Peer-reviewed articles

An influenza outbreak among pilgrims sleeping at a school without purpose built overnight accommodation facilities

Michael Staff, Maria I Torres

Abstract

This report describes a respiratory illness outbreak amongst a group of over 700 World Youth Day 2008 pilgrims staying at a basic accommodation venue for 1 week in July 2008. At this venue, 1 group of pilgrims was accommodated as a large group in a gymnasium and another group was sub-divided into smaller groups and accommodated in classrooms. Following confirmation of an influenza B outbreak by influenza point of care testing, control measures were promptly implemented. Isolation of cases, improved hand, respiratory and general hygiene, establishment of a mobile tent health facility at the accommodation venue, and the use of oseltamivir for the treatment of cases and prophylaxis of high risk contacts were implemented and the outbreak was brought under control within the week. Overall, 20% of pilgrims met the case definition for an influenza-like illness and 36% had an onset prior to arrival at the venue. The attack rate for those with onset while at the venue was significantly higher amongst pilgrims accommodated in the gymnasium than those staying in the classrooms. Findings from this study highlight the importance of early detection, the rapid implementation of control measures and appropriate prescribing of antivirals to manage influenza outbreaks. The findings also highlight the benefits of accommodating individuals in smaller groups within basic accommodation venues in the context of mass gatherings. *Commun Dis Intell* 2011;35(1):10–15.

Keywords: influenza, outbreak management, mass gathering, basic group accommodation

Introduction

In July 2008 Sydney was host to the World Youth Day (WYD), a large Catholic youth festival, which has been held every 2 to 3 years since 1986, each time in a different country. Of the 223,000 people who registered as pilgrims for WYD 2008, 110,000 were international pilgrims who came from 170 countries.[1] The majority of WYD 2008 activities occurred between 15 and 20 July. However, pilgrims started congregating in locations all over Australia from the second week in July. During this period, known as Days in the Dioceses, many of the international pilgrims were received by parishes and billeted in the homes of local pilgrims. All pilgrims then travelled to Sydney for the week of WYD 2008 activities. Approximately 100,000 pilgrims stayed at basic accommodation venues such as parish halls or schools.[2]

During the Days in the Dioceses there were unconfirmed reports of several cases of respiratory tract infections occurring among some groups of pilgrims prior to them arriving at their mass accommodation venues in Sydney. This paper aims to describe an outbreak of influenza among pilgrims at a WYD accommodation venue; describe and assess the management of the outbreak; and to determine whether sleeping in small groups in classrooms within the venue reduced the risk of contracting influenza during an established outbreak, in comparison with sleeping in a large hall.

Methods

Description of the facility and the study population

Seven hundred and five Solomon Islander and Australian pilgrims were provided with simple accommodation at a school, which did not have any purpose built facilities for overnight accommodation, from Sunday 13 July to Sunday 20 July 2008. There were 4 accommodation areas; 1 large school gymnasium with toilets and showering facilities and 3 groups of standard classrooms with each classroom housing approximately 8 pilgrims. The pilgrims in the classrooms shared a toilet/shower block that was separate to that accessed by the pilgrims sleeping in the gymnasium. The ratio of toilet/shower facilities to pilgrims met the recommendations that had been provided to the event organisers. Australian pilgrims were assigned to one of the 3 classroom groups based upon their parish of residence, and pilgrims from the Solomon Islands were accommodated in the gymnasium. Breakfast was provided in a communal area at the school while lunch and the evening meal were provided off site at other venues arranged for WYD activities. Pilgrims had been advised to be

vaccinated for influenza prior to attending WYD 2008 but it is not known what level of compliance with this recommendation was achieved.

Outbreak management

On Tuesday 15 July health authorities were notified of a probable respiratory illness outbreak at the venue. Initially, no designated health or medical facilities were available at the school and the 8 pilgrims who presented with a respiratory illness were isolated from the group and accommodated in separate classrooms where they were cared for by school staff. Cases were assessed by public health and ambulance staff with the more seriously ill transported to a local hospital emergency department for further treatment. Five cases with a clinically compatible influenza illness had point of care tests (QuickVue Influenza A+B Test, Quidel Corporation, San Diego, CA, USA) performed on nasal swabs with samples subsequently sent for laboratory immunofluorescence (IF) and polymerase chain reaction (PCR) testing. On Wednesday 16 July an additional 21 cases had nose and throat swabs collected.

