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Water Quality and treatment cost for waterborne disease in rural areas of Coimbatore District, India

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Abstract**:** *This study analysed treatment cost of waterborne disease by households in rural areas of Coimbatore district, Tamilnadu. A multistage sampling method namely systematic, stratified and proportionate random technique was used to select sample villages. 342 sample households were selected. Method of data analysis involved is descriptive statistics and linear regression for the sample households. The linear regression estimates, revealed the increase in the total expenditure per month, affected person children waterborne disease hepatitis and jaundice. Thus the cost of treatment for waterborne disease also increases.*

Keyword: *Water Quality, Treatment cost, Water borne disease, Rural water supply, India*

I. Introduction

Waterborne diseases are caused by contamination of water by virus, bacteria (cholera, typhoid fever, bacillary dysentery etc.), parasites, or chemicals. Water gets contaminated either at source level or while passing through pipes which are poorly laid and maintained, or in the homes when it is not stored properly. About 85 percent of the rural population in India is solely dependent on ground water; so quantity and quality are questionable. About 10 per cent of the rural and urban population does not have access to regular safe drinking water and many more are threatened. Most of them are left with unsafe water sources to meet their daily needs. As a quality concern, the groundwater is often found to be contaminated with fluoride, arsenic, iron and salts. In recent years, fluorosis has posed a greater threat to the public health issue in rural India (R. Srikanth, 2009). Today, 37.7 million Indians are affected by waterborne diseases annually; 1.5 million children are estimated to die of diarrhoea alone and 73 million working days are lost due to waterborne disease each year. The resulting economic loss is estimated approximately at Rs. 26,888 million a year. The problems of chemical contamination are also prevalent in India with 1, 95,813 habitations in the country due to poor water quality. The major chemical parameters of concern are fluoride and arsenic iron is also found to be a major problem with many habitations showing excess iron in the water samples. The provision of clean drinking water has been given priority in the Constitution of India, with Article 47 conferring the duty of providing clean drinking water and improving public health standards to the State. The government has undertaken various programmes since independence to provide safe drinking water to the rural masses. Till the 10th plan, an estimated total of Rs.1, 105 billion was spent on providing safe drinking water. One would argue that though the expenditure is huge, problem of safe and secure drinking water continues to be a major hurdle and a national economic burden (Indira Khurana and Romit Sen).

About 90 percent of waste water discharged daily in developing countries is untreated, contributing to the deaths of some 2.2 million people a year from diarrheal diseases caused by unsafe drinking water and poor hygiene. At least 1.8 million children below the age of five die every year from water-related diseases. Each year 1.6 million children die from diahorreal disease and other gastrointestinal for which contaminated drinking water is a foremost cause (Amrita Ahuja and et al 2010). It has been found that developing countries are facing serious waterborne diseases due to lack of safe drinking water (Bhagirath Behera and V. Ratna Reddy, 2002). UN Millennium Declaration defines a target of halving the proportion of people living in extreme poverty and halving the proportion of people who suffer from hunger and are unable to reach or to afford safe drinking water by 2015.

According to Central Ground Water Board report, Ground water in phreatic aquifers in Coimbatore district in general is colourless, Odourless and slightly alkaline in nature. It is observed that the ground water is suitable for drinking and domestic uses in respect of all the elements except total Hardness and Nitrate. Total Hardness as $CaCO_3$ is observed to be in excess of permissible limits in about 39 percent of the samples analysed, whereas Nitrate is found in excess of 45 mg/l in about 80 percent samples. The incidence of high total hardness is attributed to the composition of litho units constituting the aquifers in the district, whereas the nitrate pollution is most likely due to the use of fertilizers for agriculture and other improper waste disposal.

