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## CHLORINATION LEVEL OF WATER AND PREVALENCE OF VIRAL HEPATITIS IN FLOOD AFFECTED AREAS OF VADODARA, INDIA

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### ABSTRACT

**Introduction:** Recently Gujarat has been attacked by flood in 2005 specifically Vadodara City between June 29 to July 2, 2005. The chlorination level of drinking water is checked through house to house survey post flood and results were compared to hepatitis cases after few months in the same areas.

**Objectives:** To know the chlorination level of water in administrative ward wise municipality system in Vadodara city post flood and its association with the viral hepatitis cases after few months. **Methodology:** Study population includes purposively selected 400 households from each of the 10 wards of Vadodara city. This research has been conducted between July to October 2005 (Chlorination of water - July 4<sup>th</sup> to July 20<sup>th</sup> 2005 and Disease prevalence – July '05 to Oct '05.). Chlorination of water is checked through house to house survey while Viral Hepatitis data were collected through municipal corporation monthly reporting system. Statistical analysis was done using Epi info 6.04d. **Results:** Measuring the chlorine level in each of the 10 administrative wards of Vadodara city showed initial low level of chlorine (<0.5 ppm) in north and east zone followed by east and west zone up to 8<sup>th</sup> July 2005 which then significantly improved after regular update and follow up action daily till 12<sup>th</sup> July, but east and north zone continued to a problem of low chlorination level through study period. Higher prevalence of viral hepatitis cases reported in the month of august-Nov. 2005, which is in relation to low chlorination level of water in all zones, significantly higher in east zone through the study period. **Conclusion:** Low level of chlorine in water was associated with higher number of viral hepatitis all the wards of Vadodara city.

**Keywords:** administrative ward, households, chlorination of water

There is no substitute for a safe and sanitary water supply. Continuous chlorination used to treat recurring bacterial contamination problems. This process is similar to that used in municipal water supplies as a preventive measure. Continuous chlorination is a necessity for surface water

### INTRODUCTION

Chlorination is a water treatment that destroys disease-causing bacteria, nuisance bacteria, parasites and other organisms.

supplies such as ponds, springs, lakes or cisterns. Adequate contact time for disease-causing bacterial kill depends upon free chlorine residual, water temperature, water pH (acidity), and the specific organism. Continuous chlorination typically uses a chlorine residual of 3 to 5 ppm.

Viral hepatitis (VH) caused by A and E viruses is the major public health problem in India. 1 Out of six different types of viral hepatitis known (A, B, C, D, E, and G), hepatitis E virus (HEV) is the agent responsible for the hepatitis outbreak as well as sporadic cases of hepatitis in developing countries<sup>1,2,3</sup>. Although hepatitis A and hepatitis E both are highly endemic in India, HEV infection is responsible for most of the outbreaks. In India, HEV infection is responsible for 30-70% of the cases of acute and sporadic hepatitis<sup>4</sup>.

The virus is transmitted by the fecooral route, often through water or food supply contaminated by feces<sup>1,2,5</sup>. Intrafamilial transmission is not common for hepatitis E virus<sup>4,6</sup>. Acute viral hepatitis due to hepatitis E virus is a self-limiting disease<sup>5,7</sup>. The incubation period ranges from 2 weeks to 2 months, usually 1 month to 45 days<sup>2,8</sup>. The recognition of early warning signals, timely investigation, and application of specific control measures can contain the outbreak and prevent death<sup>7</sup>.

Recently Gujarat has been attacked by flood in 2005 specifically Vadodara City, between June 29 to July 2, 2005. The chlorination level of drinking water is checked through house to house survey post flood and results were compared to hepatitis cases after few months in the same areas. Gujarat have claimed at least 65, 000 people homeless during that flood which has affected around 10, 000 villages in 117 talukas in the 18 districts of the state. The most affected

districts include Kheda, Vadodara, Surendra Nagar, Navsari, Surat, Ahmedabad, Valsad, Anand, Amreli and Bhavnagar.

