

DISEASE ECOLOGY OF DIARRHOEA IN SOUTH 24 PARGANAS DISTRICT, WEST BENGAL

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Abstract: Diarrhoea disease and its complications remain a major cause of morbidity and mortality in developing countries of the humid tropics. Diarrhoea is characterized by an abnormal frequency of watery stools more than three to four times in a day. It is the dominant water-borne disease in the district South 24 Parganas. The district having five subdivisions and 29 C.D. blocks is located in the southern tip of West Bengal. The main objective of this study is to know causes and consequences of Diarrhoea disease in the study area. Both secondary and primary data have been collected for the purpose. All the data have been computed and interpreted. Number of Diarrhoea cases is highest in the western part of the district. Though, frequency of this disease has decreased over time in the study area. Most of the cases have been reported during rainy season. Unawareness about safe drinking water and importance of sanitation are the main reasons for outbreak of Diarrhoea in the district. The most recent advances to control Acute Diarrhoeal disease include zinc supplementation, distribution of Oral Rehydration Solution (ORS) and rota virus vaccination. The World Health Organization initiated a special programme for control of Diarrhoeal disease among children in 1980. This programme was launched in 1985-86 as the Diarrhoeal Disease Control Programme in India.

Key Words: *Diarrhoea disease, morbidity, water-borne, sanitation, rotavirus*

Introduction

Diarrhoea is the dominant water-borne disease in the study area. Rota virus *E.Coli* is spread from infected person to water and water to the new host. The relationship between environmental factors and the occurrence of Diarrhoea have been addressed in a number of studies. Environmental factors include water quantity, access to improved water sources, availability of toilet facilities, compound hygiene, healthy housing condition, and refuse disposal. Domestic water supplies are the fundamental requirements for human life. Without water, life cannot be sustained beyond a few days and the lack of access to adequate pure water supplies leads to spread of such a disease. The pathogenic agents of Diarrhoea disease spread through contaminated water. Morbidity and mortality rate coupled with case fatality rate of Diarrhoea have been taken up under this study. Most of the Diarrhoea cases have been reported during rainy season in the district. Unhygienic condition of the environ and unsafe drinking water are the main reasons for high intensity of this disease in the urban counterparts of the

district. The district South 24 Parganas is surrounded by the Bay of Bengal in the south, River Hugli in the west and neighboring country Bangladesh in the east and district North 24 Parganas and city of Kolkata in the north. The entire work of investigation has been carried out in subdivision level inclusive of Alipore, Baruipur, Canning, Diamond Harbour and Kakdwip. The World Health Organization recommends the use of Oral Rehydration Solution (ORS) and also zincs supplementation for control of Diarrhoea. Oral rehydration solution is a life saving treatment that is available for common people to use household level. Zinc supplementation during Diarrhoea has been shown to reduce the duration and severity of the episode. Department of Health and Family Welfare Programme, Government of West Bengal and several Non Governments Organizations (NGOs) take necessary actions after natural calamity in the district to reduce outbreak of this water-borne disease.

Materials and Methods

Both primary and secondary data have been collected for this study. Primary data have been generated through questionnaire based random sampling technique. 650 samples have been collected on this disease from both urban centers and rural blocks of the district. Secondary data on population, cases and deaths out of Diarrhoea have been gathered from different Government and Non Governments sources.

Both sets of data computed and tabulated. Various quantitative methods for working out mortality rate case fatality rate have been applied to derive inferences out of this research endeavor. At last all the outcomes of the investigation have been represented by various cartographic techniques followed by their interpretation and extraction of findings.

Objectives

The objectives of this study are twofold:

- To understand the epidemiological condition of Diarrhoea disease in South 24 Parganas district and
- To study the causes and consequences of Diarrhoea in the area under study

Discussion

Diarrhoea diseases have been serious to all societies since the beginning of recorded history. Hippocrates in fourth century BC used the term “dysentery” to denote a condition wherein the affected person, suffering and straining from painful defecation, passed many stools containing blood and mucus (Kiple, 1993). In developing countries of the humid tropics, Diarrhoea is almost universally infectious in origin. The infectious agents of Diarrhoea are of different types. The commonest viral agent is the Rota virus. Some bacteria are responsible for profuse watery Diarrhoea without damaging the intestinal mucosa. Among these *Vibrio cholera*, *Cryptosporidium parvum* and *Escheria coli* are important. Other like Entamoeba histolica, giardia lamblia, is responsible for acute Diarrhoeal Diseases. Diarrhoea is more common in person with malnutrition. The pathogenic organisms of Diarrhoea disease are transmitted through ‘faecal-oral’ route (Kathuria, 2012).

Morbidity

Unfiltered drinking water is the primary reason for causing Diarrhoea disease in any area. People in the study area usually collect underground water for drinking purpose from tube wells. But sometimes underground water absorbs various chemicals and pesticides and it plays an important role in the morbidity of water-borne disease like Diarrhoea (Mayer, 2007). Socio-economic environmental and demographic factors also contribute to outbreak of Diarrhoea disease. The causes of Diarrhoea are complex in nature as they are interrelated (Desai et.al. 2011). Vaccine against Diarrhoea disease has been introduced. But this is not effective enough to reduce Diarrhoea, because *rota* virus transfers from person to person through contaminated food and water. People's awareness about this disease is the best way to reduce morbidity and mortality of Diarrhoea. The vaccination against Diarrhoea is very costly. This vaccine is typically given to the infants in two doses. Each dose is available for ₹ 980/- . A medical team from Bangladesh and Vietnam has shown vaccine efficacy against *rota* virus Diarrhoea to be 48 percent. This is much lower than in western countries where it is 90 percent only (The Telegraph, December 2012). Ministry of Science and Technology under the Government of India has declared that after 28 years of research about Diarrhoea vaccine, a low cost vaccine to prevent *rota* virus has been introduced in India. Though there are five types of *rota* viruses which have been found to be active. On the country, this vaccine can prevent only one type of *rota* virus (*Anandabazar Patrika*, May, 2013). On the basis of annual data ranging from 2001 to 2014 the temporal variation of this disease has been analyzed. Number of incidences has gradually decreased in the study area. Due to lack of awareness about basic health and hygiene it was high in the earlier decades. In the year 2002, number of cases was highest in the study area. But after 2002, the concerned authority has taken necessary actions to reduce the number of cases. So, from the year 2003 frequency of this disease had declined (Fig.1). But in the year 2007, due to lack of consciousness about quality

