



**AN INVESTIGATIVE STUDY OF OUTBREAK OF ACUTE GASTRO-ENTERITIS IN A
TEMPORARY CAMP- RAPID RESPONSE AND CONTROL MEASURES**

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ABSTRACT

Background: Diarrheal diseases are present globally, making it eighth leading cause of mortality worldwide. An inequitable proportion of diarrhea morbidity occurs in individuals in temporary camp settings. Uniformed personnel by virtue of training and combat environment are at high risk of contracting disease. Acute gastro enteritis (AGE) is a significant health problem among the uniformed personnel across the world for centuries. AGE is one of the most common disease in the uniformed personnel who are operationally deployed or are training and can adversely affect operational and training activities. The authors investigated an outbreak of gastro-enteritis in a training center in Northern India. This paper highlights the outbreak investigation in temporary camp setting, determining cause and measures that can control the disease without affecting operational commitments and readiness. **Methods:** An outbreak of acute gastro-enteritis was reported in a training location in northern India during months of January and February 2019. A team comprising of Community Medicine specialist, a Senior health advisor, a Medical specialist and the health assistants investigated all cases. Detailed history was taken and lab investigations were done. The cause of the outbreak was determined and preventive measures were taken to control the outbreak. **Results:** The camp environment with bulk cooking necessitates safe drinking water facilities and hygienic practices. Epidemiological investigation of the outbreak addresses the major purpose of strengthening the preventive strategies and to reduce or eliminate risk in future.

KEYWORDS: DISEASE OUTBREAK, TEMPORARY CAMP, GASTROENTERITIS, INVESTIGATION, RAPID RESPONSE.

INTRODUCTION

Historically, Acute Gastroenteritis (AGE) has been one of the most important diseases encountered during military operations.^[1] Diarrheal diseases and dysentery are major nemesis for army since pre-literate times.^[2] Diarrhoea is defined as increased stool frequency, liquidity, or volume. Diarrheal diseases are defined as passing a stool weight or volume greater than 200 g or 200 mL per 24 hour.^[3] Outbreaks have been mostly documented in places where food is prepared and served centrally for groups of people i.e. hostels, old age homes, prisons, ships, armed forces establishments and camp settings.^[4] AGE can be caused by one of several enteric pathogens. In more than 80% cases the etiologic pathogen is bacterial (Table 1).^[5] Many diseases, especially food and water borne diseases have shown to spread readily in uniformed forces settings due to close communal living and training quarters, operational constraints and unique field hygiene conditions. Harsh environment, physical exertion, sleep deprivation, inadequate hygiene and sanitation, psychological stress all result in physiological and immunological changes

that can make uniformed personnel prone to such GI tract infections.^[6] Another challenging aspect is unavailability of full-fledged laboratory facilities in deployed and training locations for rapid and specific diagnosis.^[7] Diarrheal illness during deployment has overall attack rate of 29% per month and the mean duration of illness is 3-5 days with an average of one complete duty day lost per episode. The operational commitment of soldiers is affected for eight days (including illness and recuperation) with each episode.^[8] Preventive measures and rapid response can help to reduce the illness duration and lost duty time by 50-75%.^[9] The distinction between military diarrhoea and travellers' diarrhoea is population dynamics, treatment facilities and impact on operations.^[10] A disease outbreak is occurrence of disease cases in excess of normal expectancy in an area during a specific time.^[11] The factors that can cause such an outbreak in developing countries like India are multiple, which makes the outbreak investigation a challenging task. Studies on AGE and its impact on uniformed personnel, clinical progression of disease and preventive measures are very

less.^[12] Studies are needed to fulfil the gaps in available knowledge regarding optimal measures to prevent, diagnose and treat AGE. Successful management of AGE during deployment, training and camp settings requires action by health care providers, community medicine specialists, military commanders and communities.

Background

An Outbreak of gastro-enteritis was reported in a training centre in Jammu Area with strength of about 500 personnel. The training facilities are functional in winter season from **January - March** every year. Total 112 cases reported with AGE during the third week of January and first week of February 2019. An outbreak investigation was carried out to control the outbreak and institute preventive measures.