#### **MATERIALS AND METHODS**

Research includes purposively selected 400 households from each of the 10 administrative wards of Vadodara city municipal corporation system. Whole Vadodara city is distributed in four zones which included different wards like East zone has ward no.1, 2, 9, West zone has ward no. 6, 10, North zone has wards no. 7, 8 and South zone includes ward no. 3, 4, 5. We selected houses randomly from each of the administrative ward and total of 100 samples were collected from each zone everyday from different household. Chlorination of water was checked using chloroscope through house to house survey following flood in Vadodara city (Date of flood in Vadodara: June 29, 30 and July 1, 2 2005 and the chlorination of water checked between 4<sup>th</sup> July to 15<sup>th</sup> July 2005), while Viral Hepatitis data were collected through municipal corporation monthly reporting system for the month of July to October 2005. The results regarding the chlorination level of water following flood were regularly being communicated to the local and state health authorities to help designing precautionary measures. Statistical analysis was done using Epi info 6.04d.

#### **RESULTS**

Chlorine testing was carried out in different areas of all four administrative zone of Vadodara city, subsequent to instructions from the Department of Health, Government of Gujarat during during June 2005. Chlorination Testing was carried out between 4<sup>th</sup> June to 15<sup>th</sup> June 2005. The results were noted and information was provided by Preventive and Social Medicine

Department to the Department of Health of Govt. of Gujarat and focus was given on high chlorination level of drinking water at end user level with immediate effect.

100 random water samples were checked from each zone daily for chlorination. Initially we didn't found any water sample of <0.5 ppm chlorination level, from west and north zone till 6<sup>th</sup> june then we received some water samples of <0.5 ppm level in west (14%) and north (29%) zone respectively on 7<sup>th</sup> june, same way some samples were found on 8<sup>th</sup> june, which disappeared again for few days as a result of active steps taken by municipal corporation of Vadodara city for chlorination of water. On the other hand there was continuous presence of high number of sample of water with low chlorination of water in east and south zone starting from 4<sup>th</sup> june to 15<sup>th</sup> june of which majority of the samples were present in east zone.(Image 2)

Significantly increased number of viral hepatitis cases were recorded in all four zones after 3 months following effect of flood in june. Majority of VH cases were present in November (463) (Image 3).

Image 4 represents the number of VH cases reported between june – november. Initially it varies between 17 to 50 cases in all zone of Vadodara city which suddenly increased from august month following incubation period. As compared to east and south zone, other two zones has minimal increase in VH cases. Maximum number of VH cases reported in west zone were 50 while in north zone were 65 while in east zone it was 191 and 171 in south zone which continues to remain high during august-november (image 4). Comparing VH cases of last five years in vadodara explained sudden rise in VH cases between Aug-Nov 2005 in image 5.

## CONCLUSION

Measuring the chlorine level in each of the 10 administrative wards of Vadodara city showed initial low level of chlorine (<0.5 ppm) in east and south zone followed by east and north zone up to 8th July 2005 which then significantly improved after regular update and follow up action daily till 12th July, but east zone (ward no. 1,2,9) and north zone (ward no. 7,8) continued to a problem of low chlorination level throughout study period. Higher prevalence of viral hepatitis cases reported in the month of August-Nov. 2005, which was in relation to low chlorination level of water in all zones, significantly higher in east zone throughout the study period. Low level of chlorine in water might have been associated with higher number of cases of viral hepatitis in Vadodara city. These finding support the hypotheses that there exists the potential for the increased transmission of water borne diseases and that there occurs increased levels of endemic illnesses during the post-flood period<sup>9</sup>.

## LIMITATION

We couldn't study the types of hepatitis and compared the results of chlorination of water with the secondary data reported at municipal corporation dispensaries.

