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A Retrospective Cohort Study on an Outbreak of Gastroenteritis Linked to a Buffet Lunch Served during a Conference in Accra

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***Abstract*—**On 21st November, 2016, an outbreak of foodborne illness occurred after a buffet lunch served during a stakeholders' consultation meeting held in Accra. An investigation was conducted to characterise the affected people, determine the etiologic food, the source of contamination and the etiologic agent and to implement appropriate public health measures to prevent future occurrences. A retrospective cohort study was conducted via telephone interviews, using a structured questionnaire developed from the buffet menu. A case was defined as any person suffering from symptoms of foodborne illness e.g. diarrhoea and/or abdominal cramps after eating food served during the stakeholder consultation meeting in Accra on 21st November, 2016. The exposure status of all the members of the cohort was assessed by taking the food history of each respondent during the telephone interview. The data obtained was analysed using Epi Info 7. An environmental risk assessment was conducted to ascertain the source of the food contamination. Risks of foodborne infection from the foods eaten were determined using attack rates and odds ratios. Data was obtained from 54 people who consumed food served during the stakeholders' meeting. Out of this population, 44 people reported with symptoms of food poisoning representing 81.45% (overall attack rate). The peak incubation period was seven hours with a minimum and maximum incubation periods of four and 17 hours, respectively. The commonly reported symptoms were diarrhoea (97.73%, 43/44), vomiting (84.09%, 37/44) and abdominal cramps (75.00%, 33/44). From the incubation period, duration of illness and the symptoms, toxin-mediated food poisoning was suspected. The environmental risk assessment of the implicated catering facility indicated a lack of time/temperature control, inadequate knowledge on food safety among workers and sanitation issues. Limited number of food samples was received for microbiological analysis. Multivariate analysis indicated that illness was significantly associated with the consumption of the snacks served (OR 14.78, $P < 0.001$). No stool and blood or samples of etiologic food were available for organism isolation; however, the suspected etiologic agent was *Staphylococcus aureus or Clostridium perfringens*. The outbreak could probably be due to the consumption of unwholesome snack (tuna sandwich or chicken. The contamination and/or growth of the etiologic agent in the snack may be due to the breakdown in cleanliness, time/temperature control and good food handling practices. Training of food handlers in basic food hygiene and safety is recommended.

***Keywords*—**Accra, buffet, *C. perfringens,* cohort study, food poisoning, gastroenteritis, office workers, *Staphylococcus aureus*.

I. Introduction

SIGNIFICANT proportion of morbidity and mortality worldwide can be attributed to foodborne diseases (FBDs) [1]–[3]. Over 250 FBDs have been identified worldwide [4] and the prevalence vary from one locality to the other. In Ghana the prevalence of waterborne/ FBDs among patients visiting the Ridge hospital in the Greater Accra Region was 2.56% in 2013 and this was relatively higher among the 15-24 years age group [5]. Some studies have identified foods served at conferences, social events, restaurants as well as street vending as the major source of the etiologic food during FBDs outbreaks [4], [6]-[9].

A. The Outbreak

The Food and Drugs Authority (FDA) received a correspondence from the Chief Director, Ministry of Health, informing the authorities of a suspected FBD outbreak at one of the government agencies in the country. The letter indicated that over 20 people were experiencing various symptoms of food poisoning after consuming food served during a stakeholder consultation meeting on 21st November, 2016. The government agency ordered snacks and lunch for the meeting from a catering facility in Accra. Prior to the correspondence, the authority had received food samples, collected during the meeting, from the Regional Disease Surveillance Department (RDSD) for analysis. The Food Safety Management Department of the FDA, in collaboration with the RDSD investigated the outbreak, with the aim of characterising the affected people, determining the etiologic food, the source of contamination and the etiologic agent.

II. Method

An investigative team, from the Foodborne Disease Surveillance Unit of the FDA-Ghana, was set up to investigate the outbreak and make recommendations to prevent it reoccurrence. A retrospective cohort study was conducted, using all persons who consumed food during the stakeholder consultation meeting in Accra on 21st November as the study population. A structured questionnaire was developed from the buffet menu and used to conduct interviews via the telephone. An attendance list was obtained from organisers of the meeting. Convenient sampling of respondent was done using the attendance list (response rate of 92.50%, 37/40). Some participants indicated that they carried some of the food home for their dependants, and hence, their dependants who consumed food served at the stakeholder consultation meeting in Accra on 21st November, 2016 were also interviewed. Any person who reported symptoms such as diarrhea and/or abdominal cramps after consuming food served at the

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stakeholder consultation meeting in Accra on 21st November, 2016, were classified as cases. The food history of each respondent was taken during the telephone interview to assess the exposure status of all the members of the cohort. The data obtained were analysed using Epi Info 7. To determine the source of food contamination, an environmental risk assessment was conducted at the etiologic catering facility. Attack rates and odds ratios were calculated and these were used to determine the risks of foodborne infection from the foods eaten.

