

## Comparison of NFHS 4 and 5 data in Tamil Nadu for diarrhoeal disease and risk factors among children under 5 years

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### Abstract

**Background:** Globally, 4 billion cases of diarrhea occur every year and 88% of these can be attributed to unsafe water, inadequate sanitation and poor hygiene. One out of ten babies born in developing countries do not reach their fifth birthday as they die from diarrhoeal diseases. Diarrhoeal diseases remain the number one cause of child mortality in India even though it is a preventable illness. The study aims to compare the prevalence of diarrhoeal diseases and enumerate its risk factors among children aged below 5 years in different districts of Tamil Nadu from NFHS 4 and 5.

**Methods:** This study is a secondary data analysis based on the NFHS 4 & 5 data of Tamil Nadu, which has data available in round 4 for 26,033 households and for 27,929 households in round 5. The analysis pertains to children aged below 5 years who were 7,658 in round 4 and 6,283 in round 5.

**Results:** Overall there was a 53.8% decrease in prevalence in Tamil Nadu. Prevalence in Salem had reduced by 92.1%. Erode, Kanniyakumari and Krishnagiri achieved 84.5%, 86.6%, 89.2% reductions respectively. Nagapattinam and Virudhunagar experienced a higher number of prevalence with 7.5% and 12% increase of cases respectively. Overall Tamil Nadu 71.6% improvement in sanitation from NFHS-4. Tiruvannamalai achieved the highest improvement (96.5%), while Erode did not achieve much improvement (7.8%). Overall Tamil Nadu had 0.92% improvement in drinking water facility from NFHS-4. Nagapattinam and Perambalur have the highest improvement (6.8 and 6.5% respectively) and have achieved 100%. Ariyalur has had a 6.1% decline in quality of drinking water facility.

**Conclusion:** Between NFHS 4 and 5, the prevalence of diarrhoeal cases among children under 5 has dropped by 53.8% and child mortality has reduced by 16.8% in Tamil Nadu. We can also see that there is an overall improvement in of 27.4% in sanitation and 0.92% in drinking water quality.

**Keywords:** Diarrhoeal diseases; NFHS; Child Mortality; Sanitation; Water quality

### 1. Introduction

Globally, around 2.4 million deaths could be prevented annually if everyone practiced good hygiene and had reliable sanitation and drinking water. (1). Unsafe water, inadequate sanitation and poor hygiene practices contribute to about 88% of diarrhea-associated deaths and these deaths are mostly among children (1,2). One out of ten babies born in developing countries do not reach their fifth birthday and die from diarrhoeal diseases (3). According to the Global Health Observatory, diarrhoea is the leading cause of death in children under 5 in India (5). Previous studies have revealed that safe drinking water, proper sanitation facilities and administration of rotavirus vaccination are protective against childhood diarrhea (4). The National Family Health Survey reported that India's prevalence of childhood diarrhea increased from 5% in 2006 to 8% in 2016 (5). Due to high burden of diarrhea, the Government of India

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launched the Intensified Diarrhea Control Fortnight (IDCF) program in 2016 to reduce diarrheal deaths to zero in children under five. This program was implemented to prevent and control deaths from dehydration and diarrhea across all States & Union Territories (UTs)(4). Infant and child mortality are considered as one of the important indicators of social and economic development of any country as they provide important insights into the nature of economic disparities and social inequalities(6,7). Although the mortality rates of India have decreased considerably over the last three decades, the reduction does not correspond with the high economic growth it has achieved (7). Additionally, the progress made on the health front has not been uniform across population segments(7). Although child health has been given greatest priority over the years both at National level and at State level, there is a great disparity in child health practices among different states and even within districts (3). *This study is a secondary data analysis examining patterns in diarrhoeal diseases in different districts of Tamil Nadu using data from NFHS-5.*

### 1.1. Diarrhea

Diarrhea is best defined as excessive loss of fluid and electrolytes in the stool. WHO defines: Diarrhea as the passage of three or more loose or liquid stools per day or more frequent passage than is normal for the individual.

