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Profile of diarrhea outbreaks in Nanded district, India

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Abstract:

Introduction: Diarrhoeal disease causes a heavy economic burden on the health services. This study describes the outbreaks of diarrhoeal diseases along with the reasons for the outbreaks and documents the corrective measures taken to control the outbreak. **Methodology:** A descriptive study was conducted in which the outbreaks of diarrhoea in the rural areas of Nanded district reported and investigated by the Epidemic Response Cell during the period April 2009 to March 2010 were analysed. The data regarding demographic status of the village, geographical location, month of occurence, data of household survey, laboratory reports, source of infection and control measures were collected. **Results**:A total of 32 outbreaks were included in the study. A majority of the outbreaks i.e. 23(72%) occurred in the rainy season and remaining 9(28%) occurred in the summer season. Out of the 16 talukas in the district, outbreaks were reported from 11 talukas. The attack rates varied from 0.57% to 21.46%.No deaths were reported in 28 outbreaks and in the rest of the outbreaks the case fatality rate varied from 2.78% to 7.69% . A total of three outbreaks were confirmed to be due to cholera. Piped water and well water were identified to be sources of the outbreak in 14 and 13 outbreaks respectively. The reasons for the outbreak identified were change in the source of drinking water, irregular disinfection, open field defaecation, negligence, insanitary conditions near water source, lack of Tropicalised Chlorinated Lime (TCL). **Conclusions**: Surveillance for diarrhoeal disease outbreaks should include factors which pose a risk for drinking contaminated water such as water scarcity, change in source of water, irregular disinfection, non availability of health staff ,non availability of TCL, beginning of rains, and provision of water by tankers.

Keywords: Diarrhoea, outbreak, water contamination

Introduction

Diarrhoeal diseases represent a major health problem in developing countries. 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 causes of infectious disease deaths worldwide. Most of these deaths occur in children under five years of age [(1)]. In India, acute diarrhoeal disease accounts for about 13 percent of deaths in under five years age group. During the year 2009,about 11.2 million cases with 1762 deaths were reported in India. [(2)] It has been estimated in a study that 27,486,636 DALYS will be lost in year 2016 in India due to diarrheal diseases.[(3)] Globally, there are an estimated 3–5 million cholera cases and 100000–120000 deaths due to cholera every year.[(4)] In India, the total number of cholera cases in 2009 were 3482 with 12 deaths. [(2)] The actual number of cholera cases may be higher because of underreporting and inconsistency in case

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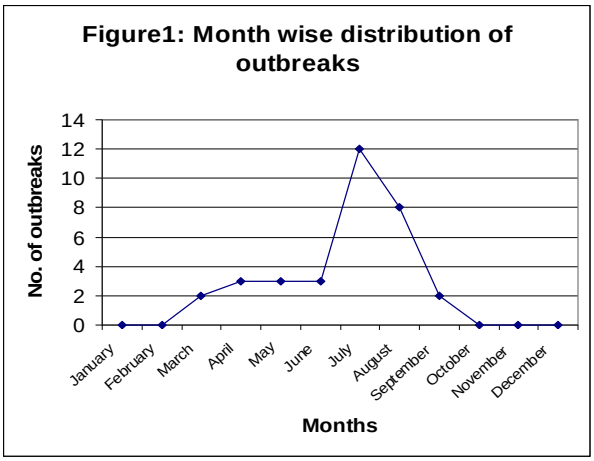
definitions. Studies have reported outbreaks of diarrhea [5-8] and cholera [9-13] in different parts of India. This study describes the outbreaks of diarrhoeal diseases in Nanded district along with the reasons and corrective actions taken for their prevention and control.

