

Infection control measures on ships and in ports during the early stage of pandemic influenza A (H1N1) 2009

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ABSTRACT

Shipping companies were surveyed to evaluate the effect of public health measures during the influenza A (H1N1) pandemic of 2009 on ship and port operations. Of 31 companies that operated 960 cruise, cargo, and other ships, 32% experienced health-screening measures by port health authorities. Approximately a quarter of ports (26%) performed screening at embarkation and 77% of shipping companies changed procedures during the early stage of the pandemic. Four companies reported outbreaks of pandemic influenza A (H1N1) 2009 on ships, which were ultimately stopped through infection control practices. Public health measures did not interfere substantially with port and ship operations with the exception of some port authorities that delayed embarking and disembarking procedures in a few ships. However, in the shipping companies' experience, measures were inconsistent between port health authorities. Access to anti-viral drugs and pandemic vaccine was not provided in all ports. Current guidelines on medical care, hygiene, and emergency procedures on ships need to address pandemic influenza preparedness in future revisions.

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Key words: influenza A virus, H1N1 subtype, ships, travel, respiratory tract infection, sanitation, public health

INTRODUCTION

The risk of disease among passengers and crew caused by transmission of seasonal influenza virus on ships is well documented. Attack rates in outbreaks of acute respiratory disease on ships range from 0.5 to 41% [1–5]. During a 2009 workshop of the International Maritime Health Association (IMHA) it was emphasized that Influenza is one of the most common health problems experienced in sea travel, for crew and passengers, with documented potential for outbreaks, and remains the most important vaccine-

preventable respiratory infection in maritime health [1]. Two outbreaks on ships during the 2009 pandemic influenza A (H1N1) were reported. An Italian Navy ship with 237 crew cruised in the Mediterranean during May to September 2009. Fifty-two cases of acute respiratory infection (ARI) were reported. Of the 211 blood test results available, 39% tested seropositive for pandemic Influenza A (H1N1) [7]. In an outbreak on a Peruvian Navy ship with 355 crew, an attack rate of 22% for confirmed pandemic Influenza A (H1N1) was documented during June to July 2009 [8].

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Influenza pandemic planning by the shipping industry was slow or non-existent during the past decade, and regulations or international recommendations regarding medical supplies aboard ships did not specifically address the issue, even those that had been recently updated [9, 10]. This situation changed rapidly in April 2009 when the World Health Organization (WHO) announced the emergence of the new influenza A (H1N1) virus. Guidelines and protocols for the prevention, detection, and control of influenza outbreaks on board ships were prepared and released by different sources. Table 2 summarizes key recommendations of the WHO, CDC, and IMHA [11-13]. This report documents the public health measures taken by the international shipping community in response to the pandemic influenza A (H1N1) 2009.

THE SURVEY

Shipping companies were surveyed to evaluate the effect of infection control measures initiated by them or port authorities on maritime operations during the early stages of pandemic influenza A (H1N1) 2009.

STUDY POPULATION

Companies were recruited to participate by the Lyon office of the WHO through the Cruise Lines International Association (CLIA – 25 cruise-line members representing > 97% of the cruise capacity marketed in North America) and the International Shipping Federation (ISF – 32 national ship owner association members). Representatives of the maritime industry were asked to respond to a questionnaire concerning their experiences from April 20, 2009 through to July 31, 2009. The survey was part of a greater multi-sectoral evaluation with four questionnaires each tailored to a specific sector as described elsewhere [14]. Collaborators for the survey in shipping included subject matter experts from the World Health Organization, the United States Centers for Disease Control and Prevention, and the Hamburg Port Health Centre of the Institute for Occupational and Maritime Medicine, Germany. The Cruise Lines International Association and the International Shipping Federation provided input for the development of the survey tool and supported dissemination of the questionnaire to the study population. The protocol was approved by the WHO and the US Centers for Disease Control and Prevention.

The cross sectional study targeted the senior administrative level of shipping companies. Representatives of the maritime industry who are familiar with

the actions taken by the company and with public health measures aboard their vessels taken in response to the pandemic (H1N1) were prompted to document the control measures from 20th April 2009 through to 31st July 2009 and to share their impressions of the impact it had. Each company was asked to complete one questionnaire. If a company operated both cruise and cargo ships, it was asked to complete a separate questionnaire for each sector.

