



# An Outbreak Investigation of Jaundice Cases in Vadodara District

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**Financial Support:** None declared  
**Conflict of Interest:** None declared  
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## How to cite this article:

Patel AS, Taviad PP, Damor RD. An Outbreak Investigation of Jaundice Cases in Vadodara District. *Natl J Community Med* 2018; 9(5): 340-345

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**Date of Submission:** 02-01-18

**Date of Acceptance:** 25-04-18

**Date of Publication:** 31-05-18

## ABSTRACT

**Background:** Water, sanitation, and hygiene related infectious diseases are common in India. The Hepatitis E virus (HEV) virus is transmitted by the fecal-oral route. Transmission of HEV through contaminated water is the major concern for public health.

**Materials and method:** Present outbreak investigation was carried out by rapid response team of medical college Vadodara. Outbreak investigation was carried out to find out probable source of infection, etiological agent, mode of transmission and to provide technical support for prevention and control of epidemic. Consumption of contaminated water was suspected as primary source of infection for formation of hypothesis. Blood samples of clinically suspected cases and water samples from various sites were collected for laboratory confirmed diagnosis of disease under investigation.

**Results:** Total 42 jaundice cases were reported. Attack rate was higher in male (14.47 per 1000 population) compare to female (8.16 per 1000 population). Diagnosis of viral hepatitis E was confirmed by blood investigations

**Conclusion:** Mixing of contaminated water with piped water distribution system was the primary source of infection and disease was spread through consumption of contaminated water was mode of transmission. Various measures for prevention and control of hepatitis E Outbreak were suggested.

**Keywords:** Outbreak, Jaundice, Hepatitis, Primary health centre

## INTRODUCTION

Water, sanitation, and hygiene related infectious diseases including diarrheal diseases and other diseases are common in India. Waterborne diseases can cause outbreak in community with potential to spread rapidly and cause morbidity and mortality.<sup>1</sup> Inadequate sanitation practice is the commonest cause for outbreak of waterborne disease. Outbreaks of hepatitis E reported frequently in developing countries where poor socio-economic and hygienic conditions lead to outbreaks by repeated contamination of water.<sup>2</sup>

The first outbreak of hepatitis E in India was reported in New Delhi during 1955–1956. Causative agent responsible for outbreak was identified retrospectively.<sup>3,4</sup> Subsequently further outbreaks of hepatitis E have been identified in India from time

to time after reorganization of hepatitis E causative agent.<sup>5,6</sup> Large number of outbreaks of hepatitis E had possibly gone unreported before 1980s because of the lack of highly sensitive tool for Hepatitis E.<sup>4,5</sup> Later on specific serological tests for HEV and other specific molecular methods to identify HEV were developed to identify the etiology of outbreaks.

Hepatitis E virus (HEV) is identified as the specific agent largely responsible for epidemic as well as sporadic hepatitis E in the developing countries.<sup>2</sup> The Hepatitis E virus (HEV) virus is transmitted by the fecal-oral route. Transmission of HEV through contaminated water is the major concern for public health. The incubation period of hepatitis E ranges from 2 weeks to 2 months, usually 1 month to 45 days.<sup>7</sup> Longer incubation period of hepatitis E is also play very important role for control and preven-

tion of outbreak. Reorganization of early warning signals, timely intervention and immediate application of control measures can limit further spread of disease. Awareness about disease and its risk factors are very crucial for prevention and control of disease. 28<sup>th</sup> July is celebrated as world hepatitis day to create awareness about hepatitis.

Few jaundice cases in Jarod village were reported by health staff of Asoj primary health centre. Chief district health officer Vadodara with district health team carried out primary investigation for jaundice cases. Outbreak of waterborne disease was suspected as per primary investigation. Chief district health officer Vadodara requested the dean medical college Vadodara for technical support and to carry out epidemic investigation of jaundice cases in Jarod village. Rapid response team (RRT) formed by the dean medical college Vadodara carried out present epidemic investigation of jaundice cases and submitted report.

