Outbreak of gastroenteritis among medical students, Madhya Pradesh, Central India

Abstract

Introduction: Although diarrheal diseases with known etiologies are under regular surveillance by the integrated disease surveillance project in India, only limited food-borne outbreaks were subjected to systematic epidemiological investigation. We examined one incidence of a food-borne outbreak among medical students in Bhopal, India, to identifying the source and mode of transmission, and to implement appropriate preventive measures. Materials and Methods: We constituted two teams. We did the line listing, filled the structured questionnaire and collected the biological samples. We did in-depth interviews of the case patients. We interviewed food handlers in mess. We randomly collected food and water samples. Results: The study results identified 30 hosteller case patients for a total of 239 students (overall attack rate [AR]: 12.6%). In female students, the AR was 18.1% and in the male students it was 6.7%. The AR was highest in female hostel no. One compared to other female and male hostel (19.8% vs. 14.3%, 6.7%). We identified four different risk factors for the illness. Discussion: As ARs are high compared to the general population. As the AR was high among the girls, the probable source of infection resides in the female hostel. Key words: Diarrhea, food-borne diseases, gastroenteritis

INTRODUCTION

Nearly 1.7 billion cases of diarrheal disease are reported every year,[1] which are significantly clustered in summer and monsoon months.[2-4] Diarrheal diseases are caused by several pathogens,[5,6] which limits the adoption of vaccination strategy to prevent them. Food-borne outbreaks, on the other hand, are caused by lack of sanitation and unhygienic practices leading to contamination of food.[6-8] Hence, a significant proportion of diarrheal disease can be prevented through safe drinking water and adequate sanitation and hygiene.[1] Although known diarrheal diseases such as typhoid are under regular surveillance by the integrated disease surveillance project of India,[1] only limited food outbreaks were subjected to proper epidemiological investigation.[9,10] Here we investigate the different epidemiological factors related to gastroenteritis among medical students in Bhopal, India, with an objective to identify the source and mode of transmission, and initiating control and preventive measures.

MATERIALS AND METHODS

A descriptive study was planned by selecting student’s hostel (1 boys and 2 girls schools) of All India Institute of Medical Sciences (AIIMS) Bhopal. Data were gathered using a standard questionnaire and analyzed. Alerted about the outbreak on 5 September 2014, we started line listing in the medical hostels. The medical students who were not available on two visit 24 h apart were excluded from the study. Operational criteria used to define a suspect hosteller case patient was the occurrence of three or more loose motions or loose stools or abdominal pain or vomiting with fever in the last 2 weeks period. We defined the probable case patients as the case patients reporting with bloody diarrhea and the confirmed case patient as the suspected...
case patient in whom laboratory investigation confirmed the presence of one or more food-borne pathogens in a clinical specimen.[1] For each hosteller case-patient, we collected information on demographic characteristics, environment, and signs and symptoms. We performed in-depth interviews of the case patients to determine the possible risk factors. We visited the hostels, including the kitchen, the water sources, and the sanitation area. We interviewed food handlers using structured questionnaire about their method of preparation and their health status. Water and food samples were collected from the student hostel and medical college. We randomly collected two food samples (one cooked and other raw) from girls hostel. We also collected two water samples one from girls hostel and other from the medical college building. We used sterile flask for the collection of samples and transported them to the Department of Microbiology for analysis.

We calculated the incidence by gender using denominators supplied by the student hostel. Audiotapes of in-depth interviews were transcribed verbatim and then translated into English. The statements were scanned to identify possible risk factors for the occurrence of gastroenteritis. However, this investigation was conducted in the context of a public health response to an outbreak and hence an ethical committee review was not possible. Nevertheless, a formal authority order was issued to the Department of Community and Family Medicine, (AIIMS) Bhopal to undertake the outbreak investigation. However, we obtained the verbal consent of medical students before initiation of the interview and their identity is not revealed in any reports.