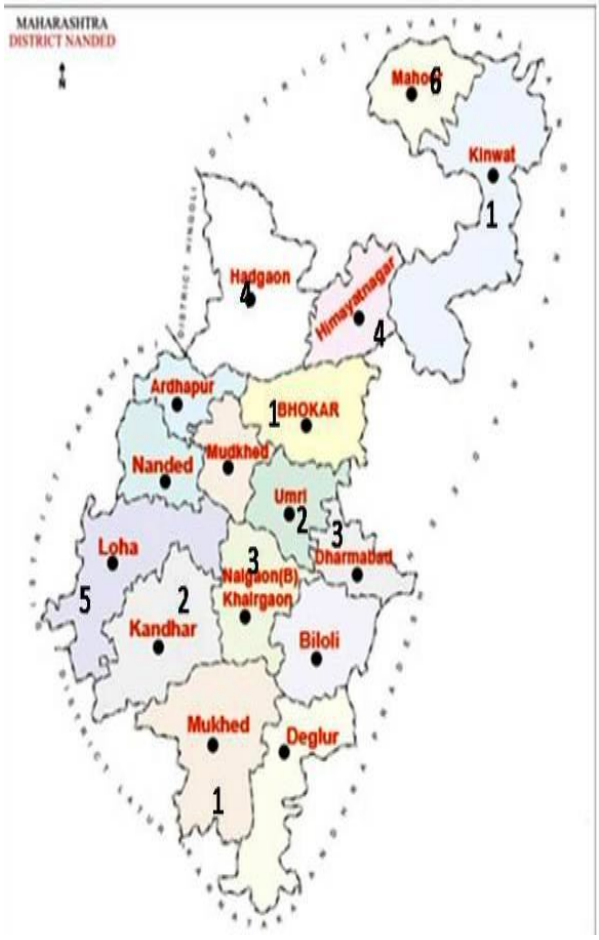
Figure1: Month wise distribution of outbreaks



Materials and Methods

A descriptive study was conducted in the rural areas of Nanded district. Nanded district is located in Maharashtra state in India. It has 1546 inhabited villages with a population of 2187195. There are 63 Primary Health Centers (PHCs) and 374 Sub-Centres (SCs) in the district.An Epidemic Response Cell (ERC) headed by a Medical Officer was functioning at the district headquarter. The contact number and address of the cell was communicated to all Primary Health Centres, Sub centres and Grampanchayats. When a cluster of diarrhea cases was reported to the ERC at the district headquarters, an investigation was carried out to ascertain the number of cases. Diarrhoea was defined as passage of three or more loose watery stool in a 24 hour period. The investigation team consisted of the staff at the ERC along with the Medical officer of the concerned Primary Health Center (PHC) and health workers from the PHC and Sub-Centre (SC). A house to house visit was conducted to identify all cases. The cases were searched for a period of twice the incubation period i.e. 10 days for cholera and five days for non cholera outbreaks. Stool samples of a sample of patients was sent to the Public Health Laboratory for microbiological investigations. Water samples from the suspected source of infection was sent to the Public Health Laboratory for microbiological analysis. Sanitary survey was conducted to identify the reasons of water contamination. Control measures implemented in the villages were noted down.

Figure 2: Taluka wise distribution of the outbreaks in Nanded district



The Medical Officer of ERC prepared the final report of the epidemic investigations which included the demographic status of the village, geographical location, month, data of household survey, laboratory reports, source of infection and control measures.At the end of the epidemic the attack rate i.e. number of cases per 100 population was calculated. If the attack rate was more than 0.5% population it was considered to be an outbreak of diarrhoea. All outbreaks of diarrhea confirmed by the epidemic cell during the period April 2009 to March 2010 were included for analysis. The data collected in the final reports of all the outbreaks were analysed in this

study. For each outbreak analysis of data of household survey, spot maps and laboratory reports were used to identify the source of the outbreak. Analysis was done by calculating the attack rate, case fatality rate and measures of central tendency and variation. The difference in the proportions was analysed by the chi square test.

Results

Table 1: Attack rates and Case fatality rates in the diarrhea outbreaks

No. of cases	Total population	Deaths	Attack rate (%)	Case fatality rate(%)
42	2056	Nil	2.04	0
13	715	1	1.82	7.69
24	3856	1	0.62	4.17
50	3630	Nil	1.38	0.00
31	1748	Nil	1.77	0.00
27	3629	Nil	0.74	0.00
58	1388	Nil	4.18	0.00
15	1550	1	0.97	6.67
17	965	Nil	1.76	0.00
10	1145	Nil	0.87	0.00
24	910	Nil	2.64	0.00
19	1534	Nil	1.24	0.00
33	1882	Nil	1.75	0.00
18	2418	Nil	0.74	0.00
7	1697	Nil	0.41	0.00
48	615	Nil	7.80	0.00
13	1336	Nil	0.97	0.00
21	1963	Nil	1.07	0.00
49	2829	Nil	1.73	0.00
11	526	Nil	2.09	0.00
22	1759	Nil	1.25	0.00
22	2521	Nil	0.87	0.00
12	2098	Nil	0.57	0.00
54	3500	Nil	1.54	0.00
13	1050	Nil	1.24	0.00
61	1300	Nil	4.69	0.00
36	2500	1	1.44	2.78
41	2500	Nil	1.64	0.00
37	1381	Nil	2.68	0.00
55	1640	Nil	3.35	0.00
95	2051	Nil	4.63	0.00
32	2690	Nil	1.19	0.00

