A multidimensional analysis of preventative healthcare measures in India, with special reference to Madurai District, Tamil Nadu

Dr. P. Devi Priya

Assistant Professor of Economics, Lady Doak College, Madurai-625002, Tamil Nadu, India
devipriya@ldc.edu.in

Abstract

Objectives: To assess the level of privileged preventive measures among the States and districts of Tamil Nadu and comprehend the pattern of preventive measures at the household level in Madurai district.

Methods and Statistical Analysis: Census 2011 data was used to study the preventive measures at the State level. Household data were collected from 720 households in Madurai district, with 360 from rural and urban each by adopting a three stage stratified sampling method. At household level Multidimensional Preventive Headcount Index was computed. Chi-square was used to find the relationship between the preventive measures and place of residence, education and economic status

Findings: At the national level, the indices reflect that most of the southern states especially Tamil Nadu was moderately privileged. A wide regional disparity was observed that 42% of urban are in privileged status while in rural it is only eight percent. A similar trend was observed in Tamil Nadu that tends to increase the morbidity rates. The same pattern was observed in the district and household level. The findings were similar to the results of Census 2011 and NFHS-4 Phase I (2015-16). Chi-square results reiterate the impact of place of residence, education of the head and economic status on the adoption of preventive measures. Zero dimension privilege was found among four percent of rural households which emphasises the urgent need to improve the rural part of the district.

Conclusion/Suggestions: Preventive healthcare should be perceived as an investment and concentration on them would mitigate the communicable disease incidence and create positive externality. To reduce the regional inequalities, rigorous implementation of the preventive measures has to be made in rural areas particularly.

Keywords: Preventive measures, Source of cooking, Drinking water and it treatment, Type of house.

1. Background

India is the seventh largest country by area and second most populous country with 1.2 billion people. Over the six and a half decades of independence India has made notable achievements in health sector. Life expectancy at birth in India which was 37.1 and 36.1 years for male and female in 1951 has increased to 65.8 and 69.3 years in 2009-13.Some diseases such as small pox, polio and guinea worm have been eradicated. Yet the country faces considerable challenges that it accounts for relatively largest share of world's disease burden. Rapid changes in India's core epidemiological profile have led to double burden of communicable diseases and non-communicable diseases. The causes of death statistics reports that the communicable disease death has declined (2001-03-38.2%; 2010-13-27.7%) while non-communicable disease is on an increase from 42.4% in 2001-03 to 49.2% in 2010-13. The communicable diseases tuberculosis, kalaazar, dengue fever, chikungunya and other vector borne diseases and water borne diseases like cholera, diarrheal diseases constitute major public health problems in India. In fact diarrheal diseases, respiratory infections,malaria and tuberculosis cause about one-quarter of all deaths in the country [1].Prevention is better than cure. Preventive healthcare is an important determinant of health since prevention means avoiding or slowing the course of a disease which is essential for a good quality of life.

Four-fifths of diseases in India are caused by five factors: lack of clean drinking water, insanitary living conditions, pollution of all types, inadequate nutrition and stress. Simple measures can prevent 80% of the infectious and communicable diseases afflicting the people [2]. Hence proper preventive measures at the household and community level would enable to lead a healthy life. But despite being about as rich as Bangladesh in terms of per capita GDP, India lags behind Bangladesh in terms of child vaccination rates, breastfeeding practices, incidence of open defecation, access to safe water and related indicators. The same point applies if we compare India with Nepal which is even poorer than Bangladesh [3]. This reflects that though rapid progress in certain areas like safe delivery, vaccination has been achieved there is still neglect of health and nutrition matters over a long period of time.

2.   Importance of the study

The living environment has the potential relationship of either impairing or improving human health. A sanitary toilet within or near the home, provides privacy and dignity to women. Drinkingunsafe water anddisposal of human excreta in open space hosts many medical problems. This has a serious impact on the health of the population. Poor environmental sanitation perpetuates water borne diseases which increases the incidence of morbidity and mortality simultaneously.