II. Review of Literature

Ravichandran M and S. Boopathi (2007), in his book of Environmental Management issues and potable water in rural Tamilnadu, the study covered 311 sample respondents across 5 villages in Tiruchirappalli District of Tamilnadu; the empirical study of water quality results confirmed that water samples collected from 20 points across the five sample village. Samples were drawn both from surface and ground water and measured the quality of samples for pH, Calcium, Magnesium, Sodium, Potassium, Fluoride, Total Dissolved Solids and etc., the results of the study shows that the presence of faecal coliform over and above the permissible level in surface water, while the physical and chemical parameters exceeded the tolerance limits in groundwater sources. Though health hazards owing to contaminate water are prevalent, the majority of the households is unaware of the linkage between unsafe water and waterborne diseases. Primary survey results confirmed that 67.8 percent of the households were unaware of waterborne diseases. More than one tenth of the household respondents suffered from typhoid fever, 4.5 percent had diarrhoea and 13.2 percent were affected with jaundice. The average treatment cost per household per annum was Rs.1983 and average travel to avail medical facilities 14.75 kilometres. In wet area, nearly 52 percent of the affected people approached Government hospitals for treatment, whereas, 28 percent preferred private hospitals and 20 percent depended on native medicines.

Oguntoke O and et al (2009) their empirical study examined the relationship between the spatial pattern of waterborne diseases with reference to water quality in parts of the Ibadan city in Nigeria. For this study 1334 cases of various waterborne diseases were collected from eight public hospitals with catchments covering the study area and 350 residents of the selected areas to elicit information on water sourcing, handling and storage. Analysis of hospital records showed significant difference in the occurrence of waterborne diseases among residential areas typhoid fever had the highest occurrence is 33.3 percent followed by bacillary dysentery and cholera. The majority (77.1 percent) of the respondents depended on wells and major source of domestic water. Provision of adequate potable water remains the most important tool for preventing waterborne diseases in the study area.

Pradhan B and et al, made a study on quality of drinking water used by the communities and their knowledge towards water quality and waterborne diseases 110 sample households used by the communities were selected for this study and twenty five water samples at sources and consumption points representing all sources, wells, stone spouts, ponds, streams, public and private taps. This study found that in dry summer month incidence of diarrhoea appears to be the most acute problem in rural region. The reason is the majority of the households are not aware about water contamination, inadequate supply and poor quality of drinking water. The Major finding of his study confirmed that one third of the sample households had used hand washing practices by water and soil after defecation, which might be a major cause of water borne diseases.

Depiction from the observations made by Swerdlow (1992), it is clear that the environmental factor 'water' and the problem of waterborne diseases, especially diarrhoeal diseases are linked up via two different mechanisms; through the supply of contaminated water and or lack of water for personal hygiene. Hence, this study carried out examining the environmental and economic component to calculate the treatment cost of waterborne disease posed by the poor water quality in the rural areas of Coimbatore District. Specifically the study examines the factor to determine the treatment cost for waterborne diseases.

III. Materials and methods

Coimbatore District, located in the state of Tamilnadu has been chosen for the study. The Primary data were collected by using structured questionnaires. The study analysed both primary and secondary data. 342 sample households were selected across 4 taluks, 3 blocks, 4 village Panchayats and 31 habitations. Multistage sampling method has used for this study namely systematic, stratified proportionate random sampling methods to select the sample villages. To identify the study area lots of inputs has been used. The variables including water level, Rainfall, Litre Per Capita per Day (LPCD), Water quality, Percentage of cultivated area, area less irrigated, area which is partially irrigated, and, partially less irrigated and percentage of water intensive crop cultivated were used in order to identify and fix the sample villages. These areas can be divided according to the nature of soil persistence, ground water availability and the produce. Totally four villages were selected and grouped under four categories viz., Wet, Mixed (partially wet & partially dry), Dry (arid) and Hilly region. As per data classified the 'Anamalai' Block was chosen under Hill and Wet area categorization, where the villages viz., 'Nedungundra' was selected under Hill area category, where the Scheduled Tribes population is located. The 'Subbegoundanpudur' was selected under Wet area and 'Ambothi' Village in 'Annur' Block was selected under dry area. Under the Mixed area (partially wet and partially dry) classification 'Thondamuthur' block was chosen in which 'Madampatti' village was selected as the study area of the total households, in the four selected villages, 10 per cent of the sample households were chosen proportionately.

