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Investigation of a foodborne disease outbreak linked to a restaurant, City of Cape Town Metropolitan, Western Cape, South Africa, February 2024

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Summary

Foodborne diseases (FBD) are a major contributor to morbidity and mortality worldwide, with an estimated 420 000 deaths globally each year and a loss of 33 million healthy life years. FBD outbreaks are a category 1 notifiable medical condition in South Africa and should be investigated to identify causative factors and institute corrective action to decrease morbidity and mortality. This report details the outbreak investigation and response following the notification of a suspected FBD outbreak linked to a restaurant. Overall, 46 suspected cases were identified: 12 staff members and 34 patrons. Clinical specimens (stool or rectal swabs) were collected from 49 individuals, and 33 tested positive for *Shigella* spp./Enteroinvasive *Escherichia coli* (EIEC) (6 patrons and 27 staff members). An inspection of the restaurant identified overstocking of cold storage and non-compliance with the first-in, first-out recommendation. Three food specimens had coagulase positive staphylococci higher than the acceptable limits, and one food specimen tested positive for *Bacillus cereus*. No definite source could be identified in this outbreak; however, it was hypothesised that a foodborne source was implicated (through contaminated food or a food handler). *Shigella* spp./EIEC was considered to be the causative organism. The outbreak was contained after the restaurant was closed for cleaning, retraining of restaurant staff, and isolation of ill staff.

Introduction

The World Health Organization (WHO) estimates that, globally, one in ten people (600 million) fall ill and 420 000 people die after eating contaminated food every year.[1] Low- and middle-income countries are particularly vulnerable to foodborne diseases (FBD); the FBD morbidity in the African region is estimated at 91 million people, with approximately 137 000 deaths (a third of the global death toll).[2] FBD can be caused by a variety of hazards, including microbiological agents (bacteria, viruses, parasites) and chemicals (environmental pollutants, naturally occurring toxins, food allergens).[3] These hazards can result in more than 200 diseases, ranging from acute to chronic diseases, cancer, permanent disability and death.[3]

The Centers for Disease Control and Prevention (CDC) estimates that, every year, approximately half of the FBD outbreaks occurring in the United States are associated with restaurant food.[4] Five major risks have been identified within the retail food industry that contribute to illness: poor personal hygiene, improper food holding time and temperature, contaminated equipment, inadequate cooking, and food obtained from unsafe sources.[4] According to data reported to the CDC through the National Environmental Assessment Reporting System for FBD outbreaks for the period 2017–2019, 40% of FBD outbreaks with contributing factors had at least one factor associated with food contaminated by an ill or infectious food worker.[5]

FBD outbreaks are a category 1 notifiable medical condition (NMC) in South Africa.[6] Healthcare workers who diagnose an FBD outbreak are legally obligated to notify within 24 hours of detection.[6] A review of FBD outbreaks notified on the NMC system found that 337 outbreaks were notified between March 2018 and August 2020 in South Africa.[7] As many people affected by FBD do not seek healthcare, FBD outbreaks are likely under-reported.[8] The case definition used for an FBD outbreak in South Africa is: Any food-poisoning incident involving two or more individuals that are epidemiologically linked to a common food/beverage source.[9]

Outbreak notification

On 08 February 2024, the Western Cape Provincial Communicable Disease Control Co-ordinator received a notification from the National Institute for Communicable Diseases (NICD) concerning a potential FDB outbreak linked to a restaurant. At approximately 22h00 on 08 February 2024, a general practitioner (GP) informed the NICD of two patients who had presented at his practice with severe diarrhoea and high temperatures. The patients reported that they were a party of five, all of whom had consumed prawns during dinner at Restaurant A, City of Cape Town Metropolitan (CoCT), on 07 February 2024. Three of these patrons were admitted to private hospitals with gastrointestinal symptoms. The GP also informed the restaurant of the cases via email. The City Health Environmental Health Practitioners (EHPs) were informed on 09 February 2024, and an outbreak investigation and response were initiated. The outbreak investigation and response were conducted to confirm the existence of an outbreak, identify additional cases, identify the source of the outbreak, and implement control measures. On 10 February 2024, two of the hospitalised patients tested positive for *Shigella* spp./Enteroinvasive *Escherichia coli (EIEC)* using polymerase chain reaction (PCR) testing.