The states which have a lower level of access to drinking water and sanitation experience poor health outcomes. The only state with diversified performance is Tamil Nadu with moderate health facility, low score of index of sanitation and still enjoying high performance in IMR. Delhi and Kerala are only two states thathave a relatively higher level of water and sanitation facilities and also low IMR i.e. high performance on health. On the other side, the states of Odisha, Chhattisgarh, Madhya Pradesh and Rajasthan have lower level of water and sanitation facilities accompanied with lower level of health performance. Six states namely Jammu and Kashmir, Himachal Pradesh, Haryana, Gujarat, Andhra Pradesh and Karnataka exhibit moderate achievement in all the indicators. Bihar, Jharkhand Maharashtra, Assam and Uttar Pradesh show low and moderate performance. West Bengal which performs high on IMR front has suffered a low level of sanitary facility [4]. Hence proper preventive measures at the household and community level would enable to lead a healthy life.

3.   Objectives

In this regard the paper makes an attempt to analyse the level preventive measures undertaken by the households. The objectives of the study are to:
1.   Assess the level of privileged preventive measures among the Indian Statesand districts of Tamil Nadu.
2.   Comprehend the pattern of preventive measures at the household level and its dimensions in Madurai district, Tamil Nadu.

1.   Design
Census 2011 data is used to know the preventive measures at the States. To study the level of preventive measures at household level and its achievement in various dimensions, household level data was collected from 720 households in Madurai district, Tamil Nadu with 360 from rural and urban each by adopting a three stage stratified sampling method.

2.   Tools of analysis
To understand and compare the level of preventive measures undertaken for the 24 states in India privileged Preventative measure index was computed state wise. The following categories of variables were considered as privileged from Census 2011:

1.   Drinking water from treated source, covered well and tube well/borehole
2.   Latrine inside the premises, usage of public latrine as alternative
3.   Closed drainage
4.   LPG/Electricity and biogas as source of cooking
5.   Permanent housing type

Each variable was standardised using the following formula,

$$S \tan dardised \ score = \frac{100 - Observed}{100 - Minimum}$$

The Preventive measure index was found from the average of these five standardised scores for each statewhich is grouped in five intervals. The least score indicates accomplishment and high score points less privilege or deprived status.

At household level, LPG and electricity as cooking source, drinking water from hand pump, tap and buying water, treated drinking water, availability of latrine, closed drainage and pucca housing are considered as achievement preventive measures. Multidimensional Achievement index for the headcount of the households were computed using the formula [5]. The Multi-dimensional Preventive Headcount Index (MPHI) is computed by

$$MPHI = \sum_{j=1}^{K} \left(\frac{j}{K} \right) H_j$$

Where H_j is the proportion of population that is privileged in exactly j dimension ($j = 0,1,2...6$) and K is the total number of dimensions considered for the analysis.

Chi-square was used to find the relationship between the preventive measures and place of residence, education of the head and economic status of the households.

4. Privileged preventive measures in India

According to 2011 census, in India the access to improved source of water is 92% (Rural-89%, Urban-96%) whereas in case of access to improved sanitation is only 35% (Rural-24%, Urban-60%). Independent understanding of improvement in each of the aspect often conceals the extent of combinedpaucity that exists. Hence a cumulative summary account for all the five dimensions is entailed.The present analysis considers the privileged feature of each dimension like drinking water from treated source, covered well and tube well/borehole, latrine inside the premises and usage of public latrine as alternative, closed drainage, LPG/Electricity and biogas as source of cooking and permanent type of housing. Preventive scores help to understand the extent of differences prevailing in the state and also the position of each among others.

