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RESEARCH ARTICLE

A REPORT ON EPIDEMIOLOGICAL AND LABORATORY INVESTIGATIONS OF OUTBREAKS OF DIARRHOEA IN MADHUBANI DISTRICT, BIHAR: IMPLICATIONS FOR CONTROL

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ABSTRACT

Acute diarrhoeal illness is very common worldwide and estimated to account for 1.8 million childhood deaths annually, predominantly in developing countries (World Health Organization, 2005). Conservative estimates place the global death toll from diarrhoeal diseases at about two million deaths per year (1.7 - 2.5 million deaths), ranking third among all cases of infectious disease death world-wide. Most of these deaths occur in children under five years of age. Diarrhoea continues to be an important contributor to childhood deaths in India. About 10% of infants and 14% of 1-4 year children die every year due to diarrhoea in India. In Bihar, Acute Diarrhoeal Disease (including Gastroenteritis) constituted 28% of total outbreaks reported & responded in the last two years i.e. 2011& 2012. Around 302 and 272 cases of Acute Diarrhoea were reported in village Arer (PHC:Benipatti) and village Kharra (PHC:Rahika) of Madhubani district in Oct 2013.The objective of the research was to find out the causes of the outbreak, the social and the environmental factors contributing to the outbreak and to suggest remedial measures to control the outbreak. To find out the reasons of the outbreak, discussion with the district authorities, medical and paramedical staffs and physicians who treated the cases was done to know about the clinical presentation of cases, results of laboratory investigations and outcome of cases, interview and clinical examination of some of the cases was done, rapid epidemiological survey by house to house visit and collection of stool, blood and water samples from cases as well as controls who suffered from Acute Diarrhoea for microbiological tests in order to trace the aetiological agent behind the outbreak was also done. In addition, examination of water storage practices, environmental investigation, knowledge, attitude and practices of the community were also analyzed as per pre-planned questionnaire. With all the available evidences, it was concluded that the present outbreaks of diarrhoea were food borne in nature and was a point source outbreak that was caused due to consumption of stale meat consumed during Bakrid in Muslim community and due to consumption of stale food cooked in Durga Puja mela in Hindu community in village Arer. In Kharra village, majority of the Muslim community were affected due to consumption of stale meat. Majority of the affected population belonged to low socio-economic strata (agricultural labour class). As majority of the affected population were illiterates/less educated/aware, they also had poor awareness regarding personal hygiene. Public health interventions to prevent disease outbreaks should focus on sanitation measures for safe water supply, food hygiene, proper sewage systems/disposal of excreta, public health education.

INTRODUCTION

Acute diarrhoeal illness is very common worldwide and estimated to account for 1.8 million childhood deaths annually, predominantly in developing countries (World Health Organization, 2005) (1). Conservative estimates place the global death toll from diarrhoeal diseases at about two million deaths per year (1.7 - 2.5 million deaths), ranking third among all cases of infectious disease death world-wide. Most of these deaths occur in children under five years of age. Diarrhoea continues to be an important contributor to childhood deaths in India. About 10% of infants and 14% of 1-4 year children die every year due to diarrhoea in India.(2) In Bihar, Acute Diarrhoeal Disease (including Gastroenteritis) constituted 28% of total outbreaks reported & responded in the last two years i.e. 2011& 2012.(3) The aetiology of diarrhoea is very varied, important aetiological enteropathogens are *V. Cholera, E. coli, salmonella, shigella*. Rotavirus has emerged as the leading cause of severe, dehydrating diarrhoea in children age less than 5 years. (4)

Most of the pathogenic organisms that causes diarrhoea are transmitted primarily or exclusively by the faecal-oral route.

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Faecal-oral transmission may be water-borne; food-borne, or direct transmission which implies an array of other faecal-oral routes such as via fingers, or fomites, or dirt which may be ingested by young children.(5). The main purpose of the outbreak investigation is to find out the cause of the outbreak, limit it and suggest ways to reduce any further impending outbreaks. (6)

Outbreak Description

Approximately, 302 and 272 cases of Acute Diarrhoea were reported from village Arer (PHC:Benipatti) and village Kharra (PHC:Rahika) of Madhubani district on Oct 13 2013.Case definition for acute diarrheal disease in the present outbreak investigation was described as 'three or more loose watery stool with or without vomiting in the last one week'.

