An outbreak of shigellosis in a child care centre

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Abstract

Outbreaks of shigellosis in child care are not commonly reported in Australia, however *Shigella* bacteria can easily spread in these settings. We report an outbreak of shigellosis in a child care centre and discuss the control measures implemented. This investigation identified 20 confirmed cases of *Shigella sonnei* biotype g and a further 47 probable cases in children and staff who attended a child care centre, and their household contacts. The investigation highlighted the importance of stringent control measures and protocols for dealing with outbreaks of *Shigella* and other enteric infections in the child care setting, and the importance of prompt notification by both doctors and child care centres, of suspected outbreaks. *Commun Dis Intell* 2004;28:225–229.

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Introduction

Shigellosis is an acute enteric bacterial infection generally characterised by a mild and self-limiting gastroenteritis, however illness may be severe. Symptoms include diarrhoea accompanied by fever, nausea and sometimes toxaemia, vomiting, cramps, and tenesmus. In typical cases, the stools contain blood and mucus. Many cases present with watery diarrhoea. Convulsions may be an important complication in young children. Illness may last from several days to weeks with an average of four to seven days. Asymptomatic infections also occur.[1]

At the time of this outbreak there were no publications of outbreaks of shigellosis in child care centres in Australia, however they are considered high-risk settings due to close contact of children with each other and the low numbers of bacteria (10–100) required to cause illness.[1] Transmission of infection can occur through inadequate hand washing after defaecation or nappy changing, faecal contamination of nappy changing surfaces and fomites, or from person-to-person directly via the faecal-oral route. We report an outbreak of shigellosis in a child care centre and discuss the control measures implemented.

On 4 December 2000, during a routine investigation by the Communicable Diseases Section (CDS), Victorian Department of Human Services, of a shigellosis notification, the notifying medical practitioner advised that other children who attended the same child care centre as his patient were ill. The Director of the centre subsequently reported that approximately 15 children, some of their family contacts and a number of staff had been ill with gastroenteritis over a two and a half week period. At the time of the outbreak, there were approximately 70 children attending the centre and 11 staff employed. The centre has three rooms; nursery/baby room (0–1 years), toddler (2–3 years) and kindergarten (4–5 years), and operates from 7 am to 6 pm. Mixing of these groups in the centre occurs in the early morning and late afternoon.

Methods

A case series investigation and active case finding was conducted. A probable case was defined as any child or staff member of the child care centre, or their household contacts, who had been ill with a gastrointestinal illness consisting of diarrhoea and self-reported fever between 12 November and 22 December 2000. Cases were confirmed if S*higella sonnei* biotype g was isolated from a faecal specimen.

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Ethical approval was not needed as the investigation was carried out as part the Communicable Diseases Section core duties under the *Health Act 1958*.

The Director provided details on the number of staff and children attending the centre and consent to contact people. All ill persons or their parents were interviewed by phone using a standard questionnaire. This included demographics, clinical symptoms, whether hospitalised, environmental exposures and which room children attended within the child care centre if the case was a child, or the staff duties at the centre if the case was a staff member. If the case was a household contact of an attendee at the centre, then their occupation was obtained.

Local Government Environmental Health Officers conducted environmental inspections according to Department of Human Services' guidelines,[2] and organised collection of faecal specimens from cases. These were collected even if symptoms had subsided as *Shigella* can be excreted for up to four weeks after symptoms cease.[3] CDS staff also visited the centre to provide advice and assistance with implementation of control measures.

Control measures were based on reports from a similar outbreak in the United States of America[4] due to an inability to identify relevant protocols in Australia.

Specimens collected were submitted to the Microbiological Diagnostic Unit and the Victorian Infectious Diseases Reference Laboratory for microbiological analysis. Confirmation of species, sub-typing and antibiotic sensitivity analyses were conducted at the Microbiological Diagnostic Unit. Testing for viral pathogens was conducted at the Victorian Infectious Diseases Reference Laboratory.

