Diarrhea Outbreak Investigation At Bulawayo Polytechnic College, Zimbabwe, 2014.

Sisasenkosi Charlotte Tshuma

Africa University, Health Sciences,
P. O. Box 1320, Fairview Rd, Mutare, PH +263 777 245 060
Email: stshuma9@gmail.com

Abstract: Diarrhea is the passing of three or more liquid stools in a period of 24hours. Bulawayo Polytechnic Clinic reported an outbreak of diarrhea cases that increased from 2cases to 55 cases in a period of 24hours and totaled to 157 cases in 6days. Objectives: The objective of the study was to investigate the diarrhea outbreak at Bulawayo Polytechnic in Zimbabwe. A 1:1 unmatched case-control study was conducted from 05 June to 14 June 2014. Sample size was calculated using Epi-info package version 7. Simple random sampling was used to pick cases and controls from the list compiled by the investigator from clinic registers. A total of 82 cases and 82 controls were interviewed for the study. Acute diarrhea was significantly associated with drinking borehole water (AOR 3.89 95% CI 0.3408-2.3128), not regularly washing hands with soap (1.35 95% CI 0.1603-0.7785) and frequent water shortages (AOR 4.37 95% CI 0.1693-0.8279). To minimize risk of diarrheal cases and associated diseases, the City Municipality should conduct frequent assessment of water quality at the college; replace old water pipes with polyvinyl chloride pipes. Good hygiene practices should be encouraged to food handlers and food preparation facilities should constantly be checked for compliance of the required hygiene standards. The Bulawayo Municipality to ensure timely collection of refuse to avoid accumulation of rubbish in the bins.

Keywords: Acute Diarrhea, Case, Control, Risk factors

1. Introduction

Diarrhea is the passing of three or more liquid stools in a period of 24hours [1]. There are different etiological agents that cause diarrhea such as viral, bacterial and protozoan organism [2]. Diarrhea can be characterized as acute watery, having an abrupt beginning and lasting less than 14 days or it can be persistent lasting more than 14days generally resulting in weight loss and nutritional problems[1]. The length of days that the diarrhea lasts depends on the causal agent [1]. Diarrhea is more prevalent in the developing countries due to the lack of safe drinking water, sanitation and hygiene [3]. The treatment of diarrhea can be done through simple case management with oral rehydration therapy. If prompt action is not taken, it can result in death due to increased loss of water and electrolytes in the liquid stool [3].

2. Methods

2.1 Study Period and Area

The data was collected from 05 June 2014 to 14 June 2014. The study area was Bulawayo Polytechnic College in Matabeleland North Region of Zimbabwe. Bulawayo Polytechnic College is situated 600m east of the City Centre.

2.2 Study Design

A 1:1 unmatched case control study was done to investigate the diarrhea outbreak at Bulawayo Polytechnic College.

2.3 Source Population

The study population comprised of Bulawayo Polytechnic students and staff. A case was any student or staff member who presented at the clinic with acute diarrhea during the time of the outbreak. A control was any student or staff member who did not experience acute diarrhea during the time of the outbreak but presented at the clinic for some other condition.

2.4 Inclusion Criteria

Cases: Any student or staff member who presented at the Bulawayo Polytechnic clinic with acute watery diarrhea at the time of the outbreak. Controls: Any student or staff member who did not experience acute diarrhea during the time of the outbreak but presented at the clinic for some other condition.

2.5 Exclusion criteria

Cases: Any student or staff member with chronic diarrhea and frequently treated at Bulawayo Polytechnic Clinic. Controls: Any student or staff member who presented to the clinic with a different ailment but was too ill to for interviews.

2.6 Sample size

Sample size was calculated using Epi-info package version 7. It was calculated by assuming that exposure to drinking water from unsafe sources in the control group was 19.3% and 39.2% in the cases at 95% confidence interval and power of 80% with Odds Ratio of 2.7. Ratio of sample size was 1:1 unmatched and the sample size was 154. After adding 10% non-responsive rate, sample size became 164 (Cases =82, Controls =82).

Sampling procedure

A list of names of all the patients who presented at the clinic was used to come up with a sampling frame. Simple random sampling was used to pick cases and controls from the list of patients taken from the clinic registers. An equal number of cases and controls was selected.

2.7 Data Collection Procedures

Clinic registers and diarrhea registers were reviewed to get the names and diagnosis of the patients. A pre-test was done on 10% of the sample before actual data collection could be done. This was to ensure reliability and validity, necessary adjustments and amendments were done on the questionnaire.

2.8 Ethical Consideration
Verbal consent was sought from all study participants. Names of study participants were not included on the questionnaire for confidentiality reasons.

2.9 Data processing and analysis
Data entry and cleaning was done using Epi-info version 7. Data was analyzed for means, frequencies, odds ratios and confidence intervals at 95% using the same package.

