



*Original Research Article*

## **Seasonal Patterns in Acute Gastroenteritis in a Hospital at Maharashtra, India**

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### **ABSTRACT**

Acute gastrointestinal illnesses are amongst the most common diseases worldwide: ranging from mild annoyances to devastating, dehydrating illnesses that can kill within hours. Although acute gastroenteritis is a common illness in all seasons, it definitely shows change in the number of cases at different times of the year. A descriptive cross-sectional study was conducted in a Government Medical College and Hospital in Maharashtra, India. The gastroenteritis patients who were admitted to this hospital during the study period of 1 calendar year from April 2006 to March 2007 were studied. The hospital records of the previous 2 calendar years from April 2004 to March 2006 were also studied to know the changing patterns in the acute gastroenteritis cases. During April 2004 to March 2007, the average monthly admissions due to gastroenteritis were 48. Gastroenteritis resulted in 1.92% (i.e. 685 out of 35644) of the total hospital admissions. Contrary to the regular belief that gastroenteritis is more common during rainy season and early parts of summer, in present study as well as in various other studies it was found that, the number of cases was more during winter.

**Key Words:** Acute gastroenteritis, Seasonal patterns, Diarrhoea

### **INTRODUCTION**

Acute gastrointestinal illnesses are amongst the most common diseases worldwide: ranging from mild annoyances

to devastating, dehydrating illnesses that can kill within hours. In children less than 5 years old, attack rates range from 2-3 illnesses per child per year in developed countries to as high as 10 to 18 illnesses per

child per year in developing countries. In Asia, Africa & Latin America, acute diarrhoeal illnesses are a leading cause of morbidity in children- with an estimated 1 billion cases per year. <sup>(1)</sup>

Although acute gastroenteritis is a common illness in all seasons, it definitely shows change in the number of cases at different times of the year.

Hence this study was undertaken with objectives to study the total number of admitted cases of acute gastroenteritis at different times in the year, their age & gender patterns.

## **MATERIALS AND METHODS**

It was a descriptive cross-sectional study conducted in a Government Medical

College and Hospital in Maharashtra, India. The study sample comprised of all the gastroenteritis patients admitted to this hospital during the study period of one calendar year i.e. from 01.04.2006, up to 31.03.2007. Total number of cases in each month was noted. The proportion of the gastroenteritis to the total number of admissions in hospital was studied over the entire year. The hospital records of the previous 2 calendar years from April 2004 to March 2006 were also studied to know the changing patterns in the acute gastroenteritis cases. This gave the number of the cases over span of total 3 calendar years from April 2004 to March 2007.

Statistical analysis: Mean and standard deviation was calculated. The chi-square test was used to calculate the p- value.

## **RESULTS**

Table 1

Gastroenteritis was responsible for 0.68% to 3.41% of the total admissions in the hospital month-wise. The admissions due to gastroenteritis accounted for as many as 123 (3.41%) of the total 3605 admissions due to all causes in December 2006.

The month-wise number of gastroenteritis cases was in the range of 20 to 123.

Table 2

In the present study it was observed that gastroenteritis cases in less than 5 years of age group were 43.6 %, cases in 6 to 10 years age group were 10.7%, in 11 to 19 age group were 5.6%, 20 to 39 age group were 20.7% and cases in age above 40 years were 19.4%.

Table 3

During winter season 53.58% cases were reported. Contrary to the regular belief that gastroenteritis is more common during rainy season and early parts of summer, in present study as well as in various other studies it was found that, the number of cases was more during winter.

Table 4

Gastroenteritis admissions in the year April 2004 to March 2006 was 774, almost same i.e. 777 in April 2005 to March 2006, and in April 2006 to March 2007 a total of 685 gastroenteritis cases were noted. The admissions in each month were in range of 113 in October to 456 in March. The increased number of cases in March was a result of outbreak situation. During April 2004 to March 2007, the average monthly admissions due to gastroenteritis were 48.