AIM: Aim of this investigational study was

- i. To find out the reasons behind the outbreak of AGE in a temporary military camp and
- ii. To assess the efficacy and adequacy of rapid response measures adapted to control the outbreak

Cases –The training centre had five cook houses to cater the strength of 500 personnel. Out of 500 people, who were residing in the centre and eating in different cookhouses, 112 had symptoms of AGE (attack rate 23%). All 112 cases during the period were investigated. Detailed history from patients and treating medical officers was taken. Cases reported with complaints of loose motions 4-8 times per day which was watery, non-foul smelling and associated with 2-3 episodes of vomiting. Symptoms lasted for 1-3 days and none of the patients had any deterioration that led to hospital admission.

METHODS

Outbreak investigation team was mobilised on the last week of January and the team responded rapidly to arrive on site the next day. Epidemiological investigation was carried out to determine cause of outbreak. The investigation team comprised of a specialized team of a community medicine specialist, a senior health advisor, an internal medicine specialist and the health assistants. The complete investigation was carried out in a prompt, specific time bound manner, in order to contain the outbreak. The team reached the location during the last week of January itself and started applying modern epidemiological tools along with data analysis. It took the team 3 days to identify the offending cause. Swift and methodological response was launched and the outbreak was finally controlled by 03 February 2019 when the last case was detected.

Lab Parameters - For lab investigations food and water samples from cook houses were taken. All five cook houses were included for sample collection. Facilities of nearest lab was utilised to conduct microbiological studies.

RESULTS

All 112 cases consumed meals in the cook houses. First index case reported on 18th Jan 2019 at 1000 hour. Fig 1 shows the Epidemic curve in total duration of 18 days of outbreak. There were no further cases reported after 2nd February. All cases recovered and there was no complications/mortality. On epidemiological investigation, majority of cases presented with diarrhoea and vomiting. None of cases required hospitalisation. The spectrum of symptoms among cases is depicted in Fig 2. None of cases presented with blood in stools or fever alone.

Findings of Investigation Team

Environmental Factors

Water Treatment Plant- As the training area was functional only in winter season, the water treatment plant was not maintained properly. It was located 200 meters from the training area with heavy vegetation. The water was supplied from a nearby stream. Free Chlorine in treated water was 0.5 ppm which was inadequate in a camp setting. Backwashing of filter bed was done regularly twice weekly and plastic tanks were used for storage of water in unit.

Cook houses- On inspection of all five cook houses, it was observed that food handlers were not maintaining food hygiene standards. Head gear & Aprons were not used and adequate hand washing facilities were not available for cooks. Infestation of rodents and cockroaches contaminated stored dry rations. Water stored in plastic tanks was used for drinking. The free Chlorine was < 0.1 ppm / absent in most of the plastic tanks. Due to non-availability of taps/long handled dippers to take out water, practice to dip water bottle was being observed to procure drinking water and that was to enough contaminate drinking water.

Washroom & Toilets- Troops were using Deep Trench Latrines (DTLs) for defecation. Washing facilities were inadequate near washrooms. No central hand wash facilities were available near toilets. This led to unhygienic ablution practices by the troops.

Housing- Both permanent barracks and tented accommodation facilities were utilised. Unexpected heavy rainfall and overcrowding made the facilities damp and prone to disease outbreak. Majority of individuals were sleeping on floor with little gap between two beds, providing quick and easy transmission of airborne diseases.

Training Area- Training area was 500 meters away from living accommodation without any drinking water facilities. This increased the likelihood of individuals drinking untreated water from unauthorised sources.