When it became apparent that an outbreak was well established among the group, a decision was made to establish a designated mobile tent health facility at the school. This was a 30 bed tent hospital staffed by nurses and medical practitioners from the local Area Health Service and was operational from 16 to 21 July 2008. It had primary care treatment capacity with more serious cases requiring transport to local emergency departments for more complex assessments such as chest x-ray. Treatment guidelines consistent with national guidelines were provided to the clinicians at the facility.[3] The guidelines recommended oseltamivir treatment (75 mg bi-daily for 5 days) for all cases meeting the case definition and whose illness onset was within 48 hours of being seen and oseltamivir prophylaxis (75 mg daily for 10 days) for well pilgrims with predisposing conditions that may have increased their risk of influenza complications.

Individuals diagnosed with suspected influenza were isolated at the mobile health facility or in other suitable rooms at the school whilst infectious (infectious period = 5 days since onset of symptoms or 48 hours after commencing treatment with oseltamivir) or allowed to return home if this was their preference. Information on simple control measures such as hand washing and cough etiquette was distributed among pilgrims, increased hand washing facilities and facial tissues were made available and professional cleaners were engaged to maximise the venue's general cleanliness. Oseltamivir was used at the mobile health facility for influenza treatment and prophylaxis. Public health practitioners also assessed contacts and provided oseltamivir prophylaxis.

Epidemiological investigation

The following case definition, modified from the National case definition for influenza, was used to identify cases:

- self reported or measured (> 38°C) fever, plus
- cough or shortness of breath or coryza or sore throat, plus
- fatigue or myalgia or rigors or headache.

On Wednesday 16 July, a written questionnaire was administered to all pilgrims at the school. For the Solomon Islander group the questionnaire was administered in a single group setting with the assistance of a leader from the group who spoke English and was able to provide translation. The questionnaire asked about the presence and time of onset of influenza-like illness symptoms. For each symptom, respondents were asked to circle the day of onset in the previous 5 days. Age, gender, church group and accommodation site at the school were also recorded.

In the week prior to the WYD the pilgrims from Solomon Islander church groups had been billeted at several of the parishes of the Australian pilgrims who were also at the school during WYD. Church groupings allowed identification of potential exposures between the two nationalities prior to arrival at the school.

The clinical medical records and facility logs from the onsite health facility were used to verify and supplement the information obtained from the self completed questionnaires. Data obtained included medical history, clinical examination findings, medication prescribed, and referral for further treatment. Information was also obtained from public health records of assessments of contacts and antiviral prophylaxis prescription logs.

Data analysis

Data were entered into Epi Info with data analysis conducted using STATA 9.2 (StataCorp, College Station, Texas 77845 USA). Chi-square and Fisher's exact tests of significance were used to test for association between attack rates and accommodation arrangements.

Results

Initial cases and laboratory confirmation of outbreak

Of the 5 initial cases swabbed on 15 July, 2 tested positive for influenza B on point of care testing. Subsequent laboratory influenza B antigen detection by IF was positive for four of this group with

3 cases also PCR positive for influenza B. Of the 21 cases tested on Wednesday 16 July, five tested positive for influenza B on point of care tests, eight were confirmed as influenza B positive by PCR, and an additional three, who had positive influenza B results on IF, returned negative PCR results.

Questionnaire results

Six hundred and ninety-three pilgrims (433 Solomon Islanders and 260 Australians) provided responses to the questionnaire (98% response rate). Of the 693 responses, 653 provided sufficient information to allow a comparison with the case definition. Of these, 132 (20%) reported a recent fever and 233 (36%) complained of having had a cough. Seventeen per cent of pilgrims reported fevers commencing five or more days prior to the date of the questionnaire and 24% reported coughs.

Mobile health facility data

The mobile health facility attended to a total of 119 pilgrims (62 Solomon Islanders and 57 Australians); 5 pilgrims were seen on two occasions. There was sufficient information available to allow a comparison with the case definition for 101 of the pilgrims seen at the mobile health facility. Fifty-six (55%) met the case definition for influenza with 37 having had symptoms commencing in the last 48 hours. Six cases were referred from the mobile health facility to hospital for further assessment and management of their influenza-like illness. Twenty-three of the presentations to the mobile health facility who met the case definition and were identified within 48 hours of onset of symptoms, were treated with oseltamivir (Table 1). A total of 43 pilgrims received prophylactic courses of oseltamivir (13 from public health practitioners and 30 from the mobile health facility). Of those who received prophylactic antivirals, 15 were eligible for prophylaxis, 10 should have received treatment doses and 18 had no indication for receiving antivirals.