Sharma et al <sup>(2)</sup> had observed typical seasonal trend. In 2003, gastroenteritis cases started increasing in the month of April 2003 declining towards October. In 2004, cholera cases (leading to an increase in gastroenteritis cases) were seen from the month of January with highest number of cases in April and prevail throughout the year. Similar increase in gastroenteritis cases was

detected from January onwards in 2005, but detection rates of cholera among the case remained low.

If the cases during the outbreaks are also counted, the mean for gastroenteritis cases during 2004-2005 was 64.5 with SD 81.6. For 2005- 2006 mean of number of gastroenteritis was 64.8 with SD 24.99, and for 2006-2007 it was 57.1 with SD 35.77. As the average number of cases is affected due to aberrant figures of more cases during the outbreak, it seems more plausible to ignore these for calculation of the statistical averages and measures of dispersion. Thus, after excluding the cases during outbreaks, the average number of gastroenteritis cases is shown as follows:

Table 1-5

**Table No. 1 Proportion of 685 cases of gastroenteritis in relation to the total hospital Admissions from April 2006 to March 2007**

| Sr. No. | Month & Year   | Number of admissions (a) | Number of Cases of Gastroenteritis (b) | Proportion of (b) to (a) in % |
|---------|----------------|--------------------------|--|-------------------------------|
|         | April 2006     | 2696                     | 32                                     | 1.19                          |
|         | May 2006       | 2726                     | 24                                     | 0.88                          |
|         | June 2006      | 2878                     | 48                                     | 1.67                          |
|         | July 2006      | 3012                     | 41                                     | 1.36                          |
|         | August 2006    | 2940                     | 31                                     | 1.05                          |
|         | September 2006 | 2941                     | 20                                     | 0.68                          |
|         | October 2006   | 3015                     | 33                                     | 1.09                          |
|         | November 2006  | 3416                     | 113                                    | 3.31                          |
|         | December 2006  | 3605                     | 123                                    | 3.41                          |
|         | January 2007   | 2888                     | 98                                     | 3.39                          |
|         | February 2007  | 2719                     | 51                                     | 1.87                          |
|         | March 2007     | 2808                     | 71                                     | 2.52                          |
| Total   |                | 35644                    | 685                                    | 1.92                          |

**Table No.2 Age & Gender wise distribution of 685 cases of gastroenteritis.**

| Sr.No | Age- group (years) | Male |      | Female |      | Total |      |
|-------|--------------------|------|------|--------|------|-------|------|
|       |                    | No.  | %*   | No.    | %*   | No.   | %*   |
|       | ≤ 5                | 173  | 50.0 | 126    | 37.1 | 299   | 43.6 |
|       | 6 to 10            | 38   | 10.9 | 36     | 10.3 | 74    | 10.7 |
|       | 11 to 19           | 16   | 4.6  | 22     | 6.4  | 38    | 5.6  |
|       | 20 to 39           | 65   | 18.8 | 76     | 22.4 | 141   | 20.7 |
|       | >40                | 54   | 15.6 | 79     | 23.3 | 133   | 19.4 |
| Total |                    | 346  | 50.6 | 339    | 49.4 | 685   | 100  |

(\* shows Group-wise percentages)

$X^2 = 13.92$ ,  $df=4$ ;  $P < 0.05$

**Table No. 3. Seasonal frequency of gastroenteritis cases in 2006-07**

| Sr. No. | Year 2006-07.<br>Month | Season | Total Cases | Percentage |
|---------|------------------------|--------|-------------|------------|
| 1       | June to September      | Rainy  | 140         | 20.44      |
| 2       | October to January     | Winter | 367         | 53.58      |
| 3       | February to May        | Summer | 178         | 25.98      |
| Total   |                        |        | 685         | 100        |