Methods

Study design and setting

A descriptive cross-sectional study design was used to describe the outbreak and public health actions that were implemented. The 7-1-7 target assessment tool for early detection and response was used to assess the response to the outbreak.[10] The 7-1-7 target aims to identify every suspected outbreak within seven days of emergence, report the outbreak to the public health authorities within one day and adequately respond to the outbreak within seven days.[11] The implicated restaurant is part of a national franchise specialising in local cuisine, including meat, seafood, and poultry. The establishment has a seating capacity for over 150 guests and employs more than 50 staff members, with an average of 15 personnel on duty per shift. These case definitions were used to identify cases:

- **Suspected case.** Any person who consumed food prepared at restaurant A between 01 and 29 February 2024 and presented to a healthcare facility with gastrointestinal symptoms within four days of the meal was classified as a suspected case. In addition, staff members who reported gastrointestinal symptoms from 01 February through 29 February 2024 were classified as suspected cases. This period was chosen to allow for a *Shigella* incubation period of seven days (26 February 2024) after the opening of the restaurant (19 February 2024) and two incubation periods (24 February 2024) following the symptom onset of the last reported case (09 February 2024). The 29th of February was used as the cut-off date for ease of reporting.
- **Confirmed case.** Cases were classified as confirmed if *Shigella* spp./EIEC was detected from a stool specimen/rectal swab using culture or molecular techniques.

Epidemiological investigations

A line list was developed of patrons and staff who met the case definition. Following the initial notification, additional cases were identified through active case finding. Healthcare facilities and laboratories reported any patients with a positive *Shigella* spp./EIEC culture or PCR or gastrointestinal symptoms with a link to the restaurant.

In addition, the restaurant provided City Health with contact information of patrons for follow-up. City Health contacted the patrons to ascertain whether they presented with symptoms during the period indicated. All suspected cases were interviewed by the EHPs using the standardised FBD case investigation form (CIF).[12] Similar food items were combined for ease of reporting.

Clinical laboratory investigations

Stool specimens collected from seven hospitalised cases were tested at a local private laboratory using a gastrointestinal PCR panel. The panel tests for several bacterial, viral and parasitic enteric pathogens including: *Campylobacter* (*jejuni, coli,* and *upsaliensis), Clostridioides difficile* (Toxin A/B), *Plesiomonas shigelloides*, *Salmonella* spp., *Yersinia enterocolitica*, *Vibrio* (*parahaemolyticus, vulnificus,* and *cholerae*), Enteroaggregative *Escherichia coli (E. coli*) (EAEC), Enteropathogenic *E. coli* (EPEC), Enterotoxigenic *E. coli* (ETEC), Shiga-like toxin-producing *E. coli* (STEC), *E. coli* O157, *Shigella* spp./Enteroinvasive E.coli (EIEC), adenovirus F 40/41, astrovirus, norovirus GI/GII, rotavirus A, sapovirus (I, II, IV and V), *Cryptosporidium* spp., *Cyclospora cayetanensis*, *Entamoeba histolytica,* and *Giardia lamblia*. One stool specimen was tested at a private laboratory using microscopy, culture, and sensitivity (MC&S) tests.

Rectal swabs were collected from 41 restaurant staff members to screen for enteric pathogens. These were submitted to the Centre for Enteric Diseases (CED) at the NICD for molecular screening. A gastrointestinal PCR panel was performed on the rectal swabs which tested for the following organisms: norovirus GI, norovirus GII, astrovirus, rotavirus, adenovirus, sapovirus, Verocytotoxin-producing *E. coli (*VTEC), *Campylobacter coli/jejuni/lari*, *Clostridioides difficile* (Toxin A/B), *Yersinia enterocolitica*, *Shigella* spp./EIEC, *Salmonella* spp., *Entamoeba hystolytica*, *Cryptosporidium* spp., and *Giardia lamblia.*

Environmental investigations

The EHPs inspected the restaurant guided by the Foodstuffs, Cosmetics and Disinfectants Act, 1972[13], and reviewed food safety processes. Swabs (environmental and hand), water specimens (from tap water and the ice machine), and raw and cooked food were collected to test for microbial contamination (Table 1). Five environmental swabs were taken at the restaurant, and nine hand swabs were collected from staff members present at the restaurant during the EHPs' visit. The EHPs inspected the facility that supplies the restaurant with food items, and one environmental swab was collected at this facility.

