

Guidance

Prevention and Management of COVID-19 Outbreaks on Merchant Ships – 1st Update

Technical, organizational, and personal protective measures to prevent infection with SARS-CoV-2 and for dealing with suspected cases on merchant ships¹.

Core Messages

- This guidance is intended to provide crews and, in particular, the ship's command on non-state ships serving the commercial transportation of goods with options, with the aid of which they can react to the challenges the COVID-19 pandemic poses. Options that enable them to flexibly and responsibly address the specific features relating to the type of ship, size of the crew, shipping route and clearance in port.
- A particular focus of activity is on organizational measures to protect occupational safety and health; here it is especially important to limit external contacts with people who are not from the ship to the level necessary during stays in port.
- On board, general measures to prevent SARS-CoV2 infections must be observed during work hours and leisure time (physical distancing, hygiene, masks covering nose and mouth, and ventilation).
- Great importance must be attached to the control of ventilation systems because SARS-CoV-2 is often transmitted in closed rooms.
- High-quality rapid diagnostic tests (Ag-RDTs) can make a considerable contribution to detecting and containing infection if they are held available on board. They can provide an intelligent supplement to testing strategies ashore and generally improve dealing with suspected infection in persons with symptoms, close contacts and other crew members.
- Crew members suspected of being infected with SARS-CoV-2 should immediately and consistently remain in quarantine, e. g. in their cabins. They should be tested using an Ag-

¹ Here the term „merchant ship“ refers to all non-state commercial ships serving the commercial transportation of goods.

RDT and retested by a laboratory with an RT-PCR (gold standard) in the next port of call, irrespective of the initial test results, and, if necessary, disembark.

- Persons with close contact to the infected person (contact persons in the “high risk exposure” category) should, if possible, immediately be put into quarantine by the ship’s command and also tested.
- Regarding the technical, organizational and personal protective measures, the shipping companies are also called upon to take the respective guidelines of their flag state into consideration and to observe the international framework conditions for maritime shipping.
- If there reason to suspect a contagious disease (particularly SARS-CoV-2) or in the case of a death on board, the health authority or the port health service in the nearest port must be informed immediately in accordance with Article 28 of the International Health Regulations (IHR) [1]. For ships on international voyage, the Medical Declaration of Health must be filled in and sent to the competent authority according to the local requirements at the port of call.

Version 02, published on 2021-02-22,

Literature search as of 2021-01-15

Background

While work activities in numerous workplaces on land are currently being shifted to the work-from-home environment or work processes are temporarily paused, ship’s crews on merchant ships are also on duty in times of pandemics as freight transportation and the worldwide provision of goods has to be secured. Especially during stays in port, seafarers can come into contact with persons potentially infected with SARS-CoV-2. The topic of protective measures to prevent infection is also particularly important in shipping because on board seafarers live together in a limited space over a long period of time and can hardly observe social distancing rules when carrying out certain tasks. Furthermore, treatment options in the case of a severe course of the infection are limited at sea and in potential countries of destination.

The course of SARS-CoV-2 infection is often accompanied by few symptoms or asymptomatic (during an outbreak on board the cruise ship Diamond Princess in spring 2020, 44.8% of the crew members who tested positive and 57.7% of the passengers who did were asymptomatic [2]). Moreover, a well described example of an outbreak on a container ship in February/March 2020 shows that more than 14 days can pass (the isolation period at home currently recommended in Germany (quarantine) [3] before signs of infection are perceived in a crew (day 22 after boarding) or the infection can be confirmed (day 27 after boarding) [4]. A testing method that detects the virus's genetic material or a virus-specific antigen is effective for confirming a tentative diagnosis. A laboratory verification of an SARS-CoV-2 infection through a RT-PCR (reverse transcription polymerase chain reaction) after a correctly performed oro-nasopharyngeal swab is the gold standard for diagnosis [5]. However, this examination cannot be carried out on the high seas and only shows a momentary state, i. e. the test result may either not yet be positive or already be negative even in the case of an infection. What is more, the quality of sampling and testing, and hence diagnosis, varies considerably in international ports [6, 7].

