

## Preliminary Investigation Report

# Paratyphoid Fever Outbreak in an apartment building of Changzamtog, Thimphu, Bhutan, June 2017

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## Background

*Salmonella enterica* is the leading cause of community-acquired bloodstream infection in low and middle income countries (1). *Salmonella enterica* serovar paratyphi B causes two clinical syndromes: paratyphoid fever and self limited gastroenteritis (2). It is predominantly transmitted through water or food contaminated with feces. The risk for infection is high with poor sanitation and lack of access to safe water and food. Fever, headache, malaise and anorexia are the most common clinical manifestation of the disease (3).

On June 21, 2017, Royal Centre for Disease Control (RCDC) was notified about the admission of three patients diagnosed with *Salmonella* Paratyphi B and one suspected patient in JDWNR Hospital. All patients were verbally confirmed to be living in the same private apartment building in Changzamtog, Thimphu. This information heralded the exposure of those patients to the same source which may lead to the sustained transmission of infection to other residents. Thus investigation was conducted to determine the source and risk factors of the outbreak for implementing evidence-based prevention and control measures. The team comprising of Public Health Professional, Clinical Officer, and Laboratory Personnel from RCDC was deputed for the investigation with the following objectives:

1. To verify the reported cases and trace for additional cases
2. To determine the source and describe risk factors for the transmission of infection
3. To implement prevention and control measures

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## Methods

### Epidemiological investigation

The building where the paratyphoid fever was reported is situated in Changzamtog (Thimthrom), Thimphu, Bhutan (Figure 1). Built in 2001, the building has eight apartments. There are 33 residents currently occupying the building. During the time of investigation, residents living in the lower apartment have all left to Phuntsholing (Southern region of Chukha district) on their vacation. On arrival in Phuntsholing, six year old child of the family was admitted to hospital with high grade fever and headache.



Figure 1 Location of apartment building (marked) in Changzamtog, Thimphu, Bhutan,

For the investigation, a suspected case was defined as a resident of private apartment building (DSB), located in Changzamtog, Thimphu, who manifested fever and headache with or without diarrhea, vomiting from 5<sup>th</sup> to 23<sup>rd</sup> June 2017. Confirmed case was defined as any suspected case who are laboratory confirmed with *S. Paratyphi B*. Cases were identified through communication via healthcare providers and by reviewing the medical records in the cabin of JDWNR Hospital. Additional cases were obtained by visiting the apartment building in each

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apartment and patients meeting the case definition of “suspected case” were enrolled for the study. Face to face interview was conducted with every household member to collect demography and clinical information in addition to identification of risk factors such as; 1) personal hygiene, 2) type of food and fruit consumed in the past five days of onset of symptoms, 3) whether they drank boiled water or milk, 4) whether they have attended any social gathering (party, picnic, dinner, etc) and 5) past travel history before the onset of their symptoms.

### **Environmental investigation**

The premise in and around the building was inspected. The inspection was done for drainage system (sewerage) and the reservoir tank through which water is supplied to each apartment. We also queried the house owner on the source of water, whether their source of water is from the City Corporation or privately owned. Water samples from reservoir tank and running water from tap of the apartment of both sick and non-sick residents were tested for fecal coliforms and identification of bacterial pathogen was done using standard microbial techniques at RCDC.

### **Laboratory Investigation**

Venous blood was collected through aseptic technique by the laboratory personnel and processed using Bact alert 3D automation in JDWNR Hospital. Blood culture bottles giving signal of bacterial growth were sub-cultured on mac-conkey agar, blood agar and chocolate agar. After identifying the organism using biochemical tests, antimicrobial susceptibility testing was performed for ampicillin, ciprofloxacin, chloramphenicol and cotrimoxazole as per the CLSI guideline. Bacterial isolates were referred to RCDC for further analysis and future reference.

## **Findings**

### **Epidemiological Investigation**

12 cases have been identified in an outbreak of paratyphoid fever in a private apartment building of Changzamtog, Thimphu resulting in an overall attack rate of 39.3% ( $13/33 \times 100$ ). The

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age of the cases ranged from 3 years six months to 50 years with a median of 23 years (IQC: 23 years). Females were affected more than males (2:1). In the occupational group, students had the highest frequency (studying in different schools) followed by housewife. All cases had fever and headache with other varying clinical manifestations (Table 1).

Table 1 Demography and clinical information of the patients with paratyphoid fever outbreak, June 2017

Variables	Frequency	Percentage (%)
Age (years)		
Median	22	
Interquartile range (IQR)	23 (31 - 8)	
Gender		
Male	4	33.3
Female	8	66.7
Occupation		
Student	5	41.3
Housewife	3	25.0
Corporate	1	8.3
Entrepreneur	1	8.3
Teacher	1	8.3
Child	2	16.7
Sign and Symptoms		
Fever	13	100.0
Headache	13	100.0
Vomiting	8	58.3
Chills	6	50.0
Anorexia	6	41.7
Diarrhea	4	33.3

The index case was a six year old male child who lived in the lower apartment of the building. He was a student of private school located above their building. He was hospitalized on

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20/6/2017 and received parenteral antibiotic (ceftriaxone) and other medications like antipyretics and intravenous fluids. Three other patients were also hospitalized with similar clinical manifestations. None of the cases developed any complications. The curve depicts the continuous common source outbreak, which means that cases were exposed to the same source and exposure is prolonged for longer period of time.