RESULTS

Of the total of 374 (170 male and 204 female) students resident in the hostels, 118 (69.4%) males and 121 (59.3%) females were involved in this study. The main reason for the low response rate was nonavailability after two visits. Of these 32 cases of gastroenteritis were detected by line listing. Among these, two were excluded from the final analysis, as the cause of diarrhea was known organic diseases. The study results identified 30 hosteller case patients for a total 239 students (overall attack rate [AR]: 12.6%). The AR among female and male students was 18.1% and 6.7% respectively. In our investigation, we noted that one girl hostel had its own mess while the other girls hostel was receiving cooked food from the male hostel. The AR was highest in girls hostel, which had its own mess (19.8% vs. 14.3%).

The most common (73.3%) symptom was watery diarrhea, followed by abdominal pain (63.3%). One case presented with a history of blood in stool and vomiting. Eating food in the mess was the risk factor most strongly associated with illness. Other exposures associated with the incidence, included drinking water from the filter of hostels or from the municipal water supply [Table 1]. Among the cases, only 30.0% received the treatment and merely 13.3% underwent hematological investigations.

On in-depth discussion with the female medical students, it was relieved that the food in the mess is not of good quality. It was also stated that the food was outsourced and contaminated. The students also mentioned that the raw material used to cook the food was not of good quality. In addition, students indicated that the water purifiers were frequently nonfunctional frequently. Poor sanitation was another probing factor as the sewage was dumped outside

| Exposure                     | Category                | Frequency of exposure in cases (total n = 24) | OR   | 95% CI   | P    |
|------------------------------|-------------------------|-----------------------------------------------|------|----------|------|
|                              | Male (n = 7)            | Female (n = 17)                               |      |          |      |
|                              | n (%)                   | n (%)                                         |      |          |      |
| Food                         | Mess                    | 7 (100.0)                                     | 17 (100.0) |        |      |
|                              | Restaurant              | 0 (0.0)                                       | 0 (0.0) |        |      |
|                              | Festival                | 0 (0.0)                                       | 0 (0.0) |        |      |
|                              | Party                   | 1 (14.3)                                      | 1 (5.9) | 0.4     | 0.0-6.9 | 0.49 |
|                              | Without filter          | 2 (28.6)                                      | 8 (47.1) | 2.2    | 0.3-14.8 | 0.40 |
|                              | With filter             | 0 (0.0)                                       | 7 (41.2) | 1.7    | 1.1-2.5 | 0.04 |
|                              | Bottle                  | 2 (28.6)                                      | 2 (11.8) | 0.3    | 0.0-3.0 | 0.31 |
| Improper sewage disposal     |                         | 0 (0.0)                                       | 2 (11.8) | 1.4    | 1.1-1.9 | 0.34 |
| History of travel present    |                         | 1 (14.3)                                      | 0 (0.0) | 3.8    | 1.9-7.6 | 0.11 |
| Contact with animal present  |                         | 0 (0.0)                                       | 2 (11.8) | 1.5    | 1.1-1.9 | 0.34 |
| History of water activity present |                     | 0 (0.0)                                       | 0 (0.0) |        |      |
| History of contact present   |                         | 1 (14.3)                                      | 5 (29.4) | 2.5    | 0.2-26.5 | 0.43 |

OR: Odds ratio, CI: Confidence interval

Table 1: Frequency of selected exposures among gastroenteritis case among medical students, Bhopal, Madhya Pradesh, 2014
the hostel. The male students, however, did not raise such issues but revealed that the water in medical college was not good to drink.

A total of 20 food handlers (10 from each hostel) were interviewed. Mean age of food handlers was 25.7 ± 5.4 years. Among them, 35.0% were females and 65.0% were males. History of migration was evident in 70.0% of the food handlers. The hygiene practices were unsatisfactory [Table 2]. Key features observed during the mess visit in the student hostel were, presence of numerous flies, the raw vegetables were rotten, presence of rodents, No records of maintenance of water filters and overhead tanks, uncovered dustbins, and unclean utensils and cloths used in the mess.

Water samples from medical college were positive for coliforms. The cultural reports from the raw vegetable of the girls hostel mess showed Citrobacter freundii and Proteus mirabilis [Table 3], which indicates poor hand hygiene among kitchen staff, in addition to poor cleaning of a vegetable before cooking and dirty cutting surface in the kitchen.

