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Letter from the Editor's Desk

Dear Readers,

We are happy to release this edition of TN Journal of Public Health and Medical research at our 3rd Annual Public Health conference by our Honourable Minister for Health, Medical Education and Family Welfare at Thanjavur.

Also this issue is being released with the new team of officials who are focusing on improving the quality of the articles further. As envisaged they will develop an exclusive portal to manage the end to end activities from article submission to publication soon with identified publisher.

As expected, our articles touch upon all the critical areas of Public Health such as Polio, Leprosy and ADD etc., in addition to focusing on Health System issues like quality with inputs from the field.

Best wishes,

Happy reading! Share your feedback.

Thanks for your support.

***Dr. T.S.Selvavinayagam MD., DPH., DNB.,
Director of Public Health & Preventive Medicine***

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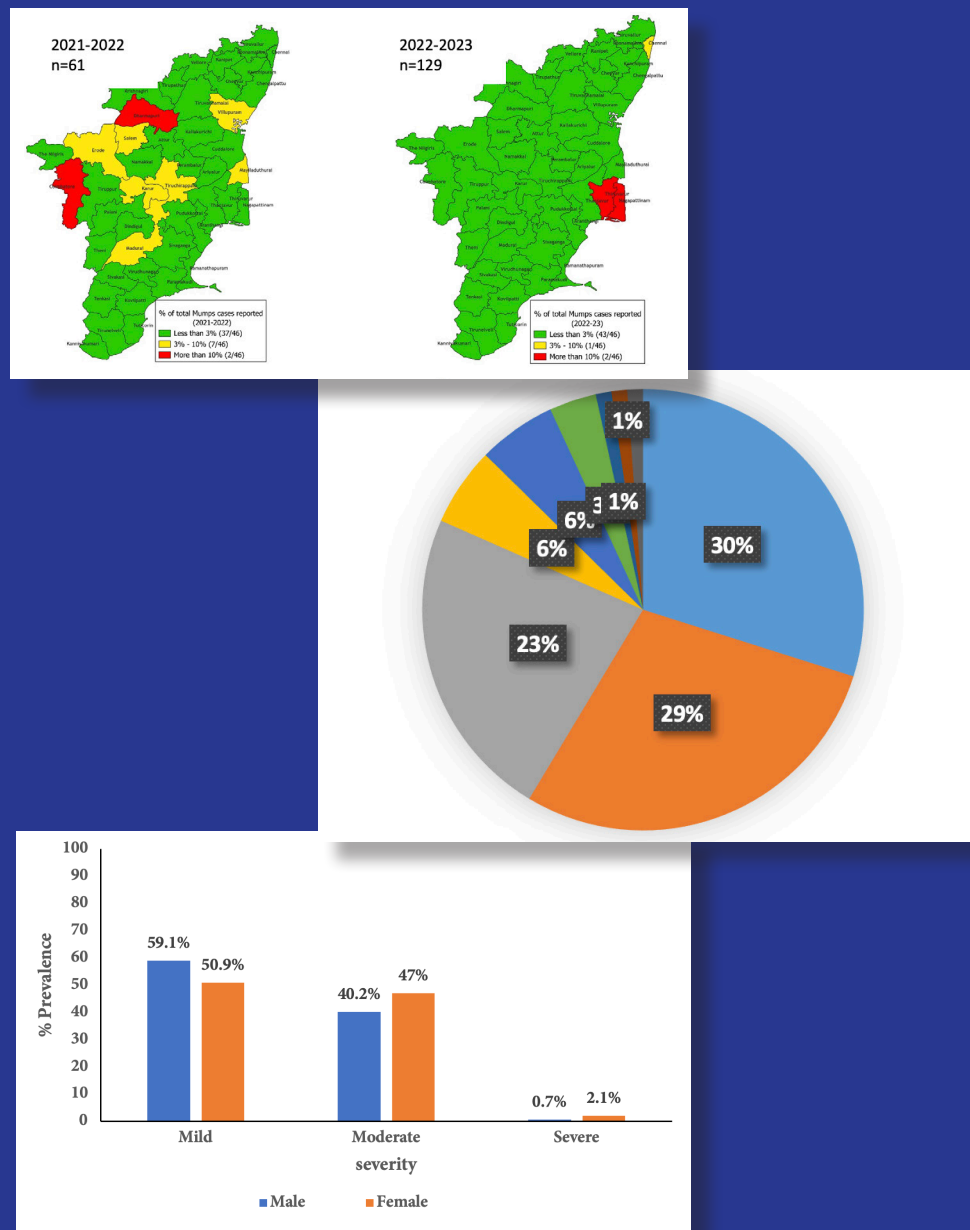
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Why do we do basic research? To learn about



RESEARCH IS TO **SEE** WHAT
EVERYBODY ELSE HAS SEEN, AND
TO **THINK** WHAT NOBODY ELSE HAS

SYSTEMATIC DOCUMENTATION-KEY TO IMPROVE CONTACT FOLLOW-UP: REVIEW OF PROGRAMME STRATEGY OF CHEMOPROPHYLAXIS FOR HOUSEHOLD CONTACTS OF LEPROSY PATIENTS, TIRUVALLUR DISTRICT, TAMIL NADU, INDIA, 2023

Sridevi Govindarajan ⁽¹⁾, Vasanthi Thangasamy ⁽²⁾, Manickam Ponniah ⁽³⁾

(1) Medical officer, O/o Deputy Director of Medical Services (Leprosy), Chennai District, Tamil Nadu, India

(2) Deputy Director of Medical Services (Leprosy), Tiruvallur District, Tamil Nadu, India

(3) Scientist-F, ICMR School of Public Health, ICMR-National Institute of Epidemiology, Chennai, Tamil Nadu, India

ABSTRACT

INTRODUCTION : Analysis of five-year data of National Leprosy Eradication Programme in Tiruvallur district of Tamil Nadu revealed fluctuating annual new leprosy case detection, poor detection through contact tracing and no evaluation since implementation. In view of this, we evaluated the extent of implementation of the National Leprosy Eradication Programme (NLEP)'s strategy of chemoprophylaxis with single dose rifampicin to close contacts of leprosy during June to August, 2023.

METHODS : Using log frame matrix, we framed input, process and output indicators and collected data through cross-sectional study across 45 health facilities. We interviewed 25 health staff implementing the programme, 57 index case-patients and their 147 household contacts. We extracted data from programme documents, reports and records generated by the district leprosy office. We obtained data on trained health care workers; availability of registers and rifampicin, information, education and communication (IEC) materials and allocated funds for drug procurement.

RESULTS : Chemoprophylaxis with single dose rifampicin was 100 % accepted among household contacts. Majority of the programme staff received necessary training (78% of medical officers; 64% of other healthcare workers). They reported challenges such as the absence of contact registers and rifampicin stock at healthcare facilities. They enrolled 92% of index cases, screened all their household contacts to identify 91% of them eligible for prophylaxis. They provided rifampicin for 94% of them and none reported adverse events. IEC materials were displayed in 93% of the surveyed health facilities. In order to enhance the effectiveness of prophylaxis strategy, we recommend implementing systematic documentation by health staff for tracking contact follow-up and considering chemoprophylaxis to social and neighbourhood contacts.

CONCLUSION: The chemoprophylaxis with single dose rifampicin to leprosy contacts was well accepted among leprosy affected persons and their household contacts after explaining the reduction of risk associated. The strategy of contact tracing followed by administration of single dose rifampicin is feasible and cost-effective.

KEYWORDS : Leprosy, Neglected disease, Chemoprophylaxis, Mycobacterial infection

INTRODUCTION

Leprosy is one of the neglected tropical diseases, caused by a bacteria called *Mycobacterium leprae*. Targeted for interruption of transmission by 2030⁴, leprosy continues to pose a risk, particularly among household contacts who experience an eightfold higher likelihood of contracting the disease. Chemoprophylaxis with single dose rifampicin reduces the incidence of leprosy among close contacts by 57%.¹

The World Health Assembly target of reducing the prevalence to less than one case per ten thousand population was reached globally in 2000 and at the national level by 2005. Leprosy services were integrated into general health care services to enhance the reach of services through primary health care, improve cost-effectiveness and promote

inclusion. However, the detection of new cases reduced at a rate of 2% per year. Visible deformities at the time of diagnosis as well as childhood leprosy continue to occur, highlighting the need for high-impact preventive initiatives to bend the case-detection curve and reduce leprosy-associated disabilities. Prolonged contact with untreated leprosy patients is known to spread infection. The screening of contacts and the provision of prophylactics are crucial to break the chain of transmission. Based on available evidence, prophylaxis



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Corresponding Author: Sridevi Govindarajan

e-mail : sridevidoctor2020@gmail.com

with single-dose rifampicin, administered to household, neighbourhood and social contacts, prevents leprosy. Secondary data analysis of Tiruvallur district, Tamil Nadu, India highlighted fluctuating annual new case detection rate (ANCDR) (7.5-5.5/million) and above state and national level since 2011 with poor case detection through contact surveys. In order to improve case detection among contacts and understand the gaps in implementation of post-exposure prophylaxis with single dose rifampicin, program evaluation of this strategy was done. The objectives of this study were to describe the implementation of post-exposure prophylaxis with single dose rifampicin for leprosy contacts and to also evaluate the extent of its implementation into routine NLEP activities in Tiruvallur district, Tamil Nadu, India as per WHO guidelines.

METHODS

We conducted a cross-sectional study involving study participants who are the healthcare workers at the provider level and leprosy patients and their household contacts at the beneficiary level after obtaining consent and assuring confidentiality. We conducted the study from June 2023 to August 2023 using January 2023 to May 2023 as the reference period. The operational definitions² used in the study are: **Post-exposure prophylaxis (PEP)**: Administration of single dose rifampicin as post-exposure prophylaxis to close contacts of newly diagnosed leprosy patient. **Index patient**: Any person diagnosed with leprosy for the first time. **Close Contact**: a person in contact with an index patient for 20 hours per week for at least three months in a year, e.g. family members, neighbours, friends, school children in same class or co-workers in same office. **Household contact**: contact living in the same dwelling or sharing the same kitchen with an index patient. This includes family members and also domestic staff or aids or co-workers or others sharing the same accommodation. A family member living elsewhere should not be considered as a household contact. **Neighbourhood contact**: a person living in the adjacent household or within 100 metres of an index patient. **Social contact**: other persons having prolonged contact with an index patient and who are not classified as household or neighbourhood contact. These may include friends, persons sharing workplace or school. To describe the strategy, we gathered information from the WHO technical guidance for contact tracing and post-exposure prophylaxis and Strategy guidelines from National Leprosy Eradication Programme (NLEP). We extracted data on the relevant guidelines, government orders issued, registers and records maintained at the district level such as drug stock

registers, monthly progress reports, contact survey reports and annual reports compiled from sub-districts using data extraction forms. We reviewed the monthly progress reports, treatment registers, drug stock registers and treatment cards maintained at the primary health centres during visit to the 45 health facilities with the health facility checklist.

Key Informant Interviews (KII) were conducted using semi-structured questionnaires among a total of 69 healthcare providers including the state leprosy officer at the state level, the district leprosy officer at the district level, 45 primary health centre Medical Officers, 12 Non-Medical Supervisors (NMS) and 10 Health Inspectors (HIs) at the sub-district level. The beneficiary survey was conducted among 57 index patients and their 147 household contacts using structured questionnaires as per the interview guidelines.

We derived three component objectives for the post-exposure prophylaxis strategy from the existing WHO technical guidance 2018 and strategy guidelines from the National Leprosy Eradication Programme which were (i) systematic tracing of contacts; (ii) active case finding by screening of contacts; (iii) prophylactic treatment of eligible contacts with single dose rifampicin (SDR). We used a log frame matrix (Table 1) for the purpose of evaluation and framed indicators using inputs, process, outputs for each of the component objective for achieving an outcome of reduction in the risk of developing leprosy among household contacts and the goal of interruption of leprosy transmission as depicted in Table 2 and 3.

RESULTS

From January to May 2023, out of 62 index patients identified from treatment registers, 57 were included in the study (one patient had died, one was from another state, and three had no contacts). For these 57 index patients, 147 household contacts were identified and line listed, all of whom were screened for leprosy.

Table 1: Log frame matrix for program evaluation of post-exposure prophylaxis for household contacts of leprosy, Tiruvallur district, Tamil Nadu, India, 2023

Goal	Interruption in leprosy transmission		
Outcome	Reduction in risk of developing leprosy among household contacts		
Component objectives	Systematic tracing of contacts	Active case finding by screening of contacts	Prophylactic treatment of eligible contacts with SDR PEP*
Outputs	All household contacts line listed for screening	All line listed household contacts screened	Eligible household contacts taken SDR-PEP
Process	Enrolment of index cases Contact tracing of household contacts	Screening of household contacts Maintaining records Displaying IEC materials	Counselling to household contacts for SDR-PEP
Inputs	Trained staff Treatment registers/cards	Trained staff Case validation team Availability of IEC material	Drug stock of rifampicin Availability of contact registers

*SDR-PEP – Single dose rifampicin post-exposure prophylaxis

During the screening, 11 new leprosy patients were detected among the household contacts, two old treated multibacillary leprosy patients were identified and two contacts were found to be pregnant.

