied about infection prevention during the nursing studies	• Limited amount of scientific research
OPPORTUNITIES	**THREATS**
• The final product (a digital booklet) may be used by the crew of the cruise ships • A digital booklet may be used by the SAMK nursing students to deepen their knowledge about infection prevention in confined spaces	• Poor time management • Change of motivation • Busy personal time schedules

In this project thesis risks were mostly time and knowledge based. The greatest risk which caused complications was the lack of physical time due to the external influences, such as studies, clinical placements and work of the authors, so during the project authors of the thesis had to extend the set deadlines and reassess the on-going schedule. Another risk that emerged was the lack of knowledge about infection prevention on cruise ships. The topic that

has been chosen is considerably new in the research world, meaning that there are not a lot of research done about this specific topic or the research papers are not relevant- many research papers were focused on the biggest Caribbean cruises or cruises operating in the hot-climate areas, while the authors have tried to gather the information about short-haul cruises and rely as much as possible on the European and Finnish companies and guidelines. Nevertheless, the authors have gathered some information from the research done about international cruise ships. Additionally, guidelines provided by WHO, the International Maritime Organization (IMO) and Center for Disease Control and Prevention (CDC). At the end, the thesis project has been finished successfully.

5.3 Ethical viewpoints of the project

By completing this project thesis about infection prevention in cruise ships, as future nursing professionals, the goal was to contribute to the communities and the public health policies by collaborating and using the knowledge of previously done research, for the benefit of global health. As well by incorporating the knowledge from previously done research, aim is to further develop, and contribute to public health policies. (International Council of Nurses (ICN), 2021.)

By writing the theoretical part of the thesis project, the authors have ensured the usage of the guidelines provided by Satakunta University of Applied Sciences (SAMK) and TENK (Finnish Advisory Board on Research Integrity). The SAMK thesis guidelines state that any information the clients find confidential shall be kept private and not included in the thesis report. The authors have reviewed the text and collected data of the research have ensured all parts of our project thesis follow these guidelines. Authors made sure not to use any data that could be considered confidential and require secrecy. (Website of SAMK, 2022.)

The citing and referring of any used materials were done by using the SAMK thesis guidelines. All the cited and referred substance matter were related to the thesis topic and were used only to justify the statements and findings of the thesis authors. (SAMK, 2022.) From the ethical point of view of the thesis project, the intention was to pay close attention to the sources we used. All sources have been gathered from reliable and academic databases, articles, and data used, which need to be peer-reviewed and before use, also reviewed by authors for acceptance. In the cases of authors of the thesis using methods or materials that are initially by other authors, appropriate use of these sources were ensured, and correct guidelines were used following the Copyright Act. (TENK, 2017.)

5.4 Discussion/ reflection

Infection prevention has always been a broad and an important topic in the medical world due to the reappearance of infectious diseases and the weight that the diseases put not only the medical communities, but as well on the economies and different social environments. Yet, the recent COVID-19 pandemic has changed the approach to the way infections are being handled and the way the outbreaks are approached. As the Covid-19 pandemic was affecting a significant period of time during the nursing studies of the authors, making this product and report was a valuable opportunity for the authors to learn more on the importance and deepen their knowledge of how infections can easily spread and how easily a pandemic can occur.

The authors of this project thesis, final year nursing students, have learnt a lot and deepened their theoretical knowledge not only about infectious diseases themselves, but as well about their prevention. The analysis of different scientific articles and guidelines helped the authors to understand that successful infection prevention or control is a combination of external and internal factors and as well depends a lot on the preparedness.

Nevertheless, during the writing process, the authors of the thesis were not only learning about the nursing aspects, but as well about the planning and execution of a project- the importance of the task scheduling, communication, and time management. After combining and implementing the aspects of the project management, the authors of the thesis have successfully finished writing the thesis report, which is a theoretical base for the final product- a digital, evidence-based booklet about infection prevention on cruise ships.

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APPENDIX 1: LINKS TO THE ENGLISH AND FINNISH DIGITAL BOOKLETS

Link to the English digital booklet about infection prevention on cruise ships:
https://sway.office.com/bqlPKcFSOSy932YI?ref=Link

Link to the Finnish version of the digital booklet about infection prevention on cruise ships:
https://sway.office.com/FGWCKaFLtQajAbEH?ref=Link