Table 1. Classification of states of India as per the preventative index, 2011

Index	Rural	Urban	Total
<0.2	Chandigarh (4%)	Chandigarh (4%)	Chandigarh, NCT of Delhi (8%)
0.21-0.4	NCT of Delhi (4%)	Himachal Pradesh, NCT of Delhi, Punjab, Uttarakhand, Haryana, Gujarat, Maharashtra, Sikkim, Andhra Pradesh (38%)	Punjab (4%)
0.41-0.6	Punjab, Himachal Pradesh, Uttarakhand, Kerala, Haryana (21%)	Karnataka, Jammu & Kashmir, Rajasthan, India, Uttar Pradesh, Tamil Nadu, West Bengal, Assam, Madhya Pradesh, Kerala (38%)	Himachal Pradesh, Uttarakhand, Haryana, Maharashtra, Kerala, Gujarat, Tamil Nadu, Andhra Pradesh (29%)
0.61-0.8	Andhra Pradesh, Uttar Pradesh, Maharashtra, Tamil Nadu, West Bengal, India, Gujarat, Bihar, Assam, Rajasthan, Sikkim, Jammu & Kashmir, Karnataka, Odisha (54%)	Bihar, Arunachal Pradesh, Odisha, Jharkhand, Chhattisgarh (21%)	Karnataka, West Bengal, India, Uttar Pradesh, Sikkim, Rajasthan, Jammu & Kashmir, Assam, Bihar Madhya Pradesh (38%)
8.1-1.0	Madhya Pradesh, Chhattisgarh, Arunachal Pradesh, Jharkhan (17%)	-	Arunachal Pradesh, Odisha, Chhattisgarh, Jharkhand (17%)

Source: Computed from Census 2011

Table 1 presents that overall one-fourth of the states fall in the moderate level whereas half of them are less privileged. Demographically advanced states show a better performance of being in better privileged and medium category. But place of residence shows a different pattern. A big regional disparity is observed that urban (42%) are in privilege status while in rural three-fourth of the states are deprived. A similar trend is observed in Tamil Nadu that tends to increase the morbidity rates. Another important inference is that the Empowered Action Group states (Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Odisha, Rajasthan, and Uttar Pradesh, except Uttarkand) and Assam are the least privileged.

The states which lagged in literacy rate were found behind all. While those that topped in literacy level, which had improved life expectancy through reduced death rates and more curative care in par lagged in preventive care which is reflected in their high morbidity levels.A disaggregated analysis is made for Tamil Nadu to draw more implications. Tamil Nadu has 32 districts. District wise preventive scores helps to understand the extent of differences prevailing in the state in the performance of the preventive variables selected and also the position of Madurai District among others.

Table 2. Classification of districts of Tamil Nadu as per the preventative index, 2011

Index	Rural	Urban	Total
<0.2	-	-	-
0.21-0.4	-	Chennai (3%)	Chennai (3%)
0.41-0.6	-	Madurai, Coimbatore, Thiruvallur, Kancheepuram, Krishnagiri, Tiruchirappalli, Tiruppur, Tamil NaduKarur, Erode (28%)	Coimbatore,Thiruvallur, Kancheepuram,Tiruppur, Madurai(16%)
0.61-0.8	Kanniyakumari, Coimbatore, Erode, Tiruppur, The Nilgiris, Namakkal, Tirunelveli, Theni, Thiruvallur, Kancheepuram, Karur, Tiruchirappalli, Thoothukkudi (42%)	Namakkal, Thoothukkudi, Vellore, Sivaganga, Cuddalore, Salem, Tiruvannamalai, Theni, Tirunelveli, Viluppuram, Pudukkottai, Nagapattinam, Dindigul, Ramanathapuram, Dharmapuri, Virudhunagar, Kanniyakumari, Perambalur, The Nilgiris, Thanjavur, Thiruvarur (66%)	Erode, Kanniyakumari, Theni, Tiruchirappalli, Namakkal, Tirunelveli, Tamil Nadu, The Nilgiris, Thoothukkudi, Salem, Karur, Vellore, Virudhunagar, Dindigul, Krishnagiri, Sivaganga, Cuddalore (50%)
8.1-1.0	Salem, Madurai, Virudhunagar, Tamil Nadu, Nagapattinam, Vellore, Dindigul, Krishnagiri, Sivaganga, Cuddalore, Tiruvannamalai, Thanjavur, Thiruvarur, Pudukkottai, Dharmapuri, Perambalur, Ramanathapuram, Viluppuram, Ariyalur (58%)	Ariyalur (3%)	Nagapattinam, Thanjavur, Ramanathapuram, Tiruvannamalai, Pudukkottai, Thiruvarur, Dharmapuri, Perambalur, Viluppuram, Ariyalur (31%)