Purpose and Amendment from Version 1 of the Guidance

Against this backdrop, the present guidance combines recommendations for shipowners and those employed in the maritime domain and includes technical, organizational, and personal protective measures for preventing COVID-19 outbreaks on merchant ships. Since autumn 2020, antigen rapid tests (Ag-RDTs), which can also be used by medical laypersons, have become increasingly important, particularly in not easily accessible settings. They aid the quicker identification of infectious cases [5, 8]. This facilitates the management of outbreaks and saves time in the identification of contact persons categorized after the first publication [9]. Laboratory tests and antibody rapid diagnostic tests (Ab-RDTs) that detect the body's own immune response still do not play a significant role in the detection of acute COVID-19 infections or the identification of contact persons [8, 10, 11]. Furthermore, the improved understanding of typical infection scenarios on land calls for importance to be attached to also ventilating those areas on the ship, whenever possible, in which several people come together in a confined space; ventilation has now been added to the practices that have been recommended since the start of the pandemic (distancing, hygiene, community masks). New occupational safety and health rules also enable the extension of the recommendations for dealing

with unavoidable contacts to external persons, i. e. persons who are not from the ship [12]. Crew members should be informed in detail by the shipping companies about typical symptoms of a COVID-19 infection, the possibility of having no symptoms despite being infected, and the clarification and protective measures that need to be taken to interrupt the chain of infection [13].

Methods

The highly dynamic spread of SARS-CoV-2 makes it necessary to pay particular attention to specific guidelines, which, given the topicality, must also be continuously reviewed for the maritime context. Current information on questions about and on dealing with the coronavirus are available on the websites of the WHO (World Health Organization), RKI (Robert Koch Institute), and the ECDC (European Centre for Disease Prevention and Control) and formed the basis for this Guidance. To date there is little established scientific evidence regarding protective measures on board merchant ships; therefore many of the available experts' recommendations [13, 14] are based on the current versions of the information provided by the institutions mentioned above and that of the EU Healthy GateWays research group and the SARS-CoV-2 Occupational Safety and Health Standard (SARS-CoV-2-Arbeitsschutzstandard) or the SARS-CoV-2 Occupational Safety and Health Rule (SARS-CoV-2-Arbeitsschutzregel) published by the German Federal Ministry of Labour and Social Affairs.

Approach

The following occupational health and safety measures were developed to protect the health of the persons on board, contain the infection in the population and on board, and sustain economic activity. They should be integrated into the safety plan on board whenever possible. For this purpose, personal safety measures, followed by detailed information on the possibilities provided by newly developed medical devices (rapid tests), were included in the Guidance in addition to technical and organizational protective measures[15].

Implementation

1. Technical Protective Measures

a. Air-handling Systems:

Living quarters on merchant ships are ventilated and, possibly, air-conditioned through air-handling systems. These systems should be operated on board exclusively with outdoor air and not with recirculated air. Air filters should be changed by trained personnel. The risk of transmission via these systems must generally be assessed as low [16]. Particularly in rooms in which infected persons are treated or isolated (e.g. in the ship's hospital on merchant ships), it is advised not to switch off the air-handling system as this can lead to an increase in aerosol concentration in the ambient air and thus to a higher risk of infection [16, 17].

Where technically feasible, there should be negative pressure in rooms with isolated infected persons, with an air exchange rate of 12 times the room volume per hour [18, 19]. As far as possible and following professional technical advice, in closed rooms accommodating patients HEPA-Filters (high efficiency particulate air filters) can be fitted over air ducts or portable HEPA filter systems set up as close as possible to the spot where the patient is staying [19]. In rooms with natural ventilation, a ventilation level of 160 liters per second should be ensured [18].

b. Transparent Partitions

Where, for operational reasons, it is not possible to observe the rule for distancing between workplaces and carrying out specific tasks requires that staff do not only have short periods of contact with one another at these workplaces, the installation of partitions should be examined as a technical measure. Such partitions must not lead to additional hazards. Partitions made of a transparent material are preferable to ensure the required intervisibility and adequate lighting conditions. For seated workplaces, the upper edge of the partition must end at least 1.5m above floor level; for standing workplaces and for seated workplaces with contact to persons standing, this edge must end at least 2m above floor level [12]. The installation of these partitions must generally be considered, but particularly for inside spaces in which an exchange takes place with external persons. If the installation of such partitions is not possible, work should, as far as possible, be carried out in such a way that persons do not face each other [13].

c. Effective Disinfectants against SARS-CoV-19

Regular contacts between crew members and external visitors make it necessary to wash hands regularly with water and soap. An alternative (which is not in any way more effective than hand washing) is the provision of hand disinfectants [20] with a proven efficacy in the „limited virucidal effect“ efficacy range as a minimum standard. Agents with a higher range of efficacy against viruses, e.g. “limited virucidal effect PLUS” or “virucidal”, can also be used [21]. Hand wash stations or disinfectant dispensers should be set up at central points (on the bridge, in the machinery control room, outside the mess rooms, in working areas with team constellations, and at the gangway).