3. Results

3.1 Diarrhea surveillance
Between 05 June 2014 and 14 June 2014, 55 patients met the surveillance case definition for diarrhea at the Bulawayo Polytechnic clinic. The diarrhea cases were reported to the Bulawayo City Health Department on the 9th of June 2014 and to the Provincial Ministry of Health on the 10th of June 2014. Using the Epidemic preparedness and rapid response guideline (EPR), The Bulawayo Polytechnic College delayed to report to the Bulawayo City Health officials. The official reports were made to the District Health Executive and Provincial Health Executive 72hours after the onset of the outbreak. Water samples were taken from different water points for coliform bacteria tests. Food samples and rectal swabs were not taken because it was 72hours after onset of the outbreak. Among the reported cases 78 (95%) presented with watery diarrhea and 4 (5%) presented with bloody diarrhea. The diarrhea was accompanied by symptoms which included vomiting 36(44%), headache 6(7%), weakness 40 (49%).

3.2 Environmental Assessment
The environmental assessment revealed that the institution had burst water pipes at three sites. The burst pipes were visibly old and rusty. The water coming out of the City Council taps was turbid (dense, dark and muddy) having a strong smell of raw sewage. The garbage bins were filled to capacity and had not been collected by the City Municipality for a week. There was litter on the ground and around the halls of residence. The dining area was dirty with flies seen buzzing. Cooking utensils were dirty and covered in rust. Water for cooking was drawn from a hosepipe. The food preparation area was covered in blood of fresh meat hours after the food had been cooked.

3.3 Descriptive statistics
164 study participants were enrolled in the study (Cases=82, Controls =82). Majority of participants were female (97) and males were (67). The median age for cases was 26.8 and standard deviation 8.6 (Q1=22, Q2=24.5, Q3=27). For controls, the median age was 24.7 and standard deviation 5.7 (Q1=21, Q2=23.5, Q3=26).

Table 1: *Bivariate analysis of demographical factors associated with Acute Diarrhea*

Variables	Category	Cases%	Controls%	COR(95% CI)	P-Value
Sex	Male	46(56)	51(62)	2.58(1.4401-2055)	0.2164
	Female	36(44)	31(38)		
Occupation	Students	74(90)	77(94)	3.21(0.756-2.5591)	0.2029
	Staff	8(10)	5(6)		
Marital Status	Single	70(85)	70(85)	9.45(2.9182-6.7791)	0.513
	Married	12(15)	12(15)		
Residence	On-campus	48(59)	38(46)	6.84(1.7383-4.1195)	0.0059
	Off-campus	34(41)	44(54)		

The bivariate analysis showed that students and staff members who reside on campus are 6.84 times more likely to contract diarrhea compared to those living off-campus (p=0.0059).

Table 2: *Bivariate analysis of risk factors associated with Acute Diarrhea*

Variables	Category	Cases%	Controls%	COR(95% CI)	P-Value
Source of water	Borehole	73 (89)	72(88)	9.24(1.5562-5.6945)	0.0000
	Tap	9(11)	10(12)		
Frequent water shortages	Yes	24(29)	11(13)	3.65(0.7392-2.4539)	0.0071
	No	58(71)	71(87)		
Source of food	Campus Canteen	56(68)	51(62)	7.66(2.5877-5.9316)	0.0050
	Vendor/Other	26(32)	31(38)		
Regular Hand washing with soap	Sometimes	25(30)	11(13)	3.22(0.5827-0.8539)	0.0044
	Most Times	57(70)	71(87)		
Handwashing before eating	Yes	68(83)	60(73)	5.61(0.4673-1.6634)	0.1281
	No	14(17)	22(27)		
Frequency of garbage collection	Once a Week	53(65)	36(44)	12.65(5.6935-7.9683)	0.0041
	Twice a week	29(35)	46(56)		
Have working flush toilets	Yes	71(87)	59(72)	2.58(3.4678-6.9905)	0.3611
	No	11(13)	23(28)		

The bivariate analysis showed that students and staff who were exposed to borehole water were 9.24 times more likely to contract diarrhea compared to persons who were exposed to tap water(p=0.0000). Experiencing frequent water shortages increased risk of diarrhea by 3.65 times (p=0.0071). Persons who eat food cooked at the college

canteen are 7.66 times more likely to have diarrhea compared to those who buy from vendors and other sources (p=0.0050). Persons who do not practice regular handwashing with soap are 3.22 times more likely to contract diarrhea compared to those who wash hands regularly with soap (p=0.0044). When garbage is collected by City Council once a week it raises the risk of contracting diarrhea by 12.65 times compared to exposure when garbage is collected twice a week(p=0041).