The secondary data sources on the status of water quality in Coimbatore District, the district chosen for study, across 12 blocks and water quality data were collected from the Tamilnadu Water supply and Drainage Board (TWAD) and Public Works Department (PWD) for 20 years. Descriptive statistics such as frequency distribution tables, mean and standard deviation was used to analyse the status of water quality and treatment cost for waterborne disease of the respondents. The linear regression analysis was used to factor determining

treatment cost of waterborne disease in rural areas of Coimbatore District. The statistical package for social sciences (SPSS version 17.0) was used for the analysis.

IV. Results and Discussion

Water quality is a major issue in rural areas in India. Unsafe water causes 4 billion cases of diarrhoea each year, and results in 2.2 million deaths, mostly of children under five. This means that 15 percent of child deaths each year is attributable to diarrhoea – child dying every 15 seconds. In India alone, the single largest cause of ill health and death among children is diarrhoea, which kills nearly half a million children each year (UNEP, 2010). The quality of water is an important as the provision of adequate water supply, since the latter satisfies the quantity while the former ensures its potability. In India drinking water gets contaminated due to a host of reasons, starting from a rapid growth of population, industrialization, urbanization and excess use of chemicals etc. In rural areas, improper maintenance of hand pumps sites and open-air defecation cause havoc on water quality besides other reasons (Ravichandran M and S. Boopathi, 2002).

Coimbatore district is divided into 6 taluks. The talks are further divided into 12 blocks, which further divided into 229 village Panchayats. The district is part of the composite east and west flowing river basins and Cauvery basins. Bhavani, Noyyil, Amaravathi, Parambikulam-Aliyar and Valparai are the important sub basins. The district receives the rain under the influence of both southwest and northeast monsoons. The northeast monsoon chiefly contributes to the rainfall in the district and summer rains are negligible. The normal annual rainfall over the district varies from about 550 mm to 900 mm. About 60 percent of the district is covered by red soils, of which red calcareous soil is predominant. Medium to deep red calcareous soils are found mainly in Pollachi taluks. The depth to water level in the district varied between 1.54 and 39.03 m bgl during pre monsoon and varied between 0.62 and 36.42 m bgl during post monsoon. As already mentioned under introduction, ground water in phreatic aquifers in Coimbatore district in general is colorless, odourless and slightly alkaline in nature, which is observed that the ground water is suitable for drinking and domestic uses in respect of all the constituents except total Hardness and Nitrate. Tamilnadu Water Supply and Drainage (TWAD) Board is the Government agency responsible for providing drinking water supplies to the rural population in the district. The water requirements of the habitations are met through either surface water sources or through various Combined Water Supply Schemes (CWSS) utilizing the available ground water resources.

Table 1: Status of water quality in Coimbatore District

Area	TDS (mg/l)	NO3 (mg/l)	Ca (mg/l)	mg (mg/l)	Na (mg/l)	Cl (mg/l)	So4 (mg/l)	F (mg/l)	p^H (mg/l)
WHO	**1000**	**45**	**200**	**100**	**200**	**250**	**400**	**1.5**	**6.5-8.5**
BIS	**2000**	**100**	**200**	**100**		**1000**	**400**	**1.5**	**6.5-8.5**
Coimbatore North	1031.81	31.35	61.79	81.32	162.93	269.54	120.48	0.76	8.08
Coimbatore South	1263.57	29.85	96.91	88.63	**204.83**	404.96	122.88	0.71	7.9
Mettupalayam	1165.08	25.69	58.14	88.46	**206.38**	345.15	107.91	0.83	8.14
Pollachi	1179.24	27.38	86.18	86.88	182.74	383.36	161.62	0.79	8
Sulur	1021.54	22.49	51.29	67.45	173.56	279.88	141.04	0.73	8.03
Valparai	434.4	11.5	41.6	22.5	70	81.33	40	0.83	7.98
Total	**1143.2**	**27.19**	**75.9**	**84.01**	**184.14**	**350.15**	**140.45**	**0.77**	**8.02**