Case-specific (workplace of external persons) and regular cleaning of surfaces seems sensible, especially of commonly used surfaces (hand rails, door handles, map table, cockpit fittings), in the ship’s galley, and sanitary facilities [20]. Frequency of cleaning and responsibility should be documented through cleaning and hygiene plans. The routine surface disinfection of all areas on board, including surfaces with frequent contact, is, however, not recommended in the current COVID pandemic. Here appropriate cleaning is the method of choice.

For the disinfection of areas on board used for medical purposes (e.g. in the ship’s hospital), a list of effective virucides against different coronaviruses can be found in the following guidelines of the ECDC (European Centre for Disease Prevention and Control) <https://www.ecdc.europa.eu/en/publications-data/interim-guidance-environmental-cleaning-non-healthcare-facilities-exposed-2019> [22]. Further current recommendations and information on tested and approved disinfectants and disinfection methods (e.g. the extension of the approval of 70% propanol in the pandemic) are made available by the RKI at https://www.rki.de/DE/Content/Infekt/Krankenhaushygiene/Desinfektionsmittel/Desinfektionsmittelliste/Desinfektionsmittelliste_node.html [23]. For voyages to the USA, disinfectants against SARS-CoV-2 approved in accordance with the United States Environmental Protection Agency (EPA) apply, which can be found at <https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2> [24]. Disinfectants used on board should always be used according to the instructions for use and must meet the standards of the respective flag state.

2. Organizational Protective Measures

On board merchant ships, the implementation of organizational protective measures to prevent infection and interrupt the chain of infection is of great importance. Both crew members and external personnel are possible sources of infection. Especially the transmission through external persons depends on the shipping route, the frequency of clearance in port, and size of the crew. On smaller ships, certain work processes (e. g. lashing of containers on board) are carried out by crew members and on large ships by land-based personnel, who can be a source of infection on board.

a. Protection concept and hygiene record-keeper

During the pandemic, a protection concept should be defined for every ship, the implementation of the necessary technical protective measures documented, and, where applicable, a hygiene record-keeper designated to record contacts with external persons.

b. Working time and break arrangements

On ships, the use of common workplaces or rooms, e. g. the mess, fitness room, common shower rooms or changing rooms, should be planned in a way that reduces contacts between persons (e. g. through schedules, staggered time slots). Where possible, always the same crew members should be organized in common cohorts. At the start and at the end of a shift, care should be taken to ensure that there is no close contact among several persons on board [17]. Handovers should, wherever possible, take place in the open, in writing or by telephone.

Within the scope of a workplace analysis on board, hazardous areas should be identified and possibilities of observing general measures to protect against infection specifically examined with regard to occupation and location.

c. Maintaining sufficient protective distance

Frequently used routes (e. g. stairs) should be used in such a way that sufficient distance can be maintained. Therefore, elevators should not be used to transport several persons at once as they do not allow for the minimum distance of 1.5 meters [25]. In places in which several persons could come together (e. g. at the gangway), protective distances should be marked in standing areas, e. g. with adhesive tape. The minimum distance of 1.5m is also to be observed when several crew members are working together, e. g. during docking maneuvers, and during leisure time. If this is not possible, at least a community mask, a double-layer cotton mask or, preferably, a mask with a higher protective level (FFP2 mask) is to be worn [12, 17, 26]. Also see Section 1.b. “Partitions made of transparent material”.