QUESTIONNAIRE DESIGN AND FUNCTIONALITY

The questionnaire was developed by use of Adobe® Acrobat Professional Life Cycle Designer. The questionnaire in English language included 18 questions for ship operators. The definitions of public health measures shown in table 1 were given to the target audience. The answer design was multiple-choice and free text. The questionnaire was designed to allow electronic reporting.

QUESTIONNAIRE ADMINISTRATION, DATA COLLECTION AND MANAGEMENT

Questionnaires were distributed from the WHO office in Lyon via the International Shipping Federation and Cruise Line International Association to the ship operators as an attachment via email. The questionnaires were returned to the WHO. The first deadline for responses was November 27th 2009, to improve response rates; the deadline was later extended to February 15th 2010. Several reminders were sent out during the study period. Responses were automatically downloaded into a secure database maintained by the WHO. Data returned by email or fax were manually entered into the database. Data were handled anonymously.

DATA ANALYSIS

Descriptive analysis was conducted in Microsoft Access and Microsoft Excel. Data were stratified for cruise-lines and other merchant ships operators.

RESULTS

A total of 31 shipping companies that operated a total of 960 ships, 820 cargo ships, 29 passenger ships, and 111 other ships (e.g. tankers, tug boats, supply ships) responded. Regarding the estimated world fleet of 53,000 ships with a gross tonnage above 500 [15], the responders represented approximately 2% of international sailing vessels. Ninety per cent (28/31) of the companies were based in Europe and the North Atlantic region. Of the 31 responding companies, 4 (13%) (3 of them cruise ship com-

panies) reported events with on-going transmission of influenza-like illness (ILI, illness with typical signs and symptoms similar to seasonal influenza including fever, cough, headache, body aches, sore throat, and others) on vessels.

ON BOARD MEASURES

During the study period, 25/31 (81%) shipping companies, including all three cruise ship companies, changed their procedures for the prevention and control of communicable diseases. Most (25/31; 81%) shipping companies provided targeted health information to crew and/or passengers. Sour-

ces of information included the WHO (19/31; 76%), regional or national public health organizations (19/31; 61%), shipping associations (10/31; 32%), and the International Maritime Organization (IMO) (6/31; 19%). Four companies (13%) reported using the media as a source of information.

Eight of 31 (26%) shipping companies, including all 3 participating cruise ship companies, reported that they implemented embarkation health screening measures (health declarations and temperature measurements). Secondary health screening was performed on board by the ships' medical personnel or private practitioners; port or local public health

Table 1. Definitions

Embarkation health screening measures	Any kind of health screening measures of persons due to pandemic (H1N1) 2009 implemented during embarkation
Visual inspection	Looking for people who appear sick or have signs of illness such as cough
Primary health screening	First health screening measure applied collectively to all persons embarking
Secondary health evaluation	Further health evaluation for persons who screened positive in primary health screening
Influenza-like illness	Illness with typical signs and symptoms similar to seasonal influenza including fever, cough, headache, body-aches, sore throat, runny nose, and sometimes vomiting or diarrhoea
Isolation	Separation of ill persons from others in such a manner as to prevent the spread of infection
Antiviral treatment:	Treatment with antiviral medications like Oseltamivir or Zanamivir
Monitoring	Regular monitoring done by ship's (medical) staff to catch ill persons in early state of disease
Self-monitoring	Demand to monitor self and report any early sign of illness to ship's (medical) staff as soon as possible
Quarantine	Restriction of activities and/or separation from others of suspect persons who are not ill to prevent the possible spread of infection
Close contact	Close contact on a ship is considered to be a passenger or crew member who had been in close proximity and in such association with an infected person or enclosed environment for such a prolonged period of time to have had opportunity to acquire the infection, such as: sharing a cabin, family members, travel group members, crew working in shifts at the same space and having cared for or had direct contact with respiratory secretions or body fluids of an active influenza-like illness case. In addition, close contact may be considered to include other fellow travellers that may have had prolonged close proximity contact with an ill passenger in a crowded and semi-closed environment on board (e.g. during collective indoor recreational activities requiring close proximity or regularly having meals together with the infected person)
Preventive antiviral treatment (prophylaxis)	Antiviral medications like Oseltamivir or Zanamivir given to prevent onset of influenza
Event	Event means cases of disease on board with on-going transmission
Free pratique	Free pratique means permission for a ship to enter a port, embark or disembark, discharge or load cargo or stores

