

# Preparedness of the maritime transport sector calling on plague endemic areas or areas with plague outbreaks, and options for public health measures in response to suspected plague affected ships

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## Introduction

Every year in certain parts of the world plague outbreaks occur. Currently, according to the World Health Organization (WHO) the most plague endemic countries are the Democratic Republic of the Congo (DRC), Madagascar, and Peru<sup>1</sup>. The countries and areas where plague outbreaks occur can be found at the WHO website: <http://www.who.int/csr/disease/plague/en/> and the Centres for Disease Control and Prevention (CDC) website: <https://www.cdc.gov/plague/index.html>.

In 2017, in Madagascar, contrary to past outbreaks a much higher proportion of pneumonic plague cases were reported, versus the bubonic plague that is endemic to the country<sup>2</sup>. Furthermore, the outbreak affected large cities, which increased the risk of person-to-person transmission. WHO advised against any restriction on travel or trade to Madagascar based on the available information<sup>2</sup>. Bibliographic references indicate that plague has not been reported on board ships since 1938<sup>3</sup>. However, the fact that the 2017 plague outbreak in Madagascar affected areas of high population density, including coastal areas, alerted authorities and the maritime industry about the importance of preparedness plans to be in place in case a plague outbreak affects port cities.

The current guidelines were produced considering the recommendations published by the WHO and other organizations and agencies, specifically in response to the Madagascar epidemic, as well as considering other existing guidelines for plague.

This document contains useful guidance for the maritime transport sector when preparing to make port calls in plague endemic areas or areas where an outbreak is on-going. Moreover, advice given in this document is useful for public health authorities developing their long-term or short-term national and local preparedness plans. Although plague is not endemic in the European Union (EU) Member States, certain outermost regions or overseas countries and territories that have a special relationship with one of the member states of the EU, are located near or have travel or trade links to plague endemic countries<sup>4</sup>.

The document is split into two parts. The first part describes plague preparedness recommendations, pre-travel advice and response measures to be implemented on board the ship. The second part gives recommendations for response measures once the ship arrives at the port. Both public health authorities and shipping companies should have a common understanding of their roles, cooperate and interact in the response measures implementation and therefore, all parts of the document are relevant to both parties.

## Pre-travel advice

Travel companies and travel agencies should provide pre-travel information to customers about health issues with their travel package<sup>5</sup>. In this context, information regarding symptoms of the plague, as well as the importance of preventive measures should be provided before the voyage, when the itinerary includes calls to plague endemic areas and areas where plague outbreaks are occurring.

Information about plague should be provided by the shipping company to passengers and crew on ships that call on plague endemic areas or areas where an outbreak is on-going.

## Information and advice for international travellers\* visiting plague endemic areas

### Transmission

- Feeding of infected fleas on humans (bites of infected fleas). The fleas can be present on rats, cats, squirrels, rabbits, and other animals.
- Touching or skinning infected animals (such as cats, squirrels, rats, and rabbits). Inhaling droplets from the cough of an infected person (person-to-person transmission) or animal (especially sick cats)<sup>6</sup>.

### Symptoms and common forms of plague

- Bubonic plague. Symptoms: swollen, painful lymph nodes, usually in the groin, armpit or neck. Other symptoms include fever, chills, headache, and extreme exhaustion. A person often becomes ill with bubonic plague 1 to 7 days after being infected. If not treated early, the bacteria can spread to other parts of the body and cause septicaemia or pneumonic plague.
- Septicaemic plague occurs when plague bacteria multiply in the bloodstream. Symptoms include high fever, exhaustion, light-headedness, and abdominal pain. Septicaemic plague can quickly cause shock and organ failure.
- Pneumonic plague occurs when plague bacteria infect the lungs. Symptoms include sudden occurrence of high fever, chills, cough, chest pain, difficulty breathing, and coughing up bloody mucus<sup>1,7,8</sup>.

Plague is highly fatal if not treated (about 50%-60% of bubonic plague cases and almost 100% of untreated pneumonic and septicaemic plague cases)<sup>7</sup>. However, early diagnosis and early treatment can save lives and reduces the mortality significantly<sup>1</sup>.