Source: Computed with data from Census 2011

Table 2 depicts that overall only 16% of the districts falls in the moderate category, 50% of them are poorly privileged and 31% in the least position. In the state the presence of regional divide is obvious. Similar pattern is observed throughout, that 28% in urban fall in the moderate category and 58% in the rural fall in the very poor level aggregate of preventive status. Out of the 32 districts, Madurai stands fifteenth in rural (0.81), second in urban (0.46) and sixth in overall (0.58) with least score. The persisting rural disadvantage results in fall in the overall plane. On the whole, Madurai district stands in a better level compared to the status of Tamil Nadu but rural needs betterment.

5. At household level

Each of the basic human needs has its own characteristics and differential impact on the health of people. Household environment factors have significant morbidity linkage and regulate morbidity prevalence and pattern at the household as well as the community level. Hygienic condition is linked with social and economic status of the individuals. Among the many preventive measures the four prime indicators like source of cooking, drinking water and its treatment, availability of toilet facility in the house and drainage has been selected and the level of preventive measures undertaken for healthy well-being by the sample household is assessed.

1. Source of cooking

Liquid petroleum gas, kerosene and biomass are the major source of cooking fuels.Biomass (wood, agricultural residues, animal dung) and coal used as energy source when burned indoors without chimneys or smoke hoods are associated with high levels of indoor air pollution and an increase in the incidence of respiratory infections, including pneumonia, tuberculosis and chronic obstructive pulmonary disease, low birth weight, cataracts, cardiovascular events and is a cause of mortality both in adults and children.

Kerosene, a cleaner alternative compared to solid fuels, has been an important household fuel since the mid-19th century. The least polluting alternatives at the household level are solar power and electricity. Gaseous fuels, particularly liquefied petroleum gas (LPG) and natural gas results in fewer products of incomplete combustion compared to solid fuels. But these alternatives are chosen based on the availability and affordability of the households. Household accessing low-emission cooking technologies are the key health-relevant and indicators of progress on sustainable energy.

Table 3. Distribution of households by the major source of cooking

Variables		LPG	Electricity	Kerosene	Firewood	Total
Place of Residence*	Rural	215(60)	0	36(10)	109(30)	360(100)
	Urban	303(84)	4(1)	42(12)	11(3)	360(100)
Education of the Head*	No Formal Education	64(62)	0	26(25)	13(13)	103(100)
	School	309(67)	1(0.2)	90(19)	63(14)	463(100)
	College	145(94)	3(2)	4(3)	2(1)	154(100)
MPCE Quintile*	Q1	43(30)	0	38(26)	63(44)	144(100)
	Q2	105(67)	0	16(10)	35(22)	156(100)
	Q3	113(84)	0	13(10)	8(6)	134(100)
	Q4	127(89)	0	7(5)	9(6)	143(100)
	Q5	130(91)	4(3)	4(3)	5(3)	143(100)
Total		518(72)	4(1)	78(11)	120(17)	720(100)

Source: Primary data

Note: Chi-square was applied combining LPG and Electricity as one source of cooking.

* $p = 0.0$ for Chi-square values

Table 3comprehends that overall LPG is the highest cooking source among all differentials followed by firewood and kerosene. But it is followed by kerosene in urban and firewood in rural areas. The share of LPG users in urban is about 84% compared to that of rural residents with 60%. The firewood users are about 30% in rural areas, this relates to its availability. Column wise percentage shows that urban registers the highest use of LPG (58%) and the rural tops in firewood (91%).Though a similar trend is observed in Census 2011 of Madurai district, there is a variation in its share, that the overall consumption of LPG has been recorded as 50%, firewood 36% and kerosene 14%. The use of LPG is high among the households with college level education of head. Firewood is used equally as the source of cooking fuel to the extent of 13 and 14% up to school level. It is obvious that economic background has a positive relation with usage of clean cooking technologies.