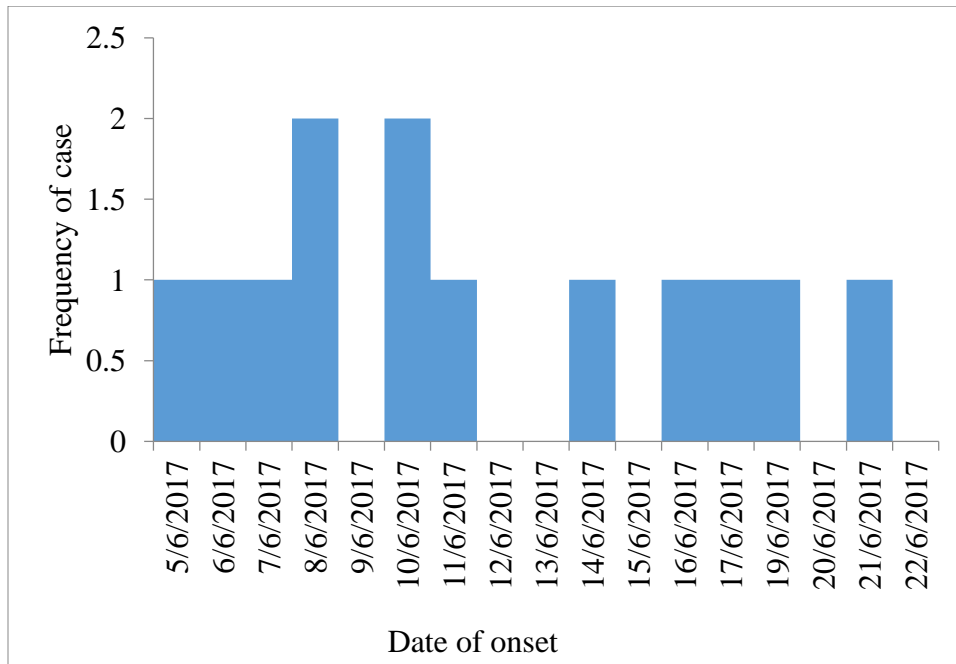


Figure 2 Paratyphoid cases by date of onset, June 2017

The team could not gather any evidence while assessing the risk factors for transmission of infection among the household members. None of them have ever attended any social activities nor did they travel anywhere besides their customary activities. Their personal hygiene was satisfactory and did not pose any risk for the transmission of infection. Some of them consumed fruits between meals but of different kinds. None of them drank direct tap water.

### Environmental investigation

The water in the building had been supplied by both privately owned water source and City Corporation, although the owner said otherwise. He said that the water supply from his private source had been discontinued after City Corporation had taken the responsibility to

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supply their water. On inspection, the team found two inlets to the reservoir tank of the building, one from the City Corporation and the other from the private source. From this reservoir tank, water is pumped to another three overhead tanks from which the water is supplied to each apartment of the building. The reservoir tank is placed underneath staircase leading to the entrance of the building. Drainage system is also constructed atop of the tank. The waste water from the drainage is more likely to spill over to staircase and enter the tank during heavy rainfall or some other untoward situations. The right side of the figure 3 shows the location and condition of drainage system just above the reservoir tank.



Figure 3 location of Reservoir tank (left) and drainage system (right)

Water samples from various sampling points (i.e., apartment, reservoir tank, water source from both City Corporation and private) were tested for fecal indicator bacteria (thermotolerant coliform). The results of the test are as shown in the table 2. Water supplied by City Corporation was found safe. On the other hand private water sound was found grossly polluted. The drinking water should be free of indicator bacteria to be safe for consumption.

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Table 2 Laboratory result for water analysis

Date of Sample Collection	Sampling Points	Test Results (CFU/mL)	Interpretation	Acceptable range
21/6/2017	4th Apartment	1000		0
21/6/2018	2nd Apartment	1000	Grossly polluted and	0
21/6/2019	1st Apartment	1000	not fit for	0
21/6/2020	Reservoir tank	1000	consumption	0
22/6/2017	Water source (Private)	1000		0
22/6/2017	Water source (City)	0	Fit for consumption	0

### Laboratory investigation

Out of eight blood samples cultured, six of them tested positive for *S. paratyphi* B. All pathogens were susceptible to ceftriaxone, ciprofloxacin, amoxicillin, cotrimoxazole and chloramphenicol. All patients could not test their blood samples because they were either not suspected to be enteric fever or they did not visit the hospital for screening their health.

### Recommendations (Immediate Control Measure)

1. The owner/consumer should refrain drinking water from private source
2. The reservoir tank must be shielded with tight lid and securely protected from litter/sewer/waste water
3. The tenants must drink boiled water and never consume water directly from tap.
4. City Corporation needs to reinforce the regulation of water supply in the city and monitor their compliance
5. RCDC should scale up water quality surveillance to capture all water sources in the city
6. Patients with high grade fever and headache with must visit hospital for screening their health.
7. Follow up cases with acute fever for effective management
8. Provide health education on the knowledge awareness of the paratyphoid fever and its prevention and control measures

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### References

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