Meals should be handed out to different groups at different times so that crew members are able to spread in the messes and maintain the required distances. Meetings should take place in the outside areas of the ship. Unavoidable collective use of inside rooms (e. g. office, recreational room) should take place solely under conscientious compliance with the protective rules. Loud singing and speaking must be avoided [27, 28]. It is sensible to close common rooms that are not absolutely necessary (e. g. recreational room) as soon as a suspected case is detected on board.

d. Crew changes

Crew changes have become more difficult since the start of the pandemic. Generally, however, it is possible for seafarers from third countries to enter Germany for the purpose of joining ship if a direct transit from the airport to the ship can be ensured. According to the requirement of the International Maritime Organization (IMO), seafarers, marine personnel, and fishermen should generally be enabled to join or leave ship in ports and to transit through national territories, e. g. to reach the nearest airport for crew changes or repatriation purposes [29]. It is important that shipping agents or other responsible persons discuss the entry in advance with the competent federal police (at the airport) and the person involved explains during the border check that they intend to transit directly to the ship. Federal police outside Hamburg could contact the Federal Police Headquarters Küste in Bad Bramstedt to confirm whether the ship is really calling at the port [30].

There must be no suspected cases of a COVID-19 infection among new crew members joining the ship. To ensure this, self-quarantining in the home country, precautions during the journey and on arrival, information provided by the person before boarding [13] and – if sufficient capacity is available – examination by trusted medical doctors who have experience in this area, e. g. from the port authorities, public health departments, or other competent disciplines, can serve as a further means of risk minimization [31]. If sufficient capacity is not available, rapid tests for virus antigen should be applied (also see Section 2.g.). If terms of contracts are unexpectedly extended, the shipping company should routinely offer to procure and deliver any needed long-term medication for the seafarers holding out on board [14]. If this is done in a proactive way at an early stage and free of repression, one psychological stressor can be avoided. Also in the case of crew changes, handovers should, if possible, take place outdoors (one of the precautionary rules), in writing or by telephone or, while observing the precautionary rule of ventilating indoor areas, at the workplaces, which are to be equipped with transparent partitions.

e. Work equipment/tools

Tools and work equipment should only be used by one person. If this cannot be ensured, it makes sense to clean them regularly before handing them over. Otherwise, suitable protective gloves are to be worn when using tools as long as this does not lead to further hazards (e. g. gloves pulled in by rotating machinery parts) [17].

f. Access to the ship by external persons

Generally, there should be as little contact to external persons as possible and, if such contact is required, it should be outside while observing the precautionary measures. The protection concept should include a documentation of the contact data, contact persons on board, the hygiene rules applied, and the times at which the persons boarded or left the ship. A hygiene record-keeper can be assigned for this purpose. Should the circumstances make the common use of indoor rooms necessary, these rooms must be conscientiously ventilated with outside air through wide-open windows, doors etc., where possible. The volume of space, number of persons present, and the size and number of ventilation openings are influencing factors for ventilation requirements. Seating areas and workplaces defined as visitor areas simplify the

use of transparent partitions (also see Section 1.b.) and facilitate the required routine disinfection after visits. Markings can make it easier to observe minimum distancing. External persons must be informed about the protective measures against infection currently applicable on board [17].

In order to further reduce the contact to external persons and ensure the operability of shipping, a variety of measures were taken in the first few months of the pandemic, which were largely withdrawn as from July 1, 2020. They included the reduction of inspections of ships under foreign flags and various rules on certifications of ships. Currently, the German flag can only dispense with inspections on a case-by-case basis, for example, if no inspection is possible in a certain port due to COVID-19 protective measures [32]. Further relevant information for seafarers and shipping companies is available at <https://www.deutsche-flagge.de/de/coronavirus/accordionview/@@accordionprint> [33]. It includes a publication by the International Chamber of Shipping (ICS), which contains printable information in a poster format that addresses many seafarers on topics around COVID-19 [14].

g. Rapid tests for antigen components SARS-CoV-2

In order to interrupt chains of infection and improve disease management, an adequate quantity (depending on crew size) of the rapid tests that have become increasingly significant since autumn 2020 (Ag-RDT) should be kept available on board. Positive rapid tests can indicate an infection with SARS-Cov-2 within 10 to 45 minutes [5, 34].

Further possible advantages of the use of rapid tests on board are:

- Rapid tests respond particularly well during the latent and early infection stages as the viral load is then normally high; with that, they enable the early detection of an infection (1-3 days before symptoms appear and in the early symptomatic stage within the first 5-7 days of the disease [5, 35]).
- In the case of a positive result, time is saved (swab taken after docking maneuver, and performance and analysis of a PCR in the laboratory), making a prompt and adequate medical reaction and, if necessary, clinical care possible after arrival in port.
- Ag-RDTs performed before the ship enters the port (also for contact persons on board) facilitate and improve decision-making for all responsible parties in case management.
- Rapid tests can be performed prior to contact with pilots, port authorities and other external parties and therefore make the handling of ships safer.