A. Data Processing and Analysis

The data was coded and refined using Microsoft Excel 2013 software. After checking for consistency and completeness of data, these records were then exported into Epi Info 7 and analysed statistically. Baseline characteristics of the population were explored using simple descriptive method such as frequency distribution. The incubation period for the etiologic agent was determined by constructing an Epi Curve using the time of onset of symptoms. To determine the risks of foodborne infection from the foods eaten, attack rates and crude odds ratios were calculated for each food item. Food showing association with the outcome were stratified to determine their adjusted odds ratios. A p-value of 0.05 was set as significant level for all the analysis.

III. Results

A. Characteristics of Cases

A total of 54 people who consumed food served during the stakeholders' meeting were interviewed. From of this population, 31 (57.41%) were males and 23 (42.59%) were females with the mean age of 30.89 years (SD: 15.12, Range: 3-61). Forty-four respondents reported with symptoms of food poisoning representing 81.45%. The outcome (cases of FBDs) were presented with symptoms such as diarrhoea (97.73%, 43/44), vomiting (84.09%, 37/44), abdominal cramps (75.00%, 33/44), weakness (56.82%, 25/44), fever (52.27%, 23/44), nausea (54.55%, 24/44), and headache (52.27%, 23/44). The earliest on-set of symptoms was reported around 4:00 pm of 21st November, 2016 and the latest was around 10:00am of 22nd November, 2016. The majority of cases, 41 representing 93.18% (41/44), needed medical attention and three were self-limiting (6.82%, 3/44). Out of the cases that sought medical attention, 26 (63.41%) were hospitalized. More males (52.27%) were affected than females (47.73%). The mean age of the affected population was 29.22 years (SD: 15.17, Range: 3-61) with the age distribution as shown in Table I. The epicurve suggests a point source outbreak with minimum and maximum incubation period of four hours and 17 hours, respectively. The peak incubation period was seven hours (Fig. 1).

B. Source of Food Borne Illness

The bivariate analysis (Table II) indicated association between population ill and the consumption of the snacks (OR= 14.78, p = 0.0008) or Fried rice (OR= 2.0, p= 1.0000). However, association between population ill and the consumption of fried rice was statistically insignificant. The multivariate analysis indicated that the association between the population ill and the consumption of the snacks served was statistically significant (AOR 11.00, P < 0.0007).

TABLE I
AGE DISTRIBUTION OF TOTAL POPULATION AND OUTCOMES IN THE COHORT

Age range	Total population		Outcomes (ill)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
<5	1	1.85%	1	2.27%
5 - 14	10	18.52%	10	22.73%
15 - 24	8	14.81%	6	13.64%
25 - 34	10	18.52%	8	18.18%
35 - 44	14	25.93%	12	27.27%
>45	11	20.37%	7	15.91%
TOTAL	**54**	**100.00%**	**44**	**100.00%**

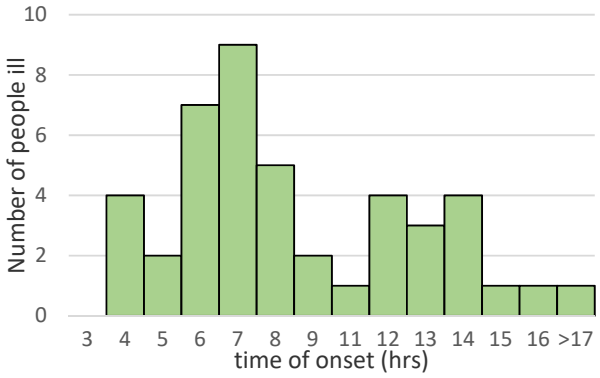

Fig. 1 Number of Cases of Foodborne illness by the time of onset of symptoms (hrs)

TABLE II
DISTRIBUTION OF POPULATION AMONG THE VARIOUS FOODS CONSUMED

Food consumed	No. ill	No. not ill	Total population	Attack rate	Crude odds ratio	p-value
Ampesi	2	1	3	66.67	0.43	0.4661
Banku	8	2	10	80.00	0.89	1.0000
Chicken	8	2	10	80.00	0.89	1.0000
Fish	3	4	7	42.86	0.11	0.0171
Garden egg stew	1	1	2	50.00	0.21	0.3389
Goat	1	1	2	50.00	0.21	0.3389
Jollof Rice	4	5	9	44.44	0.10	0.007
Snack	38	3	41	92.68	14.78	0.0008
Tilapia	6	2	8	75.00	0.63	0.6317
Fried rice	8	1	9	88.89	2.00	1.0000

C. Laboratory Investigation: Causative agent

The cases had started antibiotic treatment at the time of the investigations, and hence clinical samples could not be obtained for analysis. Most patients (63.64%) who reported at various health facilities had clinical samples taken for laboratory analysis. However, the analyses were not to confirm the presence of foodborne pathogens.