### How to prevent plague

- Avoid crowded areas where cases of pneumonic plague have been recently reported (updated information on the endemic areas can be found on the WHO website: <http://www.who.int/csr/disease/plague/en/>)
- Avoid rural areas of plague-endemic regions; particularly avoid camping or hunting or any contact with live animals such as rodents and cats. Avoid contact to live/ sick cats in any plague endemic/ outbreak area.
- Avoid contact with dead animals (such as cats, squirrels, rats, and rabbits), body fluids, tissues or materials from such animals in plague endemic/ outbreak regions.
- Avoid close contact with suspected cases or patients with pneumonic plague. Close contact means approaching a patient with pneumonic plague at a distance of less than 2 metres<sup>9</sup>.
- Avoid direct contact with suspected cases or patients with bubonic plague. Direct contact means touching the person as well as his/her clothes, bed linens, etc.<sup>10</sup>
- Immediately notify the health care personnel or authority, in case of contact with and potential exposure to pneumonic plague patients or other high risk exposures, to seek medical advice regarding chemoprophylaxis.
- When visiting a plague endemic/ outbreak area, take all essential measures to prevent flea bites<sup>11,12</sup>:
  - Cover exposed skin by wearing long-sleeved shirts, long pants, and hats.
  - Use repellent products for personal protection against mosquitoes, which may equally be protective against fleas and other blood-sucking insects. Formulations (lotions or sprays) based on the following active ingredients are recommended by the WHO Pesticides Evaluation Scheme: DEET, IR3535, Icaridin (KBR3023) or Picaridin. Always follow product directions and reapply as directed by the product instructions. If you are also using sunscreen, apply sunscreen first and insect repellent second. Follow product directions when applying repellent on children.

\* The term traveller includes both passengers and crew members.

- Avoid applying repellent to their hands, eyes, and mouth.
- Use permethrin-treated clothing and gear (such as boots, pants, socks, and tents).
- Treated clothing remains protective after multiple washings. See the product information to find out how long the protection will last.
- If a person cannot take the above mentioned prevention measures (e.g. because of pregnancy) travel should be avoided.
- Prophylactic treatment is only recommended for persons who have been in close contact with pneumonic plague cases, or who have had direct contact with bubonic plague cases or with other high risk exposures (such as bites from fleas or direct contact with body fluids or tissues of animals in plague endemic/ outbreak areas)<sup>12</sup>.
- Avoid self-administering antibiotics as prophylaxis, unless recommended by medical professionals.
- Frequent hand-washing is highly recommended.
- During your travel to the plague endemic/ outbreak area and for 7 days after returning from traveling to the endemic/ outbreak area, be on alert for plague symptoms. In case of sudden symptoms of fever, chills, painful and inflamed lymph nodes, or shortness of breath with coughing and blood-tainted sputum, immediately contact a medical service. Put on a surgical mask or if not available a scarf to protect others from the potential spread of plague bacteria through droplets when coughing. Inform your physician about your travel history to the plague endemic area.

## Recommendations to minimise the risk of introduction of plague onto ships

Implementation of pre-boarding screening onto the ship should be discussed and decided upon by the local health authorities and the shipping company<sup>13</sup>. If exit screening to all travellers leaving an endemic/ outbreak country is implemented at the port, then pre-boarding screening onto the ship does not need to be conducted by the shipping company. Pre-boarding screening on board the ship is advised if **no** exit screening of travellers is implemented in the port where a plague outbreak is on-going or plague is endemic.

It is recommended that pre-boarding screening is implemented as follows: before boarding a ship all persons (passengers, crew and visitors) should be asked to complete and sign a written health questionnaire. An example of a health screening questionnaire is included below.

<b>Example health questionnaire (primary screening). Places, animals involved and other information can be modified according to the epidemiology of disease in the endemic/ outbreak area.</b>	
In the last 7 days:	
Did you have any contact with dead animals or their tissues or other materials soiled with their body fluids while in the plague endemic/ outbreak area?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did you have any contact with a patient known or suspected to have the plague? Symptoms of plague are: fever, chills, exhaustion, abdominal pain, swollen, painful lymph node in groin, armpit, or neck, difficulty breathing with coughing and/or coughing up bloody mucus.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did you have any contact with rats, cats, squirrels, rabbits?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did you go camping or hunting while visiting the plague endemic/ outbreak area?	<input type="checkbox"/> Yes

	<input type="checkbox"/> No
Did you have any bites from fleas (i.e. small bite marks on the lower legs)* while being in the plague endemic/ outbreak area?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do you have any of the following symptoms? If yes, specify which symptoms:	<input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Fever	<input type="checkbox"/> Chills
<input type="checkbox"/> Exhaustion	<input type="checkbox"/> Abdominal pain
<input type="checkbox"/> Swollen, painful lymph node in groin, armpit, or neck	
<input type="checkbox"/> Difficulty breathing with coughing and/ or coughing up bloody mucus	

*\*The common fleas cause lesions that are typically round, domed in shape and evenly reddened in colour. The bites flatten over time, leaving red spots. Often, the bites are concentrated on the lower legs<sup>14</sup>.*

Passengers, visitors or crew who have symptoms of plague (seen by the staff performing the screening or measured e.g. with a temperature measuring device) or have noted “Yes” to any of the questions and/ or have one of the plague symptoms on the health questionnaire should undergo a secondary assessment, by qualified medical personnel such as physician or nurse and preferably at a private place at the terminal. At the secondary assessment, a medical examination should take place to identify signs and symptoms, and any participation in activities that may have caused the disease and any epidemiological link with cases of plague. Guidelines for performing screening have been provided by WHO in documents published in response to previous outbreaks<sup>13</sup>. Personal Protective Equipment (PPE) that should be worn by the assessors and medical staff are described in the European Centre for Disease Prevention and Control (ECDC) guidelines<sup>15</sup>. The instructions for use are described in the following section “During the voyage – options for response to a suspected case of plague”. Depending on the results of the assessment, the traveller could: continue the travel without any other measure, be placed under public health observation with monitoring of symptoms, quarantined or isolated.