Results

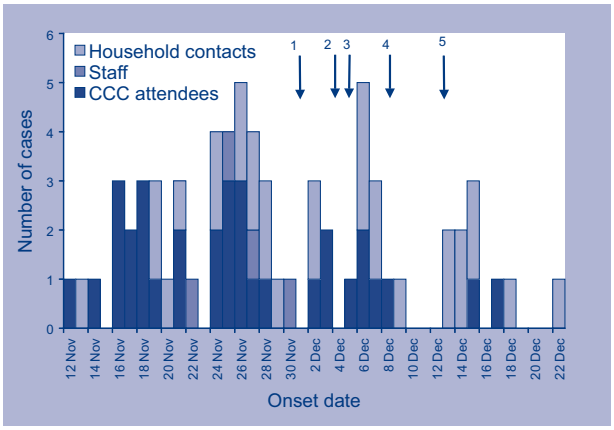
Epidemiological investigation

Sixty-seven probable cases were identified; 33 children (47% of children attending), four staff (37% of staff employed) and 30 household contacts (total denominator unknown). The age of cases ranged from 1–59 years, with household cases amongst children aged 1–17 years and adults aged 24–52 years. Twenty-seven cases were male. Two cases were hospitalised and there were no deaths. Onset of illness was between 12 November and 22 December 2000, with median duration of five days and range 0.5 to 14 days.

Characteristics of clinical details are shown in Table 1. Clinical illness was consistent with *Shigella*.

The first case was in a child from the toddler room (Figure). Staff reported illness near the middle of the outbreak, around the same time as the majority of the family contacts. Within four days after the onset of illness in the first case, cases were detected in all three rooms at the centre. Onset of illness in the first family member so early in the outbreak could not be explained. A source of illness was not identified for the case with the earliest onset.

Figure. Epidemic curve, child care centre outbreak, Victoria, 2000, by exposure category



1. Notification of first case received.
2. Outbreak identified.
3. Initial control measures implemented.
4. Case positive for both norovirus and *Shigella*.
5. Cohorting and antimicrobial treatment commenced.

Table 1. Clinical description for 63 cases with reported symptoms of *Shigella* associated with a child care centre, Victoria, 12 November to 22 December 2000

Symptom	Percentage
Diarrhoea	97
Watery diarrhoea	69
Fever	55
Abdominal pain	52
Vomiting	32
Blood in faeces	8

There were 12 pairs of siblings attending the centre (four pairs in the toddler and kinder rooms; three pairs in the kinder and baby room; three pairs all in the toddler room; one pair in the toddler and baby room; one pair in the baby room) and potentially contracted their illness from each other either at home spreading the illness to other rooms at the centre, or contracted their illness at the centre from other children in their room, or in the mixed morning and afternoon groups.

Environmental investigation

Clean-up procedures were implemented according to CDS guidelines, although a chlorine base sanitiser was not used for cleaning until 15 December 2000. Detailed information on the hygiene practices at the child care centre was incomplete, however the premises were in a good condition and it had an approved Food Safety Plan. Methods for cleaning toilets and nappy change tables were found to be inadequate. The levels of hygiene and cleanliness were evaluated according to the Department of Human Services' *Guidelines for the Investigation of Gastrointestinal Illness* [2] and *Staying Healthy in Child Care*,[5] and advice given according to these guidelines.

It was determined that children at the centre mix freely with each other at the beginning and end of each day, and were not confined to separate rooms. Staff worked in multiple rooms as child care workers; three of the staff positive for *Shigella,* worked in the toddler room, two of these also worked in the nursery and the fourth staff member occasionally assisted in all rooms as required and occasionally worked as a food handler.

Laboratory investigation

Faecal specimens were collected at a median of nine days after onset (range 0–29 days). Forty-nine stool specimens were submitted; 20 (41%) were positive for *Shigella sonnei* biotype g. Confirmed and probable cases by type of exposure are outlined in Table 2. One specimen in a child attending the centre was also positive for both *Shigella* and norovirus. Onset of illness in this child was 8 December, near the end of the outbreak.