- If a port does not offer rapid RT-PCR tests, which are more reliable than Ag-RDTs, ships equipped with rapid tests have a diagnostic alternative at their disposal.
- If there is no access to laboratory testing for the virus RNA with RT-PCR, rapid tests can also be used in the course of infections on board (e. g. change from a positive to negative result) [34].

Further possible applications are embedded in the strategies for action in the sub-sections.

The minimum requirements for the quality of tests must be taken into consideration when purchasing them: ($\geq 80\%$ sensitivity and $\geq 97\%$ specificity) [8], so that they can be used as a supplement in cases in which there is limited access to RT-PCR laboratory tests (the gold standard). For use on board, so-called point of care (PoC) rapid tests are suitable as they can be used without additional devices. The Paul-Ehrlich-Institute compared different rapid tests in an examination with identical sample material and published a table with the examined rapid tests that have adequate sensitivity [36]. Detailed information on these PoC tests and further rapid tests can be viewed in a database maintained by the Bundesinstitut für Arzneimittel und Medizinprodukte (BfArM) on its website: <https://antigentest.bfarm.de/ords/antigen/r/antigentests-auf-sars-cov-2/liste-der-antigentests?session=7906603974042>. The Federal Institute publishes manufacturers' data and does not carry out its own examinations. The Diagnostics Global Health website provides an overview of manufacturer-independent scientific examinations of rapid tests: <https://diagnosticsglobalhealth.org/> [37].

The probability that a test correctly detects an infection depends on further factors, such as the viral load at the time when the sample was taken, correct sample-taking, handling of the test kit in accordance with the manufacturer's instructions (transport, storage) and the prevalence of the infection in a cohort [5].

Hence, considering the mentioned influencing factors, a negative test result does not necessarily mean that a person is definitely not infected. It is strongly recommended that the competent port authorities for health-related issues or a telemedical maritime assistance service (TMAS), e. g. Medico in Cuxhaven, are consulted for the assessment of the results of **rapid tests and the planning of further action**. For this purpose, clinical information (symptoms in suspected cases, e. g. temperature, respiratory rate, blood pressure), information on possible sources of infection, and precise designation of the test kit used must also be held in

readiness. An infographic [38] and an interactive application of the Robert Koch Institute provide further support in the assessment of test results. Assistance for interpretation and action is available at: [RKI - Coronavirus SARS-CoV-2 - Corona-Schnelltest-Ergebnisse verstehen](#).

Manufacturers' instruction material (instructions for use, charts, training videos, courses) vary strongly. Sample material, swab techniques and preparation are tailored to the individual product. It is advisable to look at the manufacturers' materials ahead of acute situations, check that they are understandable for medical lay persons and, where necessary, make supplementary documentation from reliable sources (e. g.

https://www.awmf.org/fileadmin/user_upload/Leitlinien/053_D_Ges_fuer_Allgemeinmedizin_und_Familienmedizin/054-054st_S1_Neues_CORONA_Virus_2020-04.pdf,

<https://www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html>)

available on board, together with the rapid tests.

If samples are taken by another person, that person must wear personal protective equipment consisting of at least an FFP-2 mask together with a face shield that fits closely to the forehead and reaches below the chin or with closely fitting protective goggles. In addition, gloves and protective clothing, e. g. a protective gown that closes right down the front or a liquid-tight apron in accordance with TRBA 250, must be worn. Gloves must be changed after every tested person to avoid contamination from spreading. Furthermore, other protective clothing, particularly respirator masks, must be changed immediately when soiled or when moisture accumulates in them [39]. A variety of free-of-charge courses and diagrams funded by the WHO simplify the correct preparation, application and interpretation [40]., e. g. [How to do a SARS-CoV-2 antigen rapid diagnostic test \(who.int\)](#).

h. Definition and procedural instructions for suspect cases and close contacts

If a person on board fulfils the following criteria, they should immediately be isolated in their own cabin, a rapid test carried out, contacts identified and those with close contact (high risk exposure) put in quarantine [9]. In addition, the nearest port of call must be informed [18]:

