Introduction
On 4 Nov 2010, the Ministry of Health (MOH) was notified of 139 students suffering from food poisoning after consuming meals provided at the school canteen on 1-3 Nov 2010. The school had a total enrollment of 420 students from Secondary 1 – 5 (of which 331 students were hostelites) and is supported by 145 staff. Six meals supplied by a licensed caterer were served at the school canteen, consisting of breakfast, morning tea-break, lunch, afternoon tea-break, dinner and supper.

Field investigations were carried out immediately at the school. This report summarises the investigation into the outbreak.

Methods
A case was defined as a person who developed symptoms of gastroenteritis after consuming food from the school canteen from 1-2 Nov 2010. The students of the school were identified and their personal particulars such as age, gender, and ethnicity were recorded. Signs and symptoms of those who were ill and the types of medical treatment sought were obtained. A case-control study was conducted using a standard questionnaire to determine the vehicle of transmission based on the food items consumed over the two days by both well and unwell students of the school.

As part of field investigations, food and environmental samples were taken from the school canteen and the food premises of the caterer for microbial analysis. Implicated food handlers and cases reported were screened for enteropathogens (Shigella, Campylobacter, Vibrio, Salmonella, Rotavirus and Norovirus). A total of 39 food samples, 13 environmental swabs and 15 food handlers from the school canteen were tested. Another 3 food samples were collected from the food premises. There were also 2 stool samples collected from the affected cases.

Differences in attack rates between cases and controls using the Chi-square or Fisher’s exact test were examined first by day and then by meal. Differences in food-specific attack rates by meals were subsequently examined using bivariate analyses, with crude odds ratio (OR) and 95% confidence intervals (CI) computed. Multivariate logistic regression was used to determine independent food items associated with the outbreak, using forward stepwise selection based on maximum partial likelihood estimates. The adjusted odds ratio (AOR) and 95% CI were computed. Statistical analyses were performed using PASW Statistics Version 18.0 (SPSS Chicago, IL). A p value of 0.05 was considered statistically significant.

Findings
A total of 106 cases were identified, giving an attack rate of 32%. The cases were aged between 13 and 16 years, and the male to female ratio was 1.36:1. The attack rate was highest in Malays (56%), followed by Chinese (29%), Indians (18%) and Others (17%). Their clinical features comprised diarrhoea (99%), abdominal pain (91%), headache (24%), nausea (10%), vomiting (7%) and fever (4%). Eleven cases (10.4%) sought outpatient treatment while the rest self-medicated. None were hospitalized. All recovered uneventfully.

Of the 106 cases reported, we are able to obtain the time of onset of illness from 74 cases. Based on the available information, the mean and median incubation periods were 44.5 hours, and ranged from 3 – 58 hours. The epidemic curve is shown in Figure 1.

A total of 76 students responded to the questionnaire and remained well served as controls. Based on the case-control data, food served on 1 Nov 2010 was significantly associated with the illness (p=0.032). The specific food items which showed significant association with the outbreak were cordial drinks (odds ratio 4.6, p<0.0005) and mini chicken frank rolls (odds ratio 2.4, p=0.016). The mini chicken frank rolls were provided for morning tea-break while the drinks had been available for all the meals that day. Multivariate logistic regression showed significant associations between the occurrence of illness and the consumption of cordial drinks (adjusted odds ratio 3.7, 95% confidence interval 1.980 – 6.975; p<0.0005) and mini chicken frank rolls (adjusted odds ratio 2.7, 95% confidence interval 1.280 – 5.854; p=0.009) on 1 Nov 2010.
Of the 15 food handlers screened, one of them from the school canteen was found to be positive for *Salmonella* Group D. She was asymptomatic prior to the screening. Further investigation revealed that this food handler was involved in the handling of the mini chicken frank rolls on 1 Nov 10. One food sample taken from the food factory was positive for *Bacillus cereus* (10 cfu/g).