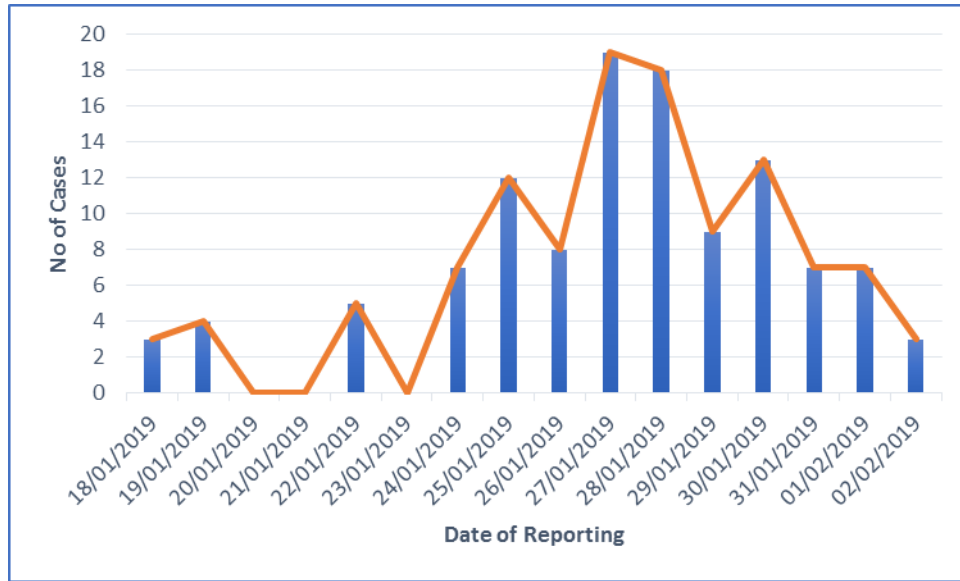


Fig 1

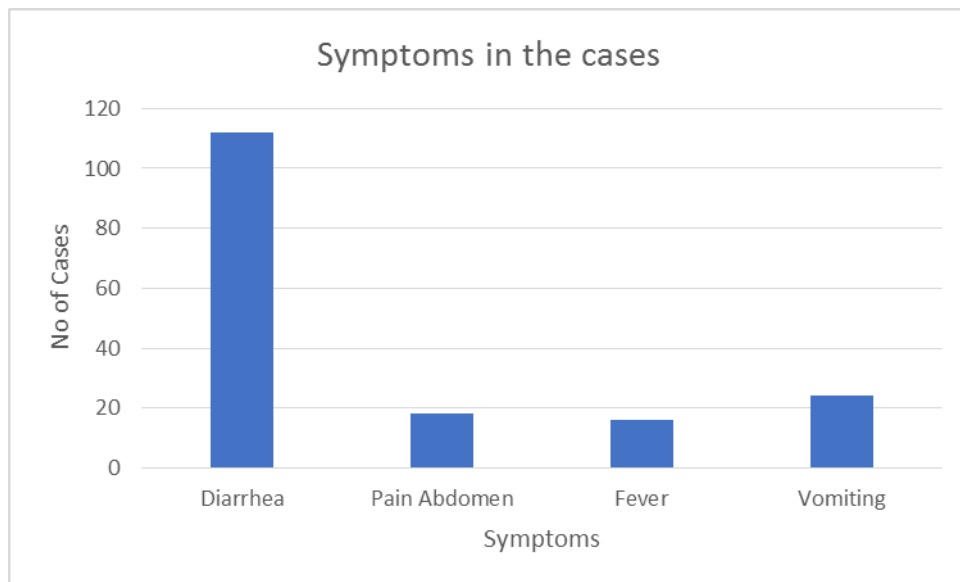


Fig 2

Table 1⁵- Symptoms and likely causative organisms in outbreaks of diarrhoeal diseases in temporary camps.

Symptoms	No of cases that presented	Likely causative organisms
Diarrhoea	112	<i>C. perfringens</i> <i>B. cereus</i> <i>Shigella spp.</i> <i>Salmonella spp.</i> <i>S. aureus</i> ETEC Vibrio Enterovirus Adenovirus
Abdominal pain/cramps	18	<i>C. perfringens</i> <i>B. cereus</i> <i>Shigella spp</i> <i>Salmonella spp</i> <i>S. aureus</i>