of drinking water as well as weak monitoring system of the Public Health Engineering Department (P.H.E.), number

of incidences was

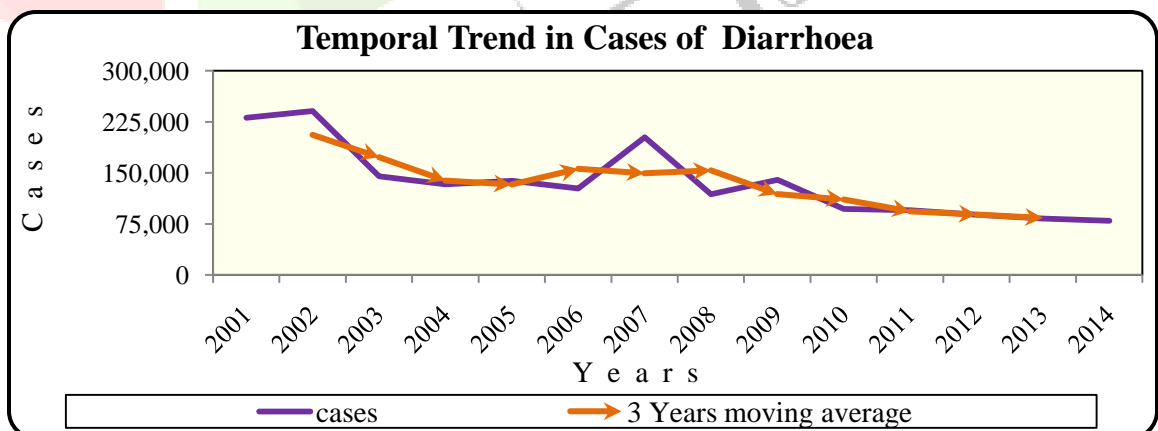


Fig.1

Data source: CMOH II, S24 Pgs

again increased followed by another rise of lower magnitude in the year 2009.

Subdivision-wise distribution of Diarrhoea cases have revealed that incidences of Diarrhoea were reported from each and every subdivision of the district. Incidences of this disease were recorded lowest in Kakdwip subdivision. In consequences of the cyclone 'Aila' frequency of Diarrhoea had reached its peak in Kakdwip subdivision in the year 2009. Incidences of this disease have decreased in this subdivision over time. In Canning, Baruipur, Alipore and Diamond Harbour subdivisions the number of cases was maximum in 2007. However, in Canning subdivision, Diarrhoea cases were lowest in 2010. In the year 2009, the notorious cyclone 'Aila' devastated the coastal areas of West Bengal. After that natural hazard, concerned

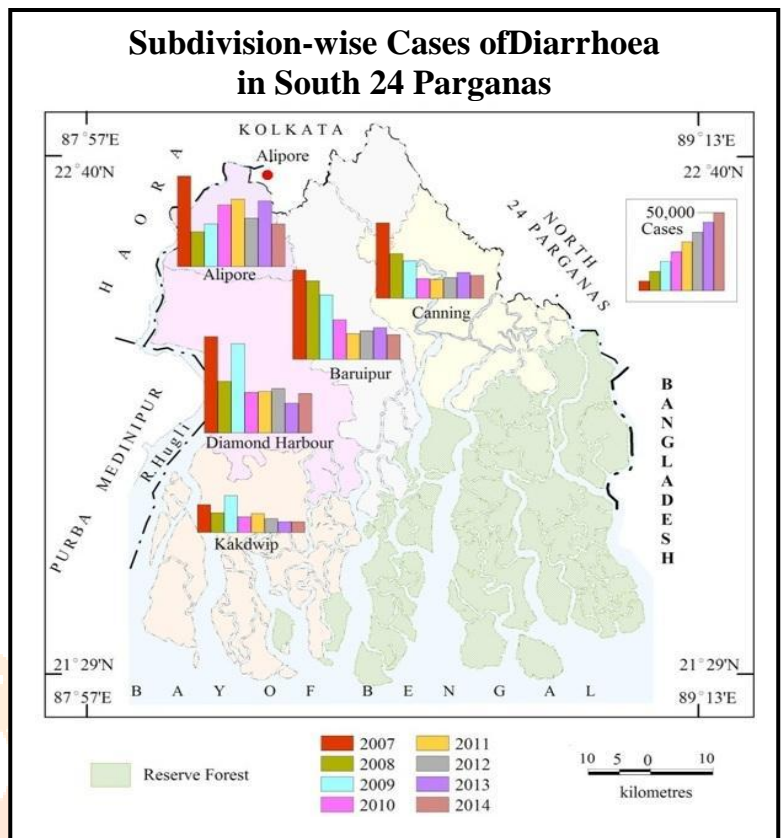


Fig.2

Data source: CMOH II, S24 Pgs

authority took necessary actions to control water borne diseases. As a result, after 2009 incidences of this disease have decreased in the subdivisions which are located near Sundarban region. Frequency of this disease has been observed to be maximum in number in the western part of the district. Where, most of the people are not aware about safe drinking water. Poor standard of sanitation is the main reason for abundance of Diarrhoeal disorder in this part of the district. After 2009 in Baruipur subdivision, number of Diarrhoea cases has abruptly decreased. Maximum number of cases was observed in Alipore subdivision in comparison to other subdivisions under the study area. Incidences of this disease have increased in Alipore subdivision over time (Fig.2).