Source: Tamilnadu Water Supply and Drainage Board (TWAD) and Public Works Department (PWD), Chennai 2010,

***BIS** – Bureau of Indian Standard; (W) - sample resource from well; (S) - sample resource from spring

Table 2: Chemical parameters of Water quality in sample areas

Area	Statistics	TDS (mg/l)	AK (mg/l)	TH (mg/l)	Iron (mg/l)	Nitrate (mg/l)	SO4 (mg/l)	CL (mg/l)	F (mg/l)
	WHO	**1000**	**-**	**500**	**0.3**	**45**	**400**	**250**	**1.5**
	BIS*	**2000**	**600**	**600**	**1.0**	**100**	**400**	**1000**	**1.5**
Wet	**Mean**	693.46	316.86	255.71	0.46	30.05	2.29	8.57	0.66
	Minimum	399	212	100	0	2.232	0	0	0.2
	Maximum	1386	385	415	0.78	93	11	40	0.96
Mixed	**Mean**	834.6	191.88	252.75	0.49	34.5	8.88	33	0.36
	Minimum	34	0	0	0	1	0	0	0
	Maximum	**1722**	340	540	**3.71**	**220**	18	80	0.6
Dry	**Mean**	763.62	186.19	249.62	0.52	29.02	24.33	62.52	0.37
	Minimum	85	32	30	0	5	0	0	0
	Maximum	**4788**	580	**1480**	**6.77**	100	60	232	1
Hilly	**Mean**	350.25	-	-	-	-	35.0	78.13	0.74
	Minimum	-	-	-	-	-	-	-	-
	Maximum	-	-	-	-	-	-	-	-

Source: Tamilnadu Water Supply and Drainage Board (TWAD) and Public Works Department (PWD), Chennai 2010,

***BIS** – Bureau of Indian Standard

The above table 1 discusses about the quality of water in Coimbatore District based on the World Health Organisation (WHO) and Bureau of Indian Standard (BIS) standards. The parameters considered to assess the water quality were TDS, NO_3 , Ca, mg, Na, Cl, So_4, F, pH. All the parameters in Coimbatore north, Coimbatore south, Mettupalayam, Pollachi, Sulur and Valparai found to be within the permissible limits. In Coimbatore south and Mettupalayam taluks, i.e., all the parameters were found to be within permissible limit except Na which was little high 204.83 mg/l and 206.38 respectively. Valparai taluk could be considered as special category which is a hilly region and water was very perfectly potable with all the parameters within the permissible limit. On the whole, Coimbatore district fulfills the permissible limits of all the parameters prescribed by WHO and BSI and found to be suitable for the safe drinking water purpose.

Table 2 the water samples were collected from different territorial regions, viz., wet, mixed, dry and hilly and the parameters used to assess the water quality were TDS, Ak, TH, Fe, Nitrate, SO_4, Cl and Fluoride based on the WHO and BIS permissible limits for potable water. Wet and Hilly region satisfies all the parameters within the permissible range of potable water; whereas mixed region has a high range of Iron and Nitrate i.e., 3.71 mg/l and 220 mg/l respectively. Likewise, dry region too found to contain some of the parameters very high from the permissible limit i.e., TDS - 4728 mg/l to 2000 mg/l; TH – 1480 mg/l to 600 mg/l and Fe 6.77 mg/l to 1.0 mg/l. In dry areas, primary survey confirms that Typhoid and Jaundice are reported in large number that is 36.36 percent and 27.27 percent respectively compare to other areas. The data suggest that, though there seems to be slight variations in the parameters mixed and dry region; water can be considered as potable from these regions, because of very less number of parameter shows variations.

