

CHALLENGES OF OUTBREAK INVESTIGATION IN RESORT SETTINGS: A CASE OF FOODBORNE ILLNESS AMONG HOTEL CONFERENCE ATTENDEES IN URBAN GHANA

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Summary

Background: Foodborne illness is of major public health concern. Identifying foodborne outbreaks in resort settings among short-stay travelers is complex, as these persons often leave ill and seek medical care at home.

Objective: We report an outbreak investigation of diarrhoeal illness among attendees of a lunch banquet held for conference participants in a 'first class' hotel in Takoradi, Ghana.

Method: A case was defined as three or more loose stools within 24 hours occurring after 15 hours GMT of 26th November, 2018 to 28th November, 2018. A full list of food items and ingredients served at the banquet was reviewed with the participants using a questionnaire. A retrospective cohort study was then conducted.

Results: A total of 49 attendees (all females) were present at the conference and 44 (90%) participated in the banquet. Approximately 36% (16) had illness that met the case definition and none of the five who were absent during the banquet developed illness. Vegetable salad was the most likely source of illness (RR= 2.33; 95% CI: 1.16-4.69; p < 0.034).

Conclusion: Although 'first class' hotels may have high sanitary standards; contamination of food may still occur. The short incubation period, mild and self-limiting nature of the illness suggest *Staphylococcus aureus* preformed toxins as the cause. Environmental and laboratory investigations were not carried out due to late notification, low laboratory capacity and bureaucratic challenges at the site.

Key Words: *Staphylococcus aureus* enterotoxin, Foodborne illness, First class hotel, Banquet

Introduction

Foodborne illness is of major public health concern. One of its main manifestations - diarrhoea usually resolves spontaneously although may interfere with carefully planned expedition. The term travelers' diarrhoea has been used to describe acute gastroenteritis experienced by individuals during journeys to destinations outside home.¹ Post-process contamination from factory or kitchen environment is a very common means by which commercially processed foods are contaminated.^{2,3} Data on foodborne illness are often sketchy. In 2010, 600 million foodborne illnesses occurred globally with highest per population burden occurring in Africa where more than 91 million cases with 137,000 deaths occur annually.³

Foodborne illnesses can be caused by bacteria, viruses, protozoa, helminthes and chemical agents.⁴ Microorganisms cause diarrhoea by either direct invasion of the gastrointestinal tract or through production of toxins.³ Toxigenic microbes produce heat resistant pre-formed toxins in food and incubation

period can be as little as 1 hour as in the case of *Staphylococcus aureus* enterotoxin.^{2,3} Pre-formed toxins from other microbes such as *Bacillus cereus* and *Clostridium botulinum* may take 8-16 hours and 12-72 hours respectively to produce symptoms.^{2,3} In contrast, non-toxin producing agents have to enter the host, colonize and invade tissues before producing illness and it can take at least 8 hours for onset of illness.²

Identifying foodborne outbreaks in resort settings among short-stay travelers is complex, as these persons often leave ill and seek medical care at home. Again, it is even more challenging in situations where illness is self-limiting. Investigation of disease outbreaks may require collaboration; interaction of several departments to identify the outbreak source, determine its etiology, and implement control efforts to interrupt transmission.^{1,5}

Isolating offending pathogens require wide range of tests which are often not available due to low laboratory capacity especially under resource-constraint settings.^{5,6} Investigators may have to rely on clinical presentation and epidemiological characteristics in arriving at diagnoses.^{5,7,8} In a foodborne outbreak investigation among hajj pilgrims camped in a hotel in Jeddah, Al-Abdullah (2019) found that chicken served at lunch was contaminated with *Staphylococcus aureus* enterotoxin based on clinical presentation as laboratory findings were inconclusive.⁷ In another outbreak investigation,

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Monini et al (2019) could not identify the source of the two episodes of Norovirus gastroenteritis outbreak occurring within one week in a cafeteria due to operational challenges.⁸

In Ghana, these challenges are aggravated by the absence of an effective foodborne disease surveillance system.⁶ The integration of surveillance systems at the operational level; though commendable, has a potential of missing small outbreaks especially if illness is self-limiting. Even when reported, capacity of the local health officials to perform the initial critical steps in the response path is often lacking.