One culture positive case was tested 29 days after their onset date. More adults (family contacts and staff) than children were culture positive (Table 2). This may be due to specimens in adults having been taken closer to their onset date making it more likely that they were still excreting *Shigella*.

Table 2. Outbreak cases by confirmation status and exposure type

Exposure type	Confirmed	Probable	Total
Toddler room	4	11	15
Kinder room	1	7	8
Nursery/baby room	2	8	10
Staff	4	0	4
Adult family contact	7	11	18
Sibling contact	2	10	12
Total	20	47	67

All isolates were resistant to streptomycin, tetracycline, sulphathiozole and trimethoprim; three were also resistant to ampicillin and the remaining were sensitive. All were sensitive to chloramphenicol, kanamycin, nalidixic acid, spectinomycin, gentamicin and ciprofloxacin.

Instances of isolates, with and without an antibiotic resistance marker, isolated from the same patient have been noted. Consequently, the result of both ampicillin-resistant and ampicillin-sensitive strains being isolated in this outbreak was not a surprise. The protocol for any testing requests a pure culture, i.e. taken from a single colony, thus laboratory tests may not have detected both sensitive and resistant isolates from the same patient. The original source of the infection may have been a mixture of both ampicillin-sensitive and ampicillin-resistant strains. Another explanation may be that the ampicillin resistance in some of the isolates may have been transferred from other enteric organisms within the patients' intestines. The isolates by all other parameters were indistinguishable other than the ampicillin resistance.

Control measures

The majority of cases had already occurred before CDS was notified of the first case (Figure), delaying control of the outbreak. Initial control measures such as clean-up procedures, enhanced hygiene and hand washing, were implemented on 5 December 2000. More stringent control measures, such as cohorting and antimicrobial therapy, were implemented on 13 December 2000. Onset of illness in the last case at the centre was 13 days after control measures were first implemented but only five days after more stringent measures were initiated (Figure).

Further transmission occurred in family contacts with the last case reporting an onset of illness on 22 December 2000. In order to minimise the impact on parents and staff, the child care centre remained open throughout the outbreak.

Case management

Those who still had diarrhoea were excluded from the child care centre until they had received an antibiotic sensitive to the *Shigella* strain for at least 72 hours[6] and diarrhoea had ceased. If a person could not or refused to take antibiotics, he or she could not return to the centre until asymptomatic and had two consecutive negative faecal specimens taken at least 24 hours apart.

Any child or staff member with a history of diarrhoea in the past month who were asymptomatic at the time of the investigation (irrespective of whether their faecal specimen was positive for *Shigella*) were presumed to have had shigellosis and to still be infectious. They were cohorted in a 'get well room' until they had taken appropriate antibiotics for at least 72 hours,[6] after which they could return to their usual room or duties whilst completing the full course of antibiotics. The use of a 'get well room' was used as an effective strategy in a similar outbreak overseas.[7]

Children in the 'get well room' were allocated a specific toilet and hand basin throughout the duration of the outbreak so as to prevent the spread of *Shigella* to others. As the centre had only one staff toilet, ill staff (who lived near work) agreed to use their home toilet rather than being excluded until antibiotics had been received for at least 72 hours. Similarly, ill staff could not conduct any cleaning or cooking at the centre for the same time period. One food handler was required to provide two consecutive negative faecal specimens taken at least 24 hours apart before returning to normal duties.

A letter of advice about the outbreak and *Shigella* fact sheet was given to all families of attendees. Parents were advised to take the letter with them to their doctor if their child or any household member had been or became ill. Family contacts in high-risk occupations (a registered nurse and supermarket worker) were identified during the interview process and provided with appropriate advice (such as recommendations for work exclusion) in order to prevent the outbreak from spreading further.

Treatment of cases with an appropriate antibiotic was recommended in this outbreak as this usually reduces duration of carriage to a few days.[1] Recommendations were based on the therapeutic guidelines[8] and the antibiotic sensitivity pattern of the first notified *Shigella* case. Ampicillin was initially recommended however parents complained that ampicillin was not available in syrup or powder form and amoxicillin was subsequently recommended for children too young to take tablets.[3]

Three cases (one child and two adults) had a strain resistant to ampicillin. An alternative antibiotic was not available for the child and norfloxacin was recommended for the adults.