Table 3 (a): Water borne diseases and Cost of treatment

Area	Persons without water borne diseases	Water borne diseases					Affected persons			Hospitals			Statistics	Treatment cost Per annum	Distance move for treatment (km)
		Typhoid	Cholera	Hepatitis	Diarrhoea	Jaundice	Women	Men	Children	GH	Private	PHC/Local			
Wet	67	8	4	1	7	4	8	10	6	3	13	8	Sum	55000	132
	(73.63)	(33.33)	(16.67)	(4.17)	(29.17)	(16.67)	(33.33)	(41.67)	(25.00)	(12.50)	(54.17)	(33.33)	Mean	2391.30	5.74
Mixed	78	8	7	4	8	9	13	18	5	9	16	11	Sum	117000	260
	(68.42)	(22.22)	(19.44)	(11.11)	(22.22)	(25.00)	(36.11)	(50.00)	(13.89)	(25.00)	(44.44)	(30.56)	Mean	3656.25	8.13
Dry	80	8	4	1	3	6	9	7	6	12	8	2	Sum	60250	314
	(78.43)	(36.36)	(18.18)	(4.55)	(13.64)	(27.27)	(40.91)	(31.82)	(27.27)	(54.55)	(36.36)	(9.09)	Mean	2869.05	14.95
Hilly	29	0	2	0	4	0	1	3	2	5	1	0	Sum	7150	159
	(82.85)	(00.00)	(12.50)	(0.00)	(25.00)	(00.00)	(16.66)	(50.00)	(33.33)	(83.33)	(16.67)	(0.0)	Mean	476.67	12.01
Total	254	24	17	6	22	19	31	38	19	29	38	21	Sum	239400	865
	(74.27)	(27.27)	(19.31)	(6.81)	(25.00)	(21.59)	(35.22)	(43.18)	(21.59)	(32.95)	(43.18)	(23.86)	Mean	2630.77	10.20

Source: Primary data (2010), GH – Government Hospital

Table 3 (b): Area wise Sources and Diseases

Diseases	Sources		% to the total
	Modern	Traditional	
Wet area			
Not affected	64 (70.33)	3 (3.30)	67 (73.63)
Typhoid	8 (8.79)	0 (0.0)	8 (8.79)
Cholera & Diarrhoea	4 (4.40)	0 (0.0)	4 (4.40)
Hepatitis	1 (1.10)	0 (0.0)	1 (1.10)
Diarrhoea	7 (7.69)	0 (0.0)	7 (7.69)
Jaundice	4 (4.40)	0 (0.0)	4 (4.40)
Mixed area			
Not affected	74 (64.91)	4 (3.51)	78 (68.42)
Typhoid	8 (7.02)	0 (0.00)	8 (7.02)
Cholera & Diarrhoea	7 (6.14)	0 (0.00)	7 (6.14)
Hepatitis	4 (3.51)	0 (0.00)	4 (3.51)
Diarrhoea	8 (7.02)	0 (0.00)	8 (7.02)
Jaundice	8 (7.02)	1 (0.88)	9 (7.89)
Dry area			
Not affected	69 (67.6)	11 (10.78)	80 (78.43)
Typhoid	6 (5.9)	2 (1.96)	8 (7.84)
Cholera & Diarrhoea	3 (2.9)	1 (0.98)	4 (3.92)
Hepatitis	0 (0.0)	1 (0.98)	1 (0.98)
Diarrhoea	3 (2.9)	0 (0.00)	3 (2.94)
Jaundice	5 (4.9)	1 (0.98)	6 (5.88)
Hilly area			

Not affected	0 (0.0)	29 (82.85)	29 (82.85)
Typhoid	0 (0.0)	0 (0.00)	0 (0.00)
Cholera & Diarrhoea	0 (0.0)	2 (5.71)	2 (5.71)
Hepatitis	0 (0.0)	0(0.00)	0(0.00)
Diarrhoea	0 (0.0)	4(11.43)	4(11.43)
Jaundice	0 (0.0)	0 (0.00)	0 (0.00)

Source: Primary data (2010)