We report an outbreak investigation of diarrhoeal illness among attendees of a lunch banquet held for conference participants in a ‘first class’ hotel in urban Ghana; bringing to fore the challenges and suggested remedial actions.

Methods

Background

A three-day training conference was held for 49 participants in the Western Region of Ghana from 26th to 28th November, 2018. The venue was a ‘first class’ hotel with over 100 guest rooms and en-suite facilities. Participants were accommodated and provided meals including breakfast, buffet banquet for lunch and two sets of snacks. Meals were prepared and served by the restaurant staffs.

On the second day of conference, some participants complained of passing watery stools since 21:00 GMT the previous day. One of the conference facilitators informed a resident Physician at the Faculty of Public Health of Ghana College of Physicians and Surgeons (FPH-GCPS) and a team was dispatched the next day to investigate the outbreak.

The hotel manager was contacted prior to the visit and voluntary informed consent was sought from all respondents. This outbreak was deemed a response to public health emergency by the College and Ghana Health Service and hence did not receive formal review by Ethical Review Committees. Confidentiality was observed throughout the investigation and the report was shared with the hotel management, the College and Ghana Health Service.

Epidemiologic Investigation

Hypothesis-generating interviews with five participants who experienced gastroenteritis indicated that the 26th November banquet was the likely source of the outbreak. No other common exposures were reported; the participants did not visit animal facilities, report animal contact or purchase food and drinks from outside. Focusing on the 26th November banquet; a full list of food items and ingredients served at the banquet was reviewed with the participants using a questionnaire. All attendees of the conference were asked to indicate when they arrived in the city and whether they experienced diarrhoeal illness. A case was defined as three or more loose stools within 24 hours

occurring after 15 hours GMT of 26th November, 2018 to 28th November, 2018. If diarrhoea was reported, the respondent was asked whether she had other symptoms and if they had participated in the 26th November banquet. A recall of food items consumed was documented. Information about sex, age, onset and nature of symptoms, and duration of illness were collected. From these data, the main symptoms and the time of onset were analyzed to determine the possible causes of the outbreak and to draw the epidemic curve.

A retrospective cohort study was then conducted: the questionnaire responses were entered into a database, analyzed with Stata statistical software (Stata Intercooled version 12; Stata Corp, College Station, TX, USA) and the specific attack rate (AR) was calculated for each type of food served at the banquet. To measure the association between the food served and the illness symptoms, estimates of the risk ratio (RR) with a 95% confidence interval for each food item were calculated. A p-value less than 0.05 were considered statistically significant.

Laboratory and Environmental Inspection

We carried out hygiene inspection of the restaurant and sanitary facilities. The restaurant manager was interviewed on source of groceries especially fresh vegetables, the processing as well as handling of banquet dishes. However, samples were not taken for laboratory analysis due to unavailability and low capacity.

Results

Epidemiological and Clinical Characteristics of Cases

A total of 49 attendees (all females) were present at the conference and 44 (90%) participated in the banquet. More than half (56.8%) of the participants were below 35 years (Table 1). The mean age was 33.5 years (SD=4.3; Range= 25-47; Median=33.5; Q₁=30.5; Q₃=36.0; Mode=36.0). Approximately 36% (16) had illness that met the case definition and the mean age was 33.1years (SD= 4.1; Range= 25-40; Median=33.0; Q₁=29.5; Q₃=36.5; Mode=29.0). None of the five who were absent during the banquet developed illness. There was no statistical difference in age between ill and well respondents.