Table 2:Attack rate according to age and sex

Categ -ory	Groups (N)	Attack rate	X^2	p
Age	Up to 14 years (n-25167)	324 (1.29%)	33.41	<0.05
	>14 years (n=36215)	686 (1.89%)		
Gend er	Males (n=31305)	496 (1.58%)	1.394	>0.05
	Females (n=30077)	514 (1.71%)		

A total of 32 clusters of diarrhoea cases were reported to the ERC during the study period and all were confirmed to be outbreaks of diarrhoea i.e. attack rate more than 0.5%. Figure 1 describes the month wise distribution of the 32 outbreaks. A majority i.e. 23(72%) outbreaks occurred in the period from July to September and the remaining 9(28%) occurred in the period from March to June. The attack rate was significantly more amongst persons aged above 14 years compared to those aged 14 years or less. There was no significant difference in the attack rates between the males and females. (Table 2).

Out of the 16 talukas in the district, outbreaks were reported from 11 talukas, with 11 of the 32 outbreaks occurring in Loha and Mahur talukas.(Figure 2).Table 1 describes the attack rates, case fatality rates and duration of the 32 outbreaks. A total of nine outbreaks had an attack rate of less than 1%, 14 had an attack rate of 1% to < 2%, four had an attack rate of 2% to 3% and five outbreaks had an attack rate of more than 3%. There were four deaths reported ,one each from four outbreaks. Of these two deaths occurred en route after referral before reaching the health centre/hospital, one death occurred at home due to refusal of admission by parents and one death occurred in the Rural Hospital. Of the four deaths due to diarrhea, three occurred in children aged six to seven years and one was in a 30 year old woman.

A total of 23 (72%) outbreaks were reported on the first day of the outbreak, seven were reported on the

second day and the remaining three were reported after the second day of the outbreak.

A total of 21 (66%) outbreaks were reported by health workers/officials including Anganwadi Worker, Auxiliary Nurse Midwife (ANM),Accredited Social Health Activist (ASHA),Rural Hospital staff, Medical Officers, padaworkers etc, six outbreaks were reported by the villagers and five by the Panchayati Raj Institution members.

Out of the 32 villages reporting diarrhea outbreaks, 19 had piped water supply. Field studies and laboratory investigations identified water from the bore well to be the source in two outbreaks. Water from handpump and well water was identified to be the source of infection in two and 14 outbreaks respectively. Piped water was identified to be the source of the outbreak in 14 outbreaks. Microbiological investigations revealed that these sources of water were not fit for drinking in 18 outbreaks though no predominant or specific pathogen were identified in the water samples. In the remaining 14 cases, water was disinfected before the sample could be collected for testing. Stool examination of the patients identified three outbreaks to be of cholera.

The investigations during the outbreak also brought out the following reasons for the outbreaks.

Change in source of drinking water. It was noted that the villagers change the source of drinking water due to water scarcity, stoppage of piped water supply or water collection after the first rains. In the summer season, when the source of water such as well went dry, the villagers started using alternate sources of water without disinfection. As soon as the rains began, the villagers again changed the source of drinking water. As soon as water collected in the wells they started using the water without disinfection. When piped water supply was stopped, people started using alternate sources of water supply. Villages facing water scarcity were provided with water through tankers without disinfection.

Irregular and inadequate disinfection: Disinfection was not done regularly due to non availability of TCL or sheer negligence.

Open field defaecation: Open field defaecation was practiced in many of the villages. Out of the 32 villages reporting outbreaks only three were open defaecation free.

Leakages: Even in villages with piped water supply, leakages in the valves and pipes led to water contamination due to back pressure, siphoning or seepage.

