Bound for Sydney town: health surveillance on international cruise vessels visiting the Port of Sydney

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ABSTRACT

- A program for routine health surveillance on international cruise ships visiting the Port of Sydney has been developed since 1998.
- Before introduction of this program, ships only reported quarantinable diseases and were not aware of the Australian requirement to report other infectious diseases.
- Voluntary routine reporting, developed in partnership with the cruise ship industry, provides timely information on all infectious diseases of public health interest during every cruise.
- During 1999–2003, the program resulted in detection of and response to 14 outbreaks of gastroenteritis or acute respiratory infection, affecting more than 1400 passengers and crew.
- The program has improved preventive action, and risk communication and management by cruise ship operators, and led to more timely investigation and support by public health authorities.

MJA 2005; 182: 391–394

The popularity and worldwide market for international cruises is growing; in 2000, 10 million people travelled on cruise ships worldwide, and this is expected to reach 22 million by 2010.[1] However, cruise ships travelling in international waters have become increasingly recognised as a setting for infectious diseases outbreaks because of conditions that increase the chance of infection, such as presence of crew and passengers from many parts of the world, shared sanitation facilities, common food and drinking water supplies, exposure to air conditioning systems or water features potentially contaminated with legionella,[2,3] and consumption of foods ashore where food safety standards may be poor. The semi-enclosed environment of the cruise ship facilitates rapid person-to-person spread of respiratory infection, such as influenza,[4-6] or enteric infection, among which norovirus gastroenteritis has become prominent in recent years.[7,8] A further consideration for the importance of disease control on cruise ships is that about a third of cruise passengers are older people, who may be more susceptible to infections and to complications arising from illness.[4]

A recent World Health Organization review of available information on outbreaks during 1970–2000 identified 108 enteric disease outbreaks affecting more than 16 000 people, and 50 legionella incidents comprising more than 200 cases. The authors acknowledged that many outbreaks are not reported and some may go undetected.[1]

Australian ports figure prominently in the itineraries of Pacific island cruises and, during the southern hemisphere summer, of around-the-world cruises. Sydney is the major Australian port of call for such cruises. Of the 207 visits to the major Australian ports (Cairns, Brisbane, Sydney, Melbourne, Hobart, Adelaide, Fremantle and Darwin) by international cruise ships carrying more than 215 000 passengers in the 2002–03 financial year, 88 visits (43%) were made to Sydney, accounting for 115 000 passengers (53%) (personal communications, port managers, 2004).

To assess the burden of disease occurring on cruise ships visiting Sydney and allow a timely and appropriate public health response to cases or outbreaks of disease on board, a system of routine health surveillance is necessary, tailored to the peculiar needs of international vessels.

Public health surveillance and response in the Port of Sydney

In New South Wales, the Port of Sydney, comprising Sydney Harbour and Port Botany, falls within the jurisdiction of the South Eastern Sydney Public Health Unit (PHU). Over the past decade, but particularly since 1998, staff of the PHU have worked with Sydney-based shipping lines operating international cruises to improve health surveillance on cruise ships. The major change has been from reporting of quarantinable diseases only when a case occurs, to routine reporting of all infectious diseases of public health interest for every cruise, even when there are no cases. Although this reporting is voluntary, it is consistent with the requirements of the *Public Health Act 1991* (NSW), the *Quarantine Act 1908* (Cwlth) and the International Health Regulations (Box 1).

An "end-of-voyage medical report" is sent in the 24 hours before the ship berths in Sydney, and provides information on the vessel, cruise details, and crew and passenger complement; presentations to the medical centre for acute respiratory illness (ARI), influenza-like illness, pneumonia and gastroenteritis; hospitalisations; medical disembarkations; and deaths. This report used to be sent by fax to the PHU via the shipping agent's Sydney office; it is now sent by email directly to designated PHU staff. With the advent of ready email communication from ship to shore, it has become routine for ships' doctors to forward a series of progress reports during a cruise when there is concern about cases of disease or an outbreak.

The public health response varies depending on need. Information can be gathered from and advice provided to the ship at sea by email, satellite phone or fax. In most cases, a public health team with expertise in infectious diseases surveillance and response, epidemiology, environmental health, food safety and public health medicine meets the vessel shortly after it arrives in port. Team members speak with the ship's doctor and staff officers, examine clinic records and any available documentation of the shipboard

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1 Legislative basis for health surveillance

Statutory reporting of disease on international vessels is governed by state/territory public health legislation, Australian quarantine legislation and the International Health Regulations.

In New South Wales, the *Public Health Act 1991* includes provisions for statutory notification of infectious diseases. Public health units receive notifications from pathology laboratories, public and private hospitals, and registered medical practitioners. State legislation applies to vessels within state coastal waters. It is unclear whether this jurisdiction covers ships' doctors, who may be registered outside the state, or the vessels, which are generally registered in other countries.