Prevalence Rate

Percentage of population suffering from Diarrhoea is high in the district which is decreasing gradually. From the year 2001 to 2002, more than three percent population had suffered out of this disease. Prevalence rate of Diarrhoea was ranging within two to three percent between 2003 and 2007(Fig.3). In 2014,

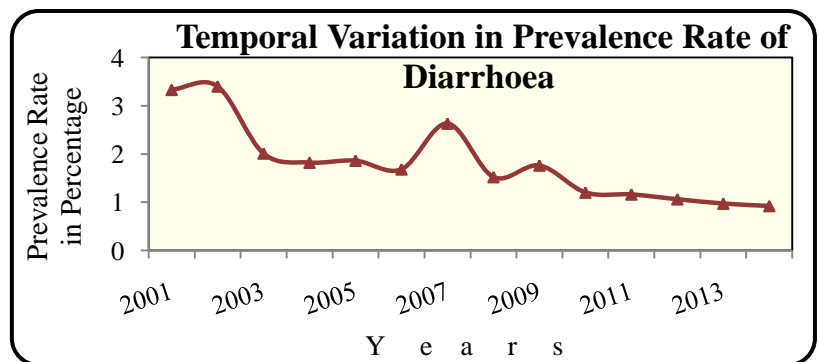


Fig.3

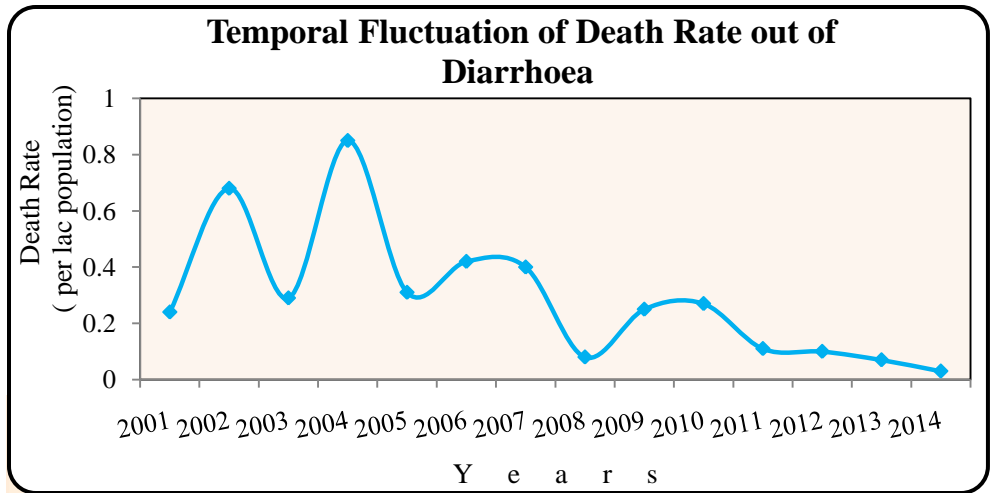
Data source: CMOH II, S24 Pgs

it has come down to below one percent in the study area.

Death Rate

For spatio-temporal analysis of death rate out of Diarrhoea, year-wise subdivision level population data and number of deaths out of Diarrhoea have been collected. Death rate has been measured out of per lac mid-year population. Death rate out of Diarrhoea has been discussed below in both spatial and temporal scale.

Death rate out of Diarrhoea has declined in the study area over time. In 2004, death rate out of Diarrhoea was highest. From the year 2001 to 2010, death rate out of this disease was more than



Data source: CMOH II, S24 Pgs

0.20 per lac mid-year population. After 2012, awareness about this has been increased. Death rate out of Diarrhoea has come down to below 0.10 per lac mid-year population (Fig.4).

Frequency of Diarrhoea cases is highest in the north-western part of the district. Due to infrastructural development death rate out of this disease is lowest in this part of the district. There is another reason for low mortality in this area. Some time people affected by this disease go to the unregistered Private Health Centre for treatment. The number of deaths in these health centers is not all considered in health related statistics. So, most of this type of cases is recorded in the urban part of the study area where the urban units are located in the north-western part. Death rate out of Diarrhoea is