Beneficiary survey - Overview

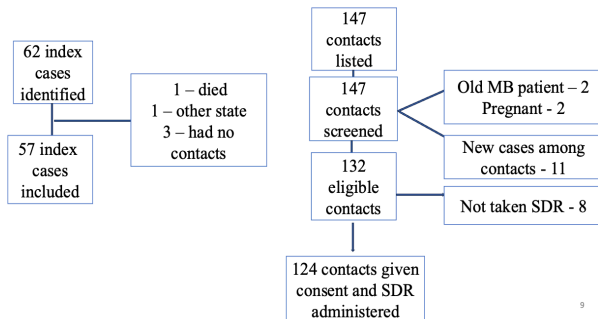


Figure 1: Flow Diagram – Beneficiary Survey

Consequently, 132 contacts (91%) were found eligible for post-exposure prophylaxis. All 132 eligible contacts received counselling about post-exposure prophylaxis, while eight refused to take the single dose rifampicin, 124 contacts (93%) accepted and took the prophylactic treatment (Figure 1).

Table 2: Input and process indicators used for program evaluation of post-exposure prophylaxis for household contacts of leprosy, Tiruvallur district, Tamil Nadu, India, 2023

Input Indicators	n	N	%
Trained medical officers in leprosy	35	45	78
Trained healthcare workers	14	24	64
Availability of case validation team	1	1	100
Availability of treatment registers/ cards	45	45	100
Availability of contact registers	0	45	0
Availability of rifampicin in health facilities	0	45	0
Availability of IEC materials in health facilities	45	45	0
Process Indicators	n	N	%
Enrolment of index patients	57	62	92
Awareness of healthcare workers on screening	20	24	83
Maintenance of treatment cards/registers	40	45	89
Utilization of IEC material	42	45	93
Identification of eligible household contacts	132	147	91
Counselling of eligible household contacts for SDR-PEP	132	132	100

During the interview conducted among the healthcare providers, we gathered information on training, field visits and leprosy services offered at the primary health centres. The district leprosy officer had not received training and among the 45 primary health centre (PHC) medical officers interviewed, 38 (78%) had received leprosy training. In rural areas, 10 out of 12 non-medical supervisors (NMS) (83%) were trained in leprosy. In urban areas, 4 out of 10 health inspectors (64%) had undergone leprosy training (Figure 2 and Table 2)

Provider and Health facilities survey - Overview

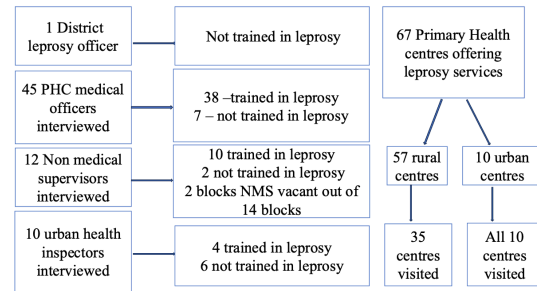


Figure 2: Flow diagram showing overview of provider and health facilities survey

A case validation team at the district level conducted at least one visit per sub-district each month to monitor program activities. Treatment cards and treatment registers were available at all the primary health facilities visited, and Information, Education, and Communication (IEC) materials were present in all facilities, with 93 percent displaying them (Table 2).

Table 3: Output indicators used for program evaluation for post-exposure prophylaxis for household contacts of leprosy, Tiruvallur district, Tamil Nadu, India, 2023

Output Indicators	n	N	%
Line listed household contacts	147	147	100
Line listed household contacts screened	147	147	100
Eligible contacts received SDR-PEP*	132	124	93

However, drug stocks of rifampicin were not maintained at any health facilities; instead, rifampicin was delivered directly to beneficiaries by healthcare workers after being received from the district office. No contact registers or line lists of contacts were maintained at the health facilities, instead, aggregate numbers of contacts were reported in the monthly progress reports from the sub-districts to the district office. From the interviews, it was found that 83% of the healthcare providers involved in screening were aware of the screening protocol, and 89% were aware of the procedures for maintaining treatment cards and registers. All the line listed contacts were screened for leprosy, out of which 93% of them received post-exposure prophylaxis with single dose rifampicin (Table 3).

DISCUSSION

The secondary data analysis of five years from 2017 to 2022 of NLEP pointed out poor detection through contact tracing stresses the need to do evaluation of this strategy. The chemoprophylaxis with single dose rifampicin to leprosy contacts was well accepted among leprosy affected persons and their household contacts after explaining the reduction of risk associated. The strategy of contact tracing followed by administration of single dose rifampicin is feasible

and cost-effective under the existing routine activities of the leprosy programme which is also well documented by previous studies done in Dadar Nagar Haveli.⁷

The study did have some limitations like information on whether adequate dosage was given as per WHO guidelines for different age groups and the timing of rifampicin after new case detection could not be assessed. More efforts are required for effective implementation of the strategy in the form of training of field staff for identification of contacts and screening for leprosy, monitoring of field staff, establishing documentation and maintaining logistics such as contact registers and drug stock of rifampicin at health facilities. The detection of new leprosy patients among screened contacts indicates ongoing transmission and recommends contact tracing crucial for early detection and intervention. The ease of administration of single dose rifampicin and the fact that no adverse events⁷ have been reported among the contacts so far has given a positive note on the strategy and emphasises the need for systematic documentation for effective implementation and further follow up of the contacts. The recommendations were to document a set of minimal essential data in the form of line-lists of contacts (currently maintained in monthly progress reports as aggregate numbers) in contact registers, to be recorded locally by the healthcare workers at the primary health centres and report periodically to the district as well to the state and national level authorities for a targeted approach towards interruption of transmission. We also emphasised the need for maintaining the drug stock of rifampicin at the primary health centres for prompt provision to the close contacts including those in the neighbourhood and workplaces.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE - PUBLIC HEALTH

TELEPHONIC SURVEY TO ASSESS VACCINATION COVERAGE IN INTENSIFIED PULSE POLIO IMMUNISATION CAMPAIGN 2024, TAMIL NADU: A RAPID ASSESSMENT

Vidhya Viswanathan⁽¹⁾, Vinay Kumar Krishnamoorthy⁽¹⁾, Kumaravel Ilangovan⁽²⁾, Ramani Satyanidhi Rao⁽¹⁾, Srimantha Sriramalu⁽¹⁾, Manimozhi Muthuswamy⁽¹⁾, Selvavinayagam T S⁽¹⁾

(1) Directorate of Public Health and Preventive Medicine, Chennai 600006

(2) Johns Snow India Private Limited, New Delhi 110070

ABSTRACT

INTRODUCTION : Despite India being declared polio-free, the risk of poliovirus importation and vaccine-derived poliovirus (VDPV) remains. Tamil Nadu has been polio-free since 2004, and in March 2024, an Intensified Pulse Polio Immunization (IPPI) campaign was conducted. A telephonic dipstick survey was initiated to assess OPV coverage and identify barriers to vaccination.

METHODS: Directorate of Public Health and Preventive Medicine conducted a telephonic survey of mothers using systematic random sampling from the Pregnancy and Infant Cohort Monitoring and Evaluation (PICME) portal. A sample of 1,200 mothers across 46 Health Unit Districts (HUDs) was targeted to assess polio vaccination coverage and reasons for non-vaccination during 3rd day of IPPI.

RESULTS : Out of 2,235 calls, 1,174 (52.5%) mothers responded, with 1073 (91.3%) reporting their children received OPV. Most vaccinations occurred at Anganwadi centres (59%). Among the unvaccinated (8.6%), the reasons included child illness (30%), being out of town (29%), and lack of awareness (23%). Subsequent follow-up increased OPV coverage to 1120 (95.4%).

CONCLUSION: The survey showed high OPV coverage but highlighted gaps in urban areas like Chennai and the need for targeted community outreach for absentee and unaware families. This rapid assessment method provided actionable insights for future campaigns to ensure sustained polio-free status.

KEYWORDS : Poliomyelitis, Oral vaccine, Sabin vaccine, Mass vaccination, Primary care

INTRODUCTION

Poliomyelitis remains a public health concern in several regions worldwide despite significant progress towards its eradication. Humans are the only reservoir/carrier of the wild poliovirus. It has three types: 1, 2, and 3. In India, the type 2 wild poliovirus was declared eradicated in September 2015, with the last virus detected in 1999. The type 3 wild poliovirus was declared eradicated in October 2019. It was last detected in November 2012. Only type 1 wild poliovirus remains.¹ The strategy for elimination/eradication of type 1 virus is to have an equally vital system of 4 components. These are robust routine immunisation, conducting supplemental immunisation, selective /focal mop-up rounds & a sensitive & responsive Acute Flaccid Paralysis (AFP) surveillance system.^{2,3}

Oral Poliovirus Vaccine (OPV) is central to the goal of polio eradication in many countries where affordable and easily administered vaccination can facilitate the prevention of disease. Widespread use of Oral Poliovirus Vaccine (OPV), whether administered in Routine Immunisation (RI) schedules or Supplementary Immunisation Sessions,

has led to the control and eradication of wild poliovirus in the industrialised world and three regions of the World Health Organization.⁴ In settings with low immunisation coverage, live vaccine viruses used in OPV can multiply for a long and undergo mutations to gain neuro-virulence. This vaccine-derived poliovirus (VDPV) can cause paralysis and circulate in the community, causing outbreaks.⁵ Increasing polio immunization coverage rates is among the strategies to minimize the risk of wild poliovirus and cVDPV transmission.

Since 2000, more than 10 billion doses of OPV have been administered to nearly 3 billion children globally. As a result, more than 13 million polio cases have been prevented, and the disease has been reduced by more than 99%. Until 2015, over 90% of circulating Vaccine-Derived



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Corresponding Author: Vinay Kumar K

e-mail : dphimm@nic.in

Polio Virus (cVDPV) cases were due to the type 2 component in OPV. As wild poliovirus type 2 had already been successfully interrupted since 1999, in April 2016, a switch was implemented from trivalent OPV (tOPV) to bivalent OPV (bOPV) in routine immunisation programmes. The removal of the type 2 virus from OPV was associated with a reduction of the risk of cVDPV2. Circulating VDPVs in the past have been rapidly stopped with 2–3 rounds of high-quality immunisation campaigns. To avert all sorts of polio outbreaks, every child should be vaccinated with the oral vaccine and fractional inactivated polio vaccine (fIPV) to prevent polio transmission.^{6,7}

South-East Asia of the WHO region, including India, was certified as polio-free on 27th March 2014. India has continued to maintain a polio-free status since January 2014,² with the last case reported in 2011. There is no evidence of VDPVs circulating in the community. India continues to face the threat of importing wild poliovirus (WPV) and vaccine-derived polioviruses (VDPV) from countries that are still reporting cases. To maintain its polio-free status, India maintains high levels of herd immunity against polio through Routine Immunization (RI) and National Immunization Days (NIDs), when all children under five years are vaccinated against the virus. Bivalent OPV (bOPV) and fractional inactivated polio vaccine (fIPV) are currently used in India's Universal Immunisation Program (UIP). The bOPV contains two serotypes of live attenuated poliovirus (type 1 and 3) and is delivered through Routine Immunisation (RI) days, National Immunization Days (NID), and Sub-National Immunizations Days (SNID) in which two drops of bOPV were administered to all children under five years of age irrespective of the previous vaccination status. A fractional dose of inactivated polio vaccine (fIPV) contains the three serotypes of the polio vaccine, thus preventing all polioviruses (type 1, 2, and 3) and does not result in VDPV. It is delivered through RI days to all infants in the 6th and 14th week, 0.1 ml intradermally.

Tamil Nadu attained a 'Polio Free Status' in 2004; for the past 19 years, no polio cases have been reported in the state. In 2024, Intensified Pulse Polio Immunization (IPPI) was conducted on March 03rd, 2024, and 59.20 lakhs of children aged 0-5 years benefitted.⁸

A dipstick survey is a rapid assessment tool to gather preliminary data on a specific issue. This method is often employed in public health, market research, and social sciences to collect data efficiently and cost-effectively. In the context of the IPPI campaign, it provides a snapshot of vaccination coverage and its gaps, if any, in a community.