Figures in parentheses indicate percentage to the total

The table 3 (a) reveals the occurrence of waterborne diseases, types of hospitals approached, expenses incurred and distance travelled towards treating it. Among the sum total of the respondents, three fourths (74.27 Percent) of them are not affected by any of the waterborne diseases irrespective of land classifications. Respondents of Hilly area (82.85 percent) are much not vulnerable than the other counterparts. Amidst the waterborne diseases, across the area classification, above one third suffered of typhoid (27.27 percent) followed by Diarrhoea (25.00 percent), Jaundice (21.59 percent), Cholera (19.31 percent) and Hepatitis (6.81 percent). Respondents who belong to the dry (36.36 percent) areas are the most affected by typhoid. One fourth of respondents are affected by diarrhoea (25.00 percent) and one eight of the respondents are affected by cholera (12.50) in the hilly area. Subsequently one fourth of the mixed area respondents are affected by Jaundice (25.00 Percent) followed by typhoid (22.22 Percent) and diarrhoea (22.22 Percent) in equal proportion, cholera (19.44 Percent) and hepatitis (11.11 Percent). One third of the respondents in wet area are affected by typhoid (33.33 percent), three out of ten are affected by diarrhoea (29.17 percent), one sixth by cholera (16.67 percent) and jaundice (16.67 percent), and the remaining are by hepatitis (4.17 percent).

The vulnerability to the diseases are higher among men (43.18 percent), followed by women (35.22 percent) and children (21.59 percent). Children's are mostly affected by diarrhoea and cholera. Among the infected, two fourths are men (50.00 percent) mixed area and (50.00 percent) hilly area followed by wet (41.67 percent) and Dry (31.82 percent) area of the respondents are affected by waterborne diseases. Whereas, in Dry area, Women (40.91 percent) are more vulnerable than others. Children affected by waterborne diseases are comparatively less in a mixed area (13.89 percent) than wet and dry that consists of one fourth (25.00 percent), more than one fourth (27.27 percent) in dry and one third (33.33 percent) in hilly areas.

More than four out of ten (43.18 percent) respondents prefer and visit private hospitals due to emergency and indifferent attitude towards treatment rendered by government hospitals, a little less one third (32.95 percent) take treatment in Government Hospitals and the remaining less than one fifth (23.86 percent) get the treatment from local hospitals, owing to accessibility pertaining to the economic conditions.

Average cost Per annum (476.67) incurred towards treating the diseases is comparatively low in Hilly areas, in spite of the fact that 17.15 percent of them are prone to waterborne diseases, since more than eight out of ten (83.33 percent) go to Government Hospitals by travelling 12 kms on an average, the rest (16.67 percent) go to private hospitals. Mixed area people expend more (Rs. 3656.25 per annum), as the geographical location of the study area is near to the Coimbatore city which facilitates availability of private hospitals in the circumference. Respondents of Dry area have to travel 15 Kilometers on an average to reach either Government or Private clinics, which costs them annually Rs. 2869.05 per household. A little above half (54.55 percent) of the dry area habitats goes to Government hospitals, due to poor economic conditions, and above one third (36.36 percent) go to private hospitals. The trend among wet area is slightly different as the proximity (5.74 kms) and service orientation towards rural people from the private hospital enables the infected to get their treatment relatively at a lower cost (Rs. 2391.30 per annum). One third (33.33 percent) of them are going to local hospitals.

Table 3 (b) reveals the area wise available sources which include Modern (house service connection, stand post and overhead tank [on spot]) and Traditional (irrigation well and spring) and resultant waterborne diseases. The traditional system of water source in Hilly area does not carry any chemical particles which causes contamination. The overwhelming majority (82.85 percent) of respondents is not affected any of the notified diseases. The significant proportion of respondents are not affected in the dry area (78.43 percent) and mixed area (68.42 percent) for they are benefited by Combined Water Supply Scheme (CWSS). In wet area, a considerable proportion (73.63 percent) of respondents is not affected by waterborne diseases due to purified supply of Aliyar Dam water by local bodies for drinking and other domestic purposes.