Specific Objectives

To review and assess the situation of Diarrhoea outbreak in Madhubani district of Bihar, to determine the causes of current outbreak, to conduct an epidemiological survey in some of the affected areas of Madhubani, to collect samples of water, stool and blood for laboratory investigation of the agent behind the outbreak, to assess the environmental and sociological factors contributing to the abundance the disease, to assess the current situation by field investigation and data analysis of recent Diarrhoeal outbreaks in Madhubani and to recommend remedial measures to overcome the current outbreak and prevent occurrence of outbreaks in future.

METHODOLOGY

Discussion with the District authorities and medical and paramedical staff to know the background information of the affected areas, genesis of outbreak, investigations carried out so far and control measures undertaken, discussion with the physicians who treated the cases about the clinical presentation of cases, results of laboratory investigations and outcome of cases; interview and clinical examination of some of the cases; visit to affected areas; rapid epidemiological survey by house to house visit and collection of stool, blood and water samples from cases as well as controls who suffered from Acute Diarrhoea for microbiological tests at PMCH, Patna in order to trace the aetiological agent behind the outbreak; examination of water storage practices; environmental investigation, knowledge, attitude & practices of the community were also analyzed as per pre-planned questionnaire; information was obtained about family structure and socio-economic status. For each member of the household, a questionnaire was used to collect information on previous and present acute and chronic illness. For all those reporting ***diarrhoea***, information was obtained about date of onset, number, colour and consistency of stool, presence of blood and or mucus, other associated symptoms such as fever, abdominal pain, nausea and vomiting.

Madhubani District profile: The district Madhubani lies between the north latitudes of $26^0$03' to $26^0$40' and east longitudes of $85^0$45' and $86^0$44'. It occupies a total geographical area of 3501 sq km. It is bounded by Darbhanga district in the south, Sitamarhi district in the west, Kosi river in the east and Nepal in the north.

As per the latest 2001 census, the total population of the district stands at 3,575,281 including rural and urban populations of 3,450,336 and 12,45,45 respectively. The decadal population growth rate has been observed to be 26.24%. Literacy Rate in the district is 41.97.No. of Sub-Division are 5 while No. of Blocks is 21, No. of Panchayats is: 399 and No. of Villages are: 1111

Paddy is the key crop of the district. Pisciculture is known to be one of the main sources of revenue in the district. Sugar factories are also present in the district, which help in income generation. Madhubani is popular world over for its art and crafts. The main sources of irrigation in the district are shallow tube wells, tanks and canals. Tanks and canals are basically rain-fed and dry up during the Rabi season.

The district experiences a sub-tropical climate, characterized by tolerable summer (March to November) and pleasant winter (November to February). The maximum and minimum daily temperatures during May are around 36^0C and 24^0C respectively. In rare cases, the summer maximum temperature reaches 43^0C. In winter the temperature varies within 24^0C and 10^0 C.

The normal annual rainfall in the district varies stands at 1257.81 mm, of which monsoon rainfall constitutes about 83.14 % (1045.71 mm). The rain usually starts in the middle of June. The maximum rainfall occurs between the second half of July and first half of August. The maximum humidity in the region is felt during rainy season and minimum in summer.

General Observations

Steps taken by the District Health Authorities: Following the outbreak, the Health Authorities of Madhubani initiated prompt control measures. The local PHC was put on high alert state with drugs and stocks to manage the outbreak. A medical team consisting of Medical Officer, ANM and Other Health Workers were mobilized to the affected site to set up a camp for few days. The community affected with Diarrhoea were symptomatically treated and provided with Zn & ORS for rehydration. Serious cases were given saline treatment. Chlorination of the hand pumps and other water sources in the region was done. The Public Health and Engineering Department was alerted for biochemical testing of water samples from outbreak regions. Biochemical water analysis showed satisfactory quality of water tested at several sites from the affected areas. Information education and communication activities to create awareness among people regarding sanitation and hygienic practices (safe drinking water) were carried out by means of pamphlets and media.