Table 1: Age distribution of banquet attendees, November 2018; Takoradi, Ghana

Age Group	Frequency	Percentage	Cumulative Frequency
25-29	8	18.2	18.2
30-34	17	38.6	56.8
35+	19	43.2	100.0

The banquet started at 14:00 and ended at 15:00 GMT. No packaging of food for later consumption was allowed. A case (arrowed on figure 1) that did not meet the case definition was excluded in the analysis. The first

case developed illness 3 hours after the banquet with peaking of cases at 6 hours post-banquet. The last case occurred 18 hours post-banquet (Figure 1). Symptoms included abdominal pain (19%) and diarrhoea (81%). All participants with diarrhoea also complained of abdominal pain. No fever, nausea, vomiting,

disorientation, weakness, myalgia, bloody stool and other constitutional symptoms were recorded. Median incubation period was 7 hours; the median duration of illness was 13 hours and all respondents were treated on outpatient basis at a local health post.

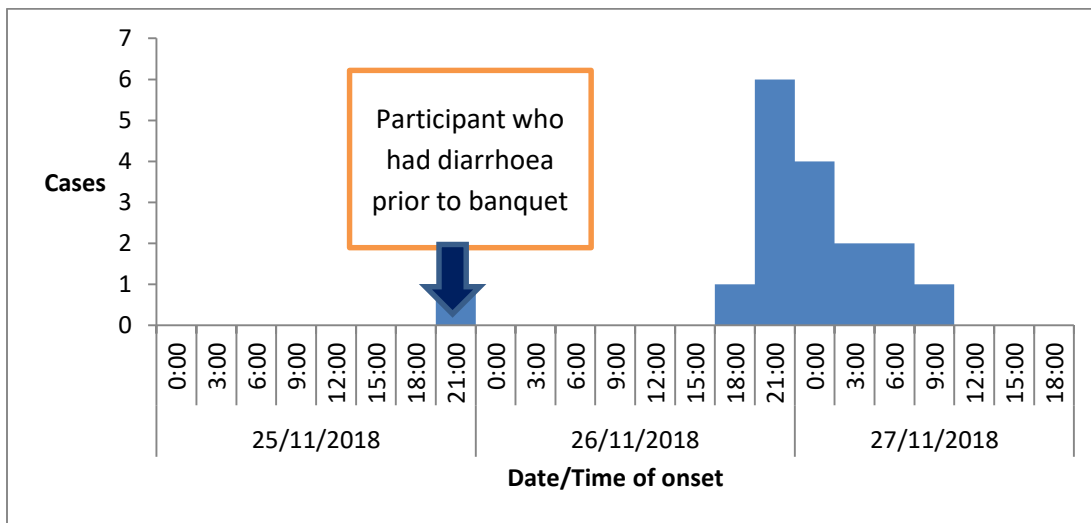


Figure 1: Cases of diarrhoeal illness by date of onset, November 2018; Takoradi, Ghana

Laboratory and Environmental Inspection

The hotel sources fresh vegetables from farmers through agents. The banquet dishes were prepared and served by separate teams of restaurant staff. The general sanitation in the restaurant and adjoining facilities was good. Soap, running water and disposable towels were available at the toilets. The restaurant had cutleries wrapped in napkins and arranged neatly. It also had a small hand washing sink hanging in obscurity in an extreme corner of the hall. However, we were denied access to the kitchen because the hotel manager was not available at the time of arrival and he could not be reached via telephone. Information on health status of staff, periodic medical screening, housekeeping and record of foodborne illnesses among guests could not be accessed for same reason. Follow up attempts for answers proved futile. The investigation team was

alerted more than 24 hours after the banquet and the restaurant had been cleared, hence samples could not be taken for laboratory investigation. Again, majority of the cases (13 out of 16) had symptoms resolved at the time of investigation and the few that were still symptomatic could not produce stool samples because the conference had ended and were departing.