Cases meeting case definition

After combining the questionnaire and mobile health facility data 131 or 20% of pilgrims met the case definition for influenza (Table 2). Thirty-six per cent of cases commenced before arrival at the school on Sunday 13 July, with the first case reported to have started on 9 July. The attack rate for the period including both the time prior and following arrival at the school was significantly higher among the Solomon Islanders at 26%, compared with that for the Australians of 11% ($P < 0.01$).

Illness among Solomon Islanders when billeted prior to the World Youth Day

There were 13 church groups from the Solomon Islands who were billeted with parishes in Australia in the week prior to staying at the school. Based upon self-reported questionnaire responses all but two of these groups (both with 6 or less members) had one or more members being unwell with a cough

Table 1: Oseltamivir treatment of presentations to mobile health facility

Received treatment	Eligible to receive treatment		Total
	Yes	No	
Yes	23	5	28
No	14	13	27
Total	37	18	55

Table 2: Attack rates, by period and by accommodation group

Nationality	Number of pilgrims	Pilgrims became unwell over whole period*		Accommodation	Number of pilgrims†	Pilgrims unwell prior to arriving at the school		Pilgrims became unwell whilst at the school‡	
		n	%			n	%	n	%
Solomon Islanders	398	104	26.1	Gymnasium	398	43	10.8	61	17.2
Australians	255	27	10.7	Classrooms A	107	3	2.8	7	6.7
				Classrooms B	54	1	1.9	3	5.7
				Classrooms C	92	0	0	13	14.1
				Classrooms total	253	4	1.6	23	9.2§
Total	653	131	20.1		651	47	7.2	84	13.9

* Whole period i.e. from 9 July to 21 July 2008.

† Accommodation data were not available for 2 pilgrims.

‡ Denominator is well pilgrims as of Sunday 13 July (i.e. 355, 104, 53 and 92 for each accommodation group).

§ *P* value <0.05, comparison of Solomon Islanders and Australians' attack rates whilst at the school.

and/or fever before arrival at the school. Each of the 3 Australian classroom accommodation groups had some members from a parish that had billeted a Solomon Islander church group with an ill member.

Attack rates by accommodation

Table 2 shows the number of cases in each accommodation area broken down by time of onset of symptoms. There were cases of influenza among pilgrims prior to arriving at the school in three of the 4 accommodation groups with the greatest number from the Solomon Islander groups. After arriving at the school, the attack rates among the pilgrims in the Australian groups were 6.7%, 5.7% and 14.1% with no significant statistical difference between groups ($P = 0.1$). Among Solomon Islanders, the attack rate after arriving at the school was 17.2%; this was significantly higher than the attack rate of 9.2% among the Australian pilgrims considered as a single group ($P < 0.01$). The Figure describes the epidemiological curve for the outbreak broken down by nationality of pilgrim, commencing from 13 July, (the commencement of their accommodation in groups at the school).

Discussion

This study describes an influenza outbreak within a group of pilgrims brought together during a week long mass gathering. It highlights the usefulness of point of care tests in confirming the outbreak, the difficulty in administering antivirals despite deploying an onsite health facility and the potential impact of different accommodation arrangements.