$X^2=96.3$ ,  $df=2$ ,  $p<0.001$

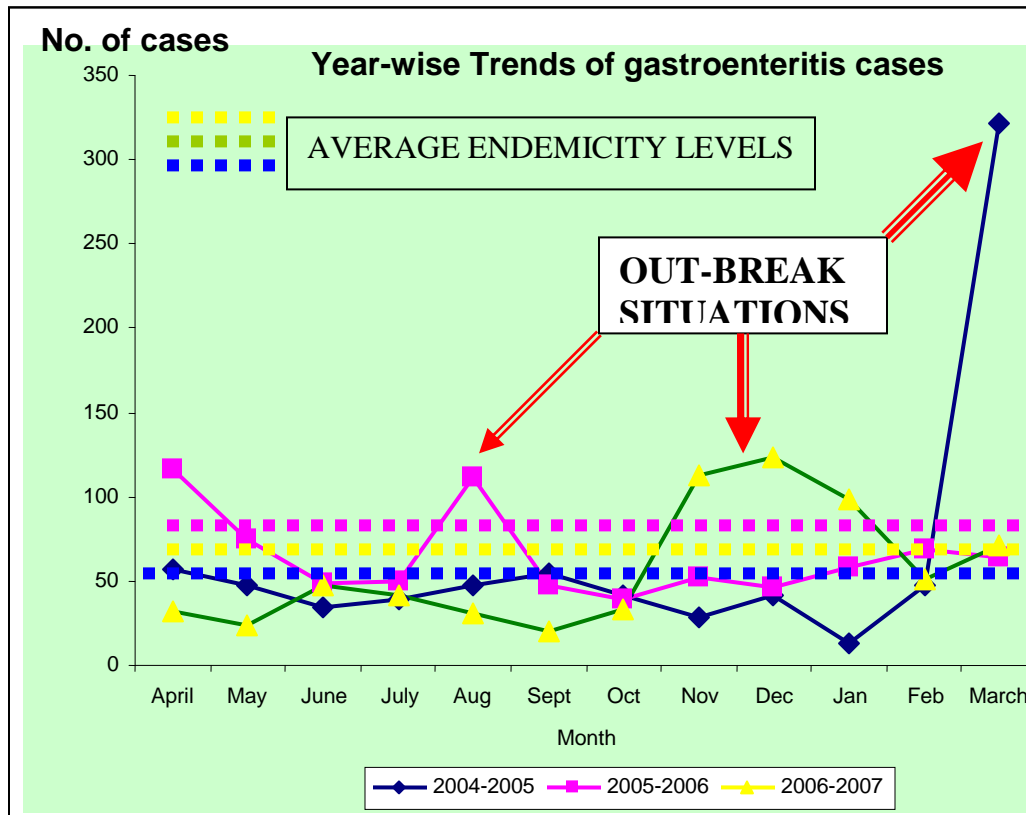
**Table No.4 Year-wise distribution of gastroenteritis cases from April 2004 to March 2007**

| Sr. No. | Month     | No. of gastroenteritis cases |           |           | Total |
|---------|-----------|------------------------------|-----------|-----------|-------|
|         |           | 2004-2005                    | 2005-2006 | 2006-2007 |       |
|         | April     | 57                           | 116       | 32        | 205   |
|         | May       | 48                           | 75        | 24        | 147   |
|         | June      | 35                           | 49        | 48        | 132   |
|         | July      | 39                           | 50        | 41        | 130   |
|         | August    | 47                           | 111       | 31        | 189   |
|         | September | 54                           | 48        | 20        | 122   |
|         | October   | 41                           | 39        | 33        | 113   |
|         | November  | 29                           | 52        | 113       | 194   |
|         | December  | 42                           | 46        | 123       | 211   |
|         | January   | 13                           | 58        | 98        | 169   |
|         | February  | 48                           | 69        | 51        | 168   |
|         | March     | 321                          | 64        | 71        | 456   |
| Total   |           | 774                          | 777       | 685       | 2236  |