Patients with acute respiratory symptoms of all severity levels, newly occurring loss of smell or taste, or death caused by illness are classified according to the definition of the Robert Koch Institute as of 2020-12-23 as possible cases [41]. The ECDC classifies those sick persons as probable cases who, in addition to one of the symptoms of coughing, fever, shortness of breath, sudden changes in or loss of senses of smell or taste, fulfill one of the following criteria:

- close contact with a confirmed or probable case of COVID-19 within 14 days before the symptoms occurred (link to the definition of close contacts: <https://www.ecdc.europa.eu/en/covid-19-contact-tracing-public-health-management>)
- living or working within a period of 14 days prior to the occurrence of symptoms in a facility in which infections with COVID-19 were confirmed, or
- evidence of radiological changes that are compatible with a COVID-19 infection [42].

Other, less specific, possible symptoms are headache, chills, pain in the limbs, fatigue, vomiting and/or diarrhea [42], as well as a runny nose and a scratchy throat [9].

Such a crew member should be isolated in a suitable ward, a cabin with a toilet only used by this person, or in a room used to control the infection, and possible disembarkation should be considered, even if a rapid test on board produces a negative result for SARS-CoV-2. RT-PCR testing ashore is to be sought to validate the results. Gloves, gowns, protective goggles (face shield where appropriate), and FFP2 respiratory masks must be worn by the group of persons allowed to enter this room, which should, if possible, be limited to 1-2 carers [18, 43, 44]. Their contacts with the suspect case and that person's state of health must be documented (medical logbook). Outside the isolation room, a decontamination zone must be designated, in which uncontaminated and potentially contaminated clothing and PPE can be changed. Guidance on the safe procedure for putting on and taking off protective equipment should be hung up at this point [45]. An example can be downloaded from the website of the WHO: https://www.who.int/docs/default-source/infection-prevention-and-control/ppe-en.pdf?sfvrsn=4b45270e_2



Means of communication with the isolated individual by telephone or chat should be set up and used. The health condition should be checked 2-3 times a day, either in person or by telephone. In suspected cases, TMAS, e. g. Funkärztlicher Beratungsdienst Cuxhaven, should be consulted, who can provide further information for treating the infected person [13].

When the responsible officer informs the competent authority about the suspected case, it should be evaluated whether the necessary capacities (e. g. for taking swabs on board, transport, isolation and care) are available in the port [18]. Even if the result of the rapid test was negative, the patient should still be immediately tested for COVID-19 with a RT-PCR test in the nearest port. During the influenza season, a supplementary test for the influenza virus is sensible [35].

The precautionary rules must be strictly observed on ships with suspected cases. The isolation of crew members with the afore-mentioned symptoms is, in some circumstances, not compatible with safety on board and can therefore not be entirely integrated into the internal measures of a ship at sea. Hence, especially close contacts (high risk exposure) must be identified, where possible, tested with a rapid test and go into quarantine (for 14 days following the last contact with a suspected case). In some cases, the classification of close contacts can be difficult as, besides factors such as distance (< 2 meters) and time (> 15 minutes, including cumulative face-to-face contacts), aspects that cannot be examined objectively (such as viral load of the suspected case at the time of the contact, room size/ventilation, volume level of speech) also play a role and a negative rapid test does not reliably rule out an infection. The International Chamber of Shipping at least classifies the following persons as suspected cases [14]:

- users of the same cabin,
- crew members that had their meals together or were together on watch duty in a machinery control room,
- crew members who travelled to the ship together,
- crew members who cleaned the cabin of a suspected case and
- the person providing medical care for the suspected case.



Reading the publications on the definition of “contact” provided by the European Center for Disease Control, the Telemedical Maritime Assistance Service (TMAS), and the competent port authority (links provided above) in advance can be helpful for deciding which contacts need to go into quarantine (possibly also secondary contacts) and whether the quarantine period can be shortened through testing at the right time. Here it is helpful if possible sources of infection of the suspected case (backward/retrospective cluster based contact tracing) and also secondary contacts can be established by asking questions. If sufficient rapid tests are available on board, the entire crew should be tested and testing repeated after seven days, or earlier if symptoms occur.