## 2. Materials and methods

Secondary data analysis of NFHS 4 and NFHS 5

### 2.1. Data source

This study has used data from the fourth and fifth rounds of NFHS conducted during 2015-16 and 2019-21. The NFHS study is the Tamil Nadu version of the Demographic and health survey (DHS). In NFHS-4 and NFHS-5 all 32 districts had been covered. The main sample included in the study were children under the age of 5 years for both NFHS-4 and 5. The research design is comparable to a cross-sectional study as it is using secondary data. The following are the definitions of variables given in NFHS:

- *Prevalence of diarrhoea among children under 5:* The data available in NFHS was of the percentage of children under age 5 years who had diarrhoea in the 2 weeks preceding the survey.
- *Population of households with improved drinking water:* Population living in households with an improved drinking-water included households that used piped water into dwelling/yard/plot, piped to neighbour, public tap/standpipe, tube well or borehole, protected dug well, protected spring, rainwater, community RO plant, tanker truck, cart with small tank and bottled water.
- *Population of households with improved sanitation:* Population living in households that use an improved sanitation facility include households with Improved facilities that are not shared with other households with flush/pour flush to piped sewer system, septic tank, or pit latrine, flush/pour flush, pit latrine with slab, ventilated improved pit (VIP) latrine/biogas latrine and twin pit/composting toilet.
- *Percentage of children who received rotavirus vaccination:* Percentage of children age 12-23 months who the vaccines at any time before the survey (according to a vaccination card or the mother's report), and percentage with a vaccination card seen by the interviewer and by background characteristics.

## 3. Results

**Table 1** Prevalence and risk factors for diarrhoea among children under 5 in Tamil Nadu

Variable	NFHS 4 (%)	NFHS 5 (%)	% DIFFERENCE
Prevalence of diarrhoea in the 2 weeks preceding the survey (%)	8.0	3.7	53.8
Under-five mortality rate (U5MR) (%)	26.8	22.3	16.8
Population living in households with an improved drinking-water (%)	97.7	98.6	0.92
Population living in households that use an improved sanitation facility (%)	52.5	72.6	27.4
Children age 12-23 months who have received 3 doses of rotavirus vaccine (%)	na	66.4	na

**Table 2** Prevalence of diarrhoea in the 2 weeks preceding the survey in districts of Tamil Nadu

S.NO	DISTRICT	NFHS-4 (%)	NFHS-5(%)	ABSOLUTE DIFFERENCE (%)
1	Ariyalur	7.2	5.6	22.2
2	Chennai	10.9	4.1	62.4
3	Coimbatore	7.6	2.9	61.8
4	Cuddalore	6.8	3.4	50
5	Dharmapuri	6.5	3.2	50.8
6	Dindigul	8.5	2.3	72.9
7	Erode	9.7	1.5	84.5
8	Kancheepuram	3.7	3.1	16.2
9	Kanniyakumari	6.7	0.9	86.6
10	Karur	10.8	5.6	48.1
11	Krishnagiri	10.2	1.1	89.2
12	Madurai	9.1	4.3	52.7
13	Nagapattinam	5.3	5.7	7.5
14	Namakkal	5.2	4	23.1
15	Perambalur	15.5	4.3	72.3
16	Pudukkottai	5.6	5.1	8.9
17	Ramanathapuram	7.9	3.3	58.2
18	Salem	8.9	0.7	92.1
19	Sivaganga	8.6	2.6	69.8
20	Thanjavur	7.7	4.8	37.7
21	The Nilgiris	6.7	1.3	80.6
22	Theni	5.8	3.8	34.5
23	Thiruvallur	7.9	5.2	34.2
24	Thiruvarur	4.8	4.3	10.4
25	Thoothukkudi	7.7	4.8	37.7
26	Tiruchirappalli	5.2	5.2	0
27	Tirunelveli	6.8	2.7	60.3
28	Tiruppur	7.3	1.5	79.5
29	Tiruvannamalai	10.8	6	44.4
30	Vellore	8.1	2.8	65.4
31	Viluppuram	11.8	5.6	52.5
32	Virudhunagar	8.3	9.3	12

From table 1 and 2 -

Overall prevalence of diarrhoea in the two weeks preceding the study among children under 5 was 3.6% in Tamil Nadu. Salem followed by Kanniyakumari had the least (0.7% and 0.9% respectively) and Virudhunagar had the highest (9.3%) prevalence in Tamil Nadu. Overall there was a 53.8% decrease in prevalence of diarrhoea in Tamil Nadu. Salem had the

highest decrease in prevalence of diarrhoea and cases had reduced by 92.1%. Erode, Kanniyakumari and Krishnagiri achieved 84.5%, 86.6%, 89.2% reductions respectively. Tiruchirappalli had no significant difference in the prevalence of cases. Nagapattinam and Virudhunagar experienced a higher number of prevalence of cases with 7.5% and 12% increase of cases respectively