The mini chicken frank rolls were prepared for the school canteen in a licensed food premises. The production processes involved forming of the dough, cooking of the chicken franks, and baking of the final product which was completed by 1.30 am on 1 Nov. The rolls were then placed in a holding area (at room temperature) and delivered to the school by 5.30 am on the same day. At the school, they were transferred by the food handler found to be positive for *Salmonella* Group D into plastic containers in a serving area before being put into the chiller by 7 am. The mini chicken frank rolls were served at 10 am. The sequence from the time of preparation of the mini chicken frank rolls to the time of delivery to the school is depicted in Figure 2.

The cordial drinks were prepared at the school from cordial syrup using a plastic bucket, measuring container and ladle. Water was collected directly from a tap using a bucket before ice and syrup were added. After thorough mixing, the mixture was then poured into the respective drink dispensers. It should be noted that the food handler preparing the cordial drink was not the one tested positive for *Salmonella* Group D.

**Discussion**

This is a common source outbreak of gastroenteritis with clinical and epidemiological features suggestive of salmonella food poisoning. However, there is insufficient evidence to pin point the exact causative agent and source of contamination. No salmonella bacteria were isolated from the implicated food items and reported cases. The asymptomatic food handler tested positive for *Salmonella* group D could have acquired the infection through handling the implicated food (or other contaminated foods) rather than being the source of infection in this outbreak.

Our investigations revealed lapses in personal and food hygiene practices. A food handler was observed to be handling ready-to-eat food with bare hands during our inspection of the food premises where chicken frank rolls were prepared. The long duration of storage at ambient temperatures between preparation and consumption of the implicated food would have allowed the bacteria to multiply to high infectious doses. The exact mechanism by which the cordial drink was contaminated could not be determined.

The caterer was directed to ensure a tighter supervision of food preparation, storage, handling and transportation and to implement a good system for monitoring the hygienic quality of all ready-to-eat food served at the canteen, including those obtained from external suppliers.
Figure 1: Onset of illness of 106* food poisoning cases at a school in Singapore, 1-3 Nov 2010

* 32 cases unable to recall either onset date or time

Figure 2: Manufacture and distribution process of mini chicken frank rolls from food premises to the school

31 Oct, 1pm: Start preparation at food factory (eg. “forming” of dough, cooking of chicken franks)

31 Oct, 12midnight: Start baking of mini chicken frank roll

1Nov, 1:30am: Finish baking of mini chicken frank roll and left to cool at room temp in holding area.

1Nov, 4:30am: Delivery trucks leave for school

1Nov, 7am: Mini chicken frank rolls transferred into plastic containers and stored in chiller room

1Nov, 10am: Mini chicken frank rolls removed from chiller room and pushed to hall for serving to students without re-heating

1Nov, 5:30am: Mini chicken frank rolls delivered to school
A CLUSTER OF MEASLES CASES IN A FAMILY SHELTER HOME

Introduction

Measles is a highly communicable disease that could cause severe complications and death in young children. It remains one of the leading causes of death among young children globally (World Health Organization, 2009). It could be prevented by immunization in the early years of life (World Health Organization, 2009) (Heymann, 2008).

Since measles immunization was made compulsory in Singapore in 1985 and with the introduction of the two-dose MMR immunization in 1998, the incidence rate of measles infection has declined significantly from 18.8 (per 100,000 population) in 1992 to 0.3 in 2009 (Ministry of Health, Singapore, 2009). Despite the low incidence rate, measles remains a disease of public health importance in Singapore and notification of measles cases to the Ministry of Health (MOH) is mandatory by law (Ministry of Health & Tan Tock Seng Hospital, 2011).

In March 2010, MOH identified a cluster of four measles cases linked to a family shelter home through the mandatory infectious diseases notification system.

Epidemiological Findings

The cases involved four children from three families who were staying in a welfare shelter for families in difficult social situations. The children were aged between nine months and nine years.