## ACKNOWLEDGEMENT

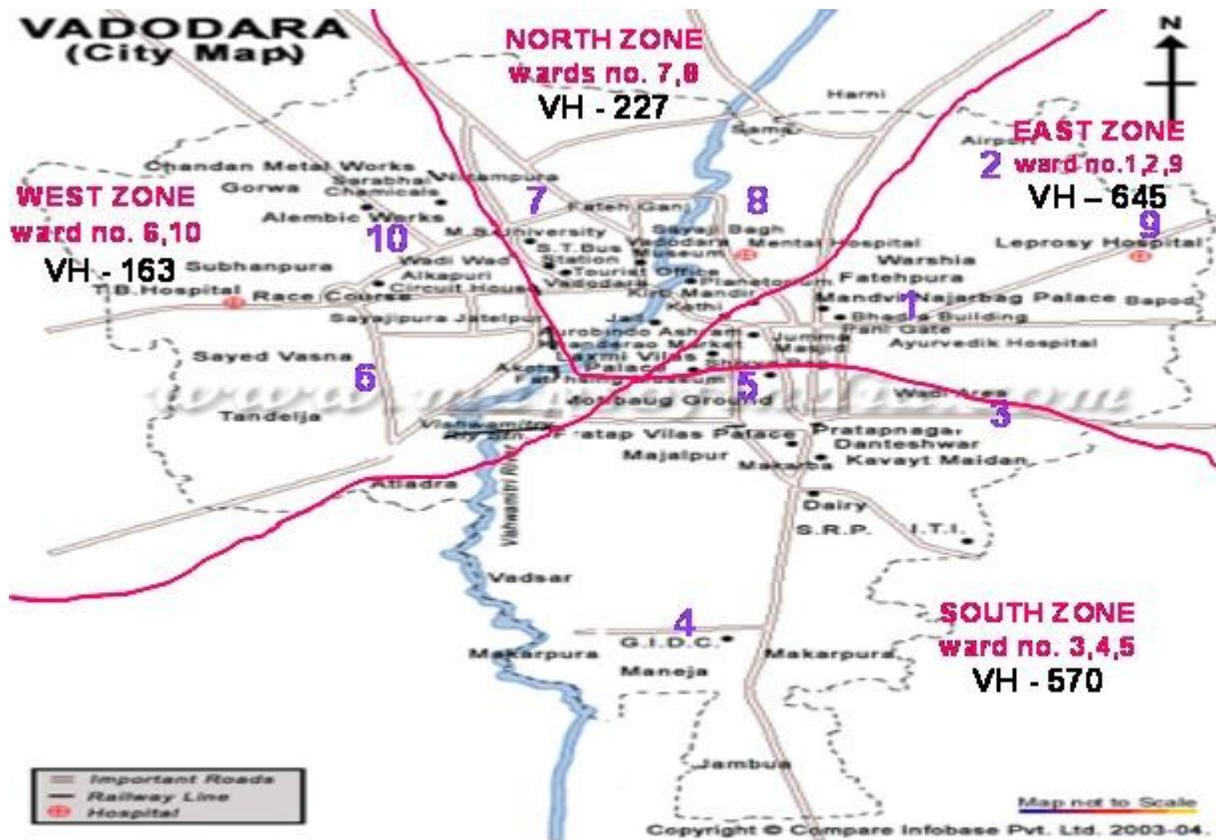
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Figure 1: Map of Vadodara City with spotting of viral hepatitis cases and lowest chlorination level of water



Vadodara City is divided into four Zones with different wards figured out in this map. This map also shows a correlation of number of Viral Hepatitis cases with low chlorination level of water post flood.

Figure 2:

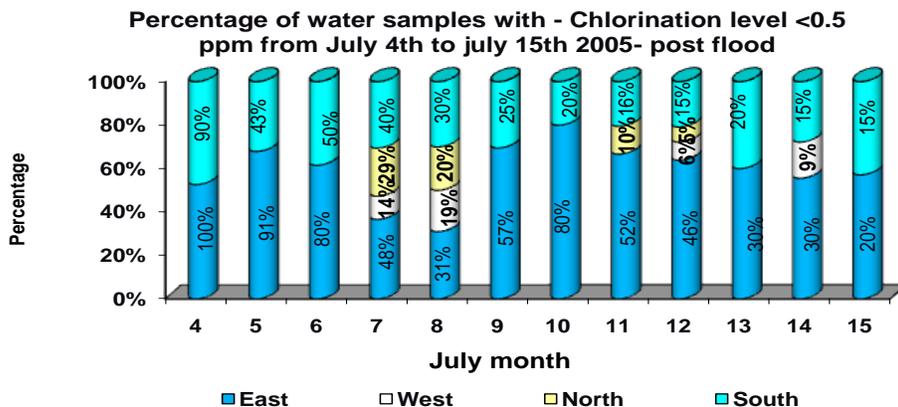


Figure 3:

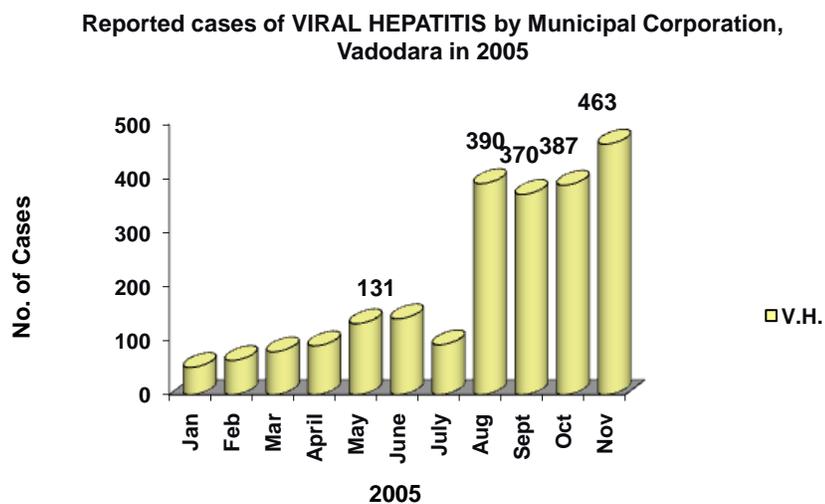
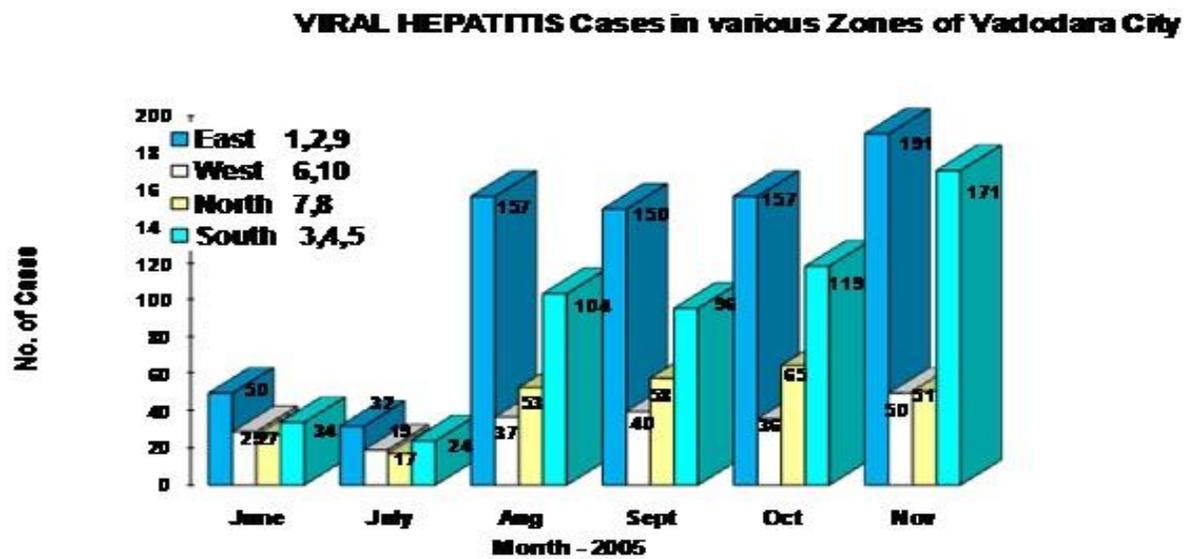


Figure4:



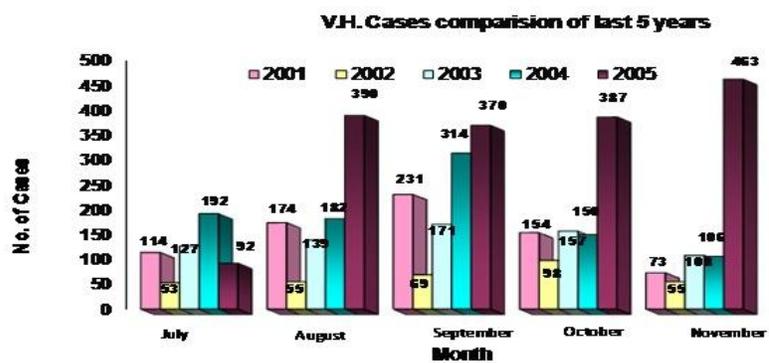


Figure 5