**Table 3** Population living in households that use an improved sanitation facility in districts of Tamil Nadu

S.N	DISTRICT	NFHS-4(%)	NFHS-5 (%)	DIFFERENCE (%)
1	Ariyalur	28.2	54.6	93.6
2	Chennai	82.7	90.4	9.3
3	Coimbatore	58.1	78.5	35.1
4	Cuddalore	39.6	61.3	54.8
5	Dharmapuri	37.5	72.4	93.1
6	Dindigul	41.6	61	46.6
7	Erode	62.7	67.6	7.8
8	Kancheepuram	66.9	75.9	13.5
9	Kanniyakumari	85.8	96.2	12.1
10	Karur	47.7	63.6	33.3
11	Krishnagiri	43.9	75.9	72.9
12	Madurai	56.3	80.1	42.3
13	Nagapattinam	42.5	69.6	63.8
14	Namakkal	51.3	75.2	46.6
15	Perambalur	37.8	57.4	51.9
16	Pudukkottai	35.3	55.2	56.4
17	Ramanathapuram	47	78.6	67.2
18	Salem	46.2	64.5	39.6
19	Sivaganga	48.7	74.4	52.8
20	Thanjavur	46.8	79.6	70.1
21	The Nilgiris	63.8	83.6	31
22	Theni	45.8	74.4	62.4
23	Thiruvallur	66.1	75.6	14.4
24	Thiruvarur	45.8	71	55
25	Thoothukkudi	52.5	79.4	51.2
26	Tiruchirappalli	46.5	67.1	44.3
27	Tirunelveli	46.7	79.8	70.9
28	Tiruppur	51.4	75.9	47.7
29	Tiruvannamalai	31.4	61.7	96.5
30	Vellore	54.5	76.2	39.8
31	Viluppuram	31.9	53.8	68.7
32	Virudhunagar	36.6	59.8	63.4

From table 1 and 3 -

Overall 72.6% of the population in Tamil Nadu live in households that use a improved sanitation facility, this is a 71.6% improvement from NFHS-4. Kanniyakumari has the highest % of population living in households with improved sanitation (96.2%) followed by Chennai (90.4%), while Villupuram has the least (53.8%). Tiruvannamalai achieved the highest improvement (96.5%), while Erode did not achieve much improvement (7.8%). Although Ariyalur achieved 93.6% improvement, only 54.6% of its population live in households with improved sanitation.

**Table 4** Population living in households with an improved drinking-water in districts of Tamil Nadu

S.No	DISTRICT	NFHS-4 (%)	NFHS-5 (%)	ABSOLUTE DIFFERENCE(%)
1	Ariyalur	99.3	93.2	6.1
2	Chennai	98.0	98.7	0.7
3	Coimbatore	97.2	99.9	2.8
4	Cuddalore	99.7	99.5	0.2
5	Dharmapuri	99.6	98.7	0.9
6	Dindigul	99.1	99.5	0.4
7	Erode	99.9	98.9	1
8	Kancheepuram	96.2	99.4	3.3
9	Kanniyakumari	95.4	98.2	2.9
10	Karur	98.0	99.4	1.4
11	Krishnagiri	99.7	99.8	0.1
12	Madurai	92.6	98.7	6.6
13	Nagapattinam	93.6	100.0	6.8
14	Namakkal	97.1	99.5	2.5
15	Perambalur	93.9	100.0	6.5
16	Pudukkottai	92.7	95.7	3.2
17	Ramanathapuram	94.2	93.9	0.3
18	Salem	95.3	97.6	2.4
19	Sivaganga	90.7	96.5	6.4
20	Thanjavur	99.6	99.7	0.1
21	The Nilgiris	94.6	96.4	1.9
22	Theni	98.0	99.9	1.9
23	Thiruvallur	99.3	100.0	0.7
24	Thiruvarur	99.8	100.0	0.2
25	Thoothukkudi	99.2	97.0	2.2
26	Tiruchirappalli	100.0	98.1	1.9
27	Tirunelveli	99.5	98.1	1.4
28	Tiruppur	99.6	99.8	0.2
29	Tiruvannamalai	99.4	98.5	0.9

30	Vellore	98.9	97.7	1.2
31	Viluppuram	99.5	98.4	1.1
32	Virudhunagar	97.2	97.4	0.2

From table 1 and 4 -

Overall 98.6% of the population in Tamil Nadu living in households with an improved drinking water facility, this is a 0.92% improvement from NFHS-4. Nagapattinam and Perambalur have the highest improvement (6.8 and 6.5% respectively) and have achieved 100%. Thiruvallur and Thoothukkudi have 100% of their population with improved drinking water facilities. Ariyalur has had a 6.1% decline and now has only 93.2% of its population living in households with an improved drinking water facility.