The richest have 91% access to LPG and the 3% use of firewood in rural area by them confronts that the traditional practice of firewood usage associated with taste is still in existence. Among all, the poorest use of LPG is the least of about 30% but peaks in the use of firewood by using it to the extent of 44%. The newer technology of use of electricity as the source of cooking is observed to be marginal (4%) only in urban, among the richest quintile of expenditure category. The modern technology is in the initial stage of introduction, has not penetrated to the population yet as it needs to be backed by sufficient electronic gadgets and required special utensils. Chi-square results also prove that residence, education and economic status have positive impact on access to safe technologies and adoption to advancement in the technology. NFHS-4 Phase I (2015-16) expose that Tamil Nadu is the foremost state that has recorded a 132% change, a considerable increase in use of cleaner fuel since NFHS-3 (2005-06) [6].

2. Drinking water

Water is essential for life, but it can and does transmit disease. The availability and access to safe drinking water is a major factor which has a direct impact on the waterborne diseases. The access to safe drinking water is an important indicator ensuring the Millennium Development Goal on environmental sustainability. Access to safe drinking water refers to the proportion of people using improved drinking water sources like household connection, public standpipe, borehole, protected dug well, protected spring and rainwater.

Table 4. Distribution of households by the source of drinking water

Variables		Buy water	Handpump/ Tap	Well/ Pond/ Tank/Canal	Others	Total
Place of Residence	Rural	23(6)	288(80)	35(10)	14(4)	360(100)
	Urban	40(11)	307(86)	12(3)	1(0.3)	360(100)
Education of the Head	No Formal Education	4(4)	88(85)	8(8)	3(3)	103(100)
	School	27(6)	388(84)	36(8)	12(3)	463(100)
	College	32(21)	119(78)	3(2)	0	154(100)
MPCE Quintile	Q1	0	117(81)	17(12)	10(7)	144(100)
	Q2	7(4.5)	132(84)	15(9)	2(1.3)	156(100)
	Q3	4(3)	123(92)	6(4)	1(0.7)	134(100)
	Q4	15(10)	123(86)	3(2)	2(1)	143(100)
	Q5	37(26)	100(70)	6(4)	0	143(100)
Total		63(9)	595(83)	47(6)	15(2)	720(100)

Source: Primary data

Table 4 presents that hand pump the safer one, is the prime source of drinking water among all the categories. Hand pump, tap and buying water together are the highly fetched drinking water sources irrespective of all differentials like place of residence, family size and the economic status (poorest-81%; richest-96%).Buying of drinking water is the new trend of this decade, in which the proportion that does spend money on fetching drinking water is higher in urban (11%), compared to that of rural folk (6%). The geographical extension of urban areas, do not have extension of drinking water connection in many places. In addition head of the household with collegiate education buying drinking water is in a higher level compared to their counterparts and they do not go in for untreated water sources. This highlights the influence of education. Economic status is directly associated with the latest source of spending money on drinking water. Highest spending on drinking water purchase is by the richest (26%).

In today's trend of paying for drinking water associates that safe drinking water also has become a dearer commodity that could be availed only by those who can afford to pay it. Hand pump/tap has been reported as the major drinking water source above 80% among all differentials (except quintile 5). Among the richest 70% seeks drinking water through hand pump and tap mode in addition to 26% buy drinking water as a second source. A notable fact is that the role of well, pond, tank and lakes in supplying drinking water are ten percent in rural but only three percent in urban areas.