**DISCUSSION**

The gastroenteritis affected a considerable proportion of the medical students, with a higher ARs compared with the general population. The relatively higher AR among girls correlated with higher unhygienic conditions in the girls hostel. The distribution of cases over time suggested a continuous source of outbreak for which we identified four different risk factors such as eating food outsourced by the mess, consuming rotten raw food from the hostel mess, drinking water from contaminated sources and drinking water from the municipal water supply due to lack of functional filter. Although the association was statistically significant, the strength of the association and the proportions of cases exposed were lower than for the mess food. These two associations may be causal or artifactual. However, a number of elements go with this hypothesis. First, the distribution of cases over time suggests a continuous source. Second, if the medical college water supply had been the source of infection, there would have been cases among staff members. Third, if the municipal water supply had been the source of infection, there would have been cases in the population. Based on which we recommended the establishment of the food committee and adopting optimal safety and hygienic standards. Additionally periodic monitoring and supervision of the hostels mess was also suggested including maintenance of all records of timely servicing of water filters, overhead tanks, and water coolers. All employees who directly or indirectly handle food at academy hostels should not pose a risk to food safety and public health, which may have been the case in our study.

### Table 2: Sociodemographic and hygiene practices of the food handlers of medical student hostel Bhopal, 2014 (n = 20)

| Variable                  | Category       | n (%) |
|---------------------------|----------------|-------|
| Sex                       |                |       |
| Female                    | 7 (35.0)       |       |
| Male                      | 13 (65.0)      |       |
| Education status          |                |       |
| Illiterate                | 1 (5.0)        |       |
| Primary                   | 2 (10.0)       |       |
| Middle school             | 7 (35.0)       |       |
| Higher secondary          | 4 (20.0)       |       |
| Intermediate              | 3 (15.0)       |       |
| Graduate                  | 3 (15.0)       |       |
| Migration                 | Yes            | 14 (70.0) |
| Bath with soap            | Yes            | 20 (100.0) |
| Toilet facility           | Yes            | 19 (95.0) |
| Past medical history      | Yes            | 0 (0.0) |
| Use of soap and water in hand-washing before defecation | Yes | 20 (100.0) |
| Use of soap and water in hand-washing before food handling | Yes | 19 (95.0) |
| Proper hand-washing*      | Yes            | 2 (10.0) |
| Nail hygiene*             | Yes            | 15 (75.0) |
| Dress hygiene*            | Yes            | 20 (100.0) |
| Hair hygiene*             | Yes            | 20 (100.0) |
| Shoes allowed in cooking area* | Yes | 20 (100.0) |

*As observed

### Table 3: Microbiological investigation of poisoning outbreak among medical students, Bhopal, Madhya Pradesh (reported on 8/9/2014)

| Type           | SI | Sample                      | Test report         | Normal acceptable range |
|----------------|----|-----------------------------|---------------------|-------------------------|
| Water samples  | 1  | Water sample from “water purifier” kept in the B-block (ground floor) of medical college building | C. freundii* (MPN**: 3/100 ml) | MPN: 0/100 |
|                | 2  | Water sample from “water purifier” kept in girl’s hostel | No bacteria recovered |                         |
| Food samples   | 3  | Cut vegetable samples from girl’s | C. freundii | P. mirabilis |
|                | 4  | Cooked food samples from girl’s mess (3 randomly selected samples received on 9/9/2014) | No bacteria recovered |                         |

*This is a coliform bacteria if the Enterobacteriaceae family. **MPN denotes the most probable number of bacterial colony forming unit in a certain volume of the sample. C. freundii: Citrobacter freundii, P. mirabilis: Proteus mirabilis
Hence, a registered medical practitioner should conduct a routine medical examination of food handlers and additionally the hostel kitchen staff should be routinely trained on best hygienic practices. Besides adopting these recommendations in the food preparation area, appropriate infrastructure facilities (hand-washing facilities, toilets, personal hygiene area, storage facility, steam washers) to ensure optimal safety and hygienic standards should be made available.

**ACKNOWLEDGMENT**

Authors express their sincere gratitude to Director, (AIIMS) Bhopal, for giving them the opportunity to do the outbreak investigation. Authors convey their deep sense of gratitude to Department of Microbiology, Warden of Boys and Girls Hostels for helping them with investigating the outbreak.

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