Primary objectives of present outbreak investigation were to find out probable source of infection, etiological agent, mode of transmission and to provide technical support for prevention and control of epidemic.

## MATERIALS AND METHODS

**First information of cases:** A health worker of Asoj primary health centre (PHC) heard about few cases of jaundice in Jarod village. He visited cases and immediately reported to medical officer primary health centre Asoj and block health officer Waghodia block. Block health officer visited cases on same day and reported to epidemic medical officer and chief district health officer (CDHO) of Vadodara district. Based on first information report, chief district health officer Vadodara formed district health team for further investigation of jaundice cases. Clustering of jaundice cases with diarrhea and fever were reported in Jarod village. Outbreak of waterborne disease was suspected as per primary investigation carried out by district health team. Chief district health officer requested the Dean medical college Vadodara to provide technical support and carry out epidemic investigation in Jarod village.

**Rapid response team:** A rapid response team (RRT) was formed by the dean medical college Vadodara based on primary information provided by the CDHO Vadodara. Rapid response team consisted of assistant professor from department of community medicine, microbiology, medicine and other paramedical staff. Rapid response team along with district health officials reached to affected village and collected primary information about suspected cases. Interviews of epidemic

medical officer Vadodara, block health officer Waghodia, medical officer of Asoj PHC and other health staff were conducted to get primary information about cases, occurrence of event, activities for prevention and control of epidemic carried out till date of epidemic investigation, records of cases and available data of previous years from integrated disease surveillance programme in detail. A meeting with gram panchayat members and water pump operator was arranged to get detailed information about water distribution system, chlorination records, information about geography and demography of village.

As per information and available records from gram panchayat and taluka panchayat water distribution system was established more than 40-50 years before and modified few times as per expansion of village. No any specific blue print of water distribution system was available. Based on various available records, maps and information, working blue print of water distribution system was prepared. Total seven major leakages were identified in water distribution system. A rapid house to house survey was carried out by rapid response team members along with district health team.

**Study Area:** Jarod village is situated in Waghodia taluka of Vadodara district. All cases were reported from four areas named Bhaliyavago, Van-karvas, Shekhvago and main bazaar area. All seven major leakages in water distribution system were reported in these four areas.

**Type of study:** An outbreak investigation of jaundice cases was carried out in Jarod village of Vadodara district. Consumption of contaminated water was suspected as primary source of infection for formation of hypothesis. Areas were divided in two groups based on potential source of contamination of water. Both groups were compared to test our hypothesis and retrospective cohort study was carried out for research and analytic purpose. Primary report of outbreak investigation was informed through telephonic talk on the same day and report was sent to CDHO next day and further detailed research was carried out.

**Data collection:** Data was collected through (1) rapid house to house survey (2) available case records from government and private hospitals (3) interviews of epidemic medical officer Vadodara, block health officer Waghodia, medical officer Asoj PHC, other paramedical health staff and water pump operator and gram panchayat members of Jarod village. Integrated disease surveillance programme data was collected from medical officer primary health centre Asoj, district IDSP officer and outbreak was confirmed. Information regarding date of onset of symptoms, sex, age, place of

residence, duration of illness, index case, water and food consumption etc was collected. Information regarding water sources, water distribution system, and chlorination of water was collected. Information regarding other potential sources for outbreak, common place for washing, personal hygiene was also collected. Detailed history of suspected cases was taken. Suspected cases were subjected to thoroughly clinical examination. Majority of cases had already taken treatment from private health facilities. Diagnosis and treatment records of such cases were also included in present study. Data was subjected to time, place and person wise analysis. Data was analyzed using Microsoft excel 2007 and Epi Info 3.4.3 version.

**Sample collection:** Blood samples of clinically suspected cases were collected for laboratory confirmed diagnosis of disease under investigation. Water samples were collected from all six water sources, site of leakages in water distribution system and households. Water samples from households of all cases and at least four households of different streets were tested for chlorination using chloroscope. Water samples collected from potential water sources and leakage sites were sent to public health laboratory Vadodara for further analysis. Entomological survey was also carried out by district entomologist to rule out other probable vector borne diseases.