A case of pneumonic plague is suspected when a traveller (passenger or crew member) leaving an area where a plague outbreak is on-going has fever associated with persistent coughing and/ or impaired breathing<sup>16</sup>.

A case of bubonic plague is suspected when a passenger or a crew member leaving an area where a plague outbreak is on-going has fever associated with swollen lymph nodes<sup>10</sup>.

Passengers, visitors or crew who have symptoms compatible with the clinical description of the pneumonic or bubonic form of plague should be denied boarding and referred to a health care facility ashore. Their personal belongings should be treated with insecticides and disinfectants. If pet animals (domestic cats, rabbits, hares, dogs) have been in contact with them, the veterinary authorities should be informed and put the suspected pet animals in quarantine and provide treatment including flea control and antibiotic therapy.

## During the voyage – preparedness

Raise awareness and knowledge of health care providers on board

Medical staff, or if not available the responsible officer in charge, working on ships that call on plague endemic ports should be trained with regard to clinical characteristics, diagnosis and treatment, precautions and control measures, surveillance and reporting requirements of plague. More information can be found at the ECDC Plague Facts for healthcare professionals. Diagnosis, clinical features, ways of transmission and preventive measures, are available at: <https://ecdc.europa.eu/en/plague>.

The crew working on ships that call on plague endemic ports should be educated about the plague, to:

- recognise the routes of transmission, signs and symptoms;
- understand the measures that prevent/ reduce the spread;
- recognise and report people with symptoms to the designated crew.

### Surveillance and notification of disease

Surveillance of infectious diseases should take place on board at the ship hospital accommodation/ medical centre. The competent authority of the next port of call must always be informed if a suspected case of an infectious disease or death has occurred on board<sup>17</sup>. For ships on international voyage, the International Health Regulations (IHR) Maritime Declaration of Health (MDH) should be completed and sent to the competent authority according to the local requirements at the port of call. Some ports require the submission of the MDH by all arriving ships.

### Supplies and equipment

Adequate medical supplies and equipment recommended by the International Medical Guide for Ships 3<sup>rd</sup> edition<sup>18</sup> and/or the flag state requirements should be available on board to respond to a potential event of plague. Moreover, the following equipment should be available to care for patients with all forms of plague: gloves, impermeable gown, goggles, surgical masks and when approaching a suspected case of pneumonic plague at a distance of less than 2 metres FFP2/ FFP3 masks should be used. More information can be found at the ECDC: Guidance for healthcare workers on the use of personal protective equipment in the management of bubonic and pneumonic plague patients<sup>15</sup>, available at: <https://ecdc.europa.eu/sites/portal/files/documents/Guidance-for-HCWs-on-use-of-PPE-in-management-of-plague%20patients.pdf>.

### Integrated Pest Management Plan and placement of rat guards

To prevent rodents from entering the ship, an Integrated Pest Management Plan should be implemented:

- Active surveillance and passive surveillance for pests with emphasis on rodents and fleas<sup>5,19,20</sup>. Ensure that ship crew is trained to recognise evidence for the presence of pests and to implement pest control measures. Intensify active surveillance for rodents and fleas on board.
- Adequate quantities of pesticides (rodenticides for rats and insecticides for fleas) should be available on board.
- Closure of ramps and any other openings such as doors and windows when they are not in use, the lighting of the ships' open spaces during the night, and installation of self-closing doors<sup>21</sup>. The gangway must be well lit and guarded, and raised when not in regular use.
- Proper placement of rat guards on all mooring lines and other appropriate rodent entry prevention measures should be fitted when the ship is in the port<sup>5,19</sup>:
  - Rat guards should have a 92 cm (36-inch) minimum outside diameter, a cone angle of 30 degrees, and be made of 18 gauge steel or aluminium.
  - Lines or group of lines should closely match the diameter of the rat guard.

- Rat guards should be placed at a point on the line at least two meters (six feet) from the pier, with the point at least 0.60 metres (two feet) from the ship.
- The point of the rat guard cone (where applicable) should face the ship.
- Two or more closely placed lines should be grouped to pass through one rat guard or the rat guard should be positioned side-by-side.
- Any gap between the sleeve and the line should be blocked with material which cannot be easily removed or destroyed.
- Stray lines must be kept out of the water.
- The position of the rat guards should be checked regularly and more intensively during the hours before sunset.
- Inspect any item brought to/ entering the ship in a plague endemic port/ port where a plague outbreak is on-going for evidence of rodents and fleas. Pests including rodents or fleas may be carried with food supplies, cargos, luggage, and vehicles, or may be carried on humans or animals as ectoparasites.
- If rats or evidence of rats are found on board of a ship that called on a plague endemic port, then this should be reported to the next port of call and pest control measures including disinsection followed by deratting should take place on the ship under the supervision of the competent port health authority with special consideration to the presence of plague affected vectors.