**Table No. 5. Mean and epidemic threshold of gastroenteritis over 3calendar years**

| Sr. no.  | Gastroenteritis cases no. | 2004-2005 | 2005-2006 | 2006-2007 | Total 2004-2007 |
|--|---------------------------|-----------|-----------|-----------|-----------------|
| 1  | Mean                      | 44        | 55        | 44.9      | 47.9            |
| 2  | Standard deviation (SD)   | 8.52      | 11.2      | 23.8      | 16.2            |
| 3  | Standard error (SE)       | 2.69      | 3.6       | 7.5       | 5.1             |
| Epidemic Threshold Level of gastroenteritis (Mean + 2 SE )<br>Rounded up to nearest complete figure. |                           | 50        | >72       | 65        | >58             |

**Graph 1. Number of gastroenteritis cases admitted to the hospitals over the period of three years.**



## DISCUSSION

From April 2006 to March 2007, gastroenteritis resulted in 1.92% (i.e. 685 out of 35644.) of the total hospital admissions. The observations coincide with the study of Rao M<sup>(3)</sup> who quoted that 1.5% of adult hospitalization was due to gastroenteritis. Srivastava et al<sup>(4)</sup> in Lucknow found that, 12.35% of total paediatric hospital admissions were due to gastroenteritis. Gupta et al<sup>(5)</sup> in a community-based study observed that 7.7% children (i.e. 202 out of 2614) had gastroenteritis. The study of Srivastava et al<sup>(4)</sup> had given the hospital admissions due to gastroenteritis out of paediatric admissions. In the present study such a thing cannot be quoted as it is a general hospital, the

services being provided to all age group (and not only the paediatric age group as is done in Paediatric hospitals) In Paediatric hospital number of cases is in proportion to paediatric admissions. However the study by Srivastava et al<sup>(4)</sup> indicates the importance of age in gastroenteritis cases.

Maximum, i.e. 123 cases occurred in December 2006 followed by November 2006 (113). While September 2006 showed only 20 cases of gastroenteritis.

Gupta et al<sup>(4)</sup> in a study in urban slum had observed that during the 1 year study period a total of 642 gastroenteritis cases were reported & in each month the cases were in range of 29 to 85 in numbers. (Similar to the present study with monthly cases of gastroenteritis in range of 20-113)

Similar to the finding of the present study, Ananthan et al <sup>(6)</sup> had found maximum cases of gastroenteritis (as well as rotavirus infection) during the months of November- December.

However, Gordon et al <sup>(7)</sup> had observed the peak number of cases of gastroenteritis in May. Srivastava et al <sup>(4)</sup> had found that the peak of admission due to gastroenteritis were in June, followed by May and July. Desai H et al <sup>(8)</sup> in Bombay had observed that maximum numbers of gastroenteritis cases were observed during June- July.

Sur D et al <sup>(9)</sup> had observed increased number of gastroenteritis as well as cholera cases during month of July. Gupta et al <sup>(5)</sup> in their study, observed the maximum cases of gastroenteritis during May. Bhattacharya et al <sup>(10)</sup> reported maximum prevalence of gastroenteritis in September. Sharma et al <sup>(2)</sup> had mentioned peak of diarrhoeal diseases in August.

The peaks reported in different months of the year as reported in various studies may be probably due to Geographical variation as well as outbreak of gastroenteritis due to the organisms in different months of the year.

Out of the total 685 cases of gastroenteritis, males were 50.6% and females were 49.4%. The cases of gastroenteritis are significantly more ( $\chi^2 = 13.92$ ) in the males of  $\leq 5$  age group. It can be observed from the table that the maximum cases of gastroenteritis (299 out of a total of 685 which accounts for 43.6%) belong to the under-5 population.

The findings are in coherence with the study of Kaishta et al <sup>(11)</sup> which revealed high percentage of children affected. Sharma et al <sup>(2)</sup> in their study had also observed that the maximum (32.7%) cases belonged to the under-5 age group. However, Srivastava et al <sup>(4)</sup> observed that 72.7% cases were up-to 1 year of age. Joshi CK et al <sup>(12)</sup> in their study

of under 5 year age children, reported that 50% of patients were infants, and 23.8% in the age group 1-2 years. The proportion of cases up-to one year of age in different series of gastroenteritis has been found to range between 50-74.8% by various workers. <sup>(13)</sup>

In the present study, there was very small gender difference about the number of cases (males 346 and females 339) with male: female ratio of 1.01: 1. Similar findings have been mentioned by Gupta et al <sup>(5)</sup> in their study. Also Bhattacharya et al <sup>(10)</sup> in their study reported that gastroenteritis was found to have no association with the sex of child with almost equal number of cases from males and females.