**Report:** Epidemic investigation report was submitted to the dean medical college Vadodara and chief district health officer Vadodara district.

**RESULTS**

Total 42 jaundice cases were reported. Attack rate was 11.50 per 1000 population. No any mortality of jaundice cases was reported. Outbreak of Hepatitis E was suspected after primary investigation carried out by district health team. Diagnosis of acute viral hepatitis E was confirmed by blood investigations using ELISA method at medical college and SSG hospital Vadodara. Highest attack rate (18.26

per 1000 population) was reported in age group of 11-20 years. Children less than 10 years of age were

not affected in present epidemic. Attack rate was higher in male (14.47 per 1000 population) compare to female (8.16 per 1000 population). Median age of cases was 35 year (95% CI 26.73 - 44.64 years) (figure.2). Cases were reported within one week duration after index case suggested rapid onset of disease under investigation. Epidemic curve showed single peak epidemic without any secondary wave (figure.3).

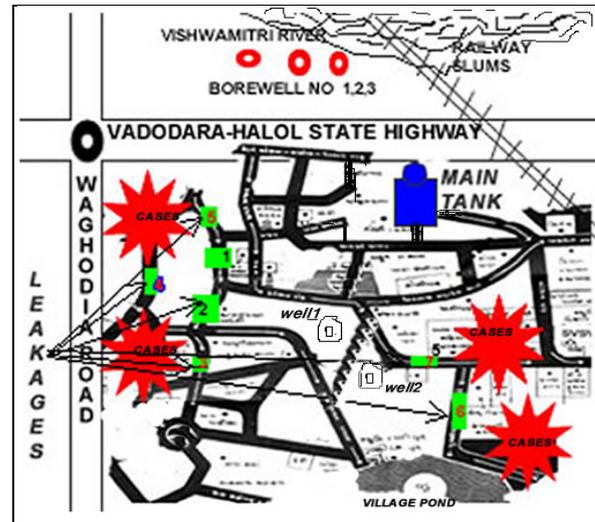


Figure1. Map of Jarod village (Based on water distribution system, Map not as per scale)

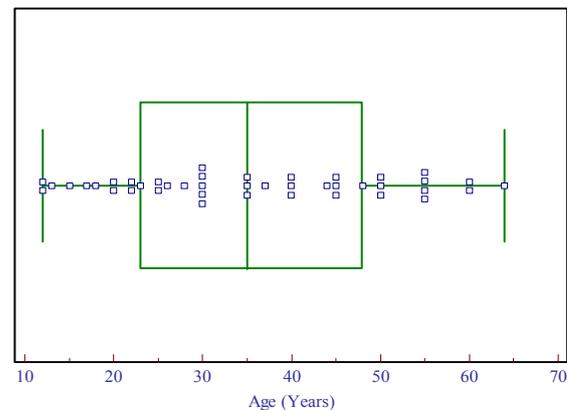


Figure 2: Age wise distribution of Jaundice cases

Table 1: Age and sex specific attack rate of jaundice cases

Age Group (yrs)	Male			Female			Total		
	Cases	PAR	AR/1000	Cases	PAR	AR/1000	Cases	PAR	AR/1000
≤10	0	150	0.00	0	106	0.00	0	256	0.00
11-20	6	201	29.85	2	237	8.44	8	438	18.26
21-30	9	550	16.36	3	399	7.52	12	949	12.64
31-40	4	442	9.05	3	361	8.31	7	803	8.72
41-50	5	304	16.45	3	280	10.71	8	584	13.70
51-60	4	209	19.14	2	266	7.52	6	475	12.63
≥61	0	79	0.00	1	67	14.93	1	146	6.85
<b>Total</b>	<b>28</b>	<b>1935</b>	<b>14.47</b>	<b>14</b>	<b>1716</b>	<b>8.16</b>	<b>42</b>	<b>3651</b>	<b>11.50</b>