The Australian *Quarantine Act 1908* requires mandatory reporting of specified quarantinable and infectious diseases using the "Quarantine Pre-arrival Report for Vessels (Pratique)". This Act is administered by the Australian Quarantine and Inspection Service (AQIS). Senior disease control staff in each state health department are authorised human quarantine officers, linking the quarantine service and state-based disease control personnel.

The International Health Regulations require all ships' masters to report the presence of quarantinable diseases on the vessel before they enter port. However, ships' doctors, who report on behalf of ships' masters, have often not been aware of the Quarantine Act requirements to report other infectious diseases. The International Health Regulations are being revised to strengthen them and make them more responsive to a wide range of current and emerging infectious diseases.[9]

A significant role of the South Eastern Sydney Public Health Unit surveillance program has been to educate ships' doctors and masters regarding the need to report all required diseases.

Conditions reported under the *Quarantine Act 1908*

Prescribed symptoms

- Temperature > 38°C
- Skin rashes or lesions thought to be caused by an infection or toxin
- Persistent or severe vomiting (other than caused by inebriation or motion sickness)
- Persistent, watery or profuse diarrhoea
- Bleeding from skin or mucosa
- Axillary or cervical lymphadenopathy
- Prolonged loss of consciousness
- Persistent cough or dyspnoea (other than chronic respiratory or cardiac disease)
- Inability to disembark (except in a person with restricted mobility or an otherwise healthy young child)

Prescribed diseases

- Cholera
- Dengue fever
- Influenza
- Malaria
- Measles
- Plague
- Polio
- Rabies
- Severe acute respiratory syndrome (SARS)
- Smallpox
- Tuberculosis
- Typhoid fever
- Viral haemorrhagic fever
- Yellow fever

outbreak response, and conduct inspections of food-handling facilities, air conditioning systems and water supply as necessary. Interviews may also be conducted with passengers and crew, and appropriate clinical samples collected from those with recent illness (or from storage in the clinic) for processing by a public health laboratory.

In unusual cases, if an investigation is required urgently and the ship is still some days from an Australian port, the public health team may board the ship on the high seas. In most situations, the public health response is provided by the PHU in cooperation with the cruise ship operators and their land-based support staff, and in conjunction with the Australian Quarantine and Inspection Service (AQIS) and the NSW Health Department's Communicable Diseases Branch.

Results of the health surveillance program

Rates of acute respiratory infection and gastroenteritis

End-of-voyage medical reports were available for 119 (55%) of the 218 cruises berthing at the Port of Sydney between January 2001 and December 2003. The reported rate of presentation for gastroenteritis on each cruise ranged from 0 to 19.9%, with a mean of 0.59%. The gastroenteritis presentation rate was less than 1.1% in 95% of cruises. There were three large gastroenteritis outbreaks in the 3 years, caused by food poisoning acquired ashore or by shipboard person-to-person spread of norovirus.

The reported presentation rate for acute respiratory illness on each cruise ranged from 0 to 4.4%, with a mean of 0.96%. The ARI rate was less than 2.8% in 95% of cruises, which supports the notional investigation threshold of 3% recommended by the United States Vessel Sanitation Program (although not all outbreaks may necessitate a formal investigation). During the 3 years, the ARI threshold was exceeded on six cruises, and all were investigated. No seasonal pattern was evident.

Investigated outbreaks

From 1999 to 2003, surveillance detected 14 outbreaks of respiratory or enteric infection, affecting more than 1400 passengers and crew (Box 2). A summer influenza outbreak has been reported previously.[10] Investigations and management of the more unusual outbreaks are summarised below.

Typhoid associated with food exposure in Papua New Guinea

On 8 June 1999, the Victorian Health Department reported typhoid in a 38-year-old man who had been ill since 30 May. As further cases were reported, it became evident that all had travelled on a Cairns to Sydney cruise, which had visited Papua New Guinea. A national outbreak investigation was conducted, coordinated by South Eastern Sydney PHU. Active follow-up of passengers identified 19 probable typhoid cases, of which 12 were confirmed by isolation from stools of *Salmonella* serovar Typhi phage type D2. All the patients had taken a Kokoda Trail tour. In addition, of the 159 participants on this tour, 143 (90%) experienced a self-limiting, presumably viral, gastroenteritis.

This investigation brought to attention the lack of awareness of the Quarantine Act requirement for ships' masters to report gastroenteritis. In addition, the cruise ship operator instigated recommendations for typhoid vaccination for travellers to Papua New Guinea.