However this does not match with the study of Srivastava et al <sup>(4)</sup> who found that male constituted 57.3% of total study, Kumar P et al <sup>(14)</sup> who observed that male to female ratio for gastroenteritis admissions was 1:0.8, Sharma et al <sup>(4)</sup> who observed that percentage of males was 60.7%.

Winter season showed significantly more number of the cases ( $\chi^2 = 96.3$ ,  $df = 2$ ,  $p < 0.001$ )

The findings are similar to the study of Ananthan et al <sup>(6)</sup> who have also reported winter peak. Broor S et al, <sup>(13)</sup> & De A et al <sup>(15)</sup> had also found increased gastroenteritis cases during winter.

Desai H et al <sup>(8)</sup> in Bombay, and Mishra M et al <sup>(16)</sup> in Nagpur had observed that maximum numbers of gastroenteritis cases were observed in rainy season during June-July. Similarly Bhattacharya et al <sup>(10)</sup> in the community-based study had observed that, the maximum number of episodes (49.1%) occurred during rainy season.

The probable explanation to increased prevalence during winter could be that rotavirus infections are common during winter. Most of times when the diagnosis is not arrived at in gastroenteritis the cause is viral; especially due to rotavirus. Over the

period of time, changes in seasonality of cases have occurred due to change in microflora.

Thus, in the present study as per the hospital data, the lowest endemicity level was in 2004-2005 (44), and highest in 2005-2006 (55). Endemicity level came down again in 2006-2007 (44.9). Thus from 2004-2007, the average endemicity of gastroenteritis cases was 47.9 with Standard error of 5.1. So the epidemic threshold of gastroenteritis cases was found to be 58 cases per month. Thus gastroenteritis cases more than this suggest an outbreak. Such situations were noted during May 2005, February-March 2006 and during January & March in 2007. An alert surveillance system is needed to identify such changes, which will go a long way in curbing the menace on a larger scale.

The outbreak of 2004-2005 (shown in the graph 1) was because of the leakage in the water supply system around the 100-foot road area. The same was repaired over the period of next 1-2 years and most of the cases from the area have ceased to come. This once again indicates the need for active surveillance and prompts corrective measures regarding environmental sanitation for the prevention and control of such water-borne diseases.

At low endemicity, majority of patients do not report to the hospital because of the mild nature of disease and also because disease can be easily & effectively controlled at house-hold level with Oral Rehydration Solution or home based fluids. Only if the gastroenteritis problem is severe enough to lead to dehydration (or 'sinking' as perceived by the lay persons), only then the patient may be taken to the hospital.

## CONCLUSION

The under 5-age group was affected the most (43.6 % of total 685 cases).

Similarly old age people (19.4% cases of 685) were also affected to a large extent due to gastroenteritis. The cases of gastroenteritis are significantly more in the males of  $\leq 5$  age group. This highlights the importance of age in the causation of gastroenteritis. During April 2004-March 2006, 2.34% of the total hospital admissions were due to gastroenteritis. During April 2006-March 2007, 1.92% (685 out of 35644) of the total hospital admissions accounted to gastroenteritis. The increased cases during 2004-2006 were due to an outbreak situation in March 2005(321 cases), because of the leakage in the water supply system around the 100 foot road area. The repairs of the same over a period of 1-2 years resulted in decrease gastroenteritis cases in 2006-2007. This decrease could also be due to the awareness in the people about the gastroenteritis management using ORS or other home based fluids.

The cases during the winter season were significantly high and it was the peak season for the gastroenteritis cases. November- December months had a higher frequency of cases. The peak in winter is in contrast to the regular belief that gastroenteritis is more common during rainy season or in early summer. This may be a result of the changing seasonal trend.

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