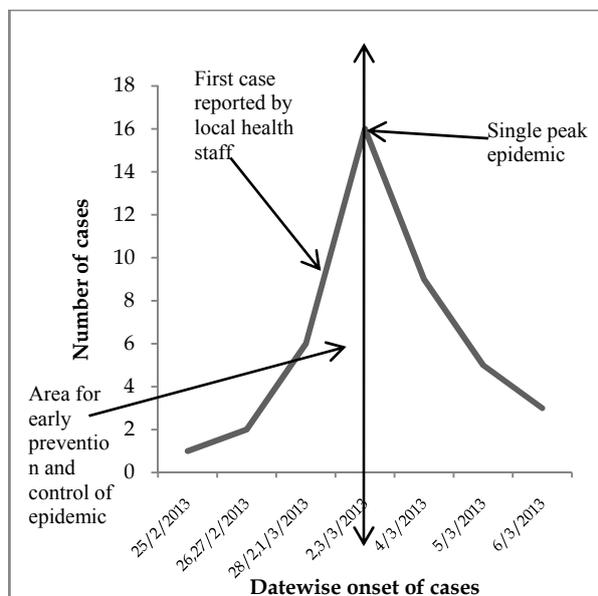
PAR= Population at risk; AR/1000=Attack rate per 1000 population

As per place wise distribution clustering of cases were reported from four main areas of Jarod vil- lage. Total seven major leakages were found in wa- ter distribution system supplying water to these four areas. Water samples from potential sources were collected and sent to public health laboratory for further investigations. All samples were found contaminated by H<sub>2</sub>S test, Coliform count and fecal coliform count in public health laboratory report.

**Table 2: Suspected exposure wise analysis of jaundice cases**

Suspected exposure	Cases (n=42)	Population at risk (n=3651)
Areas water supply system detected with leakages	37	2661
Areas water supply system detected with leakages	05	990

Relative risk (Confidence Interval) 2.73 (1.07-6.92); p value <0.05



**Figure 3: Date wise distribution of jaundice cases**

**Table 2: Water sample test results by public health laboratory Vadodara**

Source of water sample	H <sub>2</sub> S strip test	Coliform count*	Fecal coliform count*	Free chlorine (Chloroscope Method)
Tap water from Sub centre	Positive	43	35	No detectable
Pond	Positive	>180	161	No detectable
Well-1 (Shekhvago)	Positive	161	92	No detectable
Well-2 (Behind pond)	Positive	>180	>180	No detectable
Main water tank	Positive	>180	161	No detectable
Bhaliyavago stand post	Positive	>180	92	No detectable

\* Per 100 ml water

**DISCUSSION**

Hepatitis E is common water borne disease potential to cause epidemic in community. In India largest epidemic of viral hepatitis was reported in New Delhi during 1955-56.<sup>3,4</sup> From reports of outbreaks and sporadic disease it was estimated that about 2.2 million adult cases of hepatitis E occur yearly in India.<sup>7</sup> Present epidemic of jaundice was reported in Jarod village of Vadodara district in March 2013. Outbreak of acute viral hepatitis was suspected as per primary investigation carried out by district health team. Chief district health officer requested the dean medical college Vadodara for technical support and to carry out epidemic investigation in Jarod village.

Present epidemic investigation was carried out by rapid response team of medical college Vadodara. Rapid house to house survey was carried out to find out probable source of infection, etiological agent and mode of transmission. Jaundice cases were classified as per international classification of disease 10 (ICD-10.R.17). The case definition for probable case of viral hepatitis was any individual presenting with any of following symptoms fever, pain abdomen, vomiting, anorexia, yellowish discoloration of the eyes, passage of deep yellow co-

lored urine, with icterus on clinical examination.<sup>8</sup> Laboratory confirmed diagnosis of specific type of acute viral hepatitis was made by testing blood samples using enzyme linked immunosorbent assay (ELISA) for specific hepatitis virus type.