Tests were conducted at the National Health Laboratory Service (NHLS) Charlotte Maxeke Infection Control Services Laboratory (ICSL) and the CoCT specialised health laboratory services (Table 1). Hand swabs were tested at the ICSL for total plate count, coliform count, *E. coli* count and *Shigella spp.* Environmental swabs were tested for coliform count, *E. coli* count and *Shigella* spp. Food specimens were tested for the following at the ICSL: total plate count (aerobic bacterial count), coliforms, *E. coli*, *Salmonella* spp., *Shigella* spp., *E. coli* O157, *Clostridium perfringens*, *Bacillus cereus*, Coagulase-positive staphylococci, *Yersinia enterocolitica,* and *Listeria monocytogenes.* All specimens tested at the CoCT laboratory were tested for total viable counts, total coliform, *E. coli* and *S. aureus.* Results were analysed according to the standards published in the guidelines for environmental health officers on the interpretation of microbiological analyses of food data.[14]

Table 1. Details of swabs and food items tested at the Charlotte Maxeke Infection Control Services Laboratory (ICSL) and City of Cape Town (CoCT) laboratories, foodborne disease outbreak, CoCT, Western Cape Province, South Africa, February 2024.

	Samples tested at ICSL	Samples tested at CoCT
Hand swabs	Eight hand swabs	One hand swab (worker at the sauce preparation area)
Environmental swabs	Ice machine utensil Deep freeze handle Counter Fire exit door Chicken preparation area - wholesale facility	Raw chicken preparation area
Food items	Raw prawn Cooked chicken Grilled chicken Cooked halloumi Frozen raw head Prawn rissoles Salad dressing sauce Mayo sauce Peri-peri sauce	Salad-dressing containers Peri-peri sauce Mayo sauce Grilled chicken BBQ ribs Coconut rice Prawns Crayfish with prawn marinade Mixed vegetables with fish spice Halloumi Hake

Statistical analysis

The line list and CIFs were captured on Microsoft Excel (2016). Data analysis was performed in Stata version 18.0 (StataCorp, College Station, Texas, USA). The Chi-square test was used to compare the clinical characteristics of symptomatic individuals based on laboratory findings (*Shigella* spp./EIEC positive or negative). A p-value of <0.05 was considered statistically significant.

Results

7-1-7 target

The outbreak response met the 7-1-7 target.[11] The index cases presented to the GP on the day of symptom onset (08 February 2024), and the case was reported to the NICD and the Western Cape Government: Health and Wellness (WCGHW) on the same day (less than one day for detection) (Figure 1). The cases were officially notified on the NMC system within one day of detection (09 February 2024), and early public health measures were instituted on the same day of the notification.

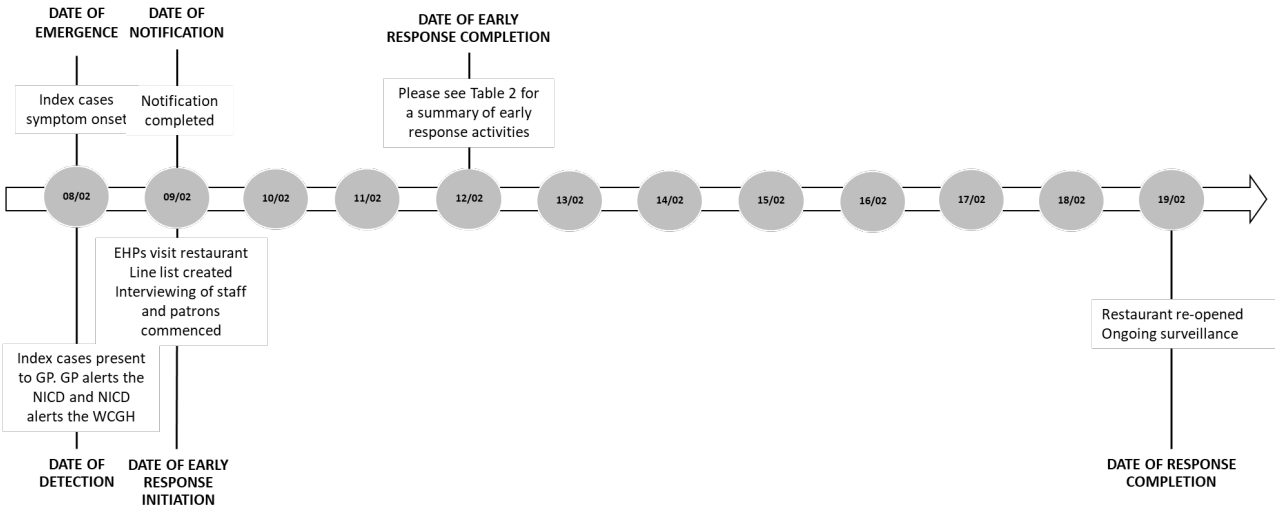

Figure 1. Assessment of the foodborne disease outbreak response according to the 7-1-7 target assessment tool[10], City of Cape Town, Western Cape, South Africa, February 2024.
EHP=Environmental Health Practitioner, GP=general practitioner, NICD=National Institute for Communicable Diseases, WCGHW=Western Cape Government: Health and Wellness

The early response activities were completed by 12 February 2024 (Table 2). *Shigella* spp./EIEC was detected in an index case on 10 February 2024 and, subsequently, three additional cases tested positive for *Shigella spp.*/EIEC on 12 February 2024. Interviewing of staff and patrons started on 09 February 2024, and we detected additional cases on 10 February 2024 through active case finding. In response to the additional cases, the restaurant was closed on 10 February 2024, and cleaning of the restaurant and training of staff commenced.