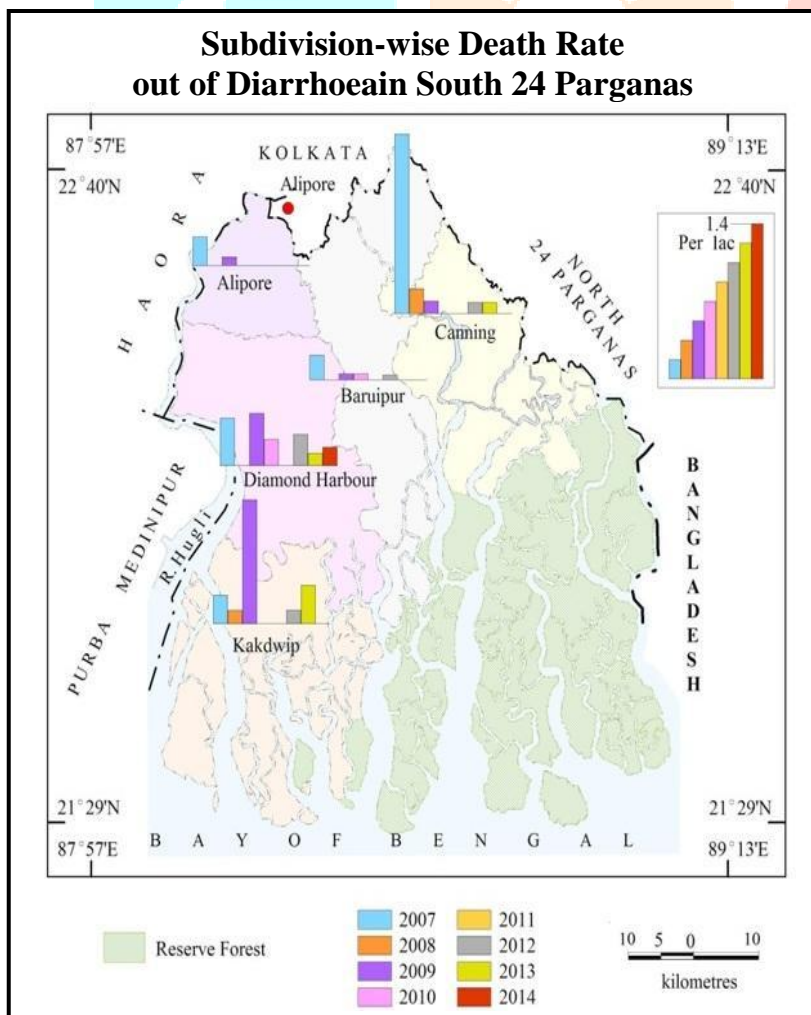


Fig. 5 Data sources: CMOH II, S24 Pgs, Primary Census Abstract. 2001 and 2011

comparatively lower in Alipore and Baruipur subdivisions in comparison to other subdivisions in the district. In these two subdivisions, death rate out of this disease was highest in 2007. In Canning subdivision, death rate out of Diarrhoea was lowest during the years 2010 and 2011. In 2007, death rate out of Diarrhoea was more than 1.3 per lac population in canning subdivision. In Kakdwip subdivision, death rate out of this disease was highest in 'Aila' affected area of 2009 (Fig.5). When many people were affected by declined access to safe drinking water which contaminated in high incidence as well as death rate out of this disease. A large number of patients, affected by such a menace assembled, in the Health Care Institutions. Due to inadequacy of health workers and medical experts, people did not get required treatment. So, death rate out of this disease was highest in the fringe area of the district. In Kakdwip subdivision, death rate out of this disease was highest in 2009 after which death rate out of this disease has declined in the study area. The State Government along with the NGOs has taken necessary actions to prevent the outbreak and spread of this disease. But it could not be averted due to lack of awareness among people as a consequence of which death rate out of Diarrhoea has increased in the study area.

Case Fatality Rate

From the temporal fluctuation of Case Fatality Rate out of Diarrhoea, it has been observed that lethal power of Diarrhoea has decreased in the study area over time. In the year 2004, lethal power of Diarrhoea was highest.

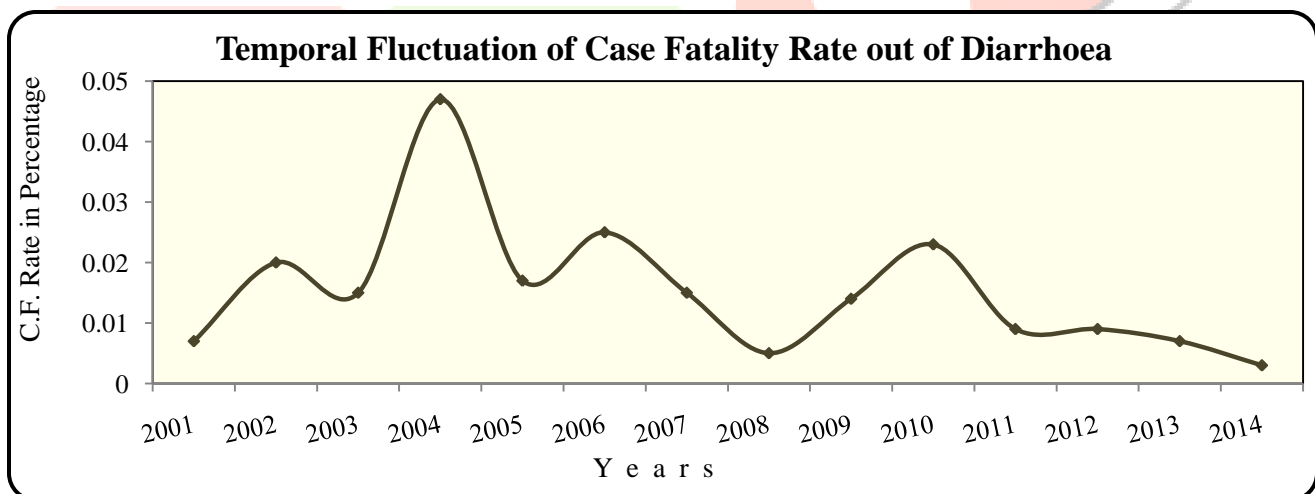


Fig.6

Data source: CMOH II, S24 Pgs

Early detection of this disease was not possible that time. From the year 2002 to 2010, fatality rate out of Diarrhoea was more than 0.015 percent. But in 2008, fatality rate out of this disease was below 0.010 percent while since 2012, fatality rate enforced by this disease is remaining below 0.010 percent (Fig.6).

On the bases of observations on eight years data analysis an informative account has been prepared. The case fatality rate of Diarrhoea is high in Kakdwip subdivision. In 2013, lethal power of Diarrhoea was highest in Kakdwip subdivision. Due to non-availability of required medicine and hospital bed, fatality rate out of this disease was high in 2009 and 2013. In general fatality rate out of Diarrhoea is low in Alipore and Baruipur subdivisions. In Canning subdivision, lethal power of this disease was highest in 2007 while in Diamond Harbour, fatality rate out of this disease was higher than other subdivisions in each and every year. In the years 2008 and 2011, lethal power of Diarrhoea was nil in Diamond Harbour subdivision. On the contrary in 2014, lethal power out of Diarrhoea was observed only in Diamond Harbour subdivision (Fig.7).