V. Results of Regression analysis

At the household level fourteen variables have been identified, which include medical expenditure per month, Total expenditure per month, LPCD, Affected person men, Affected person women, affected person children, water borne disease Cholera, waterborne disease hepatitis, where do you get treatment for waterborne disease and etc., Correlation matrices were applied to understand and shortlist the variables, which influence the cost of treatment for waterborne diseases at the household level. Out of fourteen variables, twelve variables exhibit a high percentage of correlation. Medical expenditure per month, total expenditure per month, affected person men, affected person children, waterborne disease cholera & diarrhoea, hepatitis, Jaundice, where do you get treatment for waterborne disease (dummy variable 1. Government hospital, 2. Private hospital, 3. Local

hospital), distance move for treatment, the amount spent for diseases affect by chemical parameters per year and family size were considered for running the regression against the treatment cost for waterborne diseases.

Table 4: Cost of treatment for waterborne disease

Sl.No.	Independent Variables	Regression Co-efficient	Std. Error	't' Value	Sig.
1	**Constant**	-492.330	186.332	-2.642	.009
2	X_1	.180	.229	.787	.432
2	X_2	.084	.036	2.345	.020
3	X_3	12.057	265.532	.045	.964
4	X_4	620.360	306.547	2.024	.004
5	X_5	1766.931	285.662	6.185	.000
6	X_6	3902.444	458.231	8.516	.000
7	X_7	651.469	284.034	2.294	.022
8	X_8	839.491	94.431	8.890	.000
9	X_9	13.432	14.295	.940	.348
10	X_{10}	3.754	1.407	2.669	.088
11	X_{11}	38.781	48.487	.800	.424

N = 342, **R** = .812, $\mathbf{R^2}$ = .659
Significant at 5% level

Functions: $Y = a \pm b_x$

$Y = -492.330 + .180_{(ME)} + .084_{(TEM)} + 12.057_{(APM)} + 620.360_{(APC)} + 1766.931_{(WBDCD)} + 3902.444_{(WBDH)} + 651.469_{(WBDJ)} + 839.491_{(WTWBD)} + 13.432_{(DMT)} + 3.754_{(ASDACP)} + 38.781_{(FS)} + Error$

Where Y = Cost of treatment for water borne disease

a = Constants

X_1 = Medical Expenditure per Month (ME)

X_2 = Total Expenditure per Month (TEM)

X_3 = Affected Person Men (APM)

X_4 = Affected Person Children (APC)

X_5 = Water Borne Disease – Cholera & Diarrhoea (WBDCD)

X_6 = Water Borne Disease - Hepatitis (WBDH)

X_7 = Water Borne Disease - Jaundice (WBDJ)

X_8 = Where do you get Treatment for Water Borne Disease (WTWBD) (1.Government, 2. Private, 3.Local)

X_9 = Distance Move for Treatment (DMT)

X_{10} = Amount Spent for Disease Affected by Chemical Parameters per year (ASDACP)

X_{11} = Family Size (FS)

μ = Error term

Table 4 presents the regression analysis of the factors that determine treatment cost of waterborne disease. The result shows that medical expenditure per month, affected person men, distance move for treatment, the amount spent for the disease affect by chemical parameters per year and family size do not significantly influence the treatment cost of waterborne disease. However, total expenditure per month, affected person children, waterborne disease cholera & diarrhoea, hepatitis, jaundice and where do you get treatment for waterborne disease are cost of treatment of waterborne disease are statistically significant at $P > 0.05$ level.o The R square value turns on to be 0.66. This shows that 66 percent of the variations are explained by the variations in the independent variables. All significant variables are positively related to treatment costs of waterborne disease. This increase indicates that the total expenditure per month, affected person children waterborne disease cholera & diarrhoea, hepatitis, jaundice the cost of treatment for waterborne disease also increases.

VI. Conclusion

Ground water is major source for drinking water in Coimbatore District. The Water quality data indicates that the standards prescribed for drinking with respect to all the parameters as prescribed by BIS and WHO. Significant percentage of the respondents do not affect by water borne diseases. The study points to the fact that water sources for domestic uses in different parts of study area such as wet, mixed, dry and hilly area are fit for drinking.

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