If an infected person and/or a person identified as a close contact has to leave the ship, all contact with other crew members or other persons must also be reduced to a minimum at this stage. The person must wear a medical FFP2 mask (without an exhalation valve in order to protect others), and staff members accompanying the person must wear appropriate personal protective equipment (PPE, e. g. FFP2 masks, also possible with exhalation valve) (also see Section 3). Afterwards, the cabin or quarantine accommodation must be cleaned by trained personnel. Laundry, kitchen utensils and garbage from the cabins of suspected cases and contacts [46] should be dealt with as infectious material [18].

Contacts of the suspected case who remain on board must follow the instructions of the health authorities until laboratory results are available. In the case of a positive test for SARS-CoV-2, contacts are determined by the competent health authority. Based on the instructions of the competent authority or the telemedical maritime assistance service, a decision is taken on whether the entire crew and possibly further persons should be put into quarantine. For this purpose, up-to-date information must be collected and transmitted, e. g. on which contacts have been qualified as low risk exposure [46] and whether these persons have developed symptoms (isolation requirement). Also in consultation with the authorities, a decision should be made on whether further rapid tests should be performed on board. Further points that should be ensured are:

- monitoring by the health authorities for at least 14 days from the last day of exposure,
- daily checks for possible symptoms of COVID-19,
- avoidance of social contacts, and

- reachability for monitoring [18] and, possibly, retesting.

i. Minimizing psychological strain

In shipping, particular challenges are currently arising through the travel restrictions as a result of COVID-19: Seafarers have to extend their service on board after several months as they can either not be replaced or not fly back to their home countries [29]. According to information provided by the International Maritime Organization (IMO), up to 500,000 international flights would have been needed for that purpose in August 2020. These basic conditions do not only have an impact on safety-relevant aspects on board, but especially also on seafarers' well-being. Additional information on psychosocial effects, which can also be applied to the context of a ship, can be taken from the fact sheet "Psychosoziale Folgen von Isolations- und Quarantänemaßnahmen: Womit müssen wir rechnen? Was können wir dagegen tun?" https://www.public-health-covid19.de/images/2020/Ergebnisse/Policy-Brief_Psychosoziale_Folgen_von_Isolation_30042020_final.pdf [47].

One possible secondary aspect of a long contractual term can be long-term medication that is running low, which shipping companies should therefore proactively offer to procure, without any repressions to be feared.

Furthermore, numerous other psychological stress factors on board, such as the limited possibility of planning ahead and further schedule requirements as well as those relating specifically to ports or sea voyages [48]. In addition, many people experience fears and anxieties in connection with the novel coronavirus, particularly if the voyage is prolonged considerably as crew changes do not take place and the duration of this extension is not foreseeable. The German Seafarers' Mission (Deutsche Seemannsmission e. V. (DSM)) offers a new service for persons on board. The DSM provides a chat platform under the <https://dsm.care> URL on which seafarers can direct their concerns to full-time staff at the Seafarers' Mission [49]. Moreover, crisis intervention teams are available free of charge. The International Seafarers' Welfare & Assistance Network (ISWAN) published a variety of offerings on a website intended to promote mental health during this pandemic: <https://www.seafarerswelfare.org/seafarer-health-information-programme/coronavirus-covid-19/managing-your-mental-health-during-the-covid-19-pandemic>. Furthermore, the IMO

has set up a Seafarer Crisis Action Team (SCAT), which cooperates with other maritime organizations to solve individual problems caused by the pandemic. Seafarers and their families can contact the team by email at info@imo.org.

2. Personal Protective Equipment (PPE)

Particularly strict attention must be paid to ensuring that all personal protective equipment (PPE) and work clothes (kept separate from everyday clothes) are only used by one person and are regularly cleaned [17]. FFP2 masks or, if there is a scarcity of these masks, at least community masks must be worn on board if no infections are known of and distances of 1.5m cannot be kept [26, 44]. By definition, the latter are neither medical devices nor PPE [12]. Rules for distancing must also be observed when putting on PPE.