Tamil Nadu's polio dipstick survey is conducted after each IPPI campaign. It offers a rapid and efficient means of detecting beneficiaries' coverage after each yearly IPPI campaign. In 2024, the Directorate of Public Health and Preventive Medicine (DPH&PM) telephonically conducted a polio dipstick survey after the pulse polio day on two specific dates, on the 05th and 13th March 2024, i.e. on third day and tenth day of IPPI for all 46 Health Unit Districts (HUDs) of Tamil Nadu to understand the vaccine coverage and reasons for receiving and not-receiving the OPV during the IPPI.

METHODS

A list of pregnant mothers who had delivered in the past four years with their contact numbers and residing district details was obtained from the Pregnancy and Infant Cohort Monitoring and Evaluation (PICME) portal. Using Systematic Random Sampling (SRS), telephonic interviews were attempted to achieve a sample of 1,200 mothers (25 mothers from each HUD and 75 from Chennai corporation). During this interview, the mother's name and the health unit district where they resided were confirmed after obtaining the mother's informed consent. Mothers were asked about their awareness of Pulse Polio Immunisation, whether their children received polio drops, and, if so, where the drops were administered. If not, the reasons for not receiving vaccination were recorded. Mothers who reported that their children were not vaccinated were contacted again on the 13th of March, 2024, for further inquiry. The data collected were compiled and analysed to assess the extent of poliovirus vaccine coverage.

Ethics consideration: This annual survey is part of routine public health surveillance programmatic activity to assess the OPV coverage and reasons for the non-uptake of vaccines and identify areas of improvement during the IPPI campaign. Thus, it is a program evaluation rather than research aiming to generate new knowledge. Further, voluntary participation, non-collection of personally identifiable information, and obtained verbal consent ensure transparency of this survey. The collected data is de-identified and used only for programmatic assessment. Hence, this may be exempted from ethics committee approval.

RESULTS

1174 (52.5%) have responded out of 2,235 unique calls to eligible mothers (Figure 1). Of these, 1,073 (91.3%) received OPV from 03rd to 09th March 2024 during the IPPI campaign (Table 1).

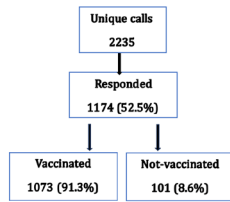


Figure 1: Number of unique mothers reached and their responses
on 5th March 2024, IPPI, Tamil Nadu

Table 1: Number of unique mothers and response for receipt of OPV during
the IPPI campaign, 3rd to 9th March 2024, Tamil Nadu

Health Unit District	No. of calls attempted	Total Responded	Vaccinated	Not Vaccinated
Aranthangi	50	25	25	0
Ariyalur	44	25	25	0
Attur	50	24	21	3
Chengalpattu	44	25	21	4
Chennai	123	73	52	21
Cheyyar	50	23	23	0
Coimbatore	50	24	23	1
Cuddalore	43	20	18	2
Dharmapuri	49	23	22	1
Dindigul	50	27	26	1
Erode	47	29	25	4
Kallakurichi	50	22	20	2
Kancheepuram	38	25	24	1
Kanniyakumari	50	27	21	6
Karur	50	25	25	0
Kovilpatti	51	24	23	1
Krishnagiri	41	25	25	0
Madurai	50	25	25	0
Mayiladuthurai	50	27	26	1
Nagapattinam	50	21	19	2
Namakkal	50	25	24	1
Nilgiris	37	27	25	2
Palani	43	14	13	1
Paramakudi	39	32	25	7
Perambalur	50	24	23	1
Poonamalle	50	25	24	1
Pudukottai	50	28	24	4
Ramanathapuram	50	22	21	1
Ranipet	41	26	25	1
Salem	50	24	21	3
Sivagangai	50	21	19	2
Sivakasi	44	25	24	1
Tenkasi	30	25	23	2
Thanjavur	48	25	19	6
Theni	50	23	22	1
Tirunelveli	50	26	24	2
Tirupattur	48	27	21	6
Tiruppur	50	25	25	0
Tiruvallur	44	25	25	0
Tiruvannamalai	50	22	21	1
Tiruvarur	50	20	15	5
Trichy	37	24	22	2
Tuticorin	50	24	24	0
Vellore	50	22	22	0
Villupuram	50	29	28	1
Virudhunagar	44	25	25	0
Grand Total	2235	1174	1073	101

Integrated Child Development Scheme (ICDS) - Anganwadi centres (AWC), erstwhile called Anganwadi centres (59%), are the most common place where children receive OPV drops, followed by (15%) health facilities and schools (14.7%) (Table 2). Of the 101 (8.6%) unvaccinated, 21% are from Chennai, followed by Paramakudi,

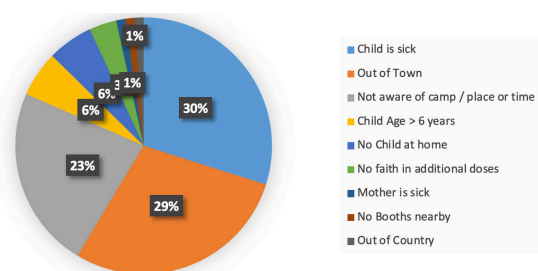
Kanniyakumari, Thanjavur and Tirupathur districts (Table 1).

Table 2: Place of vaccination in IPPI campaign, 3rd to 9th March 2024, Tamil Nadu

HUD Name	Booth Type for vaccinated (N=1073)					
	Health facility	Home Visit	ICDS (Anganwadi Centre)	Public Places (Religious places/ Malls/ etc.)	School	Transit (Bus stand/ Railways/ Toll etc.)
Aranthangi	3		17		5	
Ariyalur	2		16	2	4	1
Attur	2		11	2	4	2
Chengalpattu	9		4	2	4	2
Chennai	16	1	15	13	7	
Cheyyar	1		15		7	
Coimbatore	3		11	3	5	1
Cuddalore	3		11	2	2	
Dharmapuri	2	1	15		3	1
Dindigul	3		19	1	3	
Erode	3		13	1	6	2
Kallakurichi	8		9	1		2
Kancheepuram	1		19	3	1	
Kanniyakumari	3		12	1	5	
Karur	2	1	15	3	4	
Kovilpatti	5		14	2	1	1
Krishnagiri	1		13		10	1
Madurai	2		22	1		
Mayiladuthurai	2		18	1	5	
Nagapattinam	3		12		3	1
Namakkal			24			
Nilgiris	7		13	1	2	2
Palani	1		10	1	1	
Paramakudi	3		15	2	4	1
Perambalur	13		9		1	
Poonamalle	3	1	10	3	5	2
Pudukottai	6		15		1	2
Ramanathapuram	2	1	12	1	5	
Ranipet	4	1	14		1	5
Salem	5		7	5	4	
Sivagangai			18			1
Sivakasi	6		12	1	4	1
Tenkasi	1		17	2	2	1
Thanjavur	1		11	1	6	
Theni	5		11	1	3	2
Tirunelveli	7	1	10		4	2
Tirupattur	1		13	3	4	
Tiruppur	3		17	1	4	
Tiruvallur	4		11	3	6	1
Tiruvannamalai			20		1	
Tiruvarur	1		7	3	4	
Trichy	2		11	4	3	2
Tuticorin	1		20	1	2	
Vellore	4		12	1	4	1
Villupuram	4	1	16	2	5	
Virudhunagar	4		15	2	3	1
Grand Total	162	8	631	76	158	38

Figure 2, Child's sickness (30%), being out of state (29%), and not being aware of the place and date of pulse polio (23%) were the primary reasons quoted for not receiving the OPV during the IPPI campaign.

Figure 2: Reasons for not receiving OPV in IPPI campaign,
3rd to 9th March 2024, Tamil Nadu



DISCUSSION

The findings of this dipstick survey highlight the success of the Intensified Pulse Polio Immunization (IPPI) campaign in Tamil Nadu. With over 91% of respondents reporting that their children received the oral polio vaccine (OPV), the coverage reflects the effectiveness of the public awareness campaign and logistical execution during the immunisation day—however, the 8.6% of children who remained unvaccinated on third day of IPPI highlight gaps that need targeted interventions.

The reasons for non-vaccination, such as being out of state, sickness of the child or mother, and lack of awareness, indicate that more tailored outreach efforts, including communication about the vaccination schedule and alternative provisions for absentee children, could enhance coverage. Those who reported not being vaccinated on 3rd day of IPPI were followed by district administration through community health workers, and subsequently, 47 children were vaccinated during mop-up days. This resulted in cumulative OPV coverage of 95.4% at the end of the IPPI campaign.

The reasons for not receiving the OPV for the remaining 54 (4.6%) were (5-No child at home, 5- age more than six, 14- the child is sick, 1- out of the country).

This survey affirms the role of ICDS-Anganwadi centres as key vaccination hubs. It stresses the importance of addressing coverage disparities, especially in regions like Chennai, which had a higher rate of non-vaccination. These insights should inform future IPPI campaigns, allowing for better planning and resource allocation to maximise vaccine uptake.

The dipstick survey provides a rapid and efficient method of assessing vaccination coverage after an IPPI campaign. A large sample size (1,174 responses) offers a robust snapshot of vaccination uptake across Tamil Nadu, including data from urban and rural districts. Telephonic interviews ensure timely data collection and broad coverage, facilitating immediate action where necessary.

The survey relies on maternal self-reporting, possibly introducing recall bias. The method does not capture qualitative data about more profound barriers to vaccination, such as mistrust or logistical challenges beyond the immediate reasons provided. This approach aligns with the survey's goals, providing actionable insights for future public health campaigns.

CONCLUSION

The survey highlights the importance of continuous

public engagement through IEC and other community-oriented activities, particularly in areas with lower vaccine uptake, and underscores the need for ongoing surveillance. By leveraging rapid assessment tools like dipstick surveys, public health authorities can make data-driven decisions to fine-tune their immunisation strategies, ultimately contributing to the global goal of polio eradication.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE - PUBLIC HEALTH

UNVEILING THE BOTTLENECKS: REVIEW OF COMMUNITY HEALTH CENTRES NOT MEETING THE NATIONAL QUALITY ASSURANCE STANDARDS REQUIREMENT, TAMIL NADU, 2022 TO 2023

*Thamarai Kannan Ravichandran ⁽¹⁾, Jemini B R ⁽¹⁾, Somasundaram A ⁽¹⁾, Selvavinayagam T S ⁽¹⁾***(1) Directorate of Public Health and Preventive Medicine, Chennai 600006****ABSTRACT**

INTRODUCTION : Initiated by Government of India in 2013, the National Quality Assurance Standards (NQAS) program aims to elevate the quality of care provided in public health facilities nationwide. This study examines the performance of Community Health Centres (CHCs) in Tamil Nadu concerning the NQAS. Despite its significance, some CHCs fail to meet NQAS standards, prompting an exploration into the underlying factors contributing to this shortfall.

METHODS : Through a descriptive cross-sectional study, data from CHCs not recommended for certification were analysed to identify challenges and areas for improvement.

RESULTS : This study reveals significant shortcomings in quality management, support services, clinical care, and human resources. Results indicate that out of 423 CHCs, 30.7% participated in the NQAS assessment, with 7.7% failing to meet certification requirements.

CONCLUSION : Identified challenges include deficiencies in quality management, support services, and clinical care, along with potential human resource constraints. Recommendations include strengthening quality management systems, enhancing support services, prioritizing clinical care, addressing HR constraints and improving linkage services.

KEYWORDS : Poliomyelitis, Oral vaccine, Sabin vaccine, Mass vaccination, Primary care

INTRODUCTION

National Quality Assurance Standards (NQAS) program, initiated by the Government of India in 2013, aims to enhance the quality of care provided in public health facilities nationwide.¹ These standards are crucial for ensuring top-notch healthcare delivery in community settings, particularly in Community Health Centres (CHCs), which serve as the cornerstone of primary healthcare in India. In 2020, standards were also established for Ayushman Bharat Health and Wellness Centres and Sub-centres to ensure high-quality promotive, preventive, and primary healthcare services, early screening and identification of health issues, timely referrals, and regular follow-ups.

India's public health system operates across three tiers: primary, secondary, and tertiary. Primary care is delivered through sub-centres and primary health centres (PHCs), at the same time, CHCs are 30 bedded hospitals which serves as the First Referral Unit (FRU) for PHCs and sub-centres, offering essential services such as emergency obstetric care, blood storage, and new-born screening.² Tamil Nadu's health system operates on a three-tier structure: primary, secondary, and tertiary care. Primary healthcare services fall under the Directorate of Public Health and Preventive Medicine, which have 45 Health Unit Districts.