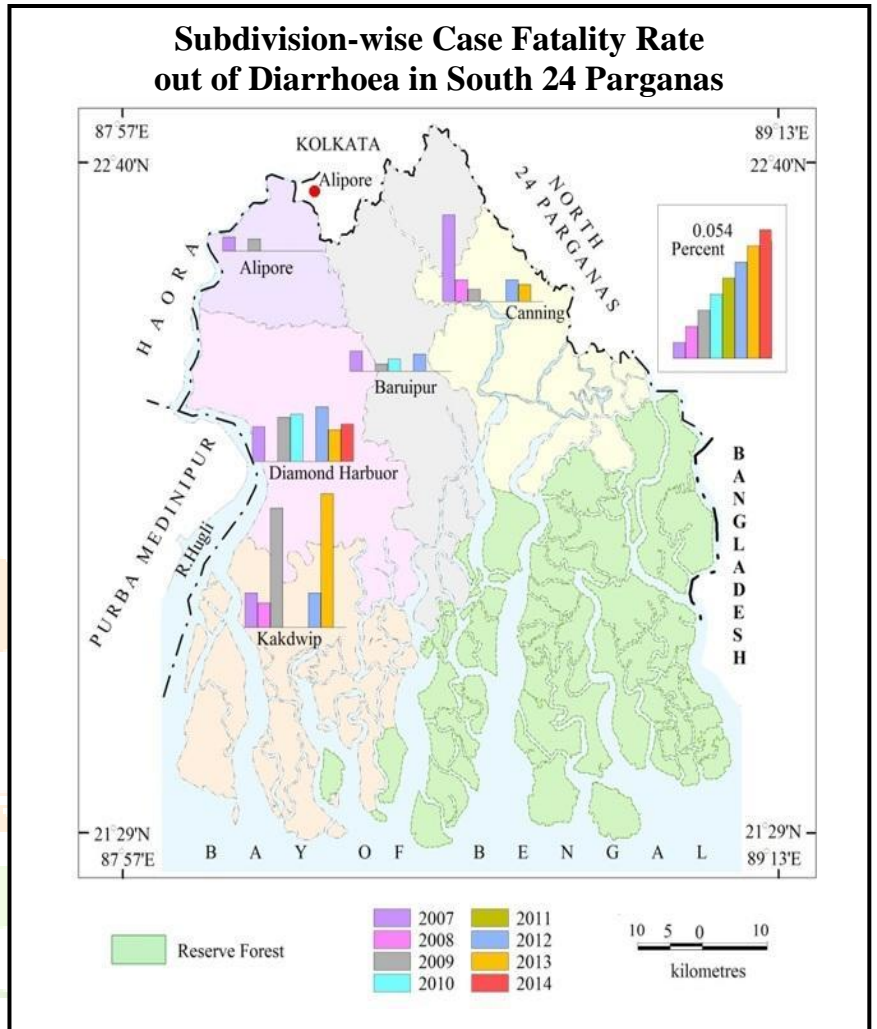


Fig.7

Data sources: CMOH II, S24 Pgs, Primary Census Abstract 2001 and 2011

Seasonal Outbreak

The study area is mainly dominated by the Tropical Monsoon climate, which gives rise to a well defined rainy season from June to September. Diarrhoea is one of the water-borne diseases prevalent in the study area. Maximum number of Diarrhoea incidences has been observed between the months of May and September. But incidences of this disease have been reported throughout the

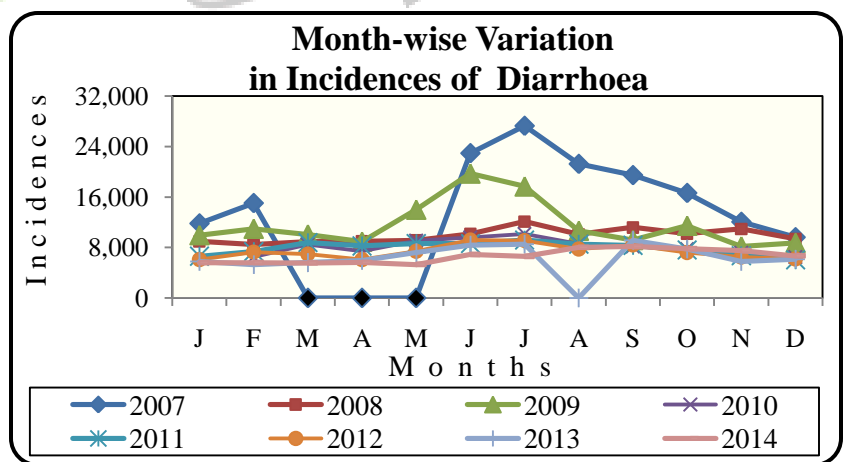


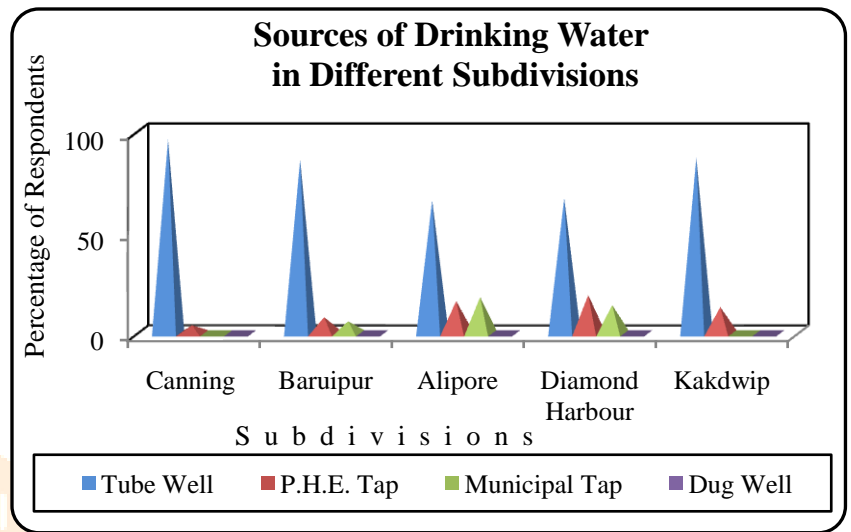
Fig.8

Data source: CMOH II, S24 Pgs

year. Most of the people are not aware about safe drinking water and food hygiene. In the years 2007 and 2009, highest number of incidences was recorded in the months of June and July (Fig.8).