Table 2. Early response actions implemented during the foodborne disease outbreak response as per the 7-1-7 assessment tool,[10] City of Cape Town, Western Cape, South Africa, February 2024.

Early response actions	Date	Narrative
Initiate investigation or deploy investigation/response team	09 February 2024	EHPs conduct 1st visit to the restaurant
Conduct epidemiologic analysis of burden, severity and risk factors, and perform initial risk assessment	09 February 2024	EHPs conduct interview of patrons and staff
	10 February 2024	Additional cases detected
Obtain laboratory confirmation of the outbreak aetiology	10 February 2024	*Shigella* spp./EIEC confirmed in index case
	12 February 2024	3 additional cases test positive for *Shigella* spp./EIEC
Initiate appropriate case management and infection prevention and control (IPC) measures	09 February 2024	Appropriate IPC instituted in all healthcare facilities with cases admitted
Initiate appropriate public health countermeasures in affected communities	10 February 2024	Closure and cleaning of restaurant Training of staff Screening of staff for enteric pathogens Ill staff advised to be off-duty
Initiate appropriate risk communication and community engagement activities	10 February 2024	Patrons contacted, staff interviewed and healthcare facilities contacted to identify more cases
Establish a co-ordination mechanism	09 February 2024	Co-ordination from City Health and Provincial Communicable Disease Control

EHP=Environmental Health Practitioner, EIEC=Enteroinvasive *Escherichia coli*, IPC=Infection prevention & control, spp=species

Epidemiological findings

Overall, we contacted 85 individuals: 51 restaurant staff members (60%) and 34 patrons (40%). A total of 46 symptomatic individuals were identified (46/85; 54%): 12 staff members (12/51; 24%) and 34 patrons (34/34; 100%) (Table 3). There were completed case investigation forms for 28 individuals: seven staff members and 21 patrons. The median age of the symptomatic individuals was 35 years, with the majority of individuals in the age group 30–39 years (10/37; 27%). Fifteen patrons (15/34; 44%), but no staff members, were admitted to hospital. No deaths were reported.

Table 3. Demographics of suspected cases, foodborne disease outbreak, City of Cape Town, Western Cape, South Africa, February 2024, (n=46).

Variables		Staff (n=12) No. (%)	Patron (n=34) No. (%)	Total (N=46) No. (%)
Age (Median, IQR)		36 (30–39)	34 (25–51)	35 (27–43)
***Age group (n=37)**				
	10–19	0 (0)	2 (8)	2 (5)
	20–29	4 (33)	9 (36)	13 (35)
	30–39	6 (50)	4 (16)	10 (27)
	40–49	2 (17)	2 (8)	4 (11)
	50–59	0 (0)	6 (24)	6 (16)
	60+	0 (0)	2 (8)	2 (5)
****Sex (n=40)**				
	Female	5 (42)	9 (32)	14 (35)
	Male	7 (58)	19 (68)	26 (65)
Admitted		0 (0)	15 (44)	15 (33)

IQR=Interquartile range
*9 age missing (9 patrons)
**6 sex missing (6 patrons)

Thirty of the 46 (65%) case patients provided a date and time of disease onset. From the afternoon of 03 February 2024 into the morning hours of Sunday, 04 February 2024, one staff member experienced symptoms including diarrhoea, nausea and vomiting, extreme body aches, and weakness (Figure 2). He then improved but became ill again with the same symptoms on 07 February 2024. He was at work during this time. Apart from this staff member, all symptomatic individuals fell ill on 08 and 09 February 2024, with 12 individuals reporting the onset of disease on the morning of 09 February 2024.