Situation of Diarrhoea in Madhubani

Epidemiological Description of the area

Village Arer & Kharra*:* The sites are an agriculture production unit where majority of the population were of labour class and

grow paddy for their living. Both males and females earned their living by working in the field. Majority of the population had small kuttcha hut made up of immature brick and plastic roof. Sizes of huts were on average 8×8 foot with height of 5 foot. They had no sanitary facility for cooking, storing food, storing drinking water and washing facility. There was no provision of sanitary latrine in the premises in majority of the houses.

Illiteracy was also very much prevalent in both the villages. All affected population stayed in periphery of agriculture production site with their families. Hygienic practices for day to day activities were also very poor in nature. Before this episode of diarrhea and vomiting 2 major feasts were organized. Among the Hindus, Durga Puja was celebrated from 4th Oct till 13th Oct while Muslims celebrated their religious event 'Bakrid' on 14th Oct 2013. In village Arer, every year on account of Durga Puja festival, a feast/mela is organized where majority of the people go for eating, recreation and entertainment.

Only hand-pump was a source of drinking water in majority of the houses in the two villages. There was no drainage facility; because of that agent host transmission of infection becomes easier.

RESULTS AND DISCUSSION

Epidemiological investigation & results: is based on field survey to the affected areas as well interpretation of data collected from IDSP reporting units, their detailed analysis as well as questionnaire on clinical signs & symptoms with the clinicians who treated the patients & their relatives as well as other health officials. In addition, detailed food history and time of onset of symptoms of Diarrhoea were also recorded through questionnaire.

After receipt of information about outbreaks of diarrhoea by the district surveillance team on 19th Oct 2013, the affected villages including various tolas were visited.

A house-to- house survey was carried out where each house in the village was visited and at least one member of each family was questioned. Information was obtained about family structure and socio-economic status. For each member of the household, a questionnaire was used to collect information on previous and present acute and chronic illness.

For all those reporting diarrhoea, information was obtained about date of onset, number, colour and consistency of stool, presence of blood and or mucus, other associated symptoms such as fever, abdominal pain, nausea and vomiting. Drinking water was obtained from semi-protected hand pump in village Arer and was never boiled. Just after the Durga Puja and Bakrid, heavy rain was experienced due to Phyline cyclone, so lots of water logged places could be identified.

Village Arer: Index case was reported on 13th Oct 2013 (last day of Durga Puja) **(Figure 1 a).** Total 302 cases of loose watery stools were reported from village Arer (Figure 2). Almost all the age groups were affected with Diarrhoea but the Attack Rate in order of increasing incidence are as under: 5-9 (11.2)>10-14 (10.95)>0-4(10.90)>70-74 (9.45) **(Table 1).**Females (59%) were more affected than males (41%) (Table 2**).** About (92%) of the cases reported onset of symptoms of Diarrhoea from 12:00 PM till 11:30 PM (Table 8). Typical clinical symptoms showed by the cases were watery stool (100%)>Vomiting (90%)>Nausea (50%). About 80% of the cases reported of having similar cases in the family. About 62% of the cases showed moderate dehydration while 38% showed severe dehydration **(Table 9).** Risk factor analysis was carried out independently for both the Muslim and Hindu community affected with Diarrhoea to draw appropriate conclusions. Risk factor analysis was based on foods consumed by the Muslim community during Bakrid and by Hindu community in Durga Puja mela/feast.

Risk Factor analysis in Hindu Community in Arer Village

Out of 90 persons ate some meal (A) in Durga Puja mela, 80 fell ill (Attack rate: 80%). Attack rate among those who did not eat any meal (A) in Durga Puja mela was 22%. So, Food (A) was likely to be a risk factor for the illness because Attack rate