According to national specifications, in addition to the existing stocks of medical equipment sufficient stocks of PPE should be kept available on board; this includes [17, 18, 50]:

- disposable gloves
- long-sleeved and impermeable protective clothing
- protective goggles or face protection (protective shields)
- community masks
- FFP2/FFP3 masks

The German Federal Institute for Occupational Safety and Health (BAuA) published an overview of further internationally used designations of masks, which makes it easier to check any stocks that may already be available on board for possible uses. In the case of infection, it is important to note that there are masks with and without exhalation valves. Masks without valves filter both the inhaled and the exhaled air and therefore provide protection for the wearer and for others. Masks with valves only filter the inhaled air and are therefore not suitable for protecting others [51]. A detailed recommendation published by the BAuA provides additional information on their use within and outside the public health setting [52]. When PPE is used by pilots and other groups in the maritime sector, the own protection and that of others as well as the respective occupational health requirements and other requirements must be taken into consideration.

a. Situations in which respiratory protection is necessary

If minimum distances cannot be observed with certainty (e. g. team work processes in the engine room or on the bridge), community masks should be provided and worn. Outside isolated rooms, infected persons or persons suspected of being infected should always wear FFP2 masks without exhalation valves. Disposable face masks should be changed after four hours at the latest [53].

b. Situations in which additional PPE is necessary

Furthermore, gloves, protective clothing, face shields and FFP2/FFP3 masks must be worn [17, 18]:

- when dealing with persons suspected of being infected;
- when performing rapid tests [54];
- when cleaning rooms that have been occupied by infected persons or persons suspected of being infected;
- when handling potentially infectious waste (this also includes used disposable PPE and filters from air-handling systems).

An overview of PPE that should be worn on board and in ports can be found here: https://www.healthygateways.eu/Portals/0/plcdocs/EUHG_PPE_Overview_24_04_2020_F.pdf?ver=2020-05-20-201841-010 [55]. Detailed information on the general use of masks is available at <https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-use-face-masks-community.pdf> [56].

In the event that there are shortages on board, recommendations by the Robert Koch Institute on the resource-saving use of masks in the public health sector also facilitate decision-making on their re-use: https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Ressourcen_schonen_Masken.pdf?__blob=publicationFile [57].

Conclusion and Recommendations

The COVID-19 pandemic is a public health emergency of international concern. Merchant shipping is centrally affected by it. The described technical, organizational, and personal protective measures and

recommendations can reduce the spread of the pandemic and the affects it has on ship operation and should be reviewed for their effectiveness in the course of time after their implementation. For this reason, the dynamic development and spread of SARS-CoV-2 requires a continual further development and adaptation of these measures.

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Authors

Dorothee Dengler¹, Thomas von Münster¹, Marcus Oldenburg¹, Ann-Christin Kordsmeyer¹, Lukas Belz¹, Natascha Mojtahedzadeh¹, Jan Heidrich¹, Elisabeth Hewelt², Martin Dirksen-Fischer², Matthias Boldt², Volker Harth¹

¹ Institute for Occupational and Maritime Medicine Hamburg (ZfAM), Hamburg, University Medical Center Hamburg-Eppendorf (UKE), Germany

² Hamburg Port Health Center, Institute for Hygiene and Environment, Hamburg

There are no conflicts of interest.

Contacts

Marcus Oldenburg (marcus.oldenburg@bgv.hamburg.de), Jan Heidrich (jan.heidrich@bgv.hamburg.de), Volker Harth (volker.harth@bgv.hamburg.de)

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Olaf von dem Knesebeck, Department of Medical Sociology University of Hamburg-Eppendorf, Germany

Nico Dragano, Department of Medical Sociology University of Düsseldorf, Germany

Eva-Maria Bitzer, Department of Public Health and Health Education, Freiburg University of Education, Freiburg, Germany



Please cite as: Dengler D, von Münster T, Oldenburg M, Kordsmeyer A-C, Belz L, Mojtahedzadeh N, Heidrich J, Hewelt E, Dirksen-Fischer M, Boldt M, Harth V. Prävention von COVID-19 Ausbrüchen auf Handelsschiffen – 1. Update. 2020 Hamburg: Kompetenznetz Public Health COVID-19.

Disclaimer: This paper was compiled within the framework of the COVID-19 Public Health Research Network. The sole responsibility for the contents of this paper lies with the authors.

The COVID-19 Public Health Research Network is an ad hoc consortium of more than 25 scientific societies and organisations that are active in the field of public health. They bring together their expertise in research methods, epidemiology, statistics, social sciences, demography, and medicine. We represent several thousand scientists from Germany, Austria, and Switzerland.