Sources of Drinking Water

Drinking water has profound influence on human health because 65 percent of the human body and 84 percent of the human brain consist of water (Misra,1970). Some communicable diseases can spread from one person to another through contaminated water. In South 24 Parganas district, tube well is the main source of drinking water. But the more than 1000 feet deep tube wells are rare in the area under study. In the rural areas of the district, Public Health Engineering Department supplies drinking water which is the second dominant source of drinking water in the district. In the urban areas of the district, many households collect drinking water from the



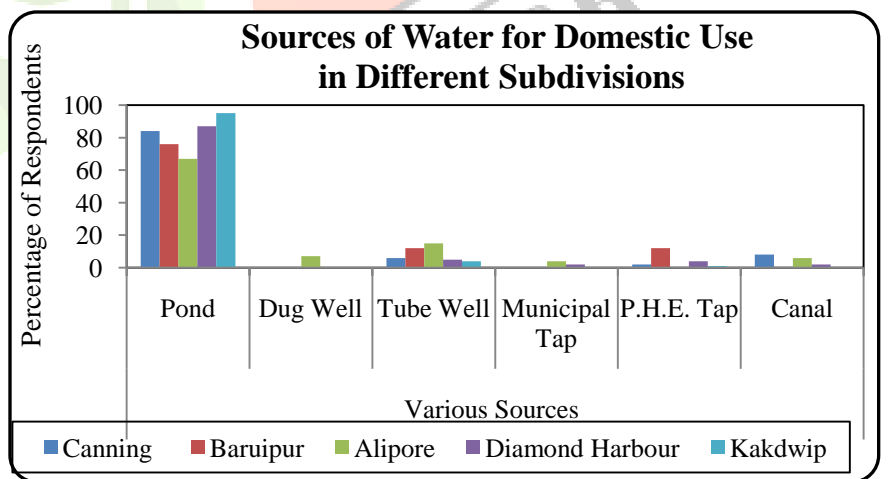
Source: Primary data, 2013-2015

Fig.9 municipal taps. It is a good sign that in recent times, people in the study area have stopped collecting drinking water from the dug wells (Fig.9).

Sources of Water for Domestic Use

Apart from the purpose of drinking, water is also essential for other domestic works in daily life. Daily household works like washing utensils and dirty linen, bathing and cooking are not possible without water.

People cannot afford to use drinking water for this purpose. So, alternative sources of water are required for these types of household works. In the rural areas of the district, most of the people use pond as the source of water for these types of works. In the urban areas of the district, tube wells and municipal taps are used as the sources of water for



Source: Primary data, 2013-2015

Fig.10 Sometimes in the rural areas, people use canal water for domestic works (Fig.10). Use of polluted water bodies seems to be the main reason for outbreak of several diseases in animals and man. Some of the pathogenic agents are transmitted to man through domestic animals too.

Filtration of Drinking Water

Unsafe drinking water is responsible for various water-borne diseases like cholera, typhoid, gastro-enteritis and various types of dysentery. Filtration of drinking water is important to prevent water borne diseases. Sometimes local authorities and NGOs arrange few deep tube wells in the rural areas. But water from these tube wells is not free from minerals like arsenic, mercury and lead. People use this water for drinking and thus they suffer from various diseases. In the district of

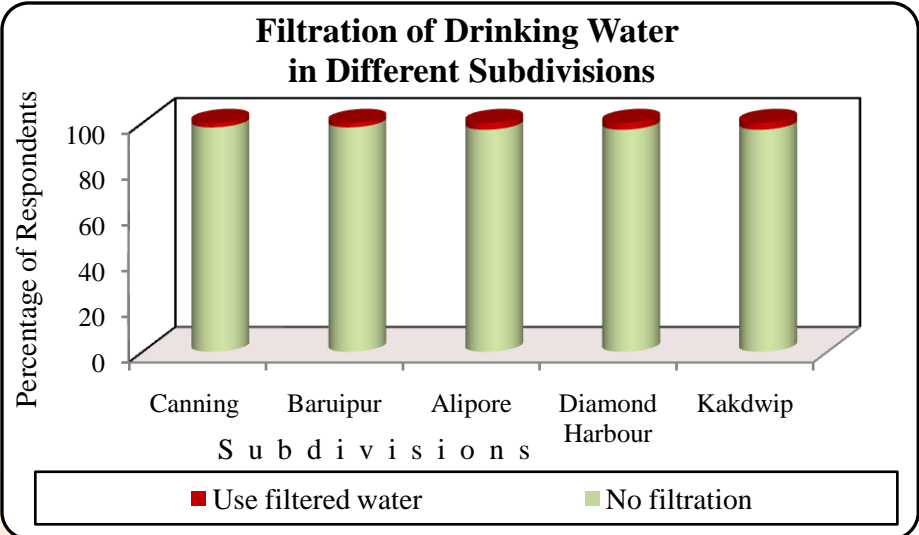


Fig.11

Source: Primary data, 2013-2015

South 24 Parganas, people suffer from enteric diseases due to unsafe consumption of drinking water. Most of the people in the study area do not filter water for safer drink. Sometimes they collect drinking water from tube wells, municipal taps and P.H.E. taps also. After collection they consume it to quench their thirst. Very few people mainly in the urban areas of the district filter it before drinking (Fig.11).