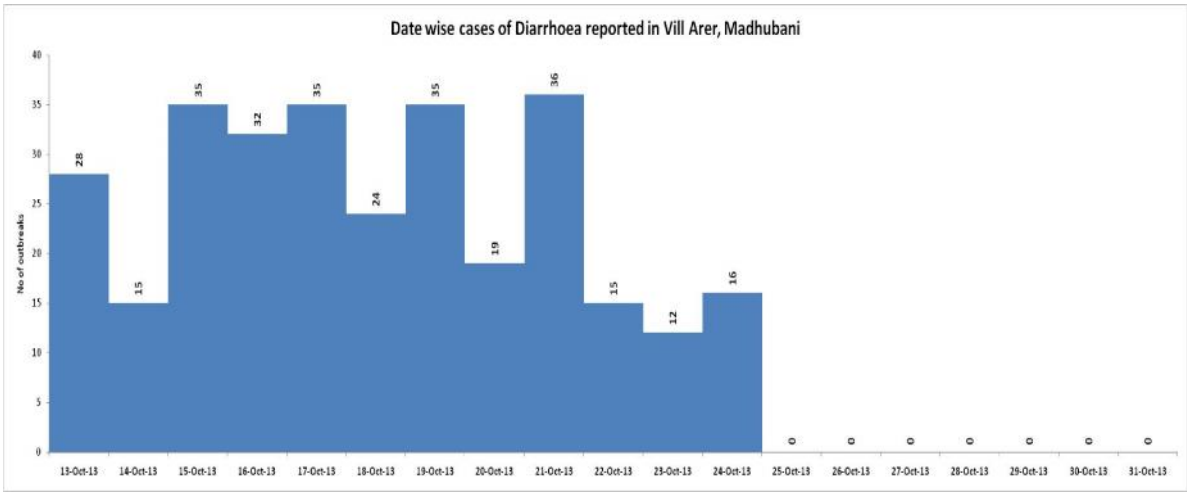

Figure 1 a Time wise analysis of diarrhoeal outbreak in village Arer, Madhubani

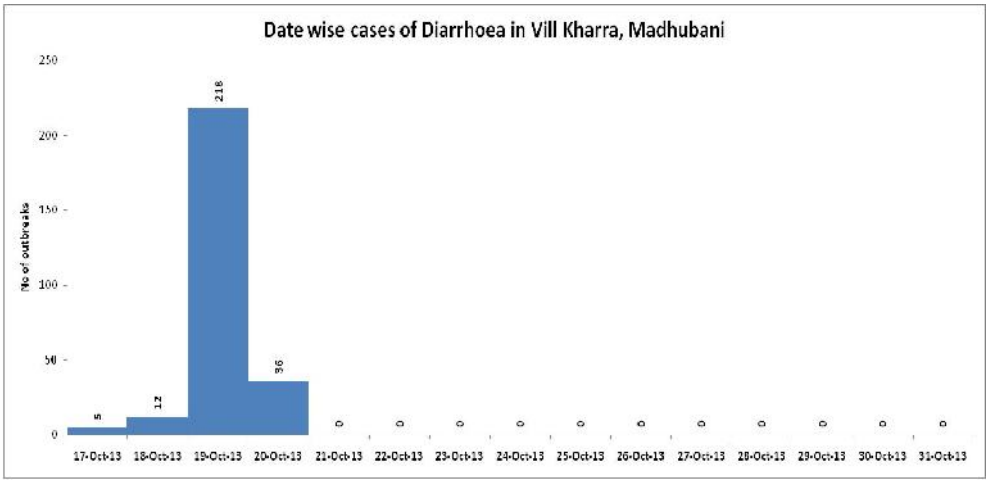

Figure 1 b Time wise analysis of diarrhoeal outbreak in Village Kharra, Madhubani