## During the voyage – recommendations for response to a suspected case of plague

ECDC has published specific guidance for the management of suspected bubonic and pneumonic plague cases identified on ships<sup>10,16</sup>. The following measures are recommendations to be implemented when a suspected case of plague is identified on board:

1. Diagnosis and treatment: rapid diagnosis and treatment are essential to reduce complications and fatality. Effective treatment methods enable plague patients to be cured, if diagnosed in time. These methods include the administration of antibiotics and supportive therapy. For detailed advice on treatment of plague see available guidance from the WHO web site and the WHO plague manual<sup>22</sup>. The ship medical log should record information on the diagnosis and treatment<sup>5</sup>. Depending on the severity of the situation, the competent authority at the relevant port may need to arrange medical evacuation or special arrangements for patient disembarkation, hospitalization and laboratory diagnosis. Maritime Telemedical Assistance Services may also be arranged as needed.
2. Isolation of patients: any person with symptoms compatible with any form of plague should be isolated as follows:
  - a. Keep the patient's cabin doors closed, if not placed in an isolation room on board.
  - b. Provide information about the risk of plague transmission to persons who will take care of the patient or enter his/ her cabin or isolation room.
  - c. Maintain a log listing all people entering the cabin or isolation room.
  - d. Ensure that anyone who enters the cabin or isolation room to provide care to the patient or to clean the cabin uses PPE as follows:
    - i. non-sterile examination gloves or surgical gloves (cleaners should preferably use heavy duty/ rubber gloves);
    - ii. a disposable impermeable long-sleeved gown to cover clothing and exposed skin, goggles, surgical mask or in case of suspected pneumonic plague FFP2/ FFP3 mask when coming in close contact (less than 2 metres) with the patient;
    - iii. before exiting the cabin or isolation room PPE should be removed in such a way that contact with the contaminated items and any area of the face is avoided. Used PPE should be disposed of as infectious waste or incinerated.

- iv. Disposable items should be used for feeding the patient and disposed of as infectious waste or incinerated.
  - e. If it is not possible to perform disinsection in the isolation area and in the suspected patient's belongings as described in paragraph 7 below, then ensure that anyone who enters the cabin or isolation room protects against flea bites using repellent products for personal protection against mosquitoes, which protect against fleas as well.
  - f. Anyone providing care to the person in isolation should perform hand hygiene by hand-rubbing with an alcohol-based hand-rub solution for about 20-30 seconds or hand-washing with soap and water for about 40-60 seconds, before putting on gloves, after any direct contact with the patient or with his/ her personal belongings or any objects/surfaces potentially contaminated with his/ her blood or body fluids and after removing PPE.
  - g. Limit the movement and transport of the patient from the cabin or isolation room to essential purposes only. If transport is necessary, the affected person must wear a surgical mask. In case of suspected pneumonic plague persons in close contact (less than 2 metres) should wear FFP2/ FFP3 masks.
  - h. All waste produced in the cabin or isolation room should be handled according to the protocol of the ship for clinical infectious waste. If an incinerator is available on board, waste should be incinerated. If waste must be delivered ashore, special precautions are needed and the port authority should be informed of waste delivery.
  - i. PPE must be used by the persons who handle bed linen. Linen should be double bagged in hazardous waste bags and sealed and then incinerated or boiled for 10 minutes<sup>16</sup>.
  - j. Disinsection should be performed in the isolation room as a terminal measure, after the patient has left.
3. Every possible measure should be taken to prevent flea bites on board as described in the section above: "How to prevent plague".
  4. Disinfection: effective disinfectants against *Y. pestis* are: 1% sodium hypochlorite, 70% ethanol, 2% glutaraldehyde, formaldehyde, and iodine-based and phenolic disinfectants<sup>23</sup>. It can also be inactivated by moist heat (121° C [250° F] for at least 15 minutes) or dry heat (160-170° C [320-338°F] for at least 1 hour)<sup>23</sup>. Materials and surfaces contaminated with potentially infectious body fluids (e.g. sputum and purulent discharges) should be disinfected. Disinfection can be performed using 10% of diluted household bleach<sup>1</sup>, which is equal to 5,000 mg/L chlorine. To prepare this, add 250 ml (1 cup) of household bleach to 2250 ml (9 cups) of water. The disinfectant solution should be freshly prepared daily.
  5. Active surveillance (case finding): case finding among travellers should be initiated to detect new cases once a suspected case has been identified. Case finding should include directly contacting travellers (e.g. passenger surveys) and crew and asking about current and recent illness; findings should be recorded in the medical log and reported to the next port of call.
  6. Contact tracing: close contacts and cabin mates of the suspected persons should be identified, assessed for their specific level of exposure and
    - a. advised on self-monitoring of plague compatible symptoms for the following 7 days from exposure and for seeking medical care;
    - b. provided with post-exposure chemoprophylaxis for 7 days to those who had close contact with a suspected case of pneumonic plague patient and those in direct contact with the body fluid or tissue or bed linen of a plague patient<sup>7</sup>.