Map of village was obtained and areas were distributed as per water distribution system and other additional sources of water supply. Available records of jaundice cases regarding treatment or diagnosis within last one month were also checked. Though first case of jaundice was identified on 3<sup>rd</sup> March 2013 by district health authority but few cases were reported before that period. 23 year female was identified as index case. No any secondary case was detected. It suggested common source, rapid onset and single peak epidemic of disease under investigation (**figure.3**). Hepatitis E as causative agent was confirmed after blood sample analysis of jaundice cases. Total 42 cases were reported which was clearly in excess as per IDSP data for last one year of Jarod village. Epidemic of hepatitis E in Jarod village of Vadodara was confirmed.

Total 42 cases of jaundice were reported including 28 male and 14 female cases. Attack rate of jaundice cases was 11.50 per 1000 population. During

hepatitis E outbreaks the overall attack rates range from 1 to 15/1000 population.<sup>5,6,9,10</sup> In Gujarat state attack rate of 10.9/1000 population was reported in study of Atul Trivedi et al<sup>11</sup> while attack rate of 27.2/1000 population was reported by Rawal DA.<sup>12</sup> In present study attack rate was higher in male (14.47/1000 population) compare to female (8.16/1000 population). It was difficult to hypothesized gender difference regarding attack rate of hepatitis. Viral et al explained gender difference regarding attack rate in viral hepatitis as behavioural factors that result in differential exposures as well as gender differences in health-seeking behaviour were possible reasons.<sup>13</sup> Similar findings were reported in studies by others where adult men may have up to twofold higher risk than women of the same age of developing clinical illness in viral hepatitis.<sup>14,15</sup> Attack rate was highest in age group of 11-20 years (18.26/1000 population) followed by 21-30 years and 51-60 years (12.6/1000 population). Children less than 10 years of age were not affected in present epidemic. Attack rate in children was very low and young people showed high attack rates in the epidemic investigation of hepatitis E carried out by others in India.<sup>6,9</sup>

Total seven leakages were identified in water distribution system. These leakages in water distribution systems were potential medium for contamination of water. Sewage water drainage was open drainage system. Sewage water from open drainage system was overflowed at various places just near to leakages and mixed with water distribution system. Water distribution was of intermittent type water supply. So when water was distributed with high pressure leads to positive pressure in piped water distribution system but when distribution was stopped after one hour of water distribution negative pressure developed and outer water (sewage water) entered to piped water system and mixed with it. When again water was distributed in evening with pressure contaminated water reached to households of Jarod village. So potential source of infection was contaminated water distributed to households.

Water samples from all major sources, leakage sites and household were taken and sent to public health laboratory Vadodara for further analysis. All samples were found contaminated in laboratory water analysis by H<sub>2</sub>S test, coliform count and fecal coliform count. Chlorination of water is very crucial for prevention and control of water borne disease. Chlorination of water from households was tested using chloroscope. Total 86 samples were tested to detect free residual chlorine level in water. 52 samples detected with residual free chlorine level of less than 0.5ppm. Contamination of drinking water with contaminated water was re-

ported in outbreak investigations studies carried out by others.<sup>11,13</sup> Contamination of drinking water with swage water is major public health problem where open drainage system is prevalent. All cases were reported from areas where leakages in water distribution system reported. It suggested mixing of contaminated water with piped water distribution system was the primary source of infection.

## CONCLUSION

Diagnosis of acute hepatitis E was confirmed. Mixing of contaminated water with piped water distribution system was the primary source of infection for hepatitis E and disease was spread through consumption of contaminated water was mode of transmission. Various measures for prevention and control of hepatitis E Outbreak were suggested.

## Limitations of study:

Termination phase of epidemic not included as present study was carried out during ongoing epidemic.

## Acknowledgement:

Authors are thankful to the Dean medical college Vadodara for inclusion in RRT. Authors are also very thankful to Dr V S Mazumdar, Head of Department of Community Medicine and Dr RK Baxi, Professor of Department of Community medicine for technical guidance whenever required to carry out outbreak investigation.

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