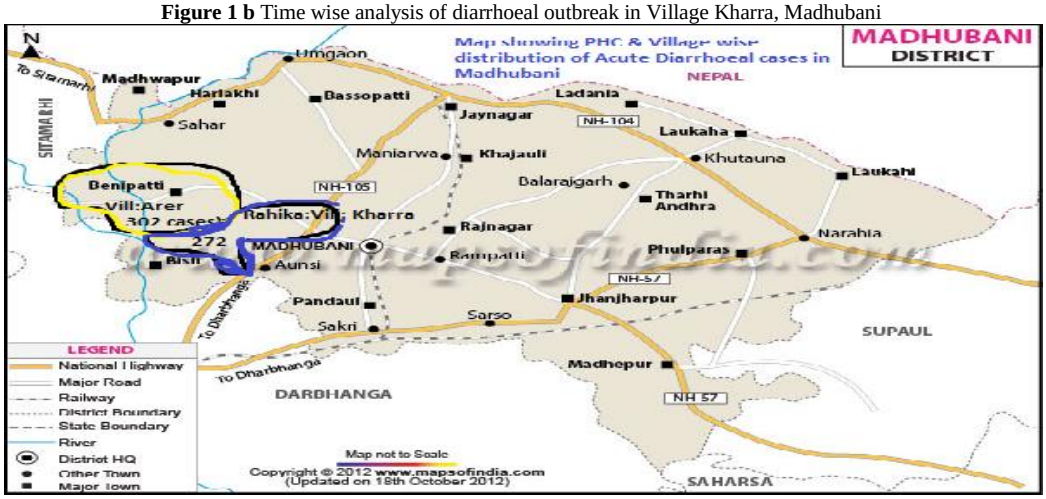

Figure 2 Place wise distribution of cases in Madhubani

Table 1 Age wise distribution of cases in Village Arer

Age group	Population (%)	Cases%	Attack Rate
0-4	486 (9.72)	53 (17.54)	10.9
5-9	500 (10)	56 (22.48)	11.2
10-14	502 (10.04)	55 (28.49)	10.95
15-19	534 (10.68)	13 (4.30)	2.43
20-24	524 (10.48)	17 (5.62)	3.24
25-29	468 (9.36)	17 (5.69)	3.63
30-34	352 (7.04)	20 (6.62)	5.68
35-39	296 (5.92)	8 (2.64)	2.7
40-44	277 (5.54)	13 (4.30)	4.69
45-49	255 (5.1)	8 (2.64)	3.13
50-54	219 (4.38)	7 (2.31)	3.19
55-59	177 (3.54)	5 (1.65)	2.82
60-64	140 (2.8)	8 (2.64)	5.71
65-69	104 (2.08)	9 (2.98)	8.65
70-74	74 (1.48)	7 (2.31)	9.45
75+	92 (1.84)	6 (1.98)	6.5
Total	**5000**	**302**	**6.04**

Table 2 Sex wise distribution of cases in Village Arer

Sex	Frequency	Percentage
Female	178	59
Male	124	41
Total	**302**	

was high in those exposed to Food A (88.8%) while attack rate was low among those not exposed to food (A) (22%) **(Table 6).** So, the risk difference between the attack rates was 58% which is high.

Table 3 Age wise distribution of cases in Village Kharra

Age Group	Population (%)	Cases%	Attack Rate
0-4	292 (9.73)	43 (16.04)	14.72
5-9	**300 (10.00)**	**70 (26.11)**	**23.33**
10-14	302 (10.06)	63 (23.50)	23.16
15-19	321 (10.70)	29 (10.82)	9.03
20-24	314 (10.46)	5 (1.86)	1.59
25-29	281 (9.36)	10 (3.73)	3.55
30-34	211 (7.03)	5 (1.86)	2.36
35-39	178 (5.93)	7 (2.61))	3.93
40-44	166 (5.53)	4 (1.49)	2.4
45-49	153 (5.10)	8 (2.98)	5.22
50-54	132 (4.40)	2 (0.74)	1.51
55-59	106 (3.53)	7 (2.61)	6.6
60-64	84 (2.80)	4 (1.49)	4.76
65-69	63 (2.10)	3 (1.11)	4.76
70-74	44 (1.46)	8 (2.98)	18.18
75+	55 (1.83)	0 (0)	0
Total	**3000**	**272**	**9.06**

Table 4 Sex wise distribution of cases in Village Kharra

Sex	Frequency	Percentage
Male	166	61.71
Female	103	38.28
Total	**269**	
*Data NA=3		

Relative risk to measure the strength of association between the exposure and the disease was calculated by the formula given below:

Relative Risk (RR) = Attack Rate for those who ate Food (A)/Attack Rate for those who did not eat Food A

In this case, RR was 3.6%. So, it can be interpreted that relative risk associated with eating Food A was 3.6% i.e., the person who ate food A in Durga Puja mela were 3.6 times more likely to develop diarrhoea than those who did not eat.

