ABSTRACT

Globally diarrhea is the second leading cause of death among children under age five. In India, about 0.4 million children are reported to die annually due to diarrhea. Diarrheal disease is caused due to ingestion of pathogens from sources of fecal contamination. Insecure drinking water and poor sanitation are two important reasons for water borne diseases, particularly among young children in suburban areas. The study explores environmental determinants which are closely related to social determinants, since environmental set up of a household decides the socioeconomic condition. Pallikaranai is one of the fast developing peri-urban areas located in the southern part of Chennai Metropolitan Area (CMA); until 2010 it was a town panchayat and from July 2011, it was annexed with Chennai Corporation. Rapid urbanisation led to drainage congestion and seasonal inundation of many of the habitation in this area and increased the population pressure in a small settlement area.

Pallikaranai, a suburb in the southern part of Chennai city located between 12° 55’ 58.87” N to 12° 57’ 48.24” N latitude and 80° 11’ 51.24” E to 80° 13’ 45.20” E longitudes covering an area of 17.36 km² was chosen as the study area. It is one of the fast developing suburban areas in south Chennai and adjoins the Pallikaranai marsh and the Perungudi solid waste dumpsite. The area is a mixture of new settlers, middle class and slum development quarters with a cross section of different economic classes of people. Preliminary survey indicates the environmental problems include access to water supply, quality of drinking water and waste disposal practices.

The study analyzed the groundwater quality and focuses on groundwater microbiology and its relation with other chemical parameters.
The study also focused on health outcomes for specific population groups and analyses the linkage of groundwater, sanitation and ADD through diarrhea index map of sanitation index, E. coli contamination and socioeconomic status of diarrhea affected households. The linkage between diarrheal prevalence and environmental determinants was probed through binary logistic regression.

Ground water quality was gradually degraded towards marsh in the eastern and northeastern part of the study area. EC, TDS and Chloride values exceeded the recommended limits of BIS and WHO standards. Microbiological contamination was not variable between three zones, while it shows variations between shallow and deep wells. The rate of risk for fecal contamination of ground water is high due to the shorter distances between septic tank and source wells and well head coverage. 95% of analyzed samples were found not meeting criteria for potability.

Since all the community wells are shallow wells, the microbial contamination is found high in the post monsoon season. The concentration of all the quality parameters was observed to be high in post monsoon and comparatively low in pre monsoon season. *Vibrio cholera* was observed in CW2, CW3, CW4 wells during post monsoon season. Household storage water shows high microbial contamination, in community water supply than in the other sources (purchased water and ground water) E. coli and Total coliform contamination observed to be increasing from source to pipeline distribution and further increases in the household storage.

The prevalence of diarrhea even in good and satisfactory level of sanitation areas shows that the unprotected water source may be the likely reason. The risk of diarrheal diseases was statistically higher in children from
households in low and middle income than in high income community. The Odds ratio analysis showed an increased risk of diarrheal disease for children drinking the water with the contamination of E. coli >30 cfu/ml (OR, 3: 95% CI).

The index map of diarrheal risk was generated by integrating the thematic map of sanitation quality index, socioeconomic conditions and E. coli contamination of the diarrhea affected households. The demarcation of the diarrheal risk zone was made by grouping the interpreted thematic layers. The weights were assigned based on the knowledge upon their significance to diarrhea. The analysis indicates that the eastern part of study area shows comparatively high diarrheal prevalence. The poor SQI, low income category and high microbial contamination were observed in the eastern and north eastern direction of the study area. The prevalence of diarrhea among children was higher in eastern and northern part of the study area where the ground water quality zone 3 is situated.

The binary logistic regression model output match with the results of index map of diarrheal risk. The model also emphasized to reduce E. coli and increase the cleaning duration of toilets. The risk ranking of the model predicted household ensured that the diarrheal occurrence were high in the northeastern part of the study area, where the water quality is poor and the low income community depend only on community water supply, which is irregular and intermittent. The results of the study suggest both public health and quality of groundwater urgently require broader protection policies for the peri-urban areas that can help develop suitable preventive measures for controlling diarrheal prevalence.