Attack Rate

Calculation of AR and RR of food items consumed at the banquet pointed to vegetable salad as the most likely source of the outbreak: the AR for persons who ate vegetables was 66.67% with RR of 2.33 (95% CI: 1.16-4.69; $p < 0.034$; Table 1). It was prepared from lettuce, tomatoes, carrot, cucumber, baked beans, eggs and cream.

Table 2: Food-specific attack rates (AR) and risk ratios (RR), November, 2018; Takoradi, Ghana

Food Item	ATE SPECIFIED FOOD			DID NOT EAT SPECIFIED FOOD			Risk Ratio	P
	Total	Cases	AR %	Total	Cases	AR %		
Vegetables	9	6	66.67	35	10	28.57	2.33[1.66-4.69]	0.034
Beef sauce	8	5	62.50	36	11	30.56	2.05[0.99-4.24]	0.089
Tilapia	13	6	46.15	31	10	32.26	1.43[0.66-3.11]	0.382
Plain rice	11	5	45.45	33	11	33.33	1.36[0.61-3.06]	0.469
Goat soup	12	4	33.33	32	12	37.50	0.89[0.36-2.22]	0.798
Spaghetti rice	11	4	36.36	33	12	36.36	1.00[0.41-2.47]	1.000

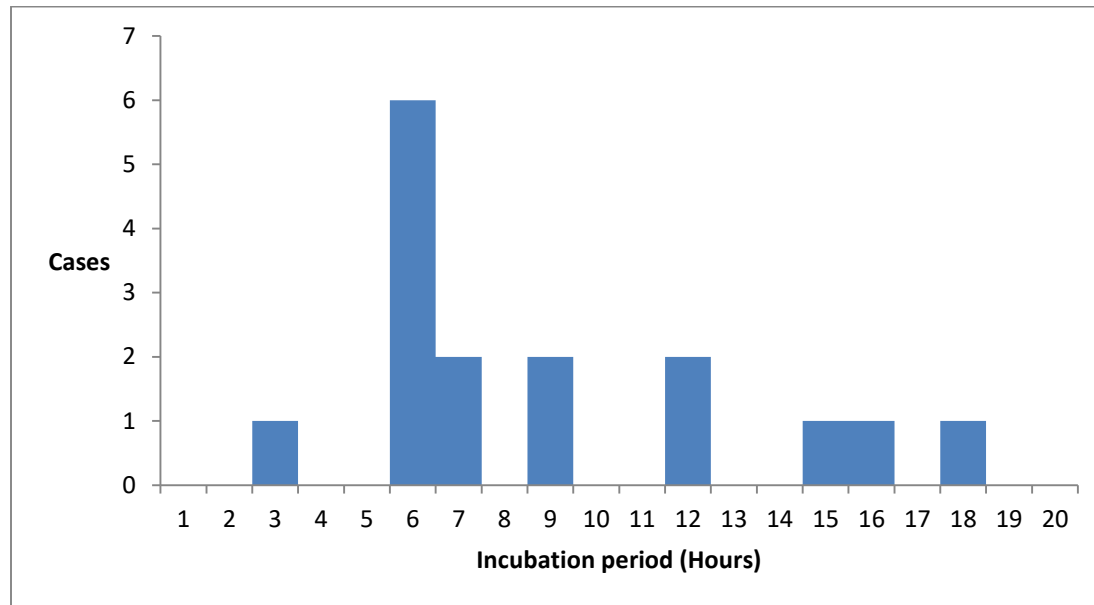


Figure 2: Cases of diarrhoeal illness by incubation period, November 2018; Takoradi, Ghana

Discussion

The epidemiologic investigation demonstrated that illness was associated with attending the banquet on 26th November. None of the five attendees who abstained developed diarrhoeal illness. The outbreak was linked to the consumption of vegetable salad. Salads have often been implicated in foodborne outbreaks at banquets and resorts^{1,9,10} probably because of its constituents and method of preparation. Pathogens introduced at any point multiply rapidly due to high protein content especially if allowed to sit for a long while before consumption. Although the vegetable salad looked fresh, it does not rule out contamination.¹¹