Each district is managed by a District Health Officer and includes 30 to 40 Primary Health Centers (PHCs). PHCs are established at a ratio of one per 30,000 people in plain areas and one per 20,000 in hilly regions. Each PHC generally oversees 5 to 6 Health Sub-Centers (HSCs), which are set up at a rate of one per 5,000 rural residents in plain areas and one per 3,000 in hilly areas.³

NQAS assessment is a vital initiative aimed at enhancing the quality of healthcare services in India, particularly within public health facilities. Developed by the National Health Mission, NQAS provides a comprehensive framework for evaluating healthcare delivery across various dimensions, including service provision, patient rights, clinical care, infection control, and facility management. The assessment process involves both self-evaluation by healthcare facilities and external validation by independent assessors. NQAS continues to align with global standards and has recently received accreditation from the International



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Corresponding Author: Thamarai Kannan

e-mail : rtkannan11@gmail.com

Society for Quality in Healthcare (ISQua). Research shows numerous benefits associated with NQAS accreditation for public health facilities, with many respondents viewing it as an effective mechanism for enhancing healthcare quality. By focusing on capacity building and training for healthcare personnel, NQAS aims to improve health outcomes and increase patient satisfaction. Ultimately, the implementation of NQAS in Tamil Nadu is a significant step toward ensuring that patients receive safe, effective, and compassionate care, thereby strengthening the overall public health system. Achieving equitable, accessible, and affordable primary healthcare of assured quality is essential to realizing the goal of 'Health for All.'

Not all CHCs comply with NQAS standards, some factors contribute to a CHC not meeting few recommendations. Understanding these reasons is crucial for developing targeted support systems to help CHCs bridge the gap and achieve NQAS certification.²

This study aims to provide a comprehensive analysis of Community Health Centres (CHCs) not meeting the requirement of NQAS, exploring the various reasons why they might fall short of meeting the criteria. This study describes the potential shortcomings in areas such as infrastructure, staffing, and service delivery processes and to identify the most common areas of non-compliance with NQAS standards and to explore the underlying factors contributing to these failures.

METHODS

A descriptive cross-sectional study was conducted to analyse the reasons why few Community Health Centres (CHCs) are failing to meet the requirements for NQAS certification in external assessments. The study population comprised those CHCs identified as not complying with the certification standards. Data were collected from state program records, specifically utilizing the external NQAS assessment checklist. The final reports generated by external assessors served as the primary data source for this research, offering valuable insights into the performance and quality deficiencies of the selected health centres.

The primary variable in this study was the external assessment scores assigned to each Community Health Centre (CHC) under the National Quality Assurance Standards (NQAS) program. These scores reflect the level of compliance with the quality standards established by NQAS. The assessment process involves trained evaluators who examine various aspects of healthcare delivery, including service provision, patient safety, and adherence to clinical protocols.

Each CHC is evaluated using a comprehensive checklist that encompasses multiple domains, such as infrastructure, staffing, clinical practices, and patient feedback.

The following quality measurement and checklist for standards by the external assessment has been reviewed for this study.³ The Areas of Concern include broad area/themes for assessing different aspects of quality like service provision, patient rights, infection control. CHC focuses on 8 areas of concern and has 65 standards to meet. It includes 297 measurable elements that are assessed using a measurement system at the CHC level, which involves a checklist with 12 items.

Table 1 describes the Areas of Concern and the corresponding standards checklist for Community Health Centres (CHCs). Each area addresses specific aspects of healthcare quality and service delivery, providing a comprehensive framework for evaluation. The checklist for Areas of concern include: **a) Service Provision:** The service provision area assesses the availability of curative services at Community Health Centers (CHCs). It also evaluates the accessibility of RMNCH+A (Reproductive, Maternal, Newborn, Child, and Adolescent Health) services. Additionally, it includes diagnostic services and evaluates participation in national health programs. **b) Patients' Rights:** This area measures the availability of essential information to patients. It ensures physical access to healthcare facilities and services. Furthermore, it protects patient privacy and confidentiality while providing mandated free services and incentive schemes. **c) Inputs:** Inputs area evaluates the availability of necessary infrastructure for effective service delivery and also assesses physical safety within health facilities. Moreover, it reviews the availability of skilled human resources, drugs, consumables, equipment, and instruments. **d) Support Services:** This area focuses on processes for equipment maintenance and inventory management. It assesses auxiliary services such as laundry, diet, housekeeping, and power backup. Additionally, it includes standards for financial management, community monitoring, and human resource management. **e) Clinical Services:** This area measures quality in areas such as consultation, admission, and continuity of care. It assesses nursing care, medication safety, and services for high-risk and vulnerable patients. It also covers clinical processes related to antenatal, intranasal, postnatal, newborn, child, and adolescent health, along with family planning. **f) Infection Control:** It evaluates the availability of hand-washing facilities and personal protection equipment. Furthermore, it assesses instrument processing, environmental control, and biomedical waste management

practices. **g) Quality Management:** This area establishes standards for the formation and functioning of a quality team. It includes internal and external quality assurance processes. Additionally, it incorporates patient satisfaction surveys and the implementation of standard operating procedures.

h) Outcome: The outcome area measures the productivity and efficiency of CHCs in delivering care. It assesses the quality of clinical services provided to patients. Lastly, it evaluates overall performance in terms of health outcomes and service quality.

Table 1: Areas of concern and Standards for

Community Health Centers (CHCs) under NQAS

Areas of Concern under NQAS	No. of Standards
A Service provision	6
B Patient rights	5
C Inputs	5
D Support services	10
E Clinical services	22
F Infection control	6
G Quality management	7
H Outcome	4
Total Standards	65

There are twelve checklists, namely – Accident and Emergency, Outpatient Department, Labour Room, Inpatient Department, Operation Theatre, Pharmacy, Laboratory, Radiology, Blood Storage, NBSU, and General Administration and Auxiliary Services, which are given in this study. Table 2 explains the criteria which a CHC should meet for award of certification.

Table 2: Criteria for issuing certification under NQAS, based on external assessment:

I.	Criterion 1 Aggregate score of the health facility $\geq 70\%$
II.	Criterion 2 Score of each department of the health facility $\geq 70\%$
III.	Criterion 3 Segregated score in each Area of Concern (Service Provision, Patient's Right, Inputs, Support Services, Clinical Services, Infection Control, Quality Management, Outcome Indicator) $\geq 70\%$
IV.	Criterion 4 Score of Standard A2, Standard B5 and Standard D10 is $\geq 70\%$ in each applicable department. <ul style="list-style-type: none"> Standard A2 States "The facility provides RMNCHA services". Standard B5 states that "the facility ensures that there are no financial barriers to access, and that there is financial protection given from the cost of hospital services". Standard D10 states "the facility is compliant with all statutory and regulatory requirement imposed by local, state or central government."
V.	Criterion 5 Individual Standard wise score $\geq 50\%$
VI.	Criterion 6 Patient Satisfaction Score of 65% in the preceding Quarter or more (Satisfied & Highly Satisfied on Mera-Aspataal) or Score of 3.2 on Likert Scale

Data entered in Microsoft Excel and data analysis was done to identify patterns, trends, and areas needing improvement. This analysis included calculating descriptive statistics, such as averages and percentages, to summarize the performance of each CHC across various standards. By examining the relationships between different areas of

concern, the analysis aimed to highlight shortfalls within the healthcare facilities.

RESULTS

Out of the 423 Community Health Centres (CHCs) in Tamil Nadu, 130 (30.7%) participated in the National Quality Assurance Standards (NQAS) assessment including 40 CHCs in 2022 to 2023. Of these, 120 (92.3%) received certification, and 10 (out of 40 CHCs) 7.7% were not recommended (deferred) in 2022 to 2023 were not recommended (deferred). This means nearly 7% of the participating CHCs failed the assessment. Also, many CHCs are yet to participate in the NQAS assessment.

Table 3: Aggregate score of NQAS Assessment of the 10 deferred

Community Health Centres (CHCs), Tamil Nadu, 2022 - 2023

S No	CHCs	Aggregate Score (%)
1	Kosavapatti CHC	70.5
2	Alangudi CHC	72.7
3	Vadagupatti CHC	73.5
4	Anchetti CHC	76.3
5	Kabisthalam CHC	78.2
6	Pandalkudi CHC	78.3
7	Kadayampatti CHC	79.8
8	Thayilpatti CHC	80.2
9	T.N.Palayam CHC	81.8
10	Vellakovil CHC	82.4

Table 3 displays the aggregate scores achieved by the Community Health Centres (CHCs) in the NQAS external assessment showing all health facilities scored above 70% but not meeting the required criteria for certification.

Table 4: Scores under each Area of Concern for 10 deferred Community Health Centres (CHCs), Tamil Nadu, 2022 - 2023

Area of concern	Kosavapatti CHC	Alangudi CHC	Vadagupatti CHC	Anchetti CHC	Kabisthalam CHC	Pandalkudi CHC	Kadayampatti CHC	Thayilpatti CHC	T.N.Palayam CHC	Vellakovil CHC
A. Service provision	69	72	71	65	72	79.4	85	78	77.3	83
B. Patient rights	73	81	82	80	89	87.5	90	84	88.1	93
C. Inputs	67	72	78	72	80	74.3	79	83	86.3	79
D. Support services	69	73	77	76	83	81.8	80	85	79.4	77
E. Clinical services	65	71	73	77	81	80.2	85	79	83.3	89
F. Infection control	86	78	78	85	86	80.7	86	83	90.2	90
G. Quality management	66	66	57	72	55	64.7	57	68	74.4	61
H. Outcome	74	71	70	80	74	87.6	79	77	80.6	98

Table 4 shows that Kosavapatti CHC scored below 70 in several areas, with service provision at 69 and inputs at 67, indicating significant room for improvement. Anchetti CHC also performed below 70 in service provision, scoring 65, while Kadayampatti CHC and Vadagupatti CHC both had lower scores in quality management, with 57 each. Five facilities scored which scored below 70 in the area of Quality Management - Kabisthalam CHC had the lowest score at

55, followed by Pandalkudi CHC with 64.7 and Thayilpatti CHC at 68. Additionally, Alangudi CHC scored 66, while Vellakovil CHC scored 61 in this critical area. Furthermore, approximately 8 out of 10 deferred CHCs failed specifically in the area of Quality Management.

Table 5: Department wise score of the 10 deferred

Community Health Centres (CHCs), under NQAS, Tamil Nadu, 2022 - 2023

S.No	Departments	Kosavapatti CHC	Alangudi CHC	Vadugapatti CHC	Anchetti CHC	Kabishalam CHC	Pandalkudi CHC	Kadayampatti CHC	Thayilpatti CHC	T.N.Palayan CHC	Vellakovil CHC
1	Accident& Emergency	48.2	82.13	60.6	70.4	89.65	82.2	89.3	83.3	84.6	86.06
2	Laboratory	88.3	69.6	78.2	75.2	75.6	83.6	76.2	86.5	78.4	78
3	OPD	82.6	86.89	75.7	78.5	85.73	87.8	88.4	76.8	90.3	89.09
4	Labour room	82.8	73.33	81	77.2	89.13	79.2	88.7	88.5	85.3	93.73
5	Pharmacy and store	76.5	75.74	83.9	78.5	90.59	79.2	82.6	85.1	67.3	71.28
6	IPD	65	80	67.3	80.6	88.02	77.1	74.5	84.3	85.3	87.46
7	Auxiliary	42.4	59.26	70.2	70.8	54.77	74.2	69.1	72.5	83.7	44.66
8	General administration	70.7	61.19	75.9	77.8	66.69	72.9	81.6	69.2	86.6	70.62
9	Operation Theatre	68.2	62.05	70.1	78.1	65.06	76.1	72.3	80	74.4	90.41
10	Blood Storage Unit	67.2			73.2		81.6	60.9			80.72

In Table 5, Kosavapatti CHC identified several departments that scored below 70. Specifically, the Accident & Emergency department received a low score of 48.2, and the Auxiliary services scored only 42.4. Additionally, the scores for IPD score 65, the Operation Theatre scored 68.2, and the Blood Storage Unit scored 67.2.

Alangudi CHC failed under lab services, Auxiliary services, general administration and Operation Theatre. Out of 10 CHC's deferred 5 of them failed in auxiliary services department. In total, CHCs have scored less than 70% in five out of ten departments.