Risk Factor analysis in Muslim Community in Arer Village

Out of 80 persons ate cow or other meat (A) in Bakrid, 75 fell ill (Attack rate: 94%). Attack rate among those who did not eat any meat (A) in Bakrid was 11.76%. So, Food (A) was likely to be a risk factor for the illness because Attack rate is high in those exposed to Food A (89%) while attack rate is low among those not exposed to food (A). So, the risk difference between the attack rates is 82.24% which is high **(Table 5).**

In this case, RR was 8%. So, it can be interpreted that relative risk associated with eating Food A was 8% i.e., the person who ate meat (A) in Bakrid festival were 8 times more likely to develop diarrhoea than those who did not eat.

Village Kharra: Total 272 cases of diarrhea were reported from village Kharra **(Figure 2).** Outbreak peak lied on 19th Oct when 218 cases were reported. Thereafter cases started declining rapidly and the outbreak was over by 21st Oct after which no cases were reported **(Figure 1 b).** Almost all age groups were affected but the attack rate was more in 5-9 (23.33)>10-14 (23.16)>70-74 (18.18) **(Table 3).**Males (61.7%) were more affected than females (38.28%) (Figure 4)**.** About 96% of the affected cases showed onset of symptoms of Diarrhoea from 12:00 PM to 11:30 PM **(Table 8).** Most common clinical symptoms showed by the cases were watery stool (100%)>Nausea (60%)>Fever (28%).

Table5 Risk Factor Analysis for Acute Diarrhoeal outbreaks in Muslim Community in Village Arer Madhubani

Risk factor Analysis for Diarrhoeal outbreak in Muslim Community in Arer Village, Madhubani				
Exposure (Muslim Community) Arer	**Ill**	**Not ill**	**Total**	**Attack Rate**
Ate Meat (Cow/other meat)(A)	75	5	80	94%
Did not eat meat (A)	5	45	50	11.76%
Total	**80**	**50**	**130**	**Risk difference b/w the 2 Attack rates (82%)**
Relative Risk (RR)= Attack Rate for those who ate Food (A)/Attack Rate for those who did not eat Food (A)				8%
(A=Cow or other meat)				

Table 6 Risk Factor Analysis for Acute Diarrhoeal outbreaks in Hindu Community in Village Arer Madhubani

Risk factor Analysis for Diarrhoeal outbreak in Hindu Community in Arer Village, Madhubani				
Exposure (Hindu Community)Arer	**Ill**	**Not ill**	**Total**	**Attack Rate**
Ate Meals in Durga Puja mela(A)	80	20	100	80%
Did not eat meals in Durga Puja mela (A)	10	35	45	22.00%
Total	**90**	**55**	**125**	**Risk difference b/w the 2 Attack rates (58%)**
Relative Risk (RR)= Attack Rate for those who ate Food (A)/Attack Rate for those who did not eat Food (A)				3.63%
(A=Any meal taken in Durge Puja mela)				

Table 7 Risk Factor Analysis for Acute Diarrhoeal outbreaks in Muslim and Hindu Community in Village Kharra Madhubani

Risk factor Analysis for Diarrhoeal outbreak in Muslim & Hindu Community in Kharra Village, Madhubani				
Exposure Kharra (both Hindu & Muslim community)	**Ill**	**Not ill**	**Total**	**Attack Rate**
Ate Meat (Cow/other meat)(A)	67	10	77	87%
Did not eat meat (A)	8	40	48	16.00%
Total	**75**	**50**	**125**	**Risk difference b/w the 2 Attack rates (71%)**
Relative Risk (RR)= Attack Rate for those who ate Food (A)/Attack Rate for those who did not eat Food (A)				5.40%
(A=Cow or other meat)				

Table 8 Time of onset of Symptoms of Diarrhoea

Time of onset of symptoms of Diarrhoea		
Time of onset of symptoms of Diarrhoea	**Village Kharra (n=272)**	**Village Arer (n=302)**
4AM-11:30 AM	10 (4%)	25 (8%)
12 PM-11:30 PM	262 (96%)	277 (92%)
Table 9: Typical Clinical Presentation		
Typical Clinical Presentation	**Present (%) Vill Kharra: n=25**	**Present (%)** Vill Arer; n=50
Stool characteristics (watery)	25 (100%)	50 (100%)
Vomiting	5 (20%)	45 (90%)
Fever	7 (28%)	20 (40%)
Nausea	15 (60%)	25 (50%)
Abdominal pain	2 (8%)	5 (10%)
Similar cases in family	23 (92%)	40 (80%)
Degree of dehydration		
Severe (IV fluids)	7 (28%)	19 (38%)
Moderate (ORS)	18 (72%)	31 (62%)