Epidemiologically, the clinical features of sudden onset of diarrhoea and abdominal pain; short incubation period (Median= 7 hours, Range= 3-18 hours); mild and self-limiting nature of the illness and association of *Staphylococcus aureus* with environment and wide range food items including vegetables suggests pre-formed toxin induced diarrhoeal illness caused by this bacteria^{2,3,12} as healthy adults are usually not susceptible to viral diarrhoea. Isolation of the aetiologic agent of this outbreak was however challenging because of the missed opportunities in the management. The association of enterotoxigenic pathogens to the outbreak was therefore based on compelling epidemiological evidence. In the absence of laboratory confirmation of aetiologic agent in food samples and clinical specimens, a thorough evaluation of epidemiological and clinical characteristics of an outbreak becomes a useful alternative. It is a golden rule in medicine that when an observed clinical picture fits a standard presentation of an identified cause, it is most likely to be the correct diagnosis.^{5,7}

The epidemic curve typically depicts a point source outbreak. The case recorded on 25th November, 2018 may be unrelated; was exposed earlier or the source of

contamination. However, the fact that attendees had no direct contact with the banquet setup because food was served solely by banquet staff trivializes possibility of the contamination from guests. The banquet staff were most likely source of contamination^{1,2,3,9,13} although none of them developed illness. As shown by the study of Monini et al (2019), asymptomatic employee may shed microbes for weeks leading to outbreaks if not identified and managed.⁸ Pathogens can remain viable on the hands and surfaces for hours or even days after initial contact.¹⁴ Gallina et al (2013), in their investigation of foodborne outbreak at a private banquet found the source of the enterotoxigenic *Staphylococcus aureus* strain contaminating the seafood salad to be one of the food handlers employed by the caterer.⁹ Nonetheless, contamination may also occur on the field. Organic fertilizers, irrigation water quality and soil are major sources.^{15,16,17} Some vegetables cultivated in the cities and peri-urban centres are irrigated with water from gutters and storm drains contaminated with faecal matter; imparting onto them harmful pathogens.^{16,17}

Generally, response to the outbreak was delayed due to late notification. The failure to obtain samples was due to low laboratory capacity and unavailability as all the cases had illness resolved at the start of investigations except three who had mild abdominal pains but could not produce stool or vomitus. As observed in the study of Shane et al (2002), outbreak investigations especially in resort settings require collaboration and cooperation from management of such facilities.¹ Objection to sanitary inspection of the kitchen raises doubts on food hygiene practices in the hotel and this is affirmed by the work of Darko et al (2017). In that study, laboratory investigations on food samples collected from randomly selected three-star hotels in Kumasi identified heavy contamination with microbes beyond WHO accepted levels.¹⁰

Limitation of the study was that environmental and laboratory investigations were not carried out to confirm offending pathogen due to reasons stated earlier. There was also a possibility of recall bias where case-patients might have recalled differently from those who were not ill. The response to this outbreak should be interpreted within the context of the limitations posed by the missed opportunities.

Conclusions

Foodborne outbreaks occur as a result of lapses in food hygiene. Although 'first class' hotels may have high sanitary standards, contamination of food may still occur. The epidemic curve indicates a point source outbreak probably caused by vegetable salad most likely contaminated with *Staphylococcus aureus* preformed toxins. Although conclusive determination of the pathogen was not carried due to low laboratory capacity and poor cooperation from the hotel management, the clinical and epidemiologic characteristics support the diagnosis.

District Health Management Teams (DHMT) should map out hospitality set ups within their catchment areas and collaborate with operators in priority health event surveillance in order to facilitate early detection and timely response. An effective foodborne disease surveillance system complemented by adequate laboratory capacity should be established at all levels of the health system to properly manage foodborne outbreaks.

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