The WHO Plague Manual: Epidemiology, Distribution, Surveillance and Control (WHO/CDS/CSR/EDC/99.2) suggests the following plague prophylaxis guidelines: Tetracycline (for adults 1-2 g/day every 6 or 12 hours, for children 9 years 25-50 mg/kg/day every 6 to 12 hours), Doxycycline (for adults 100-200 mg/day every 12 or



24 hours, for children 9 years 100-200 mg/day every 12 or 24 hours), Sulfamethoxazole/trimethoprim (for adults 1.6 g/day every 12 hours, for children 2 months 40 mg/kg/day every 12 hours)<sup>22</sup>. Chemoprophylaxis should be provided after medical doctor consultation (through Maritime Telemedical Assistance Services or by the ship doctor if available) in order to deal with specificities of each individual e.g. allergies or other conditions.

7. Disinsection of travellers' belongings: post-event disinfection should take place for the ill traveller's belongings. Disinfestation of patient's clothes can be performed by steam<sup>24</sup>. A combination of insecticide treatment and steaming for 15 minutes can kill fleas in clothing. For materials that can be damaged by steam treatment such as leather goods, clothing with leather facings or strapping, furs, rubber and others spray with a 5% formol solution can be used.
8. Quarantine or isolation and treatment of pets: pets (domestic cats, dogs, rabbits or hares) that came into contact with the patient should be quarantined for 5 days, since the incubation period is considered to be 1 to 4 days. When the ship arrives at the next port of call, they should be examined by the veterinarian services. Cats can transmit *Y. pestis* directly to humans, and if affected can develop three forms of clinical illness: a) fever, lethargy, anorexia and large lymph nodes, while oral and lingual ulcers, skin abscesses, ocular discharge, diarrhoea and vomiting have also been reported (bubonic plague – the most common and least fatal form), b) fever, lethargy and anorexia, not obviously enlarged lymph nodes, and maybe diarrhoea, vomiting, tachycardia, weak pulse, prolonged capillary refill time, disseminated intravascular coagulopathy, and respiratory distress (septicaemic plague – the second most common form), c) all the signs of septicaemic plague along with cough, sneezing, chills and difficulty breathing (pneumonic plague – the most severe form, with high mortality rate, although only secondary and no primary pneumonic plague has yet been reported in cats)<sup>25</sup>. Treatment for suspected plague must start immediately, well before the definitive diagnosis is obtained, due to the rapid progression of the disease. Antibiotics, usually streptomycin, gentamicin, doxycycline, tetracycline, chloramphenicol, are used to treat the plague in cats. The recommended duration of treatment is 10 to 21 days, while evidence of clinical improvement, including a decrease in fever and a return to normal body temperature, should be expected within a few days. Actually, 3 days of appropriate antibiotic therapy is believed to halt infectivity in treated cats, similar to humans, even though duration of infectivity in cats has not been studied. For this reason, treated cats should be isolated for at least 4 days, combined with flea control measures, to avoid the risk of transmission. Arrangements for disembarkation and hospitalization should be taken, too, especially if signs of pneumonia are evident<sup>6,25</sup>. Although less frequently than cats, dogs with plague can also develop clinical illness, but do not directly transmit plague to humans. However, rodent fleas living on dogs can transmit *Y. pestis* to humans. Clinical signs in dogs include fever, lethargy, submandibular lymphadenopathy, a purulent intermandibular lesion, oral cavity lesions, and cough. People on board that get in contact with suspect pets for their treatment or any other reason, as well as veterinarians at the port of call examining them, need to use PPE. Any material used in the examination should be disinfected, autoclaved, or incinerated<sup>26</sup>.
9. Immediately after a suspected case of plague has been identified, the ship officer responsible for the Integrated Pest Management Plan should initiate active surveillance on board the ship for evidence of rodents and fleas and record findings including the place, time, condition found<sup>5,18,20</sup>. If dead rats are found on board, they should be collected with tongs and placed in at least two plastic bags, which should be sealed with a string, weighted, marked as infectious waste and incinerated<sup>18</sup>. Alternatively and if feasible, bags with dead rats can be given to the competent authority at ports for laboratory examination. The ship

master should inform the next port of call about the findings of the active surveillance for rats and fleas<sup>17</sup>.