This reveals the force of urbanization leading to an increase in lost lakes that forms the root cause for more health and environmental disasters. Other source of drinking water like tankers is minimal overall (2%) but it is availed to the extent of 4&7% in rural and among the poorest. Inadequate provision of safe drinking water supply facilities necessitates government role in providing additional financial resources and technical inputs to bring these services to all people of the society, since all individual households may not be able to undertake the necessary expenditures to create these services by themselves. The findings are similar to the results of NFHS-4 Phase I (2015-16), that the percentage of households with improved source of drinking water in Tamil Nadu, rural and urban were 87 and 95, but it was one among the four states which has a fall (0.9%) compared to the previous survey [7].

3. Drinking water treatment

Quality drinking water is the foundation for prevention and control of water borne diseases. Based on Sen.'s 'Commodities and Capabilities' approach, the transformation efficiency of the water characteristics into achieved capabilities(avoidable morbidity rates of water borne diseases) among 15 major states shows that Kerala and Orissa have emerged as Pareto-efficient Peer states. The major reason for the input use efficiency in Kerala was due to boiling of drinking water before consumption and in Orissa it was due to better hygienic water handling practices of less contamination of well water by using same bucket for drawing water for all users from it. In the study TN hold 12th rank in the transformation efficiency [8]. Tamil Nadu Water Supply and Drainage Board has tested water sources up to 2011 and in that year reported that in Madurai district 3.71% has been contaminated.

Table 5. Distribution of households by drinking water treatment

Variables	Water treatment	Water treated					Not Treated	Total
		Aquaguard	Boiling	Cloth Screen	Filter	Mineral Water		
Place of Residence*	Rural	24(7)	48(13)	1(.3)	7(1.9)	22(6)	258(72)	360(100)
	Urban	50(14)	46(13)	7(1.9)	18(5)	43(12)	196(54)	360(100)
Education of the Head*	No Formal Education	3(3)	8(8)	0	2(2)	6(6)	84(82)	103(100)
	School	33(7)	62(13)	6(1)	16(4)	25(5)	321(69)	463(100)
	College	38(25)	24(16)	2(1)	7(5)	34(22)	49(32)	154(100)
MPCE Quintile*	Q1	2(1.4)	6(4.2)	0	2(1.4)	2(1.4)	132(92)	144(100)
	Q2	6(3.8)	24(15)	2(1)	8(5)	8(5)	108(69)	156(100)
	Q3	10(7)	20(15)	1(0.7)	5(3.7)	5(3.7)	93(69)	134(100)
	Q4	22(15)	18(13)	2(1.4)	7(5)	14(10)	80(56)	143(100)
	Q5	34(24)	26(18)	3(2)	3(2)	36(25)	41(29)	143(100)
Total		74(10)	94(13)	8(1.1)	25(3)	65(9)	454(63)	720(100)

Source: Primary data

Note: Chi-square was applied for drinking water treated and not treated as a whole with the respective variables.

$* p = 0.0$ *for Chi-square values*

From Table 5, it is obvious that only two-fifth of the households treats drinking water and the remaining do not avail any treatment but consume as it is fetched. Lack of water treatment is still more high in rural (72%), head of the household with no formal education (82%) and the poorest (92%) in comparison with urban (54%), graduated head (32%) and the richest (29%). Treating drinking water creates additional monetary burden that the poor are unable to cope up the mechanism.Even among the water treated, the safe mode of boiling was overall highest (13%) followed by aqua guard (10%) and mineral water (9%). In urban areas those three modes were dominant. Whereas in rural also boiling prevailed to 13% but the aqua guard and mineral water were only half of it. Among the water treatment methods aqua guard, boiling and mineral water was preferred to the extent of 63% whereas it was least among other categories.In absolute numbers and column percentage, the modern methods of aqua guard, mineral water were the higher among the households which was headed by educated ones that substantiated the highest purchase of drinking water by them in the previous table.