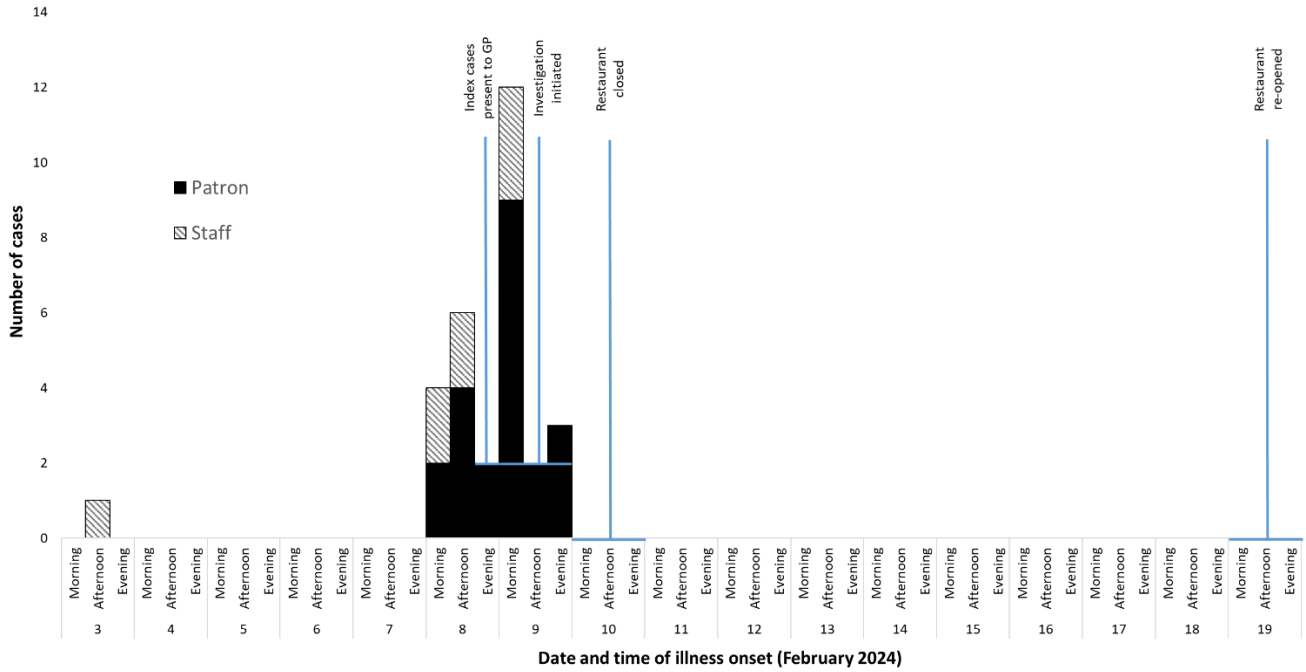

Figure 2. Date and time of disease onset by restaurant category (patron or staff), foodborne disease outbreak, City of Cape Town, Western Cape, South Africa, February 2024.
Morning: 5 am to 12 pm; Afternoon: 12 pm to 5 pm; Evening: 5 pm to 5 am

Food consumption at the restaurant

Only 15 suspected cases (one staff member and 14 patrons) completed the date of food consumption at the restaurant variable. Of these, the majority (10/15; 67%) had eaten at the restaurant on 08 February 2024 (Figure 3a). The date of consumption at the restaurant and date of symptom onset were available for 14 individuals. The median duration from the date of consumption to symptom onset was one day, with a minimum of zero days and a maximum of three days (IQR: 1–1).

History of food items consumed at the restaurant was available for 24 suspected cases: four staff and 20 patrons. Most suspected cases reported having consumed seafood (18/24; 75%), followed by chicken (10/24; 42%) (Figure 3b).