Table 3: *Multivariate analysis of factors associated with Acute Diarrhea*

Variables	Category	Cases %	Control%	COR(95% CI)	AOR (95% CI)	P-Value
Residence	On-Campus	48(59)	38(46)	6.84(1.7382-4.1195)	1.63(0.8152-3.0314)	0.9344
	Off-Campus	34(41)	44(54)			
Source of water	Borehole	73 (89)	72(88)	9.24(1.5562-5.6945)	3.89(0.3408-2.3128)	0.0057
	Tap	9(11)	10(12)			
Frequent water shortages	Yes	24(29)	11(13)	3.65(0.7392-2.4539)	4.37(0.1693-0.8279)	0.0344
	No	58(71)	71(87)			
Source of food	Campus Canteen	56(68)	51(62)	7.66(2.5877-5.9316	2.44(1.1182-8.1391)	0.4310
	Vendor/Other	26(32)	31(38)			
Regular Hand washing with soap	Sometimes	25(31)	11(13)	3.22(0.5827-0.8539)	1.35(0.1603-0.7785)	0.0017
	Most times	57(70)	71(87)			
Frequency of garbage collection	Once a Week	53(65)	36(44)	12.65(5.6935-7.9683)	2.34(1.2454-4.3787)	0.5079
	Twice a week	29(35)	46(56)			

Variables with statistical significance in the bivariate analysis were included in the multiple logistic regression model. Independent risk factors for diarrhea included drinking borehole water (AOR 3.89 95% CI 0.3408-2.3128). This was supported by laboratory findings that detected presence of coliform bacteria in the water samples that were taken during investigations. Persons who do not practice regular washing of hands with soap are 1.35 times more likely to contract diarrhea (1.35 95% CI 0.1603-0.7785). Frequent water shortages increase the risk of contracting diarrhea by 4.37 times (AOR 4.37 95% CI 0.1693-0.8279).

4. Discussion

Regular and thorough washing of hands with soap is an effective intervention to prevent diarrhea. A systematic study showed that effective handwashing with soap reduces the risk of diarrhea by 42-44% [4]. Frequent water shortages were shown to be a risk factor for acute diarrhea. Body hygiene and good sanitation practices are compromised when there is less water available. A meta-analysis of interventions done in different rigorous studies showed that increasing water quantity reduced the occurrence of diarrheal diseases by 19% and improved sanitation led to reductions in diarrheal diseases of 36% [5]. The investigation established that out of the 8 borehole samples, two boreholes were contaminated with coliform bacteria. Traces of faecal bacteria were detected in the water samples that were taken to the laboratory for analysis. This suggests possible infiltration of sewage effluent into the water table. A similar study in South Korea revealed that the presence of fecal bacteria in water samples supported the inference that contaminated groundwater was the source of diarrhea affecting students [6].

5. Conclusion

It was concluded that drinking borehole water, not practicing regular washing of hands with soap and frequent water shortages were risk factors for acute diarrhea among students and staff at Bulawayo Polytechnic College in Zimbabwe.

6. Recommendations

There should be frequent assessment of water quality at the college because they have recurrent bursting of sewer pipes. In addition, the old water pipes should be replaced with polyvinyl chloride pipes that are durable and resistant to corrosion. Food handlers should be encouraged to practice good hygiene practices such as washing of hands, wearing clean aprons and working in clean environments to avoid cross contamination. The Ministry of Health should routinely check food preparation facilities for compliance of the required hygiene standards. The Bulawayo Municipality should collect and dispose solid waste frequently and appropriately.

References

[1] WHO. (2002). Generic Protocols(i)hospital-based surveillance to estimate the burden of rotavirus gastroenteritis in children and (ii) a community-based survey on utilization of healthcare services for gastroenteritis in children. Field test version. Geneva, Vaccines and Biologicals Department, World Health Organization, 2002 (WHO/V&B/02.15).

[2] World Gastroenterology Organisation Global Guidelines. Acute diarrhea in adults and young children: A global perspective. (2012). https://webaigo.it/download/diarrea%20acuta.pdf (Accessed 10/06/14)

[3] World Health Organization. (2004). Water, Sanitation and Hygiene links to health. https://www.who.int/water_sanitation_health/publications/facts2004/en/ (Accessed 09/06/14)

[4] Curtis V, Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. Lancet Infectious Diseases 2003;3(5):275-81.

[5] Fewtrell L, Kaufmann R.B, Kay D, Enanoria W, Haller L & Colford Jr J.M. (2005). Water,

sanitation, and hygiene interventions to reduce diarrhea in less developed countries: A systematic review and meta-analysis. The Lancet Infectious Diseases, 5, 42. doi:10.1016/S1473-3099(04)01253-8

[6] Häflinger D, Hübner P and Lüthy J. (2000). Outbreak of viral gastroenteritis due to sewage-contaminated drinking water. Int. J. Food Microbiol. 54:123-126. http://jcm.asm.org/content/43/9/4836.full?sid=68c26720-a61f-4c1c-851c-97ba111fb33#ref-5 (Accessed 14/06/14)