10. Flea and rodent control measures must be initiated immediately after a suspected case has been identified. Control must start with the elimination of the fleas using fast acting insecticides followed by application of slow acting rodenticides (if rats are killed first, fleas will leave them and feed on humans more frequently, increasing the risk of disease spreading).
11. The affected crew member or passenger with symptoms consistent with any form of plague should disembark in a controlled way to avoid any contact with other persons on board the vessel and wear a surgical mask. Personnel escorting the patient during the medical evacuation should wear suitable personal protective equipment as described above (gloves, impermeable gown, goggles, surgical mask and in case of suspected pneumonic plague FFP2/ FFP3 mask).

## Measures in response to a suspected plague affected ship at the port of arrival

The competent authorities at the port should have in place a contingency plan for the port and the following should be arranged:

1. The ship should be anchored in a place where health measures can be implemented more effectively and without posing a risk to the port environment and other ships and travellers. Measures should be taken to prevent rats from leaving the ship<sup>27</sup>. The ship can be anchored away from the port or docked at a designated port area, depending on the contingency plan, the local situation at the port and as decided by the competent authorities at port.
2. Disembark the suspected traveller in a manner that will not pose any risk to other travellers and transport the patient to a medical facility, as described above in paragraph 11.
3. Measures specific for plague should be taken only after the case is considered confirmed based on the laboratory results:
  - Inspection of the affected ship with focus on: assessment of isolation measures implemented, cleaning and disinfection, bed linen and waste management handling, the presence of fleas and rodents on board, implementation of the integrated pest management plan. Every accessible part of the ship should be inspected. If the ship holds are not empty, then inspection should be conducted daily so that holds can be searched as the cargo is discharged. Any rat, trapped dead or alive, should be sent in for bacteriological examination for plague<sup>27</sup>. Bags used to place rats should be treated with insecticides effective for killing fleas and labelled with the place where the rat was trapped. If plague infected rats are found on board, then the place of origin of the cargo should be informed, as well as the place where any cargo was discharged and the ports of call from the commencement of voyage.
  - Contact tracing and placement of contacts under public health observation and/or if necessary provided with post-exposure chemoprophylaxis as described above in paragraph 6.
  - Disinsection and deratting of all ship areas including cargo holds. Flea control should be applied before deratting<sup>7,28</sup>. Deratting should be executed until the efficacy of flea control measures has been demonstrated. Flea disinsection measures should be conducted before rodent baiting by at least a week<sup>29</sup>. WHO guidance for control of rodent fleas that transmit bubonic plague can be found in the WHO guidance document: Pesticides and their application: for the control of vectors and pests of public health importance<sup>30</sup>. In case plague affected rats are found on board, the ship should be transferred to/moored at an isolated mooring station or at least stay remotely off the quay, and every precaution must be taken against rats gaining the shore or other ships<sup>27</sup>. A preliminary fumigation should be conducted, the discharge of cargo should be

arranged under supervision by the competent authority and, finally, the empty ship must be fumigated from end to end<sup>27</sup>.

Additional guidance about implementation of these measures can be found in the WHO Handbook for management of public health events on board ships<sup>13</sup>. Inspection results and health measures implemented should be noted in the existing Ship Sanitation Certificate<sup>31</sup>. The plague affected ship cannot depart until the health measures are taken and the health authority is satisfied.

