Onshore catering increases the risk of diarrhoeal illness amongst cruise ship passengers

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Abstract

Of 134 Queensland passengers on a cruise, 91 (67.9%) people reported various illnesses including 41 (30.6%) who reported diarrhoeal symptoms. Queensland passengers who ate while onshore at non-Australian ports were significantly more at risk of developing diarrhoeal symptoms than those who did not. Passengers were particularly at risk when they ate onshore while undertaking a tour compared with those who did not undertake this tour. Travellers should be warned of the possibility of contracting diarrhoeal illness from onshore catering. *Commun Dis Intell* 2001;25:15-17.

Keywords: diarrhoea, onshore catering, cruise ship, food-borne

Introduction

In May 1999, passengers and crew aboard a cruise ship visiting various non-Australian ports reported a range of gastrointestinal, respiratory or febrile symptoms. Of the 949 passengers, 138 (14.5%) were from Queensland. Although 12 people from other States were diagnosed with typhoid fever (CDN report),[1] there were no confirmed cases amongst the Queensland passengers. Possible associations between specific exposures and subsequent illness were investigated by the Queensland Health Department. We describe the findings relating specifically to reports of diarrhoeal illness.

Methods

A list of cruise passengers resident in Queensland was obtained. All were contacted and invited to take part in the study. For passengers aged less than 12 years, the respondent was a parent who accompanied them on the cruise. A questionnaire administered by telephone in June 1999 sought information on disease symptoms before and after joining the cruise, contacts with other ill passengers, activities both on-board and onshore, and food and water consumption. Respondents reporting ongoing symptoms at the time of interview were advised to seek medical attention. Those with ongoing diarrhoeal symptoms were advised to provide at least 2 stools for laboratory examination to exclude the possibility that they posed a risk to others. Dates of symptom onset and duration were also collected. We defined self-reported diarrhoeal illness as diarrhoea +/- other symptoms reported (Table 1).

Queensland Health was not able to assess environmental conditions on board ship. A subset of passengers was asked to report on sanitation, swimming pools, and overall hygiene.

Epi Info version 6.04b (CDC)[2] was used for data entry and analyses. Associations between exposures of interest and gastrointestinal symptoms were calculated using relative risk analyses. Either uncorrected ^{2} or two-tailed Fisher exact p values were used where appropriate.

Results

Of the 138 Queensland passengers, 134 (97.1%) were contacted and agreed to take part in the study. Sixty-eight (50.7%) were male. The median age was 58 years; ages ranged from 1 to 92 years. The cruise commenced in Australia on 8 May 1999 (Port 1; see Figure).

Diarrhoeal illness

There were no reports of diarrhoea prior to boarding ship. Forty-one (30.6%) respondents (Table 1) reported diarrhoeal symptoms during and after the cruise.

The first reported onset of diarrhoea and vomiting in the Queensland group was on 13 May, one day after boarding at Port 2 (Figure). Four further cases with diarrhoeal symptoms occurred on 14 May at Port 3, outside Australian waters. Subsequently, the ship docked at 5 more non-Australian ports and endured a cyclone (22 to 23 May 1999).

Passengers who ate onshore at non-Australian ports or during the onshore tour were more than three times more likely to report a subsequent diarrhoeal illness than passengers who went onshore at one or more ports but who did not eat at any of them. (Relative risk 3.6; 95% CI 1.8 – 7.3; $p < 0.0001$;Table 2). This includes passengers who ate during an onshore tour from Port 3 on day 7. These passengers were more than four times more likely to report subsequent diarrhoeal illness after this tour compared with those who did not participate. (Relative risk 4.6 95% CI 3.1 – 6.8; $p < 0.0001$;Table 2).

Only one passenger who reported diarrhoeal symptoms subsequent to participating in the tour did not eat the food provided during this or at any other onshore venue. His symptoms developed 13 days after this tour and 5 days after

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Table 1. Forty-one cruise passengers experiencing diarrhoeal symptoms

Symptoms*	Number	Frequency (%)
Diarrhoea +/- other gastrointestinal symptoms*	25	61
Diarrhoea + gastrointestinal* and other symptoms†	16	39

* Gastrointestinal symptoms were abdominal pain, vomiting, nausea, lethargy, fever, and headache.

† Other symptoms were ear, nose, cough and throat symptoms.

he complained of sanitation problems in his cabin following the cyclone.

Laboratory investigations

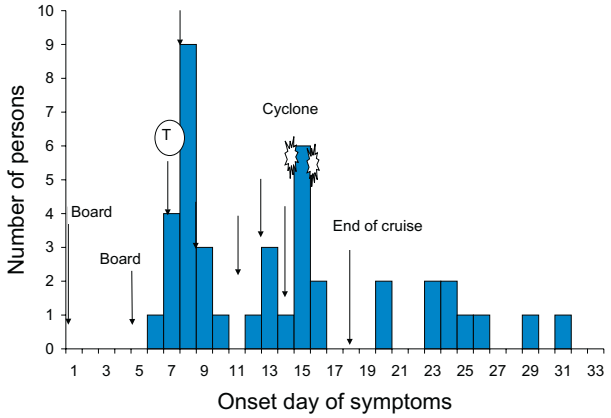
Ten passengers who had ongoing gastrointestinal symptoms at the time of interview were advised to provide a stool for faecal examination for parasitic and bacterial pathogens. No reports of significant isolates were received.

Environmental conditions

A subset of 62 /134 (46.3%) passengers was asked about sanitation on board the ship. Of this subset, 32 (51.6%) said toilets in their own cabins and toilets on the decks that they had used were overflowing and failed to flush during the cruise. During the cyclone on days 15 and 16 of the cruise, 18 of these 32 passengers also reported that toilets in their own cabins overflowed, there were smells in their cabins and that they suspected sewage to have seeped onto the carpets in their cabins.