All the three comprised to the level of 67% among the richest but it was only 6% among the poorest. Family size has inverse relation but economic status has direct relation with the water treatment measures. This signifies that the economic status plays a vital role in the allocation of expenditure and this preventive measure is not given priority besides the other core problems of seeking food. It involves not only initial cost but also requires maintenance and service cost, which further compounded the economic stress of the households. Chi-square results also substantiates that residence, education and economic status play a significant role in awareness and undertaking of drinking water treating measures.Census 2011 has stated that in Madurai district drinking water fetched travelling beyond 500 metres in rural is 8.6% and 100 metres in urban is 7.9%. This emphasizes that the State Vision set to provide "A World Class, Secure, Affordable and Sustainable Water Supply, Sanitation and Sewerage system Accessible to Every Citizen of Tamil Nadu" by the end of 2023 has to be rigorously planned and implemented.

4. Sanitation

Sanitation is one of the basic necessities for a hygienic and healthy life. Again poor environmental sanitation perpetuates water borne diseases which increases the incidence of morbidity and mortality simultaneously. Sanitation poses a unique challenge. If an individual family invests in toilets and neighbours don't, then reaping cumulative positive benefits are doubtful. This is because sanitation as a communal element if one family in the neighbourhood practices open defecation all families has the possibility of being affected by the faecal matter. Achild who lived in a village where all the households had access to latrines, toilets and other improved sanitation facilities had a 47% lower rate of diarrhoea than a child living in a village where households did n't have sanitation facilities [9].

Table 6 reveals the misery that 68% of the rural households and 11% of the urban households do not have latrines inside the premises of their house. This empirical evidence goes along with the census 2011 data on Madurai district about the availability of latrines (rural-21%; urban-85%). Non-availability is to the level of 55% among the households head with no formal education that reiterate the deprivation level among the disadvantages groups. But one alarming fact is that, graduated heads with latrines inside their premises to the extent of 15%, which underlines the dominance of socio-cultural practices in the district. Cent percent adequate latrine facility is not yet achieved even in the richest quintile. The non-availability is to the level of 17% among the richest and 66% among the poorest. This discloses the fact that irrespective of the social and economic status, cultural barriers also play a vital role in the acceptance and availability of latrine in the house. Chi-square results also confirm that residence, education and economic status have constructive part in possessing latrines inside the premises of house.Census 2011 presents that among the 41% households without latrines in their premises in Madurai district, 13% use public latrines and 87% of them use open areas as the alternate source. Open defecation pose serious sanitation problems and health hazards.

Table 6. Distribution of households by availability of latrine facility

Variables	Latrine	Yes	No	Total
Place of Residence*	Rural	114(32)	246(68)	360(100)
	Urban	321(89)	39(11)	360(100)
Education of the Head*	No Formal Education	46(45)	57(55)	103(100)
	School	258(56)	205(44)	463(100)
	College	131(85)	23(15)	154(100)
MPCE Quintile*	Q1	49(34)	95(66)	144(100)
	Q2	86(55)	70(45)	156(100)
	Q3	84(63)	50(37)	134(100)
	Q4	97(68)	46(32)	143(100)
	Q5	119(83)	24(17)	143(100)
Total		435(60)	285(40)	720(100)

Source: Primary data
*Note: * $p = 0.0$ for Chi-square values*

This pollutes water sources also. Though Tamil Nadu was the leader and pioneer in the field of sanitation until 2006 subsequently, Total Sanitation Campaign (renamed as Nirmal Bharat Abhiyan) became a target-oriented programme and hence has lost its momentum. Eleventh plan assessment on the performance of sanitation has reported that though toilets were constructed, they became dysfunctional due to various reasons. Inappropriate selection of toilet models, lack of superstructure, water scarcity, lack of technical support in case of failures are the main reasons for poor performance. Lack of sustained Information, Education and Communication (IEC) programmes has left thousands of toilets being unused. Hence a comprehensive programme to repair and rejuvenate existing toilets and establish adequate new ones would be a better measure to improve the sanitation facility and its usage in the district. Drainage facility is another important sanitation service contributing to the maintenance of health, hygiene and environment. Table 7 reveals that overall 46% of the households have drainage facility, 32% of them have open drainage and 22% have no drainage.