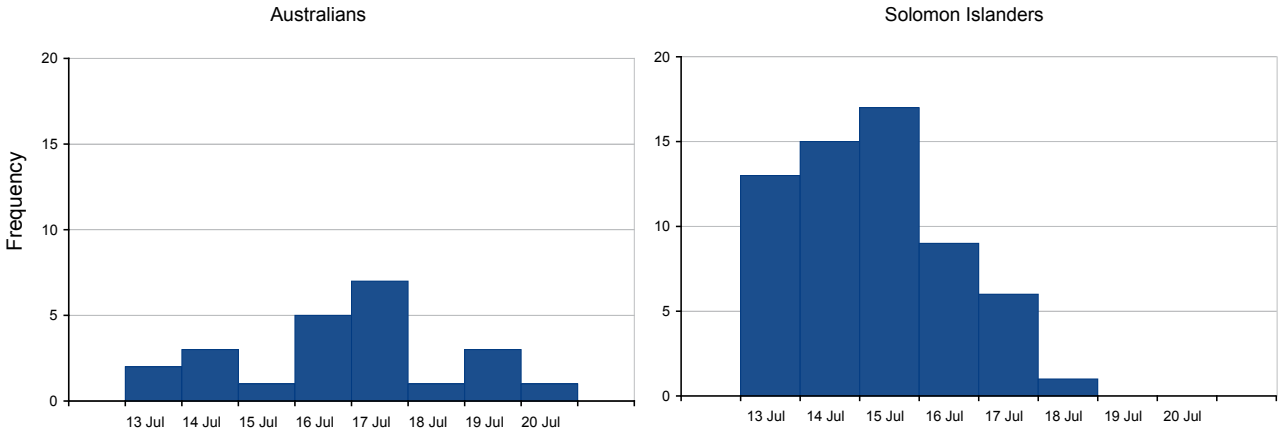
The overall attack rate of 20% observed in this study was within the range of rates reported by outbreak studies conducted during other, somewhat comparable, mass gatherings.[4,5] The setting of this outbreak differs from other group accommodation venues such as military and naval settings or residential aged care facilities, which have been the subject of previous influenza outbreak studies. WYD 2008 pilgrims accommodated at the school were grouped only shortly before or on arrival to the accommodation venue, and while they spent a significant amount of time with their group they also mixed with other pilgrims at and outside the accommodation venue. This was not comparable to military and other confined settings where members remain as part of their groups for extended periods, and where movement in and out of the setting and interaction with the outside environment is controlled.[6,7,8]

It is generally agreed that no single strategy used alone is effective in controlling infectious respiratory outbreaks.[9] As per national and state protocols, in addition to the use of antivirals for treatment and prophylaxis, several other measures including isolation of cases, promotion of sneeze and cough etiquette and hand hygiene were implemented to control the influenza outbreak. It is unknown how compliant sick pilgrims were with these voluntary control measures, but they appear to have had an effect in this population as the data suggest that the outbreak was under control by the end of the surveillance period on Monday 21 July 2008.

Given the anticipated high specificity and positive predictive value of point of care tests, a positive influenza point of care test result is very suggestive of influenza and may be sufficient to trigger an outbreak response.[10–12] The finding of 2 positive influenza B tests on the first day of this investigation gave health authorities grounds to implement control measures at the school very early in the response. Unfortunately, it is likely that their effectiveness to control the outbreak was undermined by the circulation of the virus amongst pilgrims for some time before they arrived at the school.

Establishing a mobile health facility was an exceptional measure implemented to deal with a special

Figure: Epidemiological curve, World Youth Day 2008 pilgrims, by nationality



situation. The implementation of such a measure has its own challenges such as sourcing and deploying appropriate clinical staff, maintaining appropriate documentation and medical records and establishing clear coordination and role definitions for clinicians and public health practitioners participating in the response. These issues need to be considered by all parties involved in an outbreak response to determine if and in what circumstances would such a strategy be used and how to best plan for this eventuality.

The use of oseltamivir for treatment and prophylaxis was one of the strategies considered appropriate to manage influenza outbreaks in the context of the special event that was WYD 2008, and the relevant protocols were available to clinicians and public health practitioners. The finding that only 62% of the cases eligible to be treated with oseltamivir actually received treatment is of some concern. This could be explained by the failure to identify cases, for example as a result of poor history taking by clinicians or poor symptom recall by patients, or by prescribing errors. These could also explain the mismatch between eligibility for prophylaxis and actual prescribing of prophylaxis. Strategies such as just-in-time training should be considered to ensure better clinician compliance with management protocols.

An important aspect of the WYD 2008 outbreak described here is the significantly higher attack rate observed amongst Solomon Islanders than Australian pilgrims, both prior to and after arrival at the school. It is likely that the influenza virus first started to spread amongst Solomon Islanders when they congregated in the Solomon Islands prior to arrival in Australia and continued to spread amongst the group while en-route hence explaining the higher prior to arrival attack rate.

The difference in attack rates observed between the Solomon Islander and the Australian groups whilst at the school, could be attributed to the differences in accommodation used whilst at the school. The Solomon Islander pilgrims, who were accommodated in a single large open plan area, had a significantly higher attack rate. The Australians, who were accommodated in smaller groups in classrooms, had, as a group, a significantly lower attack rate than the Solomon Islanders. The differences in attacks rates observed between the three classroom groups accommodating Australian pilgrims, although not statistically significant, suggest that the spread of illness was contained within discrete accommodation areas to some extent. This finding may have implications for planning future mass gatherings where non-purpose built facilities are used to accommodate participants.