Negligence: A review of the records also indicated a scarcity of Tropicalised Chlorinated Lime (TCL),lack of follow up action in spite of previous reports of contaminated water and irregular disinfection of water. It was also noted that in many subcentres and Primary Health Centres the post of Multipurpose Worker (MPW) or Auxillary Nurse Mid wife (ANM) was either vacant, they were not residing at the headquarters or were on leave.

Insanitary conditions near water source: Some of the wells were found to be open, without a parapet, with ditches in its vicinity. In some cases the villagers used to wash clothes and utensils at the public tap. In one village the pipe carrying the drinking water was noticed to pass through an open gutter.

Prevention and Control Measures

As soon as the ERC received the information about the outbreak the respective PHC and SC were contacted. The village was visited and a house to house visit was done to identify new cases. Triage was practised for management of the patients to identify the different grades of dehydration and manage the patients accordingly. The data collected was analysed to confirm the magnitude of the problem which was followed by report writing. Usually an isolation ward was opened in the subcentre, schools or grampanchayat to admit the patients with severe dehydration. One medical officer and two ANMS were posted in rotation to provide services for 24 hours till the outbreak was fully controlled. All the activities were monitored from the district level too. Control measures taken included action to disinfect the water and interventions to prevent further contamination of water

IEC(Information Education and Communication):
Intensive IEC activities in the form of posters, announcements through mikes and lectures during gramsabhas (village meetings)were conducted on the topics of personal hygiene and environmental sanitation.
Disinfection: Orthotoulidine test was done for all sources of water and spot disinfection was done if the test was negative. During home visits the family was given mother solution, medichlor or chlorine tablets for regular disinfection at the household level. In villages where water was provided by tankers, the water was disinfected before collection at the village level.
Sanitary conditions near the source: The wells were converted to sanitary wells by cutting trees, constructing parapet, providing motor to draw water, covering wells and constructing drains. The ditches near the tube wells were filled.
Repairs: The leakages in the valves and pipes were repaired.
Regular Disinfection: The local workers were instructed to carry out regular disinfection.
Administrative action: Show cause notices were served on workers who had defaulted in their duties. Proposals for piped water supply were sent for villages which did not have this facility.

Discussion

In the present study a majority of the outbreaks occurred in the rainy season. Late summer and early rainy season have been identified to be the peak periods for incidence of diarrhoeal disease.[14] Diarrhoeal epidemics have been reported to be caused by faecal contamination of well water following rain. [6] In the case of early and little rains, the surface water collections are contaminated by percolation of water .In the summer season there is a risk of water scarcity when the villagers start using alternate sources of water for drinking. Thus early rains and water scarcity are high risk periods for diarrhea outbreaks.
In this study persons aged above 14 years were identified to be at higher risk of diarrhea during outbreaks with no significant difference between the men and women. Some studies have reported similar findings [15,16] while others have reported that all ages and both sexes are affected though extremes of ages were at higher risk.[5]
Though many outbreaks were reported on the first day itself, in some cases there were delays in reporting. The health workers reported the outbreaks in majority of cases yet the villagers and PRI also played an important role in reporting. The failure of the health department in reporting the outbreak and delays in referrals are points of concern.
An important finding of this study is that a change in the source of drinking water without disinfection poses a risk of outbreaks. There should be a clear laid out procedure which should be formulated whenever such changes need to be made. Permission from the Panchyati Raj institutions (PRI) /SC/PHC should be obtained before changing the source of drinking water. Water should be disinfected before use and the sample sent for testing the quality of water to ensure its safety.
The actions of the community such as open field defaecation, washing clothes, utensils and animals near water source poses the risk of water contamination. This study also shows that piped water supply does not guarantee protection against faeco oral diseases. Proper layout of the pipes along with regular maintenance and repairs are needed to ensure supply of safe and potable water. In a study conducted in a rural community in Western Maharashtra overall 49.8% of the water samples were found to be polluted whereas 45.9% of the samples from piped water supply were polluted. In this study it was found that irregular and/or inadequate treatment of water, lack of drainage systems and domestic washings near the wells led to deterioration in the quality of water.(16) In a study in which the Geographic Information System was used for the epidemiological investigation of an outbreak of acute diarrhoeal disease, local cultural practices such as indiscriminate defecation in public places, washing clothes and cleaning utensils from water taps where the community collected its drinking water, and poor engineering design and maintenance of the water supply system were identified to be the risk factors that could have contributed to the outbreak.[5]Contaminated drinking water was identified to be the source of infection in all the 32