The highest of open and no drainage is reported by the rural households to about 39% each whereas it is 25% and 5% among the urban sample households. This exposes that the rural dwelling has not coincided with the phase's development and is a sign of prevalence and emergence of new diseases. It is an indicator of resurgence and sustained burden on the poorest that would increase their health expenditure. This would affect not only them but also create negative externalities even for those who own these amenities, if there are others in the neighbourhood who do not own it. As education of the head improves having better drainage system increases, but graduates living in houses with no drainage proper facilities is to the extent of 10%. Economic status though has witnessed higher underground facilities (richest-56%; poorest-32%) but open and no drainage among the richest is 38% and 5%, which is more a disturbing reality. This reveals that households with no drainage connection discharge waste water into open grounds or streets that cause stagnant water pools around the habitations providing place for mosquito breeding and of other vectors. The inadequate drainage leads to unhygienic environment that perpetuates and is a cause for spread of many communicable diseases. Chi-square results also show that residence, education and economic status have direct relationship with drainage facilities.

Table 7. Distribution of households by drainage facility

Variables		Closed	Open	No drainage	Total
Place of Residence*	Rural	80(22)	139(39)	141(39)	321(100)
	Urban	251(70)	90(25)	19(5)	370(100)
Education of the Head*	No Formal Education	35(35)	36(35)	32(31)	103(100)
	School	207(45)	143(31)	113(24)	463(100)
	College	89(58)	50(32)	15(10)	154(100)
MPCE Quintile*	Q1	46(32)	54(38)	44(31)	144(100)
	Q2	76(49)	38(24)	42(27)	156(100)
	Q3	69(51)	27(20)	38(28)	134(100)
	Q4	59(41)	55(38)	29(20)	143(100)
	Q5	81(56)	55(38)	7(4.9)	143(100)
Total		331(46)	229(32)	160(22)	591(100)

Source: Primary data

*Note: * $p = 0.0$ for Chi-square values*

The extent and prevalence of the preventive measures were analysed individually and as a composite measure. With this backdrop the phenomenon of fully privileged share is analysed in the following table. LPG and electricity as cooking source, drinking water from hand pump, tap and buying water, treated drinking water, availability of latrine, closed drainage and pucca housing are considered as privileged measures. Individual dimensions reveal the extent of deprivation that persists among the households. From Table 8 it is obvious that a wide rural and urban divide is confirmed in the district. It goes along with the Table 2 examining the districts of Tamil Nadu. Zero dimension privileged is found among 4% of rural households which emphasises the urgent need to improve the rural part of the district. One limitation is that specific combination of the indicators cannot be witnessed.

Table 8. Multi-dimensional privileged preventive headcount achievement

Dimensions	Rural	Urban	Total
0	4.44	0.0	2.22
1	47.36	76.48	61.92
2	24.04	60.65	42.34
3	12.67	47.85	30.26
4	7.13	40.26	23.69
5	4.26	33.06	18.66
6	2.5	26.94	14.72
MPHI	33.05	138.22	85.63

6. Conclusion

There are distinct differences in preventive healthcare measures among different regions, educational levels, and economic status. The evidence of such differentials is a sure indication of low health status in the country. Thus there is need for giving priority to education, safe water and sanitation, increasing public awareness of the benefits of healthy life styleand a better implementation of national health programs. The existing infrastructure for healthcare needs to be strengthened. Preventive healthcare should be perceived as an investment and receive greater budgetary allocation. More concentration on preventive measures would mitigate the communicable disease incidence and create positive externality. To reduce the inequity of wide urban-rural gap the government should focus its limited resources towards the health of the poor especially in rural areas. The judicious use of the scant resources by promoting most cost-effective strategies for disease prevention would definitely improve the health status, which would improve the quality of human capital, which in turn would be a long way in helping the country towards rapid economic development.

7. Suggestions

1. In India, more efforts to be taken in the rural parts for the preventive measures to reduce morbidity level besides their achievement in mortality.
2. Tamil Nadu also to concentrate in improving its preventive care measures in general and rural in particular.

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