An alternate explanation for the higher attack rate among the Solomon Islanders is that the outbreak was halted prematurely among the Australian pilgrims with the end of WYD 2008 activities. However, if this had been the case, the number of influenza cases among the Australian pilgrims would probably have continued to increase during the period at the school; this was not observed, on the contrary the outbreak appeared to peak among the Australian groups, as well as among the Solomon Islanders, before the end of their stay at the school.

One of the major limitations of this study is the lack of information that was available about symptoms prior to pilgrims arriving at the school. Although it is clear that a respiratory illness was circulating among the Solomon Island pilgrims prior to arrival at the school and that there was a potential for Australian pilgrims from each classroom group to have been exposed to the illness, it is likely that estimates of illness prior to arrival at the school are inaccurate. Furthermore, when looking at attack rates among accommodation groups it was not possible to adjust for the mixing that occurred during the various daytime and evening activities in which pilgrims participated.

This study has highlighted the potential of influenza to cause large outbreaks in a mass gathering setting and the need to consider the physical layout of accommodation facilities to help control the spread of illness. Early detection, rapid implementation of control measures, appropriate prescribing of antivirals and accommodating individuals in smaller groups within an accommodation venue, are all measures that need to be considered in managing and preventing these outbreaks.

Acknowledgements

We thank: Michele Puech for reviewing the draft paper and providing comments; staff at the Northern Sydney Central Coast Public Health Unit, in particular Andrew Bates, and at the NSW Health Public Health Emergency Operations Centre for their involvement in the public health management of the outbreak; Stephanie Williams for her involvement in the management of the outbreak and in the early stages of the study.

This study was conducted as part of the public health response to the outbreak and did not require approval by an ethics committee.

Author details

Dr Michael Staff, Public Health Physician
Ms Maria Isabel Torres, Public Health Epidemiologist

Northern Sydney Central Coast Health, Public Health Unit, Hornsby, NSW

Corresponding author: Maria Isabel Torres, Northern Sydney Central Coast Health, Public Health Unit, c/o Hornsby Ku-ring-gai Hospital, Palmerston Road, HORNSBY NSW 2077. Telephone: +61 2 9477 9400. Facsimile: +61 2 94821650. Email: chtorres@nsccahs.health.nsw.gov.au

References

1. World Youth Day 2008. [online] Accessed 16 April 2010. Available from: http://www.wyd2008.org/
2. Fizzell J, Armstrong PK. Blessings in disguise: public health emergency preparedness for World Youth Day 2008. *Med J Aust* 2008;189(11–12):633–636.
3. NSW Department of Health. Use of oseltamivir for the treatment of influenza: advice for clinicians managing pilgrims during World Youth Day 2008. Public Health Emergency Operations Centre. 18 July 2008.
4. Rashid H, Shafi S, Haworth E, El Bashir H, Memish ZA, Sudhanva M, et al. Viral respiratory infections at the Hajj: comparison between UK and Saudi pilgrims. *Clin Microbiol Infect* 2008;14(6):569–574.
5. Gundlapalli AV, Rubin MA, Samore MH, Lopansri B, Lahey T, McGuire HL, et al. Influenza, Winter Olympiad, 2002. *Emerg Infect Dis* 2006;12(1):144–146.
6. Balicer RD, Huerta M, Levy Y, Davidovitch N, Grotto I. Influenza outbreak control in confined settings. *Emerg Infect Dis* 2005;11(4):579–583.
7. Earhart KC, Beadle C, Miller LK, Pruss MW, Gray GC, Ledbetter EK, et al. Outbreak of influenza in highly vaccinated crew of U.S. Navy ship. *Emerg Infect Dis* 2001;7(3):463–465.
8. Klontz KC, Hynes NA, Gunn RA, Wilder MH, Harmon MW, Kendal AP. An outbreak of influenza A/Taiwan/1/86 (H1N1) infections at a naval base and its association with airplane travel. *Am J Epidemiol* 1989;129(2):341–348.
9. Jefferson T, Foxlee R, Del Mar C, Dooley L, Ferroni E, Hewak B, et al. A. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. *BMJ* 2008;336(7635):77–80.
10. Communicable Diseases Network Australia. A Practical Guide to Assist in the Prevention and Management of Influenza Outbreaks in Residential Care Facilities in Australia. [online] May 2009. Available from: http://www.health.gov.au/internet/main/publishing.nsf/Content/cdna-flu-guidelines.htm
11. Charles PG, Grayson ML. Point-of-care tests for lower respiratory tract infections. *Med J Aust* 2007;187(1):36-39.