Awareness on Safe Drinking Water

No one can live without water and pure water is always necessary for the purpose of drinking. Pathogens of various water-borne diseases are liable to be transferred from one person to another through contaminated water. Despite the fact, it has been observed that most of the respondents in the rural and urban areas do not purify water before drinking. So,

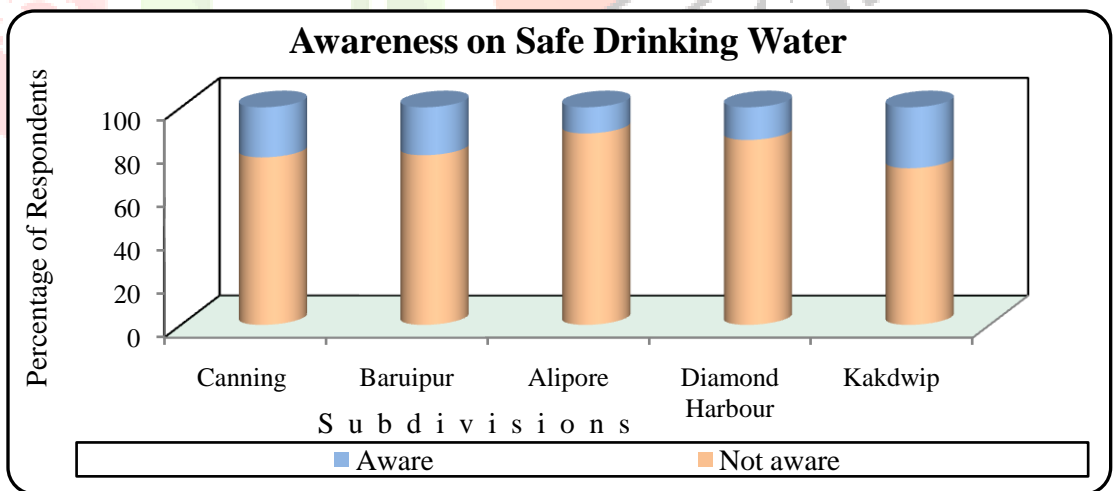


Fig.12

Source: Primary data, 2013-2015

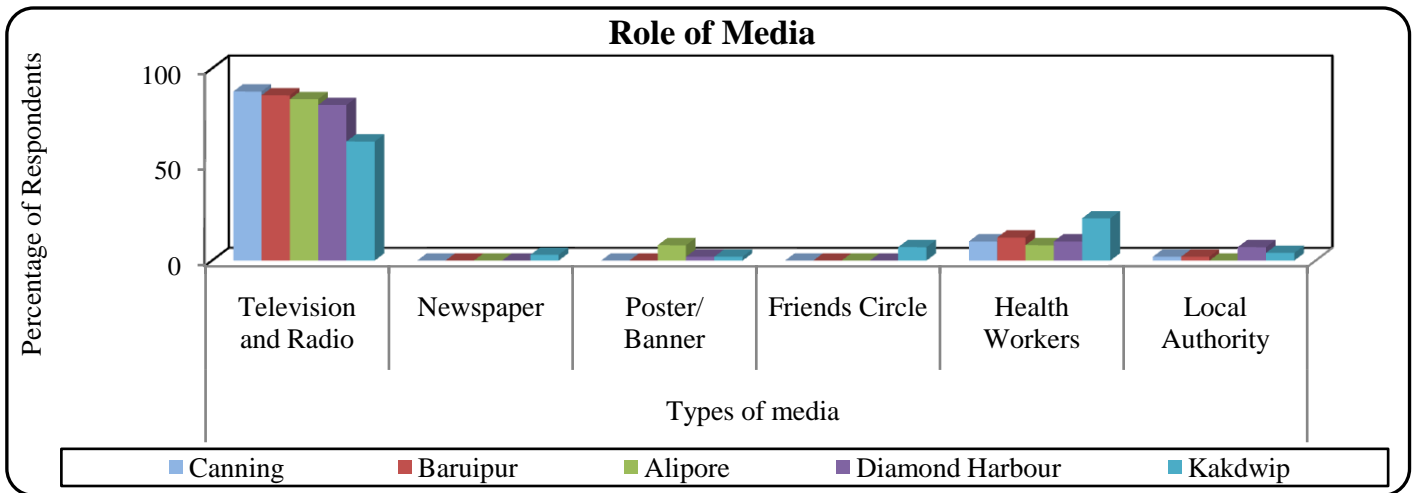


Fig.13

Source: Primary data, 2013-2015

it is necessary to make people aware about the importance of pure drinking water (Fig.12). Majority of the respondents have stated that they are not aware about it. In Alipore and Diamond Harbour subdivisions, more than 85 percent respondents are not aware about the significance of safe drinking water. Comparatively respondents from Kakdwip, Canning and Baruipur subdivisions have been found to be more conscious about safe drinking water. Radio and Television perform an important role in campaign of awareness about safe drinking water. Sometimes health workers visit the area and instruct the residents to boil water or strain through cloth for safer drink. Other sources of information include news papers, and posters or banners, which take part in creation of awareness on purified water among the literate persons only (Fig.13).

Sanitary Facility

It is an important indicator of maintaining hygienic environment in an area. The pathogens of communicable diseases can be transferred from an infected person to the local environ through urine and stool. These pathogens can attack a non infected person via water and sometimes through reared animals.