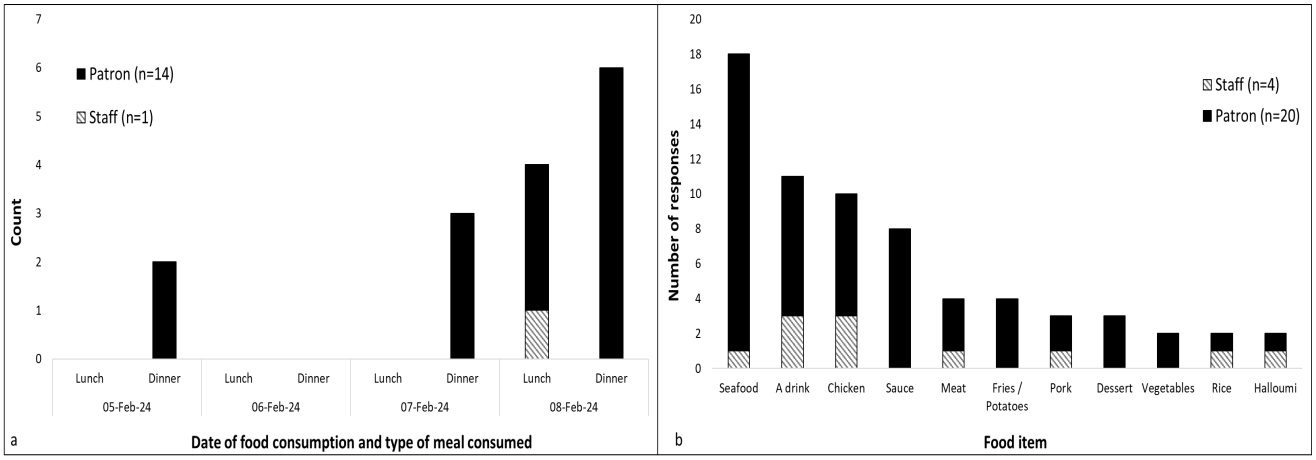

Figure 3. (a) Date of food consumption and type of meal consumed (n=15) and **(b)** food items consumed by suspected cases by restaurant category (patron or staff) (n=24), foodborne disease outbreak, City of Cape Town, Western Cape, South Africa, February 2024.

Clinical laboratory investigations

A total of 49 specimens was collected: eight from the hospitalised individuals (16%; 8/49) and 41 from staff members (84%; 41/49). Of the eight specimens, six (75%) tested positive for *Shigella* spp./EIEC on PCR. One specimen also tested positive for EAEC and EPEC, and one tested positive for *Giardia lamblia*. No pathogens were detected in the remaining two specimens. Five of the eight stool specimens were tested at the CED, NICD/NHLS, and all were confirmed positive for *Shigella* spp./EIEC on PCR. Twenty-seven (66%) of the rectal swabs submitted from 41 staff members tested positive for *Shigella* spp./EIEC on PCR: eleven of these staff members were symptomatic (11/27; 41%). Two of these specimens tested positive for VTEC. All specimens tested negative for the other organisms included in the gastrointestinal screening panel.

Clinical characteristics of *Shigella* spp. /EIEC positive individuals

Of the 33 *Shigella* spp./EIEC positive individuals, 17 (17/33; 52%) were symptomatic (11 staff members and six patrons). Six individuals who were diagnosed with *Shigella* spp./EIEC were admitted to hospital (6/15; 35%) and nine (9/29; 31%) who tested negative for *Shigella* spp./EIEC were admitted (Table 4). Diarrhoea/loose stools (15/17; 88%), abdominal cramps (11/17; 65%), nausea (9/17; 53%), and headaches (9/17; 53%) were the most frequently reported symptoms among individuals who tested positive for *Shigella* spp./EIEC. Diarrhoea/loose stools were significantly associated with testing *Shigella* spp./EIEC positive. Abdominal cramps (18/29; 62%), nausea (17/29; 59%), diarrhoea/loose stools (16/29; 55%), headache (15/29; 52%), and vomiting (15/29; 52%) were the most frequently reported symptoms among those who tested negative for *Shigella* spp./EIEC (Table 4).

Table 4. Clinical characteristics of symptomatic individuals by *Shigella* spp./EIEC diagnosis, foodborne disease outbreak, City of Cape Town, Western Cape, South Africa, February 2024, (n=46).

Clinical characteristics	*Shigella* spp./EIEC		Total	*p-value
	Yes (n=17)	No (n=29)	(n=46)	
	No. (%)	No. (%)	No. (%)	
Admitted to hospital	6 (35)	9 (31)	15 (33)	0.766
Signs and symptoms				
Diarrhoea/loose stools	15 (88)	16 (55)	31 (67)	**0.021**
Abdominal cramps	11 (65)	18 (62)	29 (63)	0.858
Nausea	9 (53)	17 (59)	26 (57)	0.708
Headache	9 (53)	15 (52)	24 (52)	0.936
Vomiting	8 (47)	15 (52)	23 (50)	0.76
Rigors (chills)	6 (35)	16 (55)	22 (48)	0.193
Fever	8 (47)	13 (45)	21 (46)	0.883
Muscle pain	6 (35)	15 (52)	21 (46)	0.28
Loss of appetite	4 (24)	15 (52)	19 (41)	0.061
Joint pain	4 (24)	11 (38)	15 (33)	0.315
Bloody diarrhoea	1 (6)	2 (7)	3 (7)	0.893
Other (n=8)				
Confusion	0 (0)	3 (75)	3 (38)	0.17
Dizziness	2 (50)	0 (0)	2 (25)	0.059
High heart rate (self-reported)	0 (0)	1 (25)	1 (12)	0.439
High white cell count (self-reported)	1 (25)	0 (0)	1 (12)	0.187
Unable to walk	1 (25)	0 (0)	1 (12)	0.187

EIEC = Enteroinvasive *Escherichia coli*, spp.=species

*p-value: Calculated using Chi-square test. Significance calculated at p<0.05

Environmental investigations

The EHPs' inspection did not identify any issues of concern regarding food preparation or hygiene practices. However, there was an overstocking of cold storage at the restaurant, resulting in non-compliance with the first-in, first-out recommendation. All ten hand swabs and six environmental swabs tested negative for the indicator organisms and bacterial pathogens as described in the methods section.