Table 6: Proportion of deferred Community Health Centres (CHCs) failed to meet Standards under specific services under NQAS, Tamil Nadu, 2022 - 2023, N=10

Services	Standards	n (%) CHC's - not met the standards
Support Services	D6 - The facility has defined and established procedures for promoting public participation in management of hospital transparency and accountability	2 (20%)
	D10 - The facility has established procedure for monitoring the quality of outsourced services and adheres to contractual obligations	4 (40%)
Clinical Care	E12 - The facility has defined and established procedures for Blood Storage Management and Transfusion	6 (60%)
	E13 - The facility has established procedures for Anaesthetic Services	2 (20%)
Infection Control	F1 - The facility has Infection Control Programme, and there are procedures in place for prevention and measurement of Hospital Associated Infections	2 (20%)
Quality Management	G1 - The facility has established organizational framework for quality improvement	2 (20%)
	G5 - The facility has established system of periodic review as internal assessment, medical and death audit and prescription audit	2 (20%)
	G6 - The facility has defined and established Quality Policy and Quality Objectives	4 (40%)
	G7 - The facility seeks continual improvement by practicing Quality tool and method	3 (30%)

Table 6 presents the proportion of CHCs which had not met the standards for specific areas of concern -

Support Services, Clinical Care, Infection Control, and Quality Management, indicating failure. Notably, six facilities scored less than 50% in Standard E12 under Blood Storage Management and Transfusion, which falls under Clinical Care. Additionally, four facilities failed in Standards D10 and G6, which are related to Support Services and Quality Management, respectively. In this study, five standards of support services, four standards of clinical care, one standard of infection control and four standards of quality management were less than 50% and failed the criteria.⁵

DISCUSSION

This study examined the performance of Community Health Centres (CHCs) in Tamil Nadu which deferred in the National Quality Assurance Standards (NQAS) assessment. Around 40% of non-recommended CHCs failed in quality management standards related to policy, continuous improvement, and quality assurance. This indicates the need of for continuous monitoring and improvement mechanisms. Deficiencies in support services, such as equipment maintenance, pharmaceutical management, and public transparency, compromise patient care and resource efficiency. Notably, over 60% failed in blood storage management, underscoring a critical need for improved practices in this area. Short comings in essential services, like Operation Theatre and Blood Storage Units, suggest potential issues with HR constraints like inadequate staff and training.

As of now in Tamil Nadu, a total of 371 Primary Health Centres (PHCs) have undergone national assessment. Out of these, 325 PHCs (87.5%) were fully certified, 41 PHCs (11.0%) received certification with conditionality, and 5 PHCs (1.5%) were deferred. Compared to PHCs (Primary Health Centres), the deferred rate for CHCs is significantly higher.

Even though NQAS was started in the year 2013, Kerala was not able to accredit many institutions with NQAS because of certain check points in the NQAS check list which are not suitable for Kerala socio economic and health conditions. In Kerala, state took initiatives to customize the NQAS check list according to Kerala standards with the help of NHSRC and the checklist were customized according to Kerala conditions in November 2017. The checklist customization was done by removing some items irrelevant to Kerala conditions and by adding palliative care into the check list.²

Around the world, more and more countries, whether developed or developing, are adopting a healthcare

assessment system to achieve hospital accreditation (Greenfield and Braithwaite, 2008).⁵ Accreditation involves a thorough evaluation of healthcare facilities against established standards by an authorized body, either governmental or non-governmental. While accreditation primarily focuses on quality management, its impact on service improvement is debated. Some argue that accreditation standards help enhance healthcare quality and bolster patient safety⁶, and they are designed to promote ongoing quality improvement efforts within accredited institutions.⁷ The study which conducted in Kerala by Sindhu Joseph regarding impact assessment of accreditation in primary and secondary public Healthcare Institutions in the State of Kerala, showed that the accreditation has a positive impact on patient satisfaction and other quality dimensions, overarching structural and procedural quality in primary healthcare facilities under the public sector in Kerala. Conversely, accreditation has not improved the quality dimensions in secondary healthcare facilities and thereby, the satisfaction of patients.⁸

The study by Erlyn K. Macarayan et al., which assessed primary care quality across ten low- and middle-income countries, found gaps in measuring key outcomes like user experience, health outcomes, and confidence. It also highlighted deficiencies in processes such as timely action, provider choice, affordability, ease of use, dignity, privacy, non-discrimination, autonomy, and confidentiality. Additionally, there was no information available on care competence beyond maternal and child health.⁹

The additional information regarding the NQAS CHC checklist customized for FRU (First Referral Unit) CHCs highlights a gap in Tamil Nadu's CHCs. The lack of 24-hour emergency care with specialists like surgeons, obstetricians/gynecologists, anesthetists, and pediatricians significantly undermines FRU functionality. This aligns with the observation that many CHCs failed to meet Criteria 5, which likely encompasses FRU requirements.

CONCLUSION

This study highlights the importance of taking a multi-faceted approach to enhance CHC performance in Tamil Nadu. The NQAS assessment results identify areas for improvement in the state's CHCs while also offering valuable opportunities to strengthen the healthcare system. In comparison to Primary Health Centres (PHCs), the deferred rate for Community Health Centres (CHCs) is notably higher. Furthermore, a number of CHCs have yet to participate in the NQAS assessment. By implementing targeted interventions and addressing identified challenges positively, like Kerala

where they customized the check list after that they made tremendous progress in NQAS accreditation.²

RECOMMENDATIONS

By addressing these challenges, Tamil Nadu can significantly improve CHC performance in NQAS assessments and deliver better healthcare to communities. Strengthening Quality Management involves implementing robust quality improvement programs, establishing clear quality policies, and conducting regular internal and external audits. Enhancing Support Services requires a focus on improving equipment maintenance programs, streamlining pharmaceutical management, and actively encouraging public participation in hospital governance. Prioritizing Clinical Care entails ensuring adherence to standard treatment guidelines, strengthening emergency preparedness, and establishing adequate blood storage and transfusion practices. Addressing Human Resources constraints involves allocating adequate resources for staffing, prioritizing training programs for healthcare personnel, and exploring financial support options from stakeholders at the state and district levels. Bridging the FRU Gap requires advocating for policy changes and customizing CHC checklists, while improving Linkage Services involves strengthening referral networks and communication channels between CHCs and higher-level facilities to ensure seamless patient care pathways. These comprehensive steps will contribute to enhancing healthcare delivery and meeting NQAS standards across Tamil Nadu's CHCs.

DECLARATION OF INTEREST

The authors declare no conflict of interest.

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REVITALIZING DHANUSHKODI: NEED FOR HEALTH AND COMMUNITY SERVICES IN THE ABANDONED 'GHOST-TOWN' IN TAMIL NADU

Ajith Brabhu Kumar C ⁽¹⁾, Surendran R K ⁽²⁾, John Aaron Prabhu ⁽³⁾

(1) Deputy Director of Health Services (District Health Officer), Ramanathapuram District, Directorate of Public Health and Preventive Medicine, Government of Tamil Nadu, India.

(2) Block Medical Officer, Mandapam, Ramanathapuram District, Directorate of Public Health and Preventive Medicine, Government of Tamil Nadu, India.

(3) Medical Officer, Urban Primary Health Centre, , Rameswaram, Ramanathapuram District, Directorate of Public Health and Preventive Medicine, Government of Tamil Nadu, India.

ABSTRACT

INTRODUCTION : Evolving landscapes and trade opportunities encourage population migration, and addressing their health care becomes crucial. Migration to a place disconnected from the health system poses significant health risks, including exposure to infectious diseases, inadequate healthcare access, mental health impacts of displacement, apart from the inappropriate medical care and emergence of quackery during health care needs. Integrated health systems that keep updated with the recent population trends and cater to the unique needs of migrants and transient populations is essential to achieve the goal of 'Universal Health Coverage'. This article explores the background of one such instance in Tamil Nadu, in which tourism opportunities coupled with technological advancements, relocated people back to an abandoned town, thereby creating a demand for their basic necessities in the abandoned place.

INTRODUCTION

Ramanathapuram district is one of the 38 districts in the state of Tamil Nadu in India, and one among the 14 coastal districts in the state. It lies in the South-East coast of India, facing the Bay of Bengal. The coastline extends up to 237 kms, and the easternmost part of Ramanathapuram district comprises the Rameswaram (also known as Pamban) island, which has an area of 96 Sq.kms and a coastline of 37 kms. Rameswaram island has cultural, ecological, spiritual and historical significance in the history of Indian sub-continent. The island is of global importance due to its rich flora and fauna. The biologically-rich coastal region comprises the Gulf of Mannar Marine Biosphere Reserve, which is the first of its kind in south and south-east Asia. The reserve houses diverse range of species and habitats and is recognized a World Heritage site.

The Deadly Disaster:

On the midnight of 23rd December 1964, the island faced a cyclonic storm which had a huge impact on Dhanushkodi, the easternmost tip of the Rameswaram island. The 1964 Dhanushkodi cyclone (also known as Rameswaram cyclone) is still considered as one of the powerful cyclone India have ever faced. The 25 feet storm surge overturned

a running Pamban-Dhanushkodi passenger train into sea, killing all the 400 people on board and submerging the Dhanushkodi island. Around 2,000 people lost their lives due to the cyclone with wind-speeds of up to 240 kms/hour. Casualties were also reported in northern part of Sri Lanka, the erstwhile Ceylon, which lies around 18 kilometers from Dhanushkodi.

Prior to the cyclone, the Dhanushkodi town had a functional railway station, a railway hospital, a customs office, a post and telegraph office, two medical institutions, a panchayat union dispensary, a higher elementary school and port offices, established by the British. The town had human settlements and was an important commercial center. The then iconic "Boat Mail Express" from Chennai (then Madras) to Colombo, Sri Lanka (then Ceylon) was operated between the two nations connecting India and Ceylon. This was once an important route for trade and public transit due to cultural bonds between the Indian and Sri Lankan Tamil People.



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Corresponding Author: Ajith Brabhu Kumar C

e-mail : dr.c.ajith@gmail.com

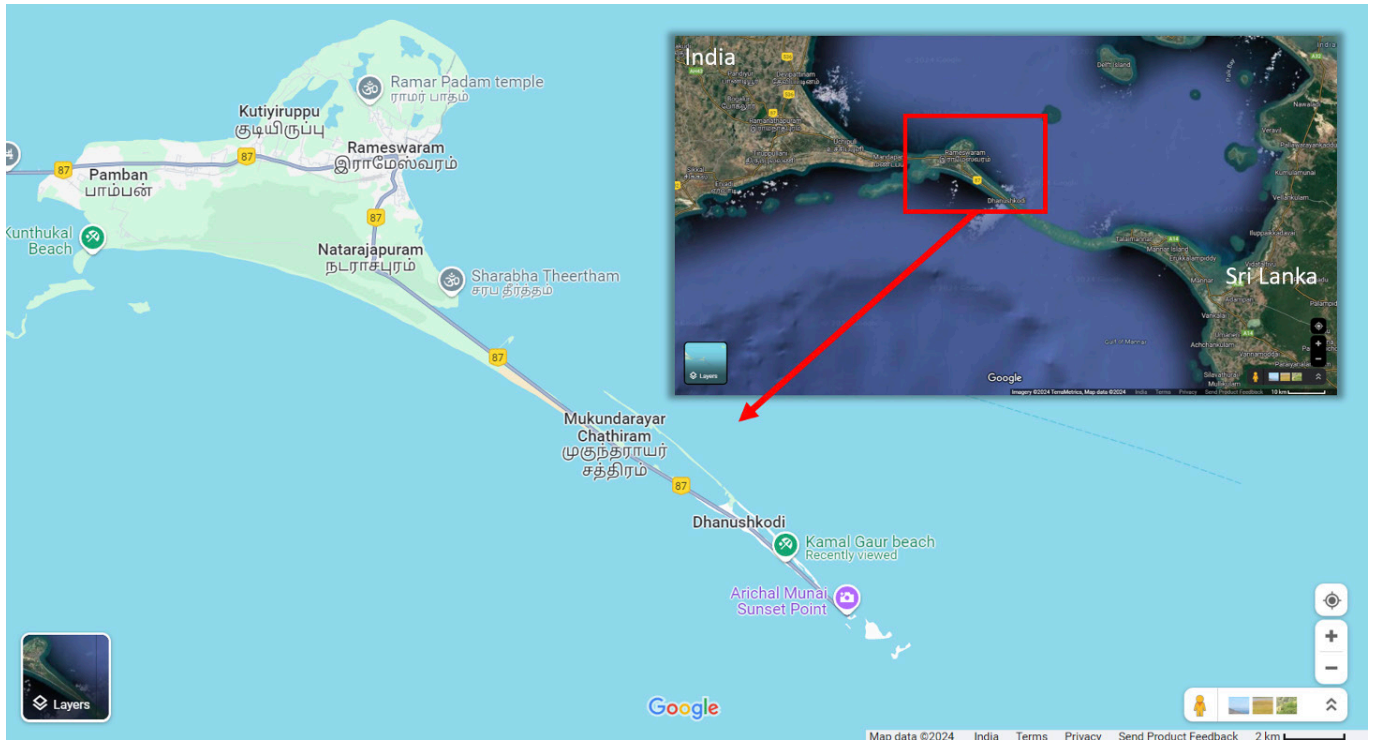


Fig.1: Map showing Rameswaram, Mukuntharayar Chathiram and Dhanushkodi.(Source: Google Maps, Retrieved: September 23, 2024)

The Town of Uncertainty:

In the aftermath of cyclonic storm and its impact, due to the extensive damages of the infrastructure, and the impending risk factors, the Government of Tamil Nadu declared Dhanushkodi town as unfit for human settlement.