Table 2. Comparison of selected measures recommended by organizations

	US Centers for Disease Control Interim Novel Influenza Interim Guidance for Cruise Ships during the 2009-10 Influenza season	World Health Organization Interim technical advice for case management of pandemic (H1N1) 2009 on ships	International Maritime Health Association IMHA Influenza A (H1N1) Interim Advice
Target audience	crew members passengers of cruise ships	National IHR Focal Points Competent authorities at ports National public health officials Ship operators Port administrators Other port personnel Ship crew members Other port authorities Stakeholders involved in ship travel.	Maritime Industry
Consequences of detection of cases of ILI during embarkation screening	Non-embarkation until at least 24 hours after resolution of fever recommended	Non-embarkation recommended	-
Isolation of crew or passenger with ILI on board	Isolation in cabin until at least 24 hours after resolution of fever	Isolation 7 days after symptom onset or until they are free of symptoms for 24 hours, whichever is longer	Isolation of person with ILI in single room or cohort isolation
Managing of passengers and crew following exposure to an ill person	Monitor health for 7 days after exposure	Quarantine for close contacts for up to 7 days after exposure People at a higher risk of developing severe or complicated illness should be closely monitored for symptoms and antiviral treatment should be initiated promptly if symptoms develop	monitor health for 7 days after possible exposure
Personal protective equipment for caregivers of persons with ILI	Facemasks Gloves Hand hygiene following CDC infection control guidelines	Facemasks Antiseptic hand rub impermeable disposable gloves	Facemasks Gloves Alcohol-based disinfectants
Stockpiling of Medication and Supplies	Antiviral treatment: either oseltamivir or zanamivir Sterile viral transport media and sterile swabs to collect nasopharyngeal and nasal specimens	Antivirals: oseltamivir and/or zanamivir. Intravenous fluids, antibiotics, antipyretics (paracetamol or acetaminophen), oral rehydration salts, oxygen, gloves, facemasks, thermometers Adequate laboratory sample medium and packaging Disinfectants; hand hygiene supplies	Antiviral drugs, such as <i>Tamiflu</i> or <i>Relenza</i> . Digital thermometer, facemasks, disinfectants, gloves Influenza rapid test. Drugs for symptomatic treatment. Influenza vaccination Antibacterial hand wipes, alcohol-based hand sanitizer gel and surface disinfectant

departments were not involved in this activity. Five of the 8 shipping companies, including all 3 participating cruise ship companies, routinely contacted public health authorities when persons screened positive for ILI.

Of the 31 shipping companies, 19 (61%), including all cruise ship companies, did not allow persons identified with symptoms of ILI to board the ship. If illness occurred during sea passage, affected persons were isolated in their cabins or in the ships'

medical facilities for 3 to 8 days (median 7 days) after symptoms started. Antiviral treatment was offered by 8 of 31 (26%) companies. Health measures targeted towards asymptomatic close contact of persons with ILI were adopted by 16 of 31 (52%) shipping companies, including all 3 cruise ship lines. In view of the 3 cruise lines that operated 29 ships, ongoing transmission of pandemic influenza was successfully prevented and controlled with the control measures used, including targeted health informa-

Table 3. Specific health actions by shipping companies from April 20 through July 31 2009 in response to pandemic influenza A (H1N1) 2009

Actions of shipping companies	All companies (N = 31) (%)	Cruise lines only (N = 3)
Implemented any new procedure to prevent or control influenza transmission (e.g. companies' travel policies, onboard measures, embarkation and disembarkation procedures)	25 (81)	3
Instituted hygiene procedures at embarkation, disembarkation, or both	9 (29)	3
Added new vessel cleaning and disinfection procedures	9 (29)	3
Required staff to avoid deferrable travel to affected areas	7 (23)	1
Prohibited shore leave to crew	6 (19)	1
Added new health screening measures for crew and passengers	6 (19)	3
Prohibited crew from going to affected areas	3 (10)	0
Cancelled vessels' journeys to certain ports	1 (3)	0
Withdrew provision orders for food consumption on board	1 (3)	0

tion, improved hand hygiene, reduction of hand shaking, avoidance of crowding, cleaning of frequently touched surfaces, health screening at embarkation, monitoring and self monitoring for symptoms, wearing of masks and gloves, isolation of ill persons, antiviral treatment, and chemoprophylaxis. All cruise ship companies modified their existing outbreak control plans due to lessons learned during the onset of the pandemic.

