

UNDER PEER REVIEW

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Case study

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Gastroenteritis Outbreak in a Senior High School,

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Akwapim North District, Eastern Region-Ghana, 2012

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Authors' contributions

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This work was carried out in collaboration ~~with between~~ all authors. Author JKLO wrote the study protocol

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helped in study, design, data analysis and drafted the manuscript. Authors EA, FW, CO, SS directed the

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work, and reviewed the manuscript. Authors GKD, DA, JA,DKA,KT,PB, OSO and JA helped in data

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collection, analysis, interpretation. All authors read and approved the final manuscript

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ABSTRACT

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Background: Gastroenteritis is an inflammation of the stomach and intestines. In Ghana the incidence is

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about 5.8 million cases annually. On the 28th of October, 12 students from a Senior High School (SHS) in the

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Akwapim North District-Ghana, reported to the district hospital with abdominal cramps, diarrhea and

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vomiting. We investigated to identify the cause, the source of infection and to recommend control

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measures.

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| Methods: We conducted a descriptive investigation, with active case-search and a retrospective cohort-study.

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| A case-patient was a student presenting with abdominal cramps, diarrhea and or vomiting from the 28th of

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| October to the 2nd of November in the SHS. We interviewed students and reviewed medical records. Stool

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from case-patients and water samples were taken from known sources of drinking water and associated boreholes for laboratory diagnosis. We performed univariate

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analysis by person, place and time and assessed risk factors through relative risk 95% confidence level.

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Results:

Aeromonas spp and Eschericia coli were isolated from stool and water samples respectively.

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The overall attack rate was 8.0 (101/1254) /1000 with no fatalities. The index case, a 15 yr-old female

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student reported on october 28th and case-patients peaked (16/101) 24hours later. The mean age of

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case-patients was 17 years (± 1.2) with females 77% (78/101) mostly affected. Eating waakye

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[RR=3.13(CI 2.35-4.17)], banku [(RR= 2.21(CI 1.33-3.69)], kenkey [RR=1.39 (CI 1.03-1.87)] and drinking

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borehole water [(RR=7.60 (CI 6.26-9.25))] were associated with the gastroenteritis.

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Conclusions:

Drinking Eschericia coli contaminated-bore hole water was the most likely cause of this

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point-source outbreak. Chlorination of the boreholes water coupled with, education on food safety and personal

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hygiene were initiated based on our recommendations and these measures were temporally associated with contain~~mented~~ of the outbreak.

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Keywords:

Food-borne, gastroenteritis, outbreak, Aeromonas spp., Eschericia coli, Akwapim North

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District, Ghana

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671. INTRODUCTION

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Gastroenteritis has been referred to as gastro, stomach bug, and stomach virus. Viruses

(particularly rotavirus) and the bacteria Escherichia coli and Campylobacter species are the primary

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causes of gastroenteritis [Szajewska, 2010; W ebber, 2009].

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It is estimated that three to five billion cases of gastroenteritis occur globally on an annual basis [Elliot,

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2007].-Pprimarily, affecting children and those in the developing world [W ebber, 2009].

It has resulted in

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about 1.3 million deaths in children less than five as of 2008, with most of these cases occurring in the world's

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poorest nations [Mandell, 2010]. Gastroenteritis is an inflammation of the stomach and intestines. In

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Ghana the incidence is about 5.8 million annually[GHS, 2010]

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On the 30th of October, 2012, at 8:30am, the District Director of Health Services (DDHS) of the Akwapim

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North District (AKND) of the Eastern Region (ER) of Ghana received a phone call from the headmaster of a

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Senior High School in the AKND about an outbreak of a-diarrhoea disease in the school which started the

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night before and had prevailed untill the time he was making the report. On further enquiry, we came to

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know that most of the case-patients were females and were admitted to a nearby private and government

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hospitals with predominant clinical features of watery stool, lower-abdominal pain, and vomiting with or

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without dehydration. W e initiated investigations on the same day to (a) assess the magnitude of the

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outbreak, (b) identify the etiologic agent and source of infection, and (c) initiate control and preventive

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measures.