The surviving people from two villages, Palam and Kambipadu in Dhanushkodi were allotted lands in the other two villages Natarajapuram and Ramakrishnapuram, both about 21 kms from Dhanushkodi and the human settlements were limited to Natarajapuram in Rameswaram, by the Government. The abandoned town had only the remnant buildings of St. Antony's church, the railway station, temples and few other structures, that partly survived the devastating cyclone. The rail and road links to Dhanushkodi were broken and not restored or attempted for reconstruction after the cyclone. The trains were limited to Rameswaram and the roads were limited to Mukuntharayar Chathiram, about 5 kms away from Dhanushkodi. Dhanushkodi, since then had been largely inhabited and was locally referred to as a "Ghost Town".

The Era of a Reborn town:

However, after the advent of private and commercial vehicles, during 1990s, the abandoned town and its remnants started attracting tourists. Tourism at Dhanushkodi was seen as a major source of income for the native people of Rameswaram, apart from fishing. Vehicles like vans and jeeps, with off-

road capabilities, starting from Mukuntharayar-Chathiram, started carrying tourists and plying into the shallow sea water along the sea coast. The activity drew huge tourists to the abandoned town, along with visits to the ruined buildings constructed with coral reefs during the British rule in India. The tourism industry proportionately improved with economic development and affordability of population, to own private vehicles and the local residents of Rameswaram were in no surprise to capitalize on this newly evolving business. However, Dhanushkodi town had no permanent residents since the Government had already relocated all the residents, allotted them alternate lands in a comparatively safer zone with amenities. The Government made no further efforts to officially declare Dhanushkodi as a habitation and neither provided any proof for any individual as a native resident of Dhanushkodi nor made efforts to provide electricity or establish transport facilities or a fuel station. Due to these limitations, the commercial tourism activity continued only till the sunset, and the tourists and residents themselves returned back to the nearby Rameswaram town with their assets and vehicles, as darkness set in, for reasons such as lack of security and lack of electricity. Also, the local residents involved in the commercial activity, who had their permanent houses at Rameswaram, with their family members, returned back to Rameswaram, after sunset.



Fig.2: Tourist attractions and activities during 2016: Clockwise from top: (i) Remnants of St. Antony's Church at Dhanushkodi, surrounded by temporary structures serving as shops for tourists; (ii) and (iii) Off-road vehicles plying tourists through the sea waters in Dhanushkodi; (iv) Road connecting Mukuntharayar Chathiram of Pamban island to Dhanushkodi, under construction during 2016.

During 2016-17, a new stretch of road was constructed connecting Mukuntharayar Chathiram of Pamban island to Dhanushkodi. This road allowed entry of private vehicles till Arichalmunai, the tip of Dhanushkodi, which eventually became a fresh destination for tourists. The Government started plying public transport buses till Arichalmunai for tourists and local residents. The new road, added with increased availability of private vehicles, completely shut down the business of off-road vans and

vehicles that were plying tourists on the sea shore. The local residents were forced to see an alternate source of income, by setting up their temporary huts with thatched roofs in the available places in areas where people congregated, establishing eateries and selling hand-made sea-shell products. Still, electricity was seen as a major detriment for the local residents, which forced them to return back to Rameswaram town after the dusk.



Fig.3: An aerial view of Dhanushkodi in 2023, showing the newly constructed road, with temporary settlements and shops set by local people on either side of the road, to cater the tourists.

The health services for the people in Rameshwaram island, including Dhanushkodi is catered by a Rural Primary Health Centre (PHC) at Pamban with its Health Sub-centers (HSCs) surrounding Pamban and by an Urban Primary Health Centre (UPHC) located at Rameswaram municipality with its Urban Health Sub-centers. The secondary care hospital is also located in the Rameswaram municipality. The nearest Health Sub-center (HSC) for Dhanushkodi is located in Natarajapuram (Natarajapuram HSC), about 13 kms away and the nearest Primary Health Centre is Rameswaram UPHC, located 16 kms away. The nearest secondary care centre, Rameswaram Government Hospital (GH) is located about 16 kms away. Few private clinics numbering around 20 are concentrated and located in Rameswaram town. The tertiary care facility for Ramanathapuram district is a Government Medical College Hospital (MCH) located 70

kms away from Dhanushkodi. Currently, the villages enlisted under Natarajapuram HSC for providing primary care and outreach services by the Directorate of Public Health & Preventive Medicine (DPH&PM) includes 13 villages, namely Karaiyur, MRT Nagar, Karaiyur Kadarkarai, Attamaal, Maariyamman Kovil, Serankottai, Natarajapuram, Puthu Road, Ramakrishnapuram, Dhanushkodi, Mukuntharayar Chathiram, Nethaji Nagar and Rajagopal Nagar, with a total of 3,147 houses, which includes 102 houses with 329 people in Dhanushkodi and 31 houses with around 50 people in Mukuntharayar Chathiram. The houses and population in both these places are enlisted by DPH&PM solely for the purpose of providing health care services. The villages still remain to be officially inhabited and since all the houses are made from temporary structures, the enlisted number of houses and population tend to be dynamic in nature.

Table 1: Village wise houses and population details of Natarajapuram Health Sub-Centre, Urban PHC Rameswaram, Mandapam Block, Ramanathapuram Health Unit District

S. No.	Villages	Houses	Population (n)										Male	Female	Total
			<1 year	1-5 years	5-10 years	10-15 years	15-19 years	19-29 years	30-45 years	46-59 years	> 60 years				
1	Karaiyur	300	7	96	85	105	98	173	518	470	197	887	862	1749	
2	MRT Nagar	383	7	86	77	86	65	142	271	248	139	512	609	1121	
3	Karaiyur Kadarkarai	172	9	75	78	87	48	138	220	220	106	491	490	981	
4	Attamaal	40	9	40	22	25	49	61	61	57	34	157	201	358	
5	Mariyamman Kovil	108	11	67	56	81	56	102	74	81	103	317	314	631	
6	Serankottai	244	9	63	74	72	106	138	307	278	226	615	654	1269	
7	Natarajapuram	887	11	75	272	331	302	332	329	364	341	1157	1200	2357	
8	Pudhu Road	164	7	57	83	83	112	318	224	352	260	777	719	1496	
9	Ramakrishnapuram	285	12	62	55	89	126	326	264	327	298	786	773	1559	
10	Dhanushkodi*	102	5	49	32	50	28	32	32	49	52	161	168	329	
11	Mukuntharayar Chathiram*	31	1	6	5	7	4	5	5	8	8	24	26	50	
12	Nethaji Nagar	218	11	72	66	62	58	69	31	90	101	276	284	560	
13	Rajagopal Nagar	213	11	64	81	86	66	126	87	47	47	305	310	615	
Total		3147	112	856	1010	1211	1145	1990	2454	2637	1949	6603	6757	13075	

*Temporary houses with Dynamic population, estimates, as of 2023, by DPH&PM

During the COVID-19 era, the movement of people was completely restricted, and tourism which was the only activity in the place, was completely shut down. The local residents had no choice but to stay in Rameswaram. Slowly, as the COVID-19 restrictions were relaxed, tourism regained its momentum and local residents were back to the abandoned Dhanuskodi town to carry on their commercial activities.

During the course of time, Solar panels as source

of electricity were marketed to a large extent in India, and were widely available across the country at cheaper costs. The local residents, reeling with lack of electricity and being forced to return after the dusk, were soon to capitalize on this and started installing solar panels on their huts. The solar panels with battery paved way for their uninterrupted power supply after sunset, and also facilitated usage of fans inside their huts. This brought all their family members including

children back to Dhanushkodi, so that they can comfortably stay even during nights and summer, without returning back to their permanent houses back at Natarajapuram or Rameswaram. Though the Government have neither granted them lands legally nor permitted them to stay in the island, the abandoned town now has significant number of huts

with solar panels atop, with population of all ages, including vulnerable groups such as pregnant women, children and elderly people, with family members engaged in commercial activities including tourism and fishing, serving as their source of income.



Fig. 4: Satellite view showing temporary structures set-up at Dhanushkodi. (Source: Google Maps, Retrieved: September 23, 2024)

Emerging need for Essential services:

During the course of above developments, a Government Primary School (Class I to V) was opened at Mukundarayar Chathiram on 01.06.2006, which was upgraded to a Middle School (Class I to VIII) in 2010, to cater the educational needs of the children residing at Dhanushkodi. The school too, relies on Solar panels for electricity. During the year 2023, around 52 students were found to be enrolled in the school, aged between 5 and 14 years with 3 teachers. An Anganwadi under the Integrated Child Development Services (ICDS), have also been set up in a temporary structure by the Government, for the women and children. However, no temporary or permanent Health Sub-Center (HSC) have been set up till date.

The Village Health Nurse (VHN) from the Directorate of Public Health and Preventive Medicine and the Anganwadi worker from the Integrated Child Development Scheme (IDCS) posted at Natarajapuram, the nearest habitable settlement declared by the Government, continue to take care of the residents at these temporary settlements, since the relocated residents have their permanent addresses within their demarked population area.

With mobile phones still, a rarity and very basic communication systems established in Dhanushkodi, people are forced to rely on their own transport vehicles during medical emergencies.

The roads connecting the settlements are at sea level making commutation difficult during rains. The services available (provided by the Government and availed by the people) to the children and pregnant women in this isolated and abandoned place, was found to be lesser compared to those of other areas.

With no qualified private medical personnel or service available at this abandoned town and with gradually increasing population, few petty shop vendors who sell snacks and consumables including vegetables, for the local residents and tourists, were found possessing and dispensing Over-the-Counter (OTC) medicines and prescription-drugs to the people residing there, due to local demand.

The pregnant women found staying in the settlements failed to turn-up for their scheduled antenatal visits to the nearest health care facility due to these limitations in transportation facilities.



Fig. 5: Clockwise from top: (i) A newborn being examined in Dhanushkodi at a temporary settlement; (ii) Interaction with the local community on health needs; (iii) Inspection of local shops for possession of OTC and prescription drugs; (iv) OTC and prescription drugs found in local shops.

CONCLUSION

The above needs and challenges necessitate the establishment of a Health Centre and Anganwadi with a permanent structure with all basic facilities at Dhanushkodi, not only to cater the needs of the resident people, but also to the tourists visiting Dhanushkodi. With the flourishing tourism and newer technologies being adopted by local people, the Government may consider rebuilding the town and supporting the local community with all basic

necessities like any other village in the district. As the nation marches towards the motto of “Universal Health Coverage”, restructuring and strengthening the health care infrastructure and extending to the grass-root level is prudent in attaining the goal.

DECLARATION OF INTEREST

The authors declare no conflict of interest

EPIDEMIOLOGY OF ACUTE DIARRHEAL DISEASES REPORTED IN TAMIL NADU IN 2022 & 2023

Avudai Selvi Rathinasamy ⁽¹⁾, Amudha A ⁽¹⁾, Sankarmani Ramasamy Mathivanan ⁽¹⁾, Subhashini K J ⁽¹⁾, Mohammed al ossama ⁽¹⁾, Vimalkumar Elangovan ⁽¹⁾, K Bhuvana ⁽¹⁾, R Ramya ⁽¹⁾, M.K Ganapathy ⁽¹⁾, M.Senthilkumar ⁽¹⁾, Sampath P ⁽¹⁾, Selvavinayagam T S ⁽¹⁾,

(1) Directorate of Public Health and Preventive Medicine, Government of Tamil Nadu, India.

ABSTRACT

INTRODUCTION : Acute Diarrheal Disease is one of a major long-standing public health problem in developing countries; factors contributing to this persistent issue include inadequate access to clean drinking water, poor sanitation and a lack of awareness regarding hygiene practices. This study aims to assess the burden of diarrheal diseases in Tamil Nadu and analyze the month-wise trends of Acute Diarrheal Disease (ADD) and related outbreaks across various districts of Tamil Nadu from January 2022 to December 2023.

METHODS : This study is carried out with secondary data analysis of Acute Diarrheal Disease cases reported in the Integrated Disease Surveillance Programme under Integrated Health Information Portal (IHIP- IDSP) in Tamil Nadu. The study data includes the patients attending the health care facilities with diarrhea which is captured in Presumptive form (P- form) of IHIP -IDSP. The study duration is from January 2022 to December 2023.

RESULTS : A total of 162,765 ADD cases were reported in P form of IHIP-IDSP during the two years 2022 & 2023. The highest number of ADD cases is reported in the age group between 31- 40 years of (19.3%) and it is predominant in females. A rising trend is observed from the month of April and peak is observed in the month of June. Of the total cases reported, four districts viz., Ramanathapuram, Tiruvanamalai, Pudukottai & Villupuram, each district constituted >5% of ADD cases. Three districts, Nilgiris, Kanyakumari & Dindigul constituted less than 1% of ADD cases.