Influenza

In September 2000, a notification was received from a cruise ship returning to Sydney to become a Sydney Olympic Games "floating hotel". Five passengers had been medically disembarked in Noumea with a provisional diagnosis of Legionnaires' disease. A public health team boarded the ship in mid-ocean to conduct a thorough

2 Infectious diseases outbreaks on cruise ships visiting Sydney, 1999–2003

Date	Cruise region	Number ill	Illness and likely pathogen	Mode of transmission
May 1999	Papua New Guinea	19	*Salmonella* serovar Typhi phage type D2	Presumed foodborne on shore
October 1999	Australian east coast	12	Gastroenteritis, pathogen unknown	Person-to-person
December 1999	South Pacific	30	Norovirus gastroenteritis	Person-to-person
February 2000	New Zealand	108	Influenza A	Person-to-person
September 2000	South Pacific	310	Mixed outbreaks of influenza A and B	Person-to-person
March 2001	South Pacific	93	Acute respiratory infection	Person-to-person
November 2001	South Pacific	64	Acute respiratory infection	Person-to-person
December 2001	South Pacific	85	Acute respiratory infection	Person-to-person
February 2002	South Pacific	91	Acute respiratory infection	Person-to-person
August 2002	South Pacific	64	Acute respiratory infection	Person-to-person
December 2002 – January 2003	Hawaii and South Pacific	42	Salmonella and norovirus gastroenteritis	Presumed foodborne on shore
February 2003	Around-the-world	154	Shigella	Presumed foodborne on shore
August 2003	South Pacific	92	Influenza A	Person-to-person
December 2003	South Pacific	259	Norovirus gastroenteritis	Person-to-person

environmental, microbiological and epidemiological investigation. Legionella infection was ruled out, and it was concluded that influenza A and B were circulating concurrently, affecting more than 30% of the passengers.[6]

Prompt reporting of the cases led to a comprehensive public health investigation with identification of the true cause. This outbreak also led to discussions with the operators regarding influenza vaccination of crew.

Norovirus gastroenteritis

In December 2003, a ship on a 10-day Pacific islands cruise reported that 200 passengers and crew had presented with gastroenteritis. A sharp increase in cases on Day 7 suggested a point source for the outbreak. However, common food or water exposures were ruled out. Stool specimens were tested both by the ship's doctor using a rapid test kit for norovirus antigen and by staff at the Enteric Laboratory at South Eastern Area Laboratory Services, Randwick. Several specimens were positive for norovirus genogroup 1, which differs from the predominant genogroup 2 isolates from previous Sydney outbreaks.[11]

Control measures included an intensive sanitisation program, closure of eating and other common areas, and encouraging ill passengers to visit the medical clinic and otherwise remain in their cabins. Early reporting led the PHU to press the operator to improve communication with passengers on both the affected and the following cruise about ways to reduce their risk of infection.

Discussion

Over the past decade, the South Eastern Sydney PHU cruise ship health surveillance program has provided a focal point for coordinated data gathering and response to public health concerns on Sydney-based cruise ships. The evolution of the program has led to a strengthening of relationships and communication protocols between the PHU, Sydney-based operators of cruise ships and the medical personnel that support them, the Sydney Ports Corporation, and AQIS. Expertise acquired by staff also informed the cruise ship vessel inspection and surveillance programs established for the Sydney Olympics.[12,13]

In practice, more open and earlier reporting of potential or actual public health issues on vessels has meant that the public health response may be more timely and effective. Moreover, public health staff have worked with vessel operators to:

- Educate ships' doctors and masters of the need to report any case of infectious disease scheduled under the Quarantine Act;
- Strengthen the role of the medical clinic as the ship's "surveillance office", where data are routinely collected on illness and questionnaires are issued to patients if an outbreak is suspected;
- Advocate for improved preventive measures and messages, such as influenza vaccination of crew and inclusion of more comprehensive pre-travel vaccination advice to passengers in cruise brochures;
- Promote risk communication by the operators in the form of advisory letters to passengers during outbreaks and "pillow letters" advising incoming passengers of public health problems on the previous cruise;
- Encourage the waiving of professional medical fees by the major operator during outbreaks to remove this financial barrier to passengers' use of the clinic (and thus to establishing the real extent of the outbreak); and
- Support the use in the medical clinic of rapid diagnostic kits for influenza,[10] legionella and norovirus for earlier confirmation of the cause of outbreaks.

Finally, it is planned to negotiate with other operators of cruise ships using Sydney (and other Australian) ports to provide standardised end-of-voyage medical reports. A similar program has recently been initiated in Queensland, and discussions are underway towards a coordinated, national cruise ship surveillance program modelled on the Sydney program.

Acknowledgements

We thank crew and support staff of the cruise ships that have participated in the health surveillance program, especially Barry Brazier, formerly of P&O Holidays, Sydney. We also thank Paul Parris, formerly of South Eastern Sydney Public Health Unit.

Competing interests

None identified.

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(Received 11 Oct 2004, accepted 21 Jan 2005) ❑