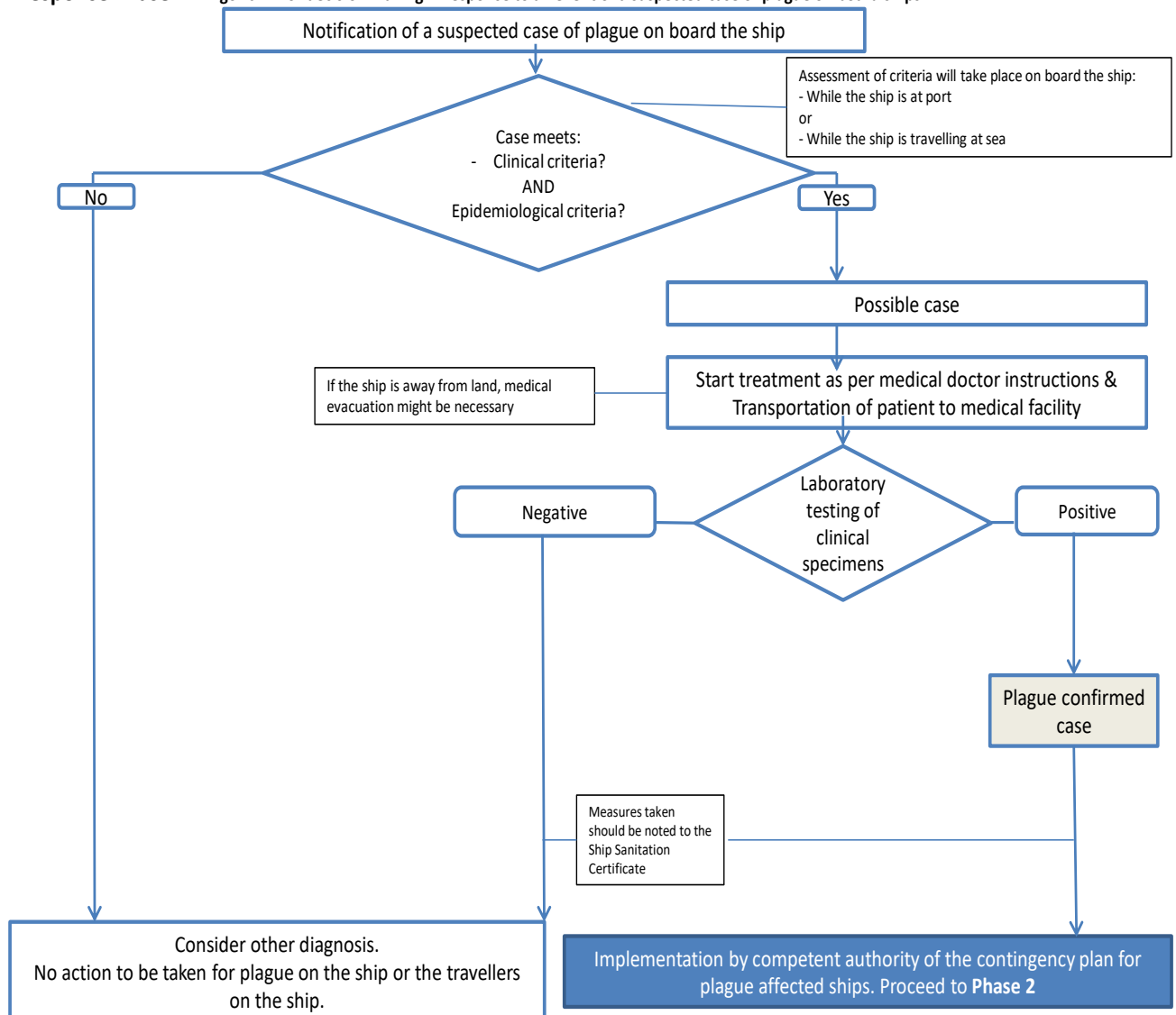
The following box presents the case definition and case classification for the plague.

<b>CASE DEFINITION</b> <sup>32</sup>	
<b>Definition</b>	
<b>Clinical criteria</b>	<p><b>Bubonic plague:</b></p> <ul style="list-style-type: none"> <li>• Fever AND sudden onset of painful lymphadenitis</li> </ul> <p>OR</p> <p><b>Pneumonic plague:</b></p> <ul style="list-style-type: none"> <li>• Fever</li> </ul> <p>AND at least one of the following three:</p> <ul style="list-style-type: none"> <li>• Cough</li> <li>• Chest pain</li> <li>• Haemoptysis</li> </ul> <p>OR</p> <p><b>Septicaemic plague:</b></p> <p>Fever and chills</p>
<b>Laboratory criteria</b>	<p><b>Laboratory criteria for a probable case</b></p> <ul style="list-style-type: none"> <li>• Detection of <i>Yersinia pestis</i> F1 antigen in a clinical specimen</li> <li>• Detection of <i>Yersinia pestis</i> anti-F1 antigen specific antibody in one blood specimen</li> </ul> <p><b>Laboratory criteria for a confirmed case</b></p> <ul style="list-style-type: none"> <li>• Isolation of <i>Yersinia pestis</i> from a clinical specimen</li> <li>• Detection of <i>Yersinia pestis</i> nucleic acid from a clinical specimen</li> </ul> <p><i>Yersinia pestis</i> anti-F1 antigen specific antibody response (four-fold or greater change in antibody titre) confirmed by neutralisation</p>
<b>Epidemiological criteria</b>	<p>Returning from a plague endemic area or contact with a traveller returning from a plague endemic area in the past 7 days.</p> <p>OR</p> <p>Working in a laboratory handling cases samples in the past 7 days.</p>
<b>Contact exposure criteria</b>	<p>In the past 7 days, at least one of the following:</p> <ul style="list-style-type: none"> <li>• Close contact with a confirmed or probable case.</li> <li>• Close contact with rodents in a plague endemic area.</li> <li>• Flea bite in a plague endemic area.</li> </ul> <p>Direct contact with a bodily fluid sample from a confirmed or probable case.</p>
<b>Classification</b>	
<b>Contact</b>	Any person meeting the contact exposure criteria.
<b>Possible case</b>	Any person meeting the clinical criteria with at least one the epidemiological criteria.
<b>Probable case</b>	Any person meeting the clinical criteria with at least one of the laboratory criteria for a probable case.
<b>Confirmed case</b>	Any person meeting at least one of the laboratory criteria for a confirmed case.
<p><i>*Please note that this case definition is based on the definition developed by ECDC specifically for the plague cases directly or indirectly linked to the 2017 epidemic in Madagascar. It may differ from the plague case definition used in other outbreaks. The case definition may be changed for other outbreaks/ epidemics.</i></p>	