outbreaks. In other studies too, contaminated drinking water has been noted to be the source for most diarrhoeal outbreaks recorded in India [10,12,17-22] Availability of potable drinking water for a large proportion of the Indian population is a major public health concern. Providing clean drinking water for all by 2009 and ensuring that there are no slipbacks by the end of the 11th plan is one of the monitorable targets of the 11th 5 yr plan.[23] One of the targets of the seventh Millennium Development Goal (MDG) of the United Nations i.e. ensuring environment sustainability is to halve the proportion of people who are unable to reach or to afford safe drinking-water between 1990 and 2015. It is important that every drinking water source should be 'improved' i.e. by nature of its construction or through the active intervention is protected from outside contamination, in particular from contamination with faecal matter.

As per the United Nations criteria, improved drinking-water sources include household connections, public standpipes, boreholes, protected dugwells, protected springs, and rainwater collection. [24]

According to Census 1991, 55.54% of the India's population had access to an improved water source. Census 2001 shows 86.77% of the rural population has access to safe drinking water. The Department's figures show that that in 2006, of the 14.23 lakh habitations, 13.80 lakh habitations (97%) have been provided with some drinking water source. At the end of 2008-09, the Department's database showed an increase in habitations to 16.61 lakhs, with 14.99 lakh (90%) in the Fully Covered (FC) or Partially Covered (PC) category. However, around 2.17 lakh habitations (14%) have water quality problems and do not have a safe source. There are over 41.55 lakh hand pumps, around 15.77 lakh public standposts, around 1.60 lakh mini-piped water supply schemes and 45000 multi village schemes in the country under the Rural Water Supply Programme. Of these systems, 88.21% handpumps, 93.49% standposts, 91.95% mini schemes and 96.26% multi village schemes are reported functional by the States. [25]

However coverage of the habitations with safe and potable water is a dynamic concept and there are reports of slippage of covered habitations to non covered and partially covered category due to reasons such as source going dry/lowering of ground water table, source outliving their lives, poor operation and maintenance and seasonal shortage of water. [25]

In India the primary responsibility of providing drinking water facilities in the country rests with the state government. The Union Government has been extending policy and technological as well as financial support through a centrally sponsored scheme i.e. Accelerated Rajiv Gandhi Water Supply programme under which funds are provided to state governments for implementing rural water supply schemes. With the 73rd and 74th amendments drinking water and sanitation are included in the list of subjects to be devolved to Panchayats.

Some of the actions of the community pose a risk of contaminating drinking water e.g.open field defaecation or drinking contaminated water e.g. changing water source. In addition the reforms being brought about in rural water supply envisage a proactive role of the community in ensuring water safety and security. The fundamental basis on which drinking water security can be ensured is the decentralized approach through Panchayati Raj Institutions and community involvement. There is a need to shift from reliance on end product testing of water quality to risk assessment and risk management of water supplies commonly known as water safety plan. Water safety plan links the identification of a water quality problem with a water safety solution. It includes both water quality testing and also sanitary inspection to determine appropriate control measures. It is a quality assurance tool that ensures protection of the water quality from the catchment to the consumer.

It is planned to appoint one person, preferably a woman from the Village Water and Sanitation Committee (VWSC) elected at the gramsabha under the control of the Grampanchayat (GP) who will be designated as Jal surakshak for data collection at the household level and at the habitation level. Her functions are monitoring with field test kits, water sampling, conducting the Orthotoulidine test, keeping a watch over TCL availability and water sources.[26] The findings of this study indicate that in

addition to these functions she along with the Village Sanitation Water Committee (VSWC) should watch out for water levels of all possible sources of drinking water, any changes in sources of water, status of pipeline, sanitary conditions near water source and conducting IEC activities to prevent activities which cause water contamination as well as ensure active community involvement in water management.

The long term solution to the problem of water scarcity is ensuring sustainability of the water sources. The conjuctive use of ground water, surface water and rain water harvesting systems will be required to be encouraged as means of improving sustainability and drinking water security. Because of its vulnerability under different circumstances, in order to achieve water security at the individual household level, the water supply system should not depend on a single source and alternate sources should be monitored during periods of water scarcity.Water security and safety along with sanitation are the prime factors necessary to prevent diarrhea outbreaks in the rural areas.

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Conflict of Interest

None Declared