Of the 32 passengers who said they had experienced sanitation problems, 17 (53.1%) reported diarrhoeal symptoms during the cruise compared with 6 of the 30 (20%) passengers who said they had not experienced any sanitation problems on the cruise (Relative risk 2.7; 95% CI 1.2-5.8; p = 0.007). Although 3 passengers reported symptoms before they reported problems with their own cabin toilets during the cyclone, it is unclear whether they and others who complained were exposed to sanitation problems prior to developing their symptoms. However, all but 3 of those who reported diarrhoeal symptoms and all but 2 who did not report diarrhoeal symptoms also reported other possible risk factors, namely eating onshore at ports including the tour, contact with other sick people and/or swimming.

Figure. Onset of diarrhoea amongst Queensland cruise-ship passengers, 13 May to 7 June 1999



* Day 1–start of cruise 8 May 1999. Day 18– cruise ended 25 May 1999. Day 33 – interviews commenced 9 June 1999. Arrows indicate ports. T = onshore tour as well as disembarkation at this port. Cyclone occurred 22-23 May 1999.

Eighteen (13.4%) reported swimming on board the ship as well as onshore. Of these, 6 (33.3%) reported diarrhoeal symptoms, but most (4/6) also reported other exposures.

Fifteen (11.2%) reported having close contact with passengers who they knew were ill on the cruise. This includes 7 who said this contact was prior to developing symptoms themselves. However, most (5/7) also reported exposure to other risk factors such as eating at ports or during the onshore tour, and experiencing sanitation problems and swimming. Only one case reported symptoms prior to engaging in any identified exposures.

Discussion

Risk factors identified by our study for diarrhoeal symptoms on this cruise included eating or drinking onshore at ports (especially during an onshore tour) and experiencing problems with on-board sanitation. However, most passengers reported exposure to a number of risk factors and so results must be interpreted with caution. The onshore tour occurred at the beginning of the cruise prior to the advent of other activities. However, most passengers reported participating in a range of activities as the cruise progressed so that it was not possible to determine if any

Table 2. Diarrhoeal illness in Queensland cruise ship passengers

Activity	Exposed: ill/total	Unexposed: ill/total	Relative risk	95% CI	P value
Ate onshore at non-Australian ports or during the tour*	27/54	8/58†	3.6	1.8 – 7.3	<0.0001
Ate during an onshore tour at Port 3‡	14/15	23/113§	4.6	3.1 – 6.8	<0.0001

* Missing data on 22 passengers who did not report or who could not recall when they developed the diarrhoeal symptoms they reported and/ or who could not recall whether they ate onshore or where they ate onshore.

† Did not eat or drink when they were onshore at any non-Australian port (Ports 3 to8; Figure) or during the onshore tour during this cruise.

‡ Missing data on 5 passengers who did not report or who could not recall when they developed the diarrhoeal symptoms they reported and/ or who could not recall whether they participated in this particular tour.

§ Did not participate in this tour

individual port was independently associated with symptoms.

Passengers suffered a range of symptoms on this cruise, although, apart from the *Salmonella typhi* isolates, the clinical and microbiological diagnoses were undetermined (viral cultures were not performed). Some of those interviewed reported more severe symptoms than those reported by others. This raises the possibility that agents other than *S. typhi* were also involved. Those who complained of vomiting and nausea alone could have been suffering from seasickness. A recent paper describes a similar occurrence of concurrent outbreaks of gastroenteritis and typhoid fever on a floating restaurant.[3] This paper also illustrates the difficulties in determining whether 2 syndromes had the same aetiology.[3]

We found that interviewers did not consistently ask about swimming in pools on board and onshore, and not all activities provided during the cruise were identified. We are therefore unable to draw any inference about a possible association between swimming and diarrhoeal illness. Additionally, we are unable to determine the role of person to person transmission because these data were incomplete including information on the temporal relationship between such exposure and symptoms. This cohort of Queenslanders was part of the larger cohort of all cruise passengers and crew, and the effect of exposures on these individuals and their activities are undetermined.

The use of onshore caterers for off-ship excursions has previously been reported as a risk factor for gastrointestinal illness amongst cruise ship passengers.[4] A cruise-associated diarrhoeal disease outbreak was defined as the occurrence of diarrhoeal symptoms among at least 3 per cent of passengers on a cruise.[4]

Reports of gastrointestinal symptoms aboard cruise ships are common.[5,6,7,8] Identified risk factors include inadequate treatment of water aboard ship and the need for strict hygienic control for food handlers and food preparation areas. This study was unable to investigate such risks.

Limitations of this study

More than 75 per cent of the passengers were interviewed more than 2 weeks and up to a month after the onset of their symptoms. Those who were ill may have been more likely to recall problems with sanitation and attribute their symptoms to particular events, especially as legal proceedings had already commenced by the time of interview. Few cases had ongoing symptoms when interviewed and many had taken antibiotics. Environmental investigations of the ship were not possible. Anecdotal reports regarding illness in the ship's crew did not indicate whether this related to food handlers. Lack of consistency of approach amongst interviewers resulted in less detailed data in some instances.

Conclusions

It has been estimated that one third of outbreaks on cruises might be prevented if onshore caterers are not used for off-ship excursions.[4] We support this conclusion, although the results of our study need to be interpreted with caution, as we cannot exclude person to person transmission, on-board sanitation and other activities as being responsible for at least some of the illness. Standard public health messages regarding care in food consumption outside Australia[9] should be reinforced.

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