MEASURES IMPOSED BY LOCAL HEALTH AUTHORITIES

Approximately 32% (10/31) of companies experienced one or more embarkation screening measures imposed on their vessels by health authorities, i.e. travellers' health declarations 7/31 (23%), visual inspections for signs of illness 5/31 (16%), or temperature measurement 6/31 (19%). No company was refused permission to enter a port because of pandemic influenza A (H1N1) 2009, but 3 companies, including 1 cruise line, were refused permission to embark or disembark passengers or crew, and 2 were not granted permission to discharge or load cargo or stores subject to inspections by health authorities. In two of the events, the delay of operations lasted less than 3 hours; however, in one event, the authorities' procedures resulted in a delay of more than 24 hours.

In the free text section the cruise ship companies raised the concern that control guidelines issued by port health authorities were not consistent between countries and also inconsistent with the WHO guidelines. In companies managing cargo and other ships,

concerns were raised that customs' requirements hindered timely delivery of medication and personal protective equipment to their ships in global ports. Access to vaccination for sailors was not in the scope of this survey because the vaccine was not available before autumn 2009; however, in the free text section two companies noted that health authorities in most countries were not supportive in providing vaccinations to crew and passengers when it was available to groups at high risk and the general population. In the authors' experience (CS, BG) administrative arrangements in many countries did not allow companies to purchase the pandemic vaccine for use on ships under non-national flags and in international waters.

CONCLUSIONS

Early in the pandemic influenza A (H1N1) 2009, points of entry throughout the world became a focus of attention in the efforts to delay the cross-border spread of influenza. Our results show that both the shipping industry and port health authorities likewise implemented infection control measures. All cruise ship and many cargo ship companies initiated infection control measures or changed existing procedures. Approximately one-fourth of all shipping companies performed screening at embarkation, and one-third experienced additional health screening measures imposed by port health authorities.

Shipping companies raised the concern that procedures by local port authorities were inconsistent between countries, as described before concerning ship inspections in Europe [16, 17].

Obstructed access to medical supplies, including vaccination, was raised as an additional concern. In our survey, no company was refused permission to enter a port because of pandemic influenza A (H1N1) 2009; however, 5 companies were refused permission to embark or disembark travellers or cargo, which resulted in minor delays for most and a delay of more than 24 hours for 1 cargo ship company.

Because of practical reasons, shipping company management responded to the questionnaire, which most likely resulted in an underestimation of events and particular actions taken. In the perception of four companies, outbreaks of Influenza A (H1N1) were stopped by their efforts; however, we could not measure this effect against predefined criteria. The study population of “shipping companies” was generally ill defined. If compared to the world fleet of ships of approximately 75,000, as estimated for the year 2009 [15], the responding companies operated 1.3% of the global fleet of all ships and approximately 1.8% of all 53,000 ships registered to the IMO with more than 500 gross tonnage. Twelve per cent of CLIA members participated; however, we do not know how many CLIA members were asked to participate but declined. CLIA mainly represents North American companies and has a policy of having outbreak control plans in place [18], which may explain the rather uniform responses of the participating cruise lines.

It is a unique feature of the shipping industry that vessels must carry medically trained personnel, equipment, and written protocols for medical care and hygiene procedures. However, current protocols for ships do not include pandemic influenza preparedness, so companies had to implement additional public health procedures. It would be beneficial to the shipping industry and port health authorities if the guidelines developed for preventing and controlling pandemic influenza A (H1N1) 2009 on ships [11–13] were incorporated into future revisions of guidance on medical care on board, such as the International Medical Guide for Ships [10] and existing outbreak control plans on cruise ships. These guidelines could also serve as a template for more generic plans for preventing and controlling infectious diseases on ships under observance of the legal requirements under the WHO International Health Regulations 2005 [19]. Shipping companies must initiate or continue comprehensive influenza pandemic planning to best be prepared for future events

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DISCLAIMER

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention and the World Health Organization.

BIOGRAPHICAL SKETCH

Dr. Clara Schlaich is a physician, board certified in Internal Medicine, Infectious Diseases, and Addiction Medicine. Since 2006 she has served as Head of the Hamburg Port Health Centre, Institute of Occupational and Maritime Medicine and as Executive Director of the Ship Sanitation Committee of German Federal States. Her interests include infectious diseases, port, airport, and ship sanitation, and maritime medicine.