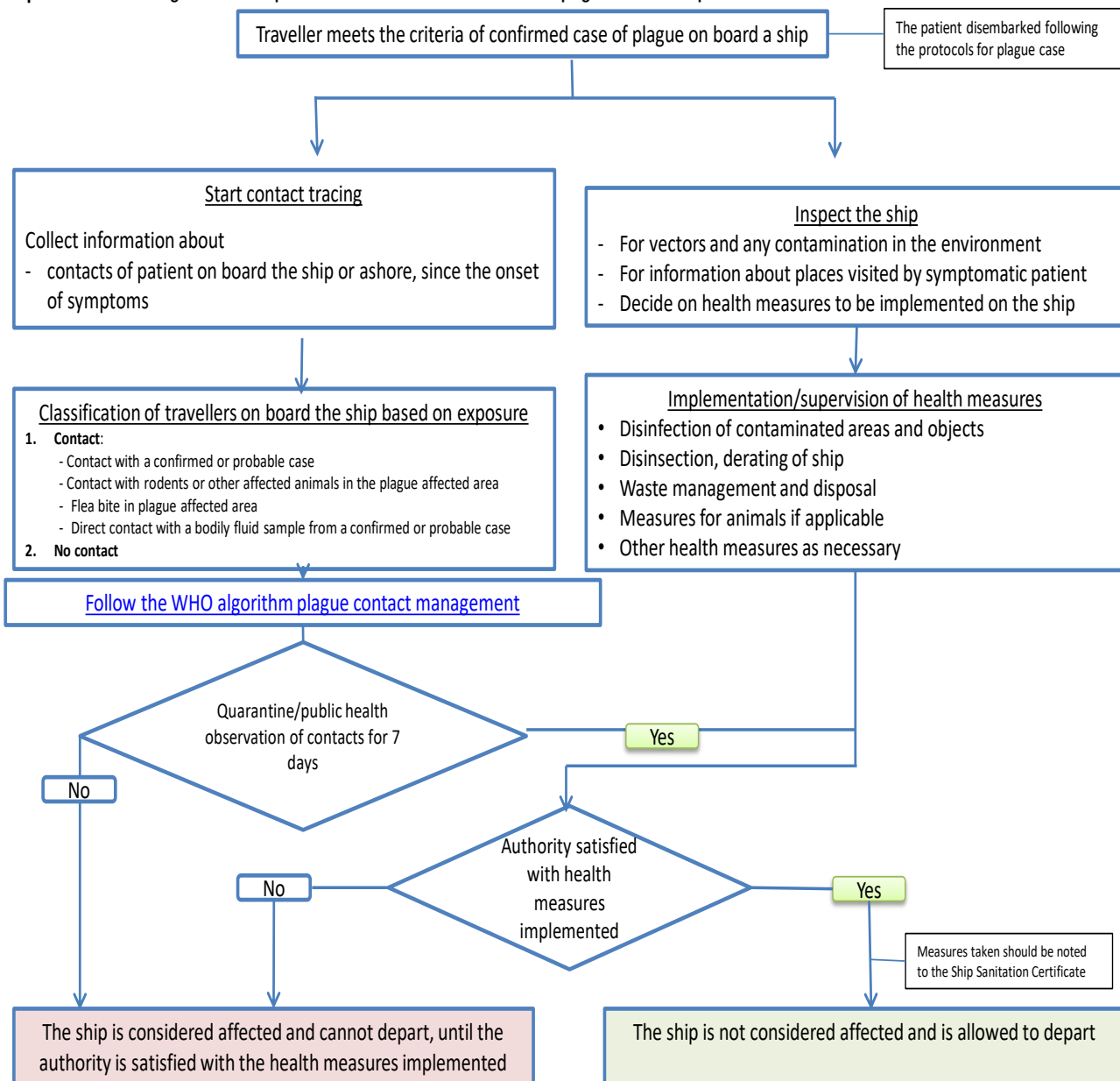
Plague diagnostic recommendations have been published by the Efficient Response to Highly Dangerous and Emerging Pathogens at EU level (EMERGE EU joint action). They include brief instructions for the diagnostic of specimens from suspected plague cases and exposed contacts, including recommendations for diagnostic confirmation<sup>33</sup> available at: [http://www.emerge.rki.eu/Emerge/SharedDocs/Downloads/EMERGE-Plague-recommendations.pdf?\\_blob=publicationFile](http://www.emerge.rki.eu/Emerge/SharedDocs/Downloads/EMERGE-Plague-recommendations.pdf?_blob=publicationFile).

The following Figure presents an algorithm for the response measures to be implemented by the competent authority at the port.

**Response Phase 1 - Algorithm for decision making in response to an event of a suspected case of plague on board ships**



**Response Phase 2 - Algorithm for response to an event of a confirmed case of plague on board ships**



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