About 92% of the cases reported to have similar cases in their family. 72% of the patients showed moderate dehydration while 28% showed severe dehydration **(Table 9).**

Hand-pumps used as a source of drinking water in Arer. No drainage facility available

Photographs of outbreak affected areas

In the village (97%) of the Muslim community were affected while only (3%) of the Hindu community had diarrhoea. Risk factor analysis was carried out for both the Muslim and Hindu community affected with Diarrhoea to draw appropriate conclusions. Risk factor analysis was based on foods consumed by the Muslim community in recent times.

Risk Factor analysis in Kharra Village

Out of 77 persons ate cow or other meat (A), 67 fell ill (Attack rate: 87%). Attack rate among those who did not eat any meat (A) was 16%. So, Food (A) was likely to be a risk factor for the illness because Attack rate was high in those exposed to Food A (89%) while attack rate was low among those not exposed to food (A). So, the risk difference between the attack rates is 71% which was high **(Table 7).**

In this case, RR was 5.4%. So, it can be interpreted that relative risk associated with eating Food A was 5.4% i.e., the person who ate meat (A) in Bakrid festival were 5.4 times more likely to develop diarrhoea than those who did not eat.

Laboratory investigations and Results

Collection of specimens from patients during the epidemics

During the outbreak, stool and blood specimens were requested from selected patients (n=7) complaining of diarrhoea over a period of 3 days.

Collection of Specimens from control

For each case 1 control was taken appropriate to age. This included family members as well as neighbours.

Transport and processing of specimens

Stool from rectum were collected from cases and controls in sterile screw-capped containers and transported in specific medium to the laboratory and processed.

Identification of enteric pathogens

Standarized Laboratory procedures (culture, staining and biochemical tests) for the identification of pathogens were done.

Examination of water sources

When stool samples were collected from a stratified sample of the residents of village Arer, water samples were also collected (from hand pumps) for microbiological examination.

Laboratory results

Nothing substantial results came out in the laboratory investigation. Reports showed that ***moderate growth of E coli was found in stool samples***. *E coli* is generally commensal in nature in the human body and so moderate growth in stool in

the present investigation may be treated as insignificant. However, in one of the blood specimen mild growth of ***staphylococcus*** was seen.

No pathogenic microorganisms were seen in the drinking water samples collected from the affected sites.

Environmental & Sociological Observations and Results

Are based on standard pre-planned questionnaire & interview with the patients & their relatives as well as community members residing in visited villages.

Majority had small kuttcha hut made up of immature brick and plastic roof. Sizes of huts were on average 8×8 foot with height of 5 foot. They had no sanitary facility for cooking, storing food, storing drinking water and washing facility. There was no provision of sanitary latrine in the premises in majority of the houses.

Majority of the affected population belonged to low socio-economic strata. Their main living was based on cultivation of paddy. The majority of the population belonged to labour class. Just during & after the Durga Puja (4-13th Oct) and Bakrid (14th Oct), heavy rains occurred in Bihar including Madhubani due to **Phyline cyclone (13-16th Oct)**. Madhubani diarrhoeal outbreaks post -cyclones might also have been aggravated due to defective functioning of available facilities i.e. water supply, power supply and sanitation facilities, forcing the community to consume unsafe water and stay in unsanitary conditions, leading to water borne diseases. Power cuts related to disasters might have disrupted water treatment and supply plants, thereby increasing the risk of water-borne diseases. So, Phyline cyclone might also be responsible for increased reporting of diarrhoea cases from the district of Madhubani. Majority of the hamlets had the source of drinking water as hand-pump. At the places visited the platforms of the hand-pump site was found to be broken with no appropriate drainage facilities. This may be a potential risk factor for future outbreaks for diarrhoeal and other water borne disease outbreaks in the affected areas. Majority of the population was illiterate and unaware about the basic sanitation and hygienic issues.