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2. MATERIALS AND METHODS

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2.1 Descriptive Epidemiology

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We defined a suspected case of gastroenteritis as any person with vomiting and diarrhoea between the 30th

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of October to 2nd of November at Benkum Secondary School. The demographic and clinical details of the

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suspected case-patients were collected from the hospital-records and denominator data from the records

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from the school. Active case search and interview of the staff and students in the school were conducted

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to trace other cases and contacts to identify the possible common source of infection to generate a

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hypothesis. Data abstracted included age, sex, date of onset, date of presentation at health facility, signs

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and symptoms and outcomes. We drew a spot-map, constructed an epidemic curve (Fig.1), and

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calculated the attack rates by age-group.

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2.2 Laboratory Investigations

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Eighteen stool samples were taken from case-patients and sent to the Regional Hospital Laboratory,

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Koforidua, for a laboratory diagnosis. Similarly, water samples from the boreholes and storage tanks were

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sent to the Ghana Water Company, Kpong for analysis.

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2.3 Environmental Survey

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We inspected the school compound for different sources of water used for drinking, cooking and domestic

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purposes ~~and to~~ identify the possible sources of drinking-water contamination. We also inspected all

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conditions for food preparation and handling and interviewed the kitchen and canteen staff, and other

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food vendors about the storage of drinking water and clinically examine the food-handlers. An

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environmental survey of the school compound was undertaken to inspect and interview the students on

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the sanitary conditions of the school. Geographical co-ordinates of landmarks of the school were taken with

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a GPS Receiver to construct a spot map.

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2.4 Analytical Epidemiology

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Review of the descriptive epidemiological findings led us to suspect that the diarrheal illness was associated with

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a) Eating food either from the schools kitchen, canteen or the various food vendors at the dormitory ~~-or~~ b)

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Drinking water from the bore-holes. To test these hypotheses, we conducted a retrospective cohort study

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among the students of the school. The students were interviewed to collect information about their source

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of food and drinking water.

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3.0 RESULTS

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3.1 Descriptive Epidemiology

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Among the 1800 students, 101 were affected. The overall attack rate was 5.6 (101/1800) /1000 with no

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fatalities. The mean age of case-patients was 17 years (± 1.2) with females 77% (78/101) mostly affected.

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Sex specific attack rates were 3.8% (23/600) and 6.5 % (78/ 1200) for males and females respectively

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The index case, a 15 yr-old female student reported on october 28th and case-patients peaked (16/101)

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24hours later.

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Figure: 1

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The outbreak was a point source (Figure 1). The onset of the diarrhoea started around 16 hours of the 28th

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of October and peaked between 16 to 24 hours of the same day. It then plateaued on the second day.

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The number of cases reduced drastically ~~from within~~ 40 hours ~~of onset until to~~ 80 hours ~~of onset~~. Afterwards very few cases

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were seen between the third and fourth day ie 88 to 120 hours of onset.

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3.2 Laboratory Investigations

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Out of the 15 samples tested on the 2nd of November, 2012, only one showed growth for *Aeromonas* spp.

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All the others were free from pathogens. Preliminary results from the Ghana Water Company indicated

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faecal contamination of the school's bore-hole water. *Aeromonas* spp and *Escherichia coli* were isolated

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from stool and water samples. Most of the students shared a common place of convenience with their

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colleagues. The likely mode of transmission is faeco-oral.

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3.3 Environmental Investigations

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There were three bore-holes located on the school compound. These had been cited together in a closed

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area. About 20 meters ~~from to~~ this area is a pit latrine being used by the students of the school. Filthy drains,

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both in and outside the school kitchen, an open refuse dump and dirty urinals (near the sick bay) were identified. The

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area around the water storage tanks was weedy, poorly kept and few places littered with human fecal by

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the students. The site of the school canteen was filthy with an open refuse dump. It was observe that the

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‘waakye’ and ‘banku’ sellers handled food with their bare fingers.

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3.4 Analytical Epidemiology

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We included 1254 (70%) of the 1800 students available in the cohort study. 412(40%) were males.