**Table 5** Children age 12-23 months who have received 3 doses of rotavirus vaccine<sup>14</sup> in districts of Tamil Nadu

S.No	DISTRICT	NFHS-5 (%)
1	Ariyalur	80.3
2	Chennai	45.7
3	Coimbatore	86.9
4	Cuddalore	68.0
5	Dharmapuri	69.6
6	Dindigul	72.5
7	Erode	53.8
8	Kancheepuram	54.3
9	Kanniyakumari	66.7
10	Karur	43.1
11	Krishnagiri	60.2
12	Madurai	69.9
13	Nagapattinam	73.6
14	Namakkal	73.8
15	Perambalur	49.7
16	Pudukkottai	47.0
17	Ramanathapuram	62.1
18	Salem	69.1
19	Sivaganga	70.6
20	Thanjavur	33.2
21	The Nilgiris	81.9
22	Theni	80.9
23	Thiruvallur	59.2
24	Thiruvarur	78.7
25	Thoothukkudi	85.2
26	Tiruchirappalli	67.3
27	Tirunelveli	72.3

28	Tiruppur	*
29	Tiruvannamalai	76.2
30	Vellore	80.8
31	Viluppuram	55.6
32	Virudhunagar	71.0

From table 5 –

Overall 66.4% of the children aged 12-23 months have received 3 doses of rotavirus vaccine in districts of Tamil Nadu in NFHS 5. There is no data from NFHS 4. Coimbatore district has the highest percentage of children vaccinated (86.9%), while Thanjavur has the least (33.2%). There is no data available for Tiruppur district.

#### 4. Discussion

The evidence from the data shows that there is drastic fall in prevalence of diarrhoeal diseases among children under 5 years in Tamil Nadu between NFHS 4 and NFHS 5. We can also see improvement in both water quality and sanitation with a 27.4% increase in population living in households using improved sanitation and 0.92% increase in population living in households with improved drinking water supply. Among the districts in Tamil Nadu, Kanniyakumari has one of the least prevalence of diarrhoeal diseases among children under 5 years along with having one of highest percentage of population living in households with improved sanitation facilities. Similar results were found in a study conducted by Shrestha et al in Nepal where the prevalence of diarrhoea among children was highly associated with hygiene, sanitation and supply of water (8).

Another study done by Saha et al in Jawadhi hills identified the base-line WASH standard and drinking water quality was associated with various diarrheal diseases (9). Our study corroborates this as a part of Jawadhi hills are spread across Tiruvannamalai district which has achieved the highest increase in the percentage of population living in households with improved sanitation facilities. Virudhunagar had the highest prevalence of cases among all the districts and has only 59.8% of its population living in households with improved sanitation. Salem district of Tamil Nadu reported the least prevalence of diarrhoea among children, although it did not have any significant difference in sanitation, it had nearly 97.6% of its population living in households with improved drinking water. This results was supported by a study conducted by Giri et al in Odisha which stated unsafe drinking water as the main risk factor for developing childhood diarrhoea (10).

Interestingly, Tiruchirappalli district had no difference in the prevalence of diarrhoea among children between NFHS 4 and 5, although their sanitation had an improvement, the percentage of their population living in households with improved drinking water decreased by 1.9%. According to ABM model study conducted by Gleason et al from NFHS 5 data, rotavirus incidence in India dropped from one case per child per year to 0.34 cases per child per year following only about 17.8% current national rotavirus vaccination coverage(11). This result is supported while comparing districts of Coimbatore, which has the highest rotavirus vaccine coverage (86.9%) and a 61.8% reduction in the prevalence, and Thanjavur, which has the least coverage (33.2%) and only 37.7% in prevalence. There is no data available for Tiruppur district, which is geographically adjacent to Coimbatore.

#### 5. Conclusion

Drinking water, sanitation and hygiene are the door way to health which is a pre- requisite for progress, social equity and human dignity to improve the quality of life of people. Evidence from the data suggests that between NFHS 4 and 5, the prevalence of diarrhoeal cases among children under 5 has dropped by 53.8% and child mortality has reduced by 16.8% in Tamil Nadu. We can also see that there is an overall improvement in of 27.4% in sanitation and 0.92% in drinking water quality. Although there are improvements, much work needs to be done on these important public health fronts, which are contributing factors to the high rates of mortality and morbidity in the country.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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