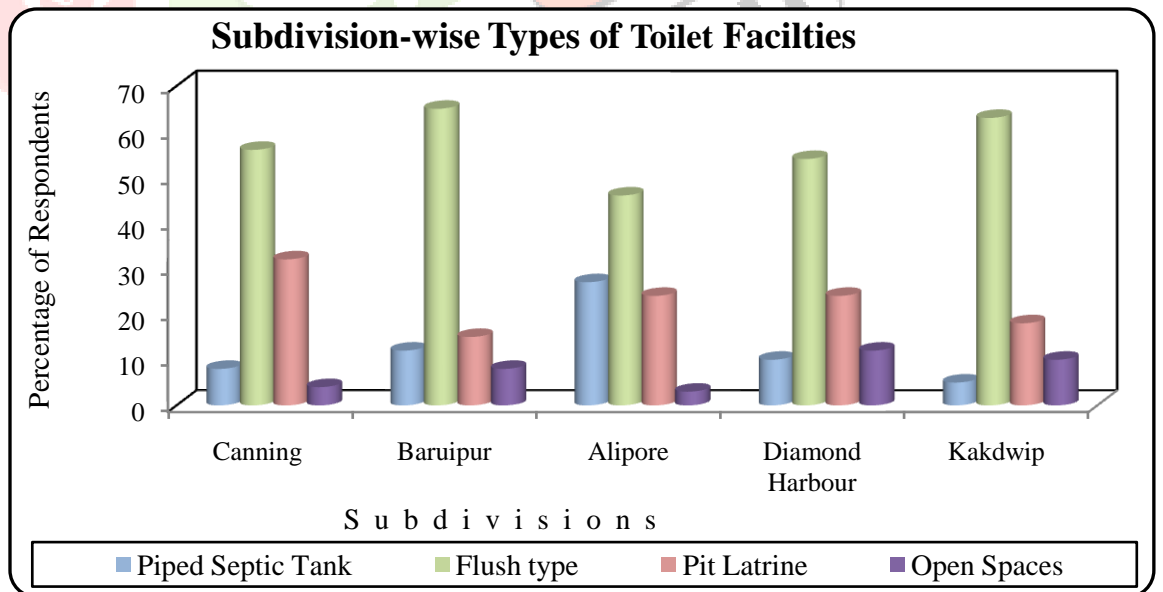


Fig.14

Source: Primary data, 2013-2015

Different types of latrine are in use in the study area. The structure of latrines is dependent on few factors like

economic condition of the household, nature of soil in surroundings and habits of the people (Gupta et.al. 2003). Three types of toilet facility are visible in the district. These are pit latrine, flush toilet and septic tank of which pit latrines toilet are highest in number in the remote areas of the district. People usually dig soil few feet deep and cover it with carpet or torn clothes. It is used for few months and then it is constructed in another place. It cannot be hygienic for human health. Various types of flies and insects which carry pathogens of diseases can breed within these types of toilets. Such type of toilets has recorded the highest percentage of the households under survey in Canning subdivision. Flush latrine type toilets also dominate the study area. Most of the surveyed households have flush latrine type toilets. This type of toilet is constructed with lower cost in comparison to that of the septic tanks. First a bore well is constructed and then a cementing slab with a sanitary pan is put on the bore well. In the rural areas of the district, local authorities have distributed such slabs with cementing facility to create a hygienic environment. More than 60 percent of the surveyed households in Baruipur and Kakdwip subdivisions have flush latrine type toilet (Fig.14). In the urban areas of the district people normally use septic tank type toilet. Construction cost of this type of toilet is higher than that of other toilets. It is constructed with concretized tank. Smell of organic matter does not leak from the tank. The pathogenic bacteria are destroyed within the tank itself. In the remote areas of the district, some surveyed households do not have any type of toilets. They defecate in the open spaces. In the notified areas of the district, local authority has constructed few 'Sulabh Shauchalaya' (pay and use toilet) in bus stand or market areas.

Findings

It has already been stated that Rota virus *E.Coli* is responsible for the outbreak of diarrhoea disease. Due to lack of awareness about safe drinking water and basic hygiene, incidences of this disease were high in the earlier days. Now a day's Oral Rehydration therapy and introduction of vaccine against diarrhoea, frequency of this disease have decreased over time. Different Non-government Organization extends their helping hands for control of this disease in the study area. Highest number of incidences of this disease has been recorded in Diamond Harbour subdivision. Unhygienic environmental condition is a formidable reason for outbreak of diarrhoea in the urban counter parts of the district. Lack of adequate infrastructural facilities death rate out of this disease is high in Diamond Harbour subdivision which is lower in Alipore and Baruipur subdivisions in comparison to other subdivision. In the study area, death rate out of this disease has decreased over time. Number of deaths to cases out of diarrhoea was highest here in the year 2004. Due to inadequate infrastructural facilities, lethal power out of diarrhoea is high in Kakdwip and Diamond Harbour subdivisions. Maximum number of incidences has been recorded during the rainy spell of monsoon extending from the month of June to September. Agents of diarrhoea disease are very much active during this season. Though, this disease is not unknown throughout the year. Rota virus *E.Coli* also passes through unsafe drinking water. Most of the people collect their drinking water from tube well. After which they do not filter it for safer drink. So they easily fall

victim of this disease. They usually collect water for domestic purpose from the pond. In the remote areas of the district, most of the people use pit latrine toilets which are not hygienic. During rainy season, ponds, canal and low land are fulfilled with rain water. The pit which is used in the rural area also filled with stagnant water and various germs with microbial agents from human stools and urine get mixed with other water bodies. Many persons used this source of water for domestic purpose. As a result they from various water-borne diseases like diarrhoea. Most of the people are not aware about the transmission process of pathogen of such a disease. They are not conscious about safe drinking water. Various mass media like radio, television and news paper take an important role for creation of awareness on safe drinking water.

Conclusion

Education regarding basic health and hygiene among mothers, guardians and health-care providers is necessary for control of diarrhoea disease in the district. The presence of feces around the pit-hole and absence of refuse disposal facility are the major factors associated with diarrhoeal morbidity. Appropriate intervention programmes targeting availability of refuse disposal facilities and care of latrines facility should be improved. People are made aware of this disease and consequences of diarrhoea disease have decreased over time. Government of India has introduced a programme for control of diarrhoea disease in 1985-86. But in many occasions this programme was not successfully implemented in this district. Different NGOs and local authority take important role for control of diarrhoea disease in the area under study. People are needed to become more conscious about the transmission process of pathogen of diarrhoea during and after natural calamity in this fragile ecosystem of West Bengal.

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