Food items

All food items tested at the CoCT laboratory were within the acceptable reference ranges according to the standards set by the Foodstuffs, Cosmetics and Disinfectants Act, 1972.[13] All of the food specimens tested at the ICSL tested negative for *E. coli* and *Shigella* spp. Three food specimens (grilled chicken, prawn rissoles, and mayonnaise sauce) had coagulase-positive staphylococci higher than the acceptable limits, and the mayonnaise had *B. cereus* higher than the acceptable limits. The prawn rissoles had coliforms (120 colony-forming units per gram) present and had a high aerobic bacterial count (12 000 000 colony-forming units per gram). Toxin-negative *S. aureus* were also detected in the grilled chicken and the cooked halloumi with a high bacterial count (41 000 colony-forming units per gram).

Discussion

We identified 46 symptomatic individuals who met the suspected or confirmed case definition for this FBD outbreak. All cases had eaten at or worked at restaurant A. *Shigella* spp./EIEC were identified in 75% (6/8) of the stool specimens submitted from patrons and 66% (27/41) of symptomatic staff members screened for gastrointestinal pathogens.

Shigella spp. and EIEC are closely related gram-negative bacteria that cause gastroenteritis in humans. Both *Shigella* and *E. coli* are listed among the big six pathogens identified by the CDC that can contaminate food through infected food handlers.[15] Humans are the only natural host for *Shigella*. *Shigella* is highly contagious with a low infectious dose (10–100 organisms are sufficient to cause disease).[16] There are four species of *Shigella*: *Shigella sonnei, Shigella flexneri, Shigella boydii* and *Shigella dysenteriae,* which are further divided into serotypes and subserotypes.[17] Following an incubation period of one to four days, infection with *Shigella* can result in a range of diseases, from asymptomatic infection to severe bloody diarrhoea.[17,18] Fever, headache, malaise and vomiting are often the initial symptoms, followed by the onset of watery diarrhoea (indicating invasive infection of the small bowel).[17] In some cases, the infection progresses to involve the colon, resulting in diarrhoea with bloody mucoid stools, abdominal cramps, and tenesmus (a repeated, painful urge to pass stool without excreting stool).[17,18]

Similar to *Shigella*, infection with EIEC can cause profuse diarrhoea and fever.[19] Enteroinvasive *E. coli* are highly invasive, and although they do not produce toxins, infection can severely damage the intestinal wall. Both *Shigella* and EIEC can cause large FBD outbreaks.[18,20] Both organisms are spread through the faecal-oral route. Transmission can be person-to-person or through food and water contaminated by an infected person.[20]

The 46 case patients identified may be an underestimation of the true number of cases linked to this outbreak, as asymptomatic infections can occur and cases with mild symptoms may not seek healthcare. In addition, healthcare workers may fail to link individual cases to an FBD outbreak or fail to notify them.[8]

Only one of the hospitalised patients tested negative for any enteric pathogens on the PCR panel (1/8; 13%). This could be due to late specimen collection or the patient being on antibiotics before the collection of the specimen. Testing for pathogens using PCR is typically more sensitive than culture, particularly for detection of

Shigella spp., and is less affected by delays in the specimen reaching the laboratory.[21] Overall, the number of hospital admissions (15/47; 32%) attests to the severity of illness in this outbreak.

No definitive source was identified for the outbreak, which, while suboptimal, is not uncommon in FBD outbreak investigations. Of the 337 FBD outbreaks notified in South Africa between March 2018 and August 2020, 129 (38%) were investigated.[7] Only 14 (11%, 14/129) of those investigated outbreaks had comprehensive epidemiological, laboratory and environmental investigations conducted.[7] Similarly, the majority of foodborne outbreaks in the United States are unsolved, meaning that no source was identified.[22]

Several hypotheses were investigated as a potential source, including a foodborne source (through a contaminated food item or an infected food handler) or an environmental source through touch points contaminated by an infected staff member or patron. Although *Shigella* spp. or *E.coli* were not detected in the food specimens tested, several food items did not meet the food hygiene standards, suggesting that food handling practices and inadequate personal hygiene among staff members may have contributed to the spread of enteric pathogens in this outbreak. *Staphylococcus aureus* is a commensal organism and can contaminate food through unwashed foods.[23] *Bacillus cereus* is ubiquitous in the environment and can easily spread to food and food products, especially through the improper holding of cooked foods.[24]