Nausea and Vomiting	24	<i>S. aureus</i> <i>B. cereus</i> <i>Shigella spp.</i> <i>Salmonella spp.</i> <i>C. perfringens</i> <i>C. botulinum</i>
Fever	16	<i>C. perfringens</i> <i>Salmonella spp</i> <i>Vibrio spp</i> ETEC

(*C. perfringens*: *Clostridium perfringens*, *B. cereus*: *Bacillus cereus*, *S. aureus*: *Staphylococcus aureus*, *ETEC*: *Enterotoxigenic Escherichia coli*, *C. botulinum*: *Clostridium botulinum*)

(Adapted from Table 6.2- Major foodborne hazards: predominant clinical features, Page 56-60, WHO Guidelines Investigations and Control of Food Borne Diseases 2008)

DISCUSSION

Based on clinical picture/spectrum of symptoms among cases and salient findings of the investigation, the likely cause of the outbreak was failure of supply of safe drinking water. Free chlorine levels of 0.5ppm were being maintained at source end against the recommendation of 1-2 ppm in a camp setting. These levels are inadequate to neutralise subsequent contamination at storage and consumer end. At user end unhygienic practices made it unfit for drinking. Overcrowding at personnel lines and temporary accommodation caused quick transmission of water borne infection among troops. Non availability of adequate ablution and hand washing facilities near DTLs lead to possibility of faeco-oral transmission of infection. Any of these deficiencies in environmental conditions can be implicated as cause of water contamination.

Kasper MR et al in his study, Diarrhoea Outbreak during U.S. Military Training in El Salvador, concluded that prompt recognition of cases and implementation of mitigation strategies was the key to contain outbreaks in such crowded training areas.^[13] The implementation of prevention and control measures, especially in uniformed services organisation, demands multi-disciplinary approach. A good water quality surveillance with efficient water supply and behaviour change communication to address hand hygiene are the main requirements in temporary settings.^[14] Based on the epidemiological investigation of outbreak of AGE in the training camp of Northern India following recommendations can help to prevent water borne disease transmission

Recommendations

a) Public Health Engineering

Adequate chlorination at source to ensure 1-2 ppm free chlorine at water treatment plant can help to neutralise the subsequent contamination at storage point and

consumer end. In addition, periodic cleaning of water treatment plant, sedimentation tank and daily backwashing of filter beds are required.

b) Proper water, food and personal hygiene

Storage of water in clean covered containers is must. Provision of taps/ long handles dippers for drawing water from storage tanks can help to prevent contamination.

Adequate hand washing facilities for cooks, personnel lines, toilets and DTLs are imperative for keeping troops free from diseases.

Provision of mobile toilets or pre-fabricated structures can also be helpful in camp settings especially in rainy season when chances of water borne infections are high.

Daily physical examination of cook houses and food handlers is required. Behaviour change communication to implement food hygiene is must.

c) Health Support

Water samples should be checked daily for free chlorine levels by health staff at treatment, storage and user end. The cases and symptoms should be reported at earliest. Training and equipment should be provided by public health authorities. Regular Interactive lectures can be helpful in bringing long term behavioural changes among troops.

d) The management/ organisers perspective

The organizers and managers of the training facilities should emphasize on providing adequate infrastructure for living and daily activities of trainees. Measures should be taken to ensure safe drinking water supply and provision of proper ablution facilities in training camps. Sensitization of trainees to maintain and practice hygiene practices is must.

CONCLUSION

Prompt outbreak investigation and quick containment of acute gastrointestinal diseases in training areas at remote locations is the key to limit morbidity and loss of man hours. In the instant event the same was achieved with precision at the shortest possible time (three days) so that the trainees could continue their training thereafter with least interruption. Outbreak investigation was beneficial in identifying the inadequacies that caused such an event. Corrective measures and protocol

14. Rakesh PS, Narayanan V, Pillai SS, Rethesh R, Dev S. Investigation of an Outbreak of Acute Gastroenteritis in Kollam, Kerala, India. *Journal of primary care & community health*, 2016 Jul; 7(3): 204-6. DOI: <https://doi.org/10.1177/2150131916641286>, PMID: 24926165, PMCID: PMC4049041