CONCLUSION : In this article IHIP - IDSP data that are available in the web portal have provided a better platform for analyzing the seasonal dependency of the outbreaks. IHIP- IDSP acts as a ready reckoner for analyzing the pattern of the outbreaks for any communicable diseases in Tamil Nadu by enabling with necessary information which will be useful to the policy makers and administrators to circumvent the effect of morbidity and mortality due to outbreaks or any Health Events.

KEYWORDS : Acute Diarrheal Diseases, IHIP-IDSP, Surveillance

INTRODUCTION

Acute Diarrhoea refers to episodes of loose stool with rapid onset and lasts for 3 to 7 days but it can also last up to 10 to 14 days. The causative agent of Acute Diarrheal Diseases (ADD) are virus, bacteria and parasitic (protozoan and helminths).¹ The WHO/UNICEF Joint Monitoring Program for Water Supply, Sanitation and Hygiene (JMP) 2017 report revealed that 844 million people worldwide lack access to basic drinking-water services and 2.3 billion lack basic sanitation services, while 892 million still practiced open defecation.² Ballester., et al. suggested that seasonal variations should be considered as prime factor while analyzing any public health issues.³

Diarrhoea is one of the top 10 diseases to contribute to global DALY, even in recent years. In the developing world, infectious causes of Acute Diarrhoea are largely related to contaminated food and water supplies⁴ In the developed countries, technological progress and an increase in mass production of food have paradoxically contributed to the

persistence of foodborne illness, despite higher standards of food production.⁵ Mortality due to diarrheal disease has been declining due to various preventive measures taken by the individual and at the State level in spite of this intervention the incidence of ADD cases remain constant. Apart from this, the recovered individuals develop various public health burdens such as impaired cognitive development, reduced immune response, Developmental delay etc.^{6,7}

Diarrheal diseases have indeed been a significant public health challenge in India since independence. Factors contributing to this persistent issue include inadequate access to clean drinking water, poor sanitation, and a lack of awareness regarding hygiene practices.⁸



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Corresponding Author: M.Senthilkumar

e-mail : dphepi@nic.in

Despite various interventions, such as improved water supply and sanitation programs, diarrheal diseases still account for a substantial burden of morbidity and mortality, particularly among children under five. Research indicates that these diseases often result from a combination of environmental, socio-economic, and health system-related factors.⁹

Efforts to combat this issue have included promotion of oral rehydration therapy, initiatives aimed at improving sanitation and hygiene practices. Continued investment in these areas, along with community education and robust health infrastructure, remains crucial for reducing the incidence and impact of diarrheal diseases in India.¹⁰

Outbreak is the occurrence of unusual increase of cases of disease or syndrome in excess, what would normally be expected in a defined community, geographical area or season. Variations in weather and climate significantly influence the intensity of outbreaks. The seasonal changes affect the incidence of infectious diseases which is crucial for effective public health monitoring and response.

This study aims to assess the burden of diarrheal diseases in Tamil Nadu and analyze the month-wise trends of Acute Diarrheal Disease (ADD) and related outbreaks across various districts of Tamil Nadu from January 2022 to December 2023.

METHODS

This study is carried out with secondary data analysis of Acute Diarrheal Disease cases reported in the Integrated Disease Surveillance Programme under Integrated Health Information Portal (IHIP- IDSP) in Tamil Nadu. The study data includes the patients attending the health care facilities with diarrhea which is captured in Presumptive form (P-form) of IHIP -IDSP. The study duration is from January 2022 to December 2023. Official permission to conduct this study was obtained from the Director of Public Health and Preventive Medicine (DPH&PM), Tamil Nadu.

The line listing format includes information on name, age, sex, address, date of diagnosis, and the patient care (in-patient or out- patient). The IDSP - IHIP data were collected from all Government Primary health centers (PHCs), Community Health Centers (CHCs), Sub-District Hospitals, District hospitals (DHs), Government Medical College Hospitals and other health facilities. The personal identifiers of the patients were not disclosed in this study. Deidentified data used and confidentiality maintained.

Based on the line list data of ADD cases during the study period, a preliminary analysis was carried out by SPSS software (version 16.0). District wise and month

wise incidence of ADD cases & the outbreaks reported was analyzed and interpreted using mapping by QGIS software (version 3.34).

RESULTS

In Tamil Nadu, IHIP – IDSP has 10,019 P-form reporting units which includes all health facilities like Government Primary health centers (PHCs), Community Health centers (CHCs), Sub-District Hospitals(SDH), District Hospitals (DHs), Government Medical College Hospitals(MCH) and Other Health Facilities (OHF) which includes Private Hospitals

A total of 1,62,765 ADD cases were reported in P form of IHIP-IDSP from January 2022 to December 2023. Table 1 & 2 shows socio-demographic distribution and gender distribution of ADD cases.

Table 1: Age Wise distribution of ADD cases reported in IHIP-IDSP in Tamil Nadu from January 2022 to December 2023, N =1,62,765

Age Group in Years	2022	2023	n	%
0-10	9623	9995	19,618	12.1
11-20	6399	6781	13,180	8.1
21-30	11573	12270	23,843	14.6
31-40	14605	16870	31,475	19.3
41-50	13932	16191	30,123	18.5
51-60	11692	13820	25,512	15.7
61-70	6157	7291	13,448	8.3
71-80	1916	2273	4,189	2.6
81-90	513	531	1,044	0.6
91-100	155	178	333	0.2
Total	76565	86200	1,62,765	100

Table 2 : Gender wise distribution of ADD cases reported in IHIP-IDSP in Tamil Nadu from January 2022 to December 2023, N=1,62,765

Gender	n	%	95% CI
Female	90,149	55.4	5.51 to 5.56
Male	72,513	44.6	4.43 to 4.47
Transgender	103	0.1	0
Total	1,62,765	100	

19.3% cases are reported in the age group between 31-40 years followed by 18.5% in 40-50 years of age and the lowest number of ADD cases reported in the elderly age group of above 71 years of age. In terms of gender distribution, 55.4% reported among females and 44.6% among males.

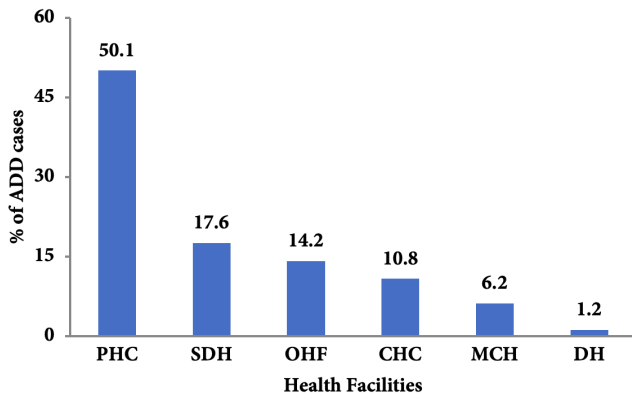


Figure 1: Facility wise % of ADD cases reported in IHIP-IDSP in Tamil Nadu from January 2022 to December 2023, N=162765

About 50.1% of ADD cases reported in Primary Health Centers, followed by 17.6% in Sub-District Hospitals, 14.2% in other Health facilities which includes all private reporting units, 10.8% in Community Health Centers and 6.2% in Government Medical College Hospitals and 1.2% in District Hospitals.

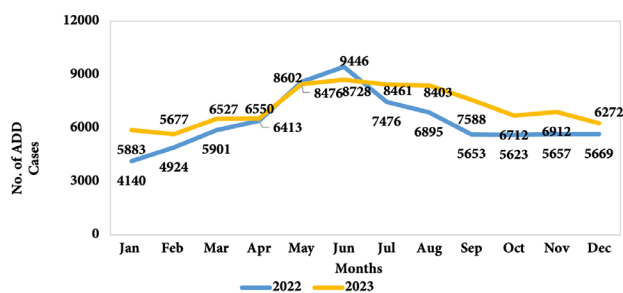


Figure 2: Month Wise Trend of ADD cases reported in IHIP-IDSP in Tamil Nadu from January 2022 to December 2023, N=162765

As per the figure 2, the overall ADD cases reported in the year 2023 is high throughout the year when compared with 2022 except for a dip in the month of May & June. A rising trend is observed from the month of April and peak is observed in the month of June in both years.

Of the total cases reported, four districts viz., Ramanathapuram, Tiruvanamalai, Pudukottai & Villupuram, each district constituted >5% of ADD cases and ADD outbreaks were observed in Villupuram and Pudukottai. Similarly, each of the following district constituted 3-5% of total ADD cases viz., Tiruchirapalli, Mayiladuthurai, Thanjavur, Madurai, Chennai, Salem, Ranipet, Kallakurichi, & Krishnagiri but ADD outbreaks reported in Tiruchirapalli, Salem, Kallakurichi, Thanjavur & Krishnagiri. 21 districts constituted 1-2% cases of ADD viz., Erode, Nagapattinam, Dharmapuri, Coimbatore, Theni, Namakkal, Kanchipuram, Tiruppur, Perambalur, Tirunelveli, Tenkasi, Tiruvallur,

Tiruvarur, Tuticorin, Tirupathur, Chengalpattu, Sivaganga, Vellore, Virudhunagar, Ariyalur, Karur & Cuddalore and ADD Outbreaks reported in Ariyalur, Chengalpattu, Coimbatore, Kanchipuram, Dharmapuri, Thiruvallur and Vellore

Three districts - Nilgiris, Kanyakumari & Dindigul constituted less than 1% of the total ADD cases reported.

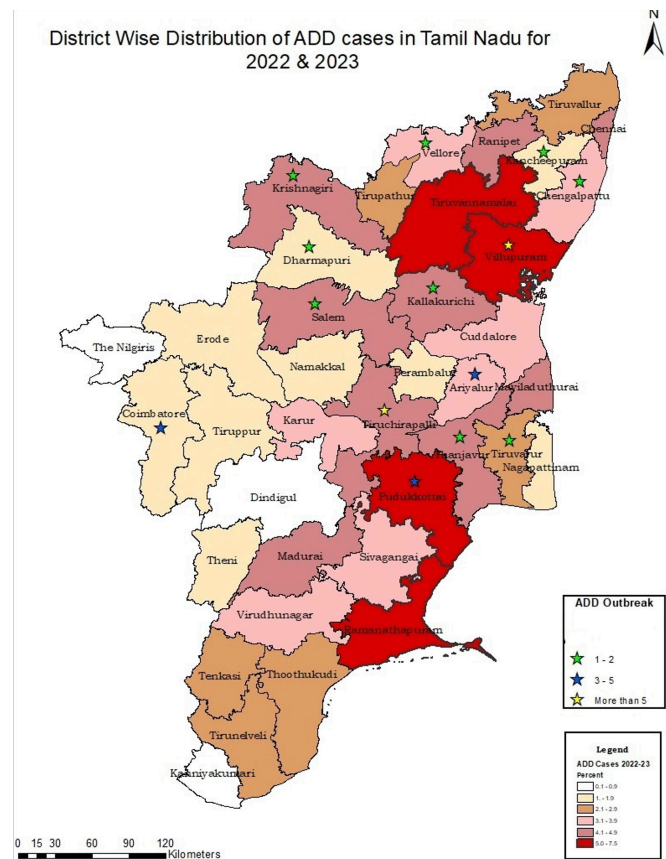


Figure 2: Month Wise Trend of ADD cases reported in IHIP-IDSP in Tamil Nadu from January 2022 to December 2023, N=162765

DISCUSSION

Occurrence of ADD cases and outbreaks are persistent public health challenge imposing a significant burden on both healthcare systems and communities. The country has experienced numerous ADD outbreaks, often with severe consequences, particularly among vulnerable populations. In this study, we have analyzed the data which is collected over the past two years to better understand the pattern of ADD cases reported all over the state and correlated with ADD Outbreaks. Although diarrheal diseases are common in younger age group as per Anandan M et al, which shows maximum number of ADD cases in less than 5 years of age, a study carried out at Tiruvallur District.¹¹ but in our study it is observed that ADD cases were higher between 31 to 60 age group, it clearly indicates consumption of unsafe water, especially in workplaces where water sanitation may be

compromised. Key factors that contribute to contamination at workplaces include inadequate water filtration, poor hygiene and improper sanitation practices.¹²

Our study findings show high ADD cases reported among female population, this finding is similar to Mohan Anandan, et al who reported a higher rate of acute diarrheal disease among female population¹³ it shows women likely to seek medical care than males which leads to higher reported cases in healthcare facilities.