CONCLUSION

With all the available evidences, it may be concluded that the investigated outbreaks of diarrhoea were food borne in nature and was a point source outbreak that was caused due to consumption of stale meat consumed during Bakrid in Muslim community and due to consumption of stale food cooked in Durga Puja mela in Hindu community in village Arer. In Kharra village, majority of the Muslim community were affected due to consumption of stale meat. The outbreaks of acute diarrhoea might also have been aggravated by **Phyline cyclone** that led to heavy rains across the state for 3-4 days affecting the routine power and water supply and leading to contamination of drinking water sources. Laboratory investigation report showed that ***moderate growth of E coli was found in stool samples***. *E coli* being commensal in nature in general in the human body, so moderate growth in stool specimens in the present investigation may be assumed to be insignificant to establish its correlation with the occurrence of the present outbreak. However, in one of the blood specimen mild growth of ***staphylococcus*** was seen. No pathogenic microorganisms were detected in the drinking water samples collected from the affected sites. Majority of the affected population belonged to low socio-economic strata (agricultural labour class). As majority of the affected population were illiterates/less educated/aware, they also had poor awareness regarding personal hygiene. So, agent, host and environmental factors already coexist. Thus, platform for an outbreak is always set at such sites. Only single hand pump was a source of drinking water in hamlets affected that had no proper drainage facilities and because of that chance of transmission of infection becomes easier. Creating awareness among the community may be the key factor in preventing such food borne illnesses.

Recommendations

The state of Bihar in India has its action plan in place for floods, cyclones and heavy rains. Public health interventions to prevent disease outbreaks after disaster should focus on post disaster sanitation measures for safe water supply, food hygiene, proper sewage systems/disposal of excreta, public health education.

1. Strengthening epidemiological surveillance system for early detection of outbreak is vital. Protocols for identification of source of contamination of water and remedial measures, chlorination of water and case management of Acute Diarrhoeal Disease (ADD) should be communicated to medical officers, as part of disaster management and preparedness.
2. The local community must be encouraged to participate in activities for the prevention and control of outbreaks including taking appropriate action for storage of water at household level and personal hygiene. Engagement of the local stakeholders including district administration and key public health officials at every stage of investigation starting from planning through execution may play a pivotal role

Short term measure*:* Outbreak was food borne in nature. Awareness among the locals to avoid eating stale food should be taken on a priority basis. Symptomatic treatment should be provided to the affected population along with distribution of Zn & ORS. Holding camps in affected area to treat the cases promptly would be effective.

Regular chlorination of water at mass level in water tank as well as household level chlorine tablet should be distributed regularly. Health education regarding hygienic practice like hand washing before eating or drinking and after defecation, drinking boiled water during rainy seasons etc should be imparted to the community.

Long term measure: Regular surveillance regarding epidemic prone disease especially before any major events (Durga Puja and Bakrid) in this case through the health workers needs to be strengthened to prevent any major outbreaks. Sensitization of the local community through the health workers regarding

importance of basic sanitation and hygienic issues should be taken on a routine basis.

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References

1. Annual Communicable Disease Surveillance Report, 2013 (website:www.statehealthsocietybiihar.org)
2. B. N. Tyagi. A Review of Diarrhoeal Disease Control Programme in India. Health and Population-Perspectives & issues 1983;6(4):209-225.
3. Dr. Jotna Sokhey, Dr. Kim-Farley. Investigation of Outbreaks of Vaccine Preventable Diseases. A Field Guide. WHO; Regional office for South-East Asia, New Delhi,1988.
4. Kosek M, Bern C, Guerrant RL. The global burden of diarrhoeal disease, as estimated from studies published between 1992 and 2000. Bull World Health Organ.2003;81:197-204.
5. Management Practices for Childhood Diarrhoea in India. Survey of 10 Districts, UNICEF, 2009. Available from: http://www.unicef.org/India/health_5578.htm. [Last accessed on 13th Jan. 2013].
6. Park K. Epidemiology of Communicable Diseases: Acute Diarrhoeal Diseases. Park's textbook of Preventive and Social Medicine.20th ed. Jabalpur: Bhanot Publisher; 2009,p.196.

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