The investigation identified eight staff members who were symptomatic and continued to work. This might have contributed to the FBD outbreak. According to the Foodstuffs, Cosmetics and Disinfectants Act of 1972 regulations governing general hygiene, food may not be handled by a person who has reported or who is suspected of suffering from or being a carrier of a disease or condition in its contagious stage and likely to be transmitted through food; the symptoms include jaundice, diarrhoea, vomiting, fever, sore throat with fever, and discharges from the ear, eye, or nose.[13] In addition, the person may only resume the handling of food if they provide a medical certificate stating that they are fit for work.[13]

There were several limitations to this outbreak investigation. A case-control or cohort study was not conducted, and CIFs were only completed for 28 cases due to time and resource constraints. In addition, restaurants do not keep a register of patrons, so tracing of controls could not be conducted. Food histories were only available for 24 individuals, all of whom were cases. Of these, seven had specimens collected, all of which tested positive for *Shigella* spp./EIEC. Therefore, attack rates and odds ratios could not be calculated to identify the likely source of the outbreak. Several questions were also not fully completed on the CIFs – perhaps due to recall bias or the individual not wanting to disclose their information. Symptoms were self-reported and can lead to misclassification of cases, and the timing of the interviews may have led to recall bias when reporting food consumption history. Molecular tests were conducted on stool specimens, but culture and whole genome sequencing were not performed on the specimens that were positive for *Shigella* spp./EIEC. Available molecular tests are unable to distinguish between *Shigella* and EIEC infection. The lack of culture prevented further characterisation of isolates in terms of performing serotyping and antimicrobial susceptibility testing. Whole genome sequencing would have been of value in establishing the genetic relatedness of the outbreak isolates. Currently, no national *Shigella* guideline exists to guide outbreak response teams, and teams are required to use international guidelines such as those of the CDC[25] and a joint guideline from Public Health England and the Chartered Institute of Environmental Health.[26]

Public Health Actions

To control this FBD outbreak, we implemented several public health and environmental actions (Figure 1 and Table 2). We immediately closed the restaurant while the investigation was taking place (10 February 2024) and reopened it on 19 February after the implementation of interventions. There was retraining of staff members on food safety, chemical safety, and effective hand and personal hygiene. The restaurant was deep-cleaned and disinfected. We screened staff for *Shigella* and advised all ill staff members to stay at home until their symptoms resolved (48 hours after diarrhoea stopped) and to adhere to labour department guidelines in relation to illness.[13,27] Asymptomatic staff could return to work on condition that they adhered to strict, safe food handling and personal hygiene practices. There were no further cases reported following the reopening of the restaurant. We are conducting routine assessments at the restaurant as per the National Norms and Standards guidelines for Environmental Health.[28]

Conclusion

We could not identify the source of this foodborne outbreak. Food handling practices and inadequate hygiene among staff members may have contributed to the spread of enteric pathogens during the outbreak. The closure of the restaurant and prompt public and environmental health actions prevented the occurrence of additional cases. This outbreak highlighted several of the common obstacles encountered during FBD outbreak investigations.

Recommendations

- The Department of Health (Communicable Disease Control, Environmental Health, Food Control) and local authorities should institute health education for restaurant managers regarding *Shigella* and FBDs. The NICD can assist with developing material. Training can include the importance of restaurants developing schedules and having extra staff on call, to decrease the pressure on staff to work while they are ill and for staff to comply with the occupational health and hygiene system.
- All restaurants need to be aware of and adhere to food safety and good hygiene practices, including training of new staff and regular retraining of existing staff. EHPs can reinforce the importance of training when they are conducting routine inspections.
- The NICD, in collaboration with the Department of Health, should develop national guidelines for the investigation and control of outbreaks caused by *Shigella* spp.
- The NICD can review and update the current FBD CIF, which requests a case to provide food history for three days prior to symptom onset. For infections with an incubation period longer than three days, contaminated food might be missed.
- Healthcare facilities should complete a CIF for each case of FBD to assist with source investigation.
- Outbreak investigation teams should be multi-disciplinary, including DoH and EHPs, with input from laboratory personnel.
- Whenever possible, case-control studies should be conducted for future foodborne outbreaks. In this way, attack rates and odds ratios can be calculated to assist with identifying the source of contamination.

- In addition to molecular tests, all outbreak-related specimens should be cultured for further characterisation and whole-genome sequencing.

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Ethical considerations

The University of the Witwatersrand Human Research Ethics Committee granted ethical approval for the surveillance of notifiable medical conditions under the Notifiable Medical Conditions Surveillance System (NMCSS) ethics (M210752). In addition, no identifying information is presented in the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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