Environmental measures

At least twice daily clean-up procedures were carried out throughout the centre. Diluted household bleach (one cup of bleach to nine cups of water) was used as a sanitiser; spray bottles with the bleach were used to clean door handles, knobs and surfaces and the solution was made up twice daily. Hand washing was re-emphasised and posters were displayed in bathrooms. Staff supervised the hand washing of children and assisted those children too young to wash their own hands. Loose soap in the toilets was replaced with liquid soap dispensers, which were washed and refilled at various times throughout the day; paper towels were provided for hand drying.

Food on common plates was not permitted and children in the cohort room were not allowed contact with children from other rooms. Separate batches of toys were used in the morning and the afternoon and were required to be cleaned and sanitised prior to use at each session. The nappy changing area was cleaned and sanitised twice daily.

New admissions to the centre were not permitted during the outbreak and the transfer of children to other centres was monitored.

Discussion

This investigation identified 20 confirmed cases of *Shigella sonnei* biotype g and a further 47 probable cases in children and staff who attended a child care centre, and in their household contacts. The extent of this outbreak is likely to be due to person-to-person transmission. The implementation of stringent clean-up procedures, enhanced hand washing and hygiene and the support of staff and families at the child care centre was an effective strategy in controlling the outbreak. While we did not investigate asymptomatic infection, once these procedures were fully implemented, transmission at the centre appeared to have ceased after five days and no further cases were reported.

The finding of one co-infection with norovirus is interesting and it is possible that other cases of norovirus were not detected, however we do not believe other cases of gastroenteritis in the centre were viral infections. Although a broad case definition was used, the clinical illness (Table 1) was consistent with *Shigella* and did not resemble the explosive nature of viral gastroenteritis outbreaks. In addition, over 30 per cent of the faecal specimens collected were tested within 0–10 days after onset of illness and if norovirus was present more positive specimens would have been expected. It is however plausible to assume that the stringent control measures implemented in this setting potentially prevented a concurrent viral gastroenteritis outbreak.

The interventions adopted in this outbreak of *Shigella* appeared to be effective. Excluding persons with diarrhoea from attending the child care centre until symptoms have ceased is critical. Active follow-up of illness in household members gave the opportunity to educate on gastrointestinal illnesses and ways of mini-

mising the spread to other family contacts. Persons in high-risk occupations were educated on exclusion requirements and personal hygiene at work.

Providing support to staff and parents was important. An earlier visit to the centre would have been beneficial in ensuring staff obtained clear and uniform information on the outbreak and the importance of adhering to control measures. Keeping the child care centre open but with extensive restrictions appears to have been justified. It prevented parents from taking their children to another centre and spreading the outbreak further. Allowing staff to work whilst excreting *Shigella* also eliminated the stress of insufficient staff.

Antibiotic treatment appeared effective with only two cases in attendees and no cases in staff occurring after this intervention (Figure). However, as faecal specimens were not collected after the completion of antimicrobial treatment, the true effectiveness of antimicrobial treatment in this setting could not be determined. Further evaluation of antibiotic effectiveness in outbreak settings would be beneficial. The lack of appropriately formulated antibiotic therapy for small children was problematic and we suggest that therapeutic guidelines are reviewed to take into account the lack of availability of ampicillin for small children and the use of amoxicillin in shigellosis.

This investigation also highlighted the importance of prompt notification by both doctors and child care centres of suspected outbreaks, so that investigations and control measures can be implemented in a timely fashion. Similarly, specific protocols for the management of outbreaks in childcare settings are essential and the Department of Human Services is incorporating those used in this outbreak into gastrointestinal illness management guidelines.

To further minimise such outbreaks, child care centres are required under the Health Infectious Diseases Regulations, to exclude children with diarrhoea until ceased or a medical certificate is provided (and a policy around this should be in place at child care centres). Child care centres should seek advice from their local health department where an outbreak is suspected or where advice is required regarding infectious diseases.

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