REFERENCES

1. Brotherton JM, Delpech VC, Gilbert GL, Hatzi S, Paraskevopoulos PD, McNulty JM. A large outbreak of influenza A and B on a cruise ship causing widespread morbidity. *Epidemiol Infect* 2003; 130: 263–271.
2. Centers for Disease Control and Prevention. Influenza B virus outbreak on a cruise ship in Northern Europe, 2000. *MMWR Morb Mortal Wkly Rep* 2001; 50: 137–140.
3. Miller JM, Tam TW, Maloney S et al. Cruise ships: high-risk passengers and the global spread of new influenza viruses. *Clin Infect Dis* 2000; 31: 433–438.
4. Minooee A, Rickman LS. Infectious diseases on cruise ships. *Clin Infect Dis* 1999; 29: 737–743.
5. Schlaich CC, Oldenburg M, Lamshöft MM. Estimating the risk of communicable diseases aboard cargo ships. *J Travel Med* 2009; 16: 402–406.
6. Lim PL. Influenza and SARS: the impact of viral pandemics on maritime health. *Int Marit Health* 2011; 62: 170–175.
7. Tarabbo M, Lapa D, Castilletti C et al. Retrospective investigation of an influenza A/H1N1 pdm outbreak in an Italian military cruise ship cruising in the Mediterranean sea, May–September 2009. *PLoS On2* 2011; 6: 1–6.
8. Outbreak of 2009 pandemic influenza A (H1N1) on a Peruvian Navy Ship – June–July 2009. *MMWR* 2010; 59: 162–165.

9. Schlaich CC, Kalkowski M, Oldenburg M. Influenza pandemic planning – considerations for the maritime industry. In: Abstracts Quality maritime health & seafarers welfare – a global perspective. 10th International Symposium on Maritime Health; Goa, India; 2009 Sep 23–26. Book of Abstracts. Poster Session, Poster 1. International Maritime Health Association; 2009.
10. World Health Organization. International Medical Guide for Ships: including the ship's medicine chest 3rd edition. ISBN-13 978924154720, ISBN-10 9241548110. WHO Library Cataloguing – in Publication Data 2007 [cited 2011 October 1st]. <http://apps.who.int/bookorders/WHP/etart1.jsp?sesslan=1&codlan=1&codcol=15&codcch=3078>.
11. International Maritime Health Association. Interim Guidance Regarding Influenza A (H1N1) for the Maritime Community. May 2009 [cited 2011 October 1st].
12. World Health Organization. Interim technical advice for case management of pandemic (H1N1) 2009 on ships. 13. November 2009 [cited 2011 October 1st]. http://www.who.int/csr/resources/publications/swineflu/cp011_2009_1029_who_guidance_H1N1_ships.pdf.
13. Centers for Disease Control and Prevention. Interim novel influenza A (H1N1) guidance for cruise ships. 4 May 2009 [cited 2011 October 1st]. <http://www.cdc.gov/h1n1flu/guidance/cruiseships.htm>.
14. World Health Organization. Public health measures taken at international borders during early stages of pandemic influenza A (H1N1) 2009: preliminary results. Weekly Epidemiological Record, No. 21, 2010; 85: 185–196.
15. European Maritime Safety Agency. 13. November 2009 [cited 2011 October 1st]. (<http://www.emsa.europa.eu/implementation-tasks/equasis-a-statistics/item/472--annual-statistical-report-on-the-world-merchant-statistics-from-equasis-from-equasis.html>).
16. Mouchtouri AV, Westacott S, Nichols G et al and the SHIP-SAN partnership. Hygiene inspections on passenger ships in Europe – an overview. BMC Public Health 2010; 10: 122 (doi:10.1186/1471-2458-10-122).
17. Mouchtouri VA, Bartlett C, Nichols G et al from the SHIP-SAN TRAINET project. Decision making process on public health measures related to passenger ships: the example of influenza pandemic 2009. Int Marit Health 2010; 61: 241–245.
18. Cruise Lines International Association. Cruise Industry Policies & Resources [cited 2011 October 1st]. <http://www2.cruising.org/industry/tech-intro.cfm>.
19. World Health Organization. International Health Regulations (2005), 2nd edition. ISBN-13 978241580410, ISBN-10 9241580410. WHO Library Cataloguing – in Publication Data 2008. [cited 2011 October 1st]. <http://www.who.int/ihr/9789241596664/en/index.html>.