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>MMR vaccination status at onset of symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9 yrs</td>
<td>Female</td>
<td>Malay</td>
<td>Received 1 dose four days prior to symptom onset</td>
</tr>
<tr>
<td>2</td>
<td>2 yrs</td>
<td>Male</td>
<td>Malay</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>1 yrs</td>
<td>Female</td>
<td>Malay</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>9mths</td>
<td>Male</td>
<td>Chinese</td>
<td>None</td>
</tr>
</tbody>
</table>

Figure 1: Demographics and MMR vaccination history of the cases

Figure 2: Date of Onset of 4 cases of measles in a family shelter home, 2 – 31 March 2010
Case 1

Only the 9-year-old case received one dose of MMR prior to onset of symptoms. However, it was likely that the case was already exposed to measles at the point of vaccination as the incubation period for measles is about 10 days from exposure to fever. This case was not vaccinated in early childhood according to the National Childhood Immunization Programme (NCIP) because the family thought it was unnecessary. As such, the case was not vaccinated until 8th March 2010 when the School Health Service team went to the school where the case was attending to carry out the school’s annual immunization exercise.

Case 2 and 3

The 1-year-old and 2-year-old were siblings. They were not vaccinated because their parents were concerned about the cost involved and were not aware that MMR their children could receive MMR vaccination free of charge in polyclinics.

Case 4

The 9-month-old case was not due for MMR vaccination when exposed to the cases in the shelter home.

Control measures

The shelter home was community living with rooms assigned to the families and common kitchen, toilet and activity area. The home was restricted to staff and occupants only and no visitors were allowed into the home. While the common areas were cleaned by the staff, the individual rooms were cleaned by the respective occupants. Control measures implemented in the home includes:

1. Maintaining good ventilation in common areas by keeping the fans switched on during periods of high human activity level
2. Cleaning of common areas with diluted bleach solution twice daily
3. Encouraging the occupants to clean their rooms twice daily with the diluted bleach solution provided
4. Informing all occupants in the shelter of the cases and advising the importance in maintaining good personal and environmental hygiene to prevent further transmission
5. Advising all parents to vaccinate their children if they have not done so
6. Advising all parents to seek medical attention early if their child fell ill
7. Informing the parents to notify the shelter home staff if their child fell ill

Active case detection

Active case detection found no case with similar symptoms in the school that the 9-year-old case was attending. There was no new case detected in the shelter home since the 1st April 2010.

Comments

This cluster showed the transmission of a highly infective disease being introduced and propagated in a congregated setting. Although the MMR vaccination coverage among Singaporean children and children of permanent residents has achieved 93% or more by age two, there remained a portion of susceptible population at risk in the community. The presence of this susceptible population has the potential of causing an outbreak in the community, especially if a substantial number of them were exposed in congregated settings such as childcare centres, schools and social welfare homes. The infection could be caught by the 9-year-old from the community and transmitted to the later three cases because the case had seemingly more mobility when compared to the others.

Although there are regulations for prove of vaccination when enrolling children into childcare centres and primary schools, those without prove of vaccination were still accepted by the centres and schools with a notice to the parents to follow-up with the child’s vaccination. The enforcement of having all children meeting the vaccination requirements was left to the individual centres and schools. Even if the school did enforce their vaccination requirement on the 9-year-old case, the case, still, might not stay in the school long enough for the enforcement to be effective because of the case’s frequent change in schools as the family moved from shelter to shelter. Also, the case’s frequent change of residential addresses and schools made it difficult for the School Health Service (SHS) to track her even though they know that she has not been vaccinated.
This cluster has identified a possible susceptible population in the community staying in congregated settings. In order to prevent future outbreaks of vaccine preventable diseases in such settings, it might be worth considering extending the vaccination requirement established for schools and childcare centres to social welfare homes with children. This is especially so for diseases that are highly infective and when cost of vaccination is funded by the government.

More needs to be done to identify susceptible population in the community, inform them of the government funded immunization programmes, and facilitate the accessibility to such programmes. Future studies could be undertaken to understand the various aspects of vulnerability to disease outbreaks among foreign workers staying in dormitories in the arena of public health and occupational health.

References