Limited food samples were available at the time of investigation. The sample of suspected etiologic food (snack) received was compromised; hence, laboratory assessment

could not be done. However, laboratory analysis conducted on foods such as fish, fried rice and stew showed absence of *E. coli*, *Salmonella and S. aureus*. The probable etiologic agent associated with the etiologic food and having an average incubation period close to 4-17hrs are *Staphylococcus aureus* (1-7hours) and *Clostridium perfringens* (8-16hours) [3], [10].

D. Findings from Environmental Risk Assessments

The implicated catering facility prepared snacks and lunch to two agencies on the day of the reported poisoning. However, no complaints were received from any of the clients, with the exception of the agency organizing the stakeholders' meeting. The snacks were prepared at 6:00 a.m. and transported to the agency at 8:15 a.m. The tuna sandwiches however were the first to be prepared. These were not refrigerated after preparation and were packed together with the other components of the snacks served, in polystyrene packages. The snack packs each contained Tuna Sandwich, Chicken pieces, Meat pie and Samosa.

The environmental assessment revealed time/temperature abuse during preparation and transportation of food, poor sanitation at the catering facility, inadequate knowledge of staff in food safety, lack of policy on personnel hygiene and heavy infestation of houseflies at the sandwich preparation area.

IV. Discussion

Staphylococcus aureus is a gram-positive bacterium which is mostly found on the skin, throats and nostrils of healthy people and animals. It usually does not cause illness but when transmitted onto food products, it can multiply and produce harmful toxins. Staphylococcal food poisoning is one of the common foodborne illnesses worldwide and this occurs as a result of the ingestion of food contaminated with enterotoxins produced by *Staphylococcus aureus* [10], [11]. The enterotoxins are heat resistant and cannot be destroyed by cooking. Common symptoms of Staphylococcal food poisoning include nausea, stomach cramps, vomiting or diarrhoea.

Clostridium perfringens is a gram-positive bacterium which is widely distributed in the environment and commonly found in the intestines of humans and domestic animals. *C. perfringens* type of food poisoning is due to the production of the enterotoxin CPE, which is generated in the small bowel during sporulation of the ingested vegetative cells (at least 10^7). Symptoms include abdominal pain, nausea, and diarrhoea which occur 6–24 hours after intake of contaminated food [12].

Clinical characteristics of the cases reported by the various patients; diarrhoea (97.73%), vomiting (84.09%), abdominal cramps (75.00%), and nausea (54.55%), is very consistent with the common symptoms of Staphylococcal food poisoning and *C. perfringens* type of food poisoning. The patients reported of sudden onset of symptoms (earliest onset was four hours after consumption) with 59% of the cases being hospitalized. Cases with self-limiting symptoms lasted for 24 hours or less. Various studies on the outbreak of Staphylococcal food poisoning have reported of the sudden onset of symptoms with symptoms being self-limiting and resolving within 24 hours. However, cases are sometimes severe enough to warrant hospitalization [13]-[15].

Food mixtures such as: meat and meat products; poultry and egg products; salads such as egg, tuna, chicken, potato, and macaroni; bakery products such as cream-filled pastries have been associated with outbreaks caused by *Staphylococcus aureus*. Foods that require a lot of handling and are stored at inappropriate temperatures are often involved with *S. aureus* food poisoning [10], [16], [17]. Findings from the environmental risk assessment support the epidemiological inference of S. *aureus* food poisoning. The findings indicated that the tuna sandwiches which were the first to be prepared were left to sit on the kitchen counter (at room temperature) for more than six hours, giving the bacteria ample time to proliferate and produce toxins.

Even though staphylococci can be found in food or on food surfaces, humans and animals serve as the main reservoir. The environmental risk factors include poor hand washing practices, time/temperature abuse, inadequate knowledge in food safety, poor sanitation especially cleaning of kitchen counters and food equipment before and during food preparation [16]. These risk factors were present at the implicated catering facility especially where the production of the sandwiches was done.

V. Conclusion

The outbreak could be due to the consumption of snacks (tuna sandwich or chicken) that were probably contaminated with *Staphylococcus aureus or Clostridium perfringens*. The environmental risk assessment indicated breakdown in cleanliness, time/temperature control and good food handling practices. This may have resulted in contamination and subsequent proliferation of the etiologic agent in the snack. It was recommended that food handlers be trained in basic food hygiene and safety.

A. Limitation

The lack of food samples at the time of investigations made is impossible to confirm the presence of the suspected etiologic agent (*C. perfringens or Staphylococcus aureus*) in the etiologic food, and this is a limitation to the study. As a result, no firm conclusions could be made.

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