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Compared with students who ate banku and jollof rice from the school canteen , white porridge and

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waakye (rice shito and fish) from the school's kitchen and those who used other sources of water,

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students who reported to have eaten waakye and banku from the school canteen, ate kenkey and fish

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from the school kitchen and used borehole water for drinking were more likely to develop the acute

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diarrhoea and vomiting (RR=3.13(CI 2.35-4.17), RR= 2.21(CI 1.33-3.69), RR=1.39 (CI 1.03-1.87),

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RR=7.60 (CI 6.26-9.25). However, students who ate white porridge and waakye from the school's kitchen

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were protected from the ailment. (Refer Table 1)

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Table 1: Attack of Gastroenteritis in Bunkum Senior High School according to selected factors, Akwapim

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North District, 2012

Number of persons who ate food item Number of persons who did not eat food item

Ill Total Attack

Rate %

Ill Total Attack

Rate %

RR CI

Dining Hall

White porridge and

bread

40 478 8.4 114 773 14.7 0.57 0.40-0.80

Waakye, shito and

fish

72 698 10.3 82 553 14.8 0.67 0.50-9.0

Kenkey and Pepper

with fish

87 605 14.4 67 646 10.4 1.39 1.03-1.87

Black Market

Waakye 68 252 27.0 86 999 8.6 3.13 2.35-4.17

Banku 12 46 26.1 142 1205 11.8 2.21 1.33-3.69

Jollof rice 2 18 11.1 152 1233 12.3 0.90 0.24-3.36

Girls' Dormitory

Macaroni 12 106 11.3 142 1145 12.4 0.91 0.52-1.59

Egg 28 167 16.8 126 1084 11.6 1.44 0.99-2.10

Jollof rice 17 144 11.8 137 1107 12.4 0.90 0.56-1.44

Boys' Dormitory

Jollof rice 9 85 10.6 145 1166 12.4 0.85 0.45-1.61

Rice 11 92 12.0 143 1159 12.3 0.97 0.55-1.72

Banku 7 38 18.4 147 1213 12.1 1.52 0.77-3.02

Water Source

Borehole water 50 60 83.3 135 1232 11.0 7.60 6.26-9.25

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4.0 DISCUSSIONS

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A point source outbreak of gastroenteritis occurred among the students of the Senior High School. The

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outbreak was associated with drinking water from the schools bore-holes. The points supporting our

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findings included: (a) absence of any cases among the populace in the district residing outside the school

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using other borehole water for drinking purposes; (b) presence of E.Coli in the bore-hole water. The

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presence of Aeromonas spp in the stool specimen probably exacerbated the condition and

| was (c) a

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significant risk associated with drinking water from bore-hole, with more than 95% of the cases

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attributable to this exposure. Although, the depth of the latrine was not assessed, they are generally very

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deep since they are designed to serve many people for many years. The possibility exists that the bottom

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of the latrines are very close to the water-table. It has been recommended that latrines should be at a

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lower level than the nearest wells, the bottom of latrines must be at least 1-5 m above the ground-water

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table and the distance between latrine and any water source should be as large as possible, but never

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less than 30 m [De Araoz & Subrahmanyam, 1970].

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E.Coli transmission from fresh water source has been documented but not common,

| however it causing-has been a cause of

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| individual infections as well as outbreaks in ~~the~~ developed countries ~~has been identified~~ [Armstrong,

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1996] while reports from developing countries like India and Bangladesh are sparse.

[Albert, 1995]. The

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detection of E Coli in water is an indication that the water source has been contaminated with human

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faeces

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It was also realized from the environmental assessment that the area surrounding the water storage tanks

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was poorly kept and contaminated with human faeces. Poor hygiene is considered a main risk factor for

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acquiring E.coli infection (Huang et al., 2006).

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Our study found out that some of the food vendors at the school canteen handled food (waakye & banku)

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in unacceptable conditions. Inappropriate food handling as a risk factor for a disease outbreak has been

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documented by Smith et al. [1997]

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It was a challenge to collect information on the entire student population since about 10 of them had gone

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home to see their family physicians. This reduced the denominator for the retrospective cohort study.

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Despite the exclusion of these individuals from analysis, our study had sufficient power to detect the

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association between the illness and the risk factors (power 98%). We were unable to get some food

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samples for further laboratory diagnosis since the team was invited to investigate the outbreak a few

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days after the onset.

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In Conclusions, drinking Eschericia coli contaminated-bore hole water was the most likely cause of this

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point-source outbreak. Chlorination of the boreholes water, coupled with education on food safety and personal

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hygiene were initiated based on our recommendations and temporally associated with ~~the~~ ese containmented of the outbreak.

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Conflict of interest:

None declared

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