Interestingly, it is observed that in our study the highest number of patients were reported in Primary Health Centre, it indicates that the PHCs are often easily accessible for medical care. Only 1.2% and 6.1% cases were reported in Secondary and Tertiary care institutions respectively and this indicates complications due to ADD is very minimal and it is similar with another study by Jarir At Thobari, et al, carried out at Indonesia.¹⁴

In this study period, the first upsurge of ADD cases is observed in the month of April and reaches the peak in the month of June which is the similar finding in 2022 & in 2023. It could be due to high temperature during this month which causes water scarcity in many regions and people may resort to use unsafe water resources. Similar findings are also observed in studies Giribabu Dandabathula., et al and DL et al.^{15, 16} whereas Pathak., et al. used the field level data from two hospitals and concluded that during the summer and rainy season the probability of diarrheal diseases is higher for part of Ujjain region.¹⁷

Very few ADD cases in Nilgiris, Dindigul and Kaniyakumari, which could be attributed by several factors like improved sanitation or better Health education in among the population. In Nilgiris, the Environmental and Geographical factor like high altitude region with cooler temperature, it experiences lower incidence of ADD cases which may be due to boiling habit which is a regular practice and it is one of an effective method to eliminate a pathogen especially waterborne pathogens¹⁸ and also the pathogens are less likely to thrive in lower temperature.¹⁹ It appears that the prevalence of ADD cases in the Western belt of Tamil Nadu, specifically in Coimbatore, Salem, Namakkal, Dharmapuri, Krishnagiri, Erode, and Tiruppur, is relatively low (Under 2%). This statistic could indicate various factors such as effective public health measures, socio-economic conditions, or community awareness in this region.

Even though ADD cases were higher in Ramanathapuram, Tiruvanamalai, Pudukottai & Villupuram, only Villupuram had 4 ADD Outbreaks. Ramanathapuram, Tiruvanamalai has not documented ADD outbreaks during

the study period, this may be due to better surveillance activity at the district.

LIMITATIONS

The limitations of this study include the reliance on only two years of data, which restricts the ability to identify seasonal trends or expected patterns.

This short time frame may not capture fluctuations due to seasonal variations, long-term trends or other external factors that could influence ADD cases. Future research with a longer time span with information on social, educational and other demographic details could enhance the understanding of these patterns, trends and risk factors attributing to ADD outbreaks and cases.

Patterns of diarrheal cases occur as per the climatic condition of particular location. The seasonality of diarrhea in India, peaked both years during the summer. Diarrheal cases were found to be substantially higher in summer for most part of Tamil Nadu. In this article, IHIP - IDSP data that are available in the web portal have provided a better platform for analyzing the seasonal dependency of the outbreaks.

IHIP- IDSP acts as a ready reckoner for analyzing the pattern of the outbreaks for any communicable diseases in Tamil Nadu by enabling with necessary information which will be useful to the policy makers and administrators to circumvent the effect of morbidity and mortality due to outbreaks or any Health Events.

RECOMMENDATIONS

Education and Awareness Campaigns to the public about the causes, prevention, and management of ADD should be provided with focus on hygiene practices, such as handwashing with soap, safe food preparation, and safe drinking water.

Distribute ORS packets in communities and educate caregivers on their use to prevent dehydration. Establish robust surveillance systems to monitor the incidence of ADD and identify outbreaks quickly.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE- PUBLIC HEALTH

EVALUATION OF MEASLES AND RUBELLA SURVEILLANCE IN TAMIL NADU DURING JAN 2023-DEC 2023.

*Kanagabala Balasubramanian ⁽¹⁾, Vinay Kumar Krishnamurthy ⁽¹⁾, Vidhya Viswanathan ⁽¹⁾,
Ramani Satyanidhi Rao ⁽¹⁾, Somasundaram Anavarathan ⁽¹⁾, Selvavinayagam T S ⁽¹⁾*

(1) Directorate of Public Health and Preventive Medicine, Government of Tamil Nadu, India.

ABSTRACT

INTRODUCTION : As India progresses towards elimination of Measles and Rubella (MR), a sensitive case-based MR surveillance system is essential to monitor and sustain progress towards elimination of MR. To achieve the Immunization Agenda 2030 and accomplish Measles elimination, monitoring the performance indicators of MR surveillance becomes imperative. The objective of this study is to evaluate Measles and Rubella Surveillance in Tamil Nadu during Jan 2023-Dec 2023.

METHODS : This is a retrospective observational study conducted using secondary data on MR surveillance. All the Fever Rash (FR)/suspected MR cases reported in VSIMS - Vaccine Preventable Diseases Surveillance Information Management System portal during the period Jan 2023 to Dec 2023 is taken for the study. All the key performance indicators were compared with Measles and Rubella Surveillance Field guide 2020 guidelines released by Ministry of Health and Family Welfare, Government of India.

RESULTS : Of the 6,588 FR cases reported in VSIMS portal, timely case investigation were done for 96.91% of the cases. Adequacy of serological sample collection is 99.73%. There is a substantial delay in timely laboratory reporting. All the outbreaks have been investigated. NMNR discard rate for Tamil Nadu for the year 2023 was 6.13/10,00,000 population.

CONCLUSION : All the outbreaks flagged were investigated and final classification completed. Non-Measles and Non-Rubella Discard rate is well above the target set by MoHFW. Overall, Tamil Nadu's performance in MR Surveillance aligns well with the established guidelines, demonstrating significant progress toward measles elimination.

KEYWORDS : Surveillance, Measles, Rubella, VSIMS, Vaccine Preventable Diseases

INTRODUCTION

Measles is one of the world's most contagious diseases¹ with basic Reproduction Number (R_0) range of 12-18, which means that each person with Measles would, on average, infect 12-18 other people in a totally susceptible population². It has an increased risk of severe complications or death among children aged less than five years of age. Rubella infection occurring during early pregnancy might result in Congenital Rubella Syndrome (CRS). However, both these diseases are preventable and can be eliminated through effective vaccination practices.¹

India introduced the first dose of Measles-Containing Vaccine (MCV1) in the Routine Immunization (RI) programme in 1985 and a second dose of Measles Containing Vaccine (MCV2) was introduced into the RI schedule in 2010. Rubella-containing vaccine (RCV) was introduced in RI as MRCV1 and MRCV2 in 2017. In 2018-2019, India achieved an MRCV1 coverage of 85% and an MRCV2 coverage of 71%. In addition, Measles and Rubella Supplementary Immunization activity (MR-SIA) catch-up campaign was implemented since 2017.¹

To accelerate progress, the GoI started Mission

Indradhanush, the flagship Routine Immunization campaign of the Union Ministry of Health and Family Welfare in 2014, and Intensified Mission Indradhanush in 2017. The recent Intensified Mission Indradhanush (IMI 5.0) specially focussed on Measles and Rubella, under the theme "A big leap towards measles and Rubella Elimination". Between 2017 and March 2023, over 348 million children have been vaccinated through nationwide Measles-Rubella vaccination campaign. Measles cases dropped from 10.4 to 4 cases per million population, by 62% between 2017 and 2021, and Rubella cases dropped from 2.3 to 1.2 cases per million population, by 48%.³

Under the Universal Immunization Programme (UIP), Government of Tamil Nadu provides 11 Vaccines to children and pregnant mothers against the 12 Vaccine Preventable Diseases, namely, Poliomyelitis, Diphtheria,



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Corresponding Author: Vinay Kumar K

e-mail : dphimm@nic.in

Pertussis, Tetanus, Measles, Rubella, Tuberculosis, Hepatitis B, Hemophilus Influenza type B (Hib), Rotavirus, Pneumococcal and Japanese Encephalitis, the latter being given in 14 selected endemic districts.⁴

In spite of effective immunisation services, Vaccine Preventable Diseases (VPDs) may occur. Surveillance for VPDs form part of wider infectious public health surveillance and is the key focus for achieving strategic priority in Immunisation Agenda 2030.⁵ Currently, Six Vaccine Preventable Diseases namely, Poliomyelitis, Measles, Rubella, Diphtheria, Pertussis and Neonatal Tetanus are under Surveillance in the state of Tamil Nadu.

Initially, Measles and Rubella (MR) Surveillance in India was pioneered as laboratory supported outbreak -based surveillance in 2005 starting with one state, Tamil Nadu. It was eventually expanded to all states in a phased manner by 2015. Since 2016, MR Surveillance has transitioned from being laboratory-based surveillance to WHO laboratory supported MR case-based surveillance starting in Karnataka, and then expanded to all states by 2019.⁶

As India progresses towards elimination of Measles and Rubella, a sensitive case-based MR surveillance system is essential to monitor and sustain progress towards elimination of MR. The goal of MR case-based surveillance is to detect, investigate and classify all suspected cases and subsequently respond to confirmed outbreaks. A suspected Measles / Fever with Rash case is any person with fever and maculopapular rash or any person in whom, the clinician or health worker suspects Measles. A suspected Rubella / Fever with Rash case is a patient with fever and maculopapular (non-vesicular) rash, or in whom a healthcare worker suspects Rubella. A healthcare worker should suspect Rubella when a patient presents with the following: fever, maculopapular rash and cervical or suboccipital or postauricular adenopathy or arthralgia/ arthritis. For case confirmation, laboratory testing is done at an accredited laboratory within the Global Measles and Rubella Laboratory Network.⁶

VPD surveillance system in India encompasses more than 45,000 Reporting Sites (RS). The RS network includes Reporting Units (RU) and Informer Units (IU). All RUs are required to report suspected Measles cases or suspected Measles deaths immediately. In addition, all RUs are required to send weekly reports including nil reports with details of cases reported in the past one week to the District Health Officer, who also functions as District Immunization Officer. Informer Units (IU) such as hospitals and clinics with single practitioners, facilities with traditional healers or faith healers that are likely to encounter suspected Measles

cases should also report cases to the DIO/SMO, but are not mandated to send weekly reports⁶. Currently, there are approximately 1,308 RUs functional in Tamil Nadu. VPD surveillance is supported by World Health Organization. All the VPD cases are updated in VSIMS - Vaccine Preventable Diseases Surveillance Information Management System.

Immunisation Agenda 2030 envisions a world where everyone, everywhere, at every age, fully benefits from vaccines to improve health and well-being. One of the strategic priority goals of Immunization agenda 2030 is to ensure timely, well-organized response to outbreaks of epidemic prone vaccine preventable diseases.⁵ Thus, in order to achieve the Immunization Agenda 2030 and accomplish Measles elimination, monitoring the performance indicators of MR surveillance becomes imperative. Hence, this study is attempted to evaluate Measles and Rubella Surveillance in Tamil Nadu during Jan 2023-Dec 2023.

METHODS

This is a retrospective observational study conducted using secondary data on MR surveillance. All the suspected MR cases reported in VSIMS - Vaccine Preventable Diseases Surveillance Information Management System portal during the period Jan 2023 to Dec 2023 has been taken for the study.

A data extraction sheet containing details on date of onset of symptoms, notification, investigation, date and number of sample collection, transport of samples, receipt of samples, reporting of results, flagging of Outbreak, preliminary search, Active Case Search (ACS), outcome and follow up was used.

The data was extracted and analysed in Microsoft Excel. Qualitative variables are expressed as proportions. All the key performance indicators were compared with Measles and Rubella Surveillance Field Guide 2020 released by Ministry of Health and Family Welfare (MoHFW), Government of India.

RESULTS

In the VSIMS portal, for the year 2023, 6,588 Fever Rash (FR)/suspect cases were reported in Tamil Nadu.

a. Timeliness of case investigation: Of the 6,588 FR cases reported, most of the cases were reported by Government PHCs and health set ups. 176 (2.67%) cases are reported from Private Health facilities. All the reported cases were investigated and updated in VSIMS. Among the cases investigated, 6,385 (96.91%) cases were investigated within 48 hours of notification.

b.Adequacy of serological sample collection: Since clinical diagnosis alone is insufficient to confirm Measles and Rubella infection, the role of laboratory in diagnosis is crucial as we progress towards Measles and Rubella elimination. The common investigation used to confirm the diagnosis of MR is to test for the presence of IgM antibodies in serum. A single blood specimen is sufficient to confirm or discard suspected cases. MoHFW recommends collecting blood sample to test for IgM within 28 days of rash onset. Among the 6,588 FR cases, blood sample was collected within 28 days of onset of rash in 6,568 (99.69%) cases. This is above the required target of 80% serum sample collection. (Table 1)

Table 1: Adequacy of sample collection among the eligible suspect cases,
MR Surveillance, Tamil Nadu, Jan 2023-Dec 2023

Sample to be collected	Time between onset of rash and notification	Eligible suspect cases	Performance of TN	Target set by MoHFW
Serum (To confirm the infection)	Within 28 days	All FR cases reported (N=6588)	6,568 (99.73%)	>80%
Throat swab (Necessary for genomic characterization) (OR)	Within 7 days	All FR cases in the interval of 7 days between onset of rash and notification, (N=6137)	5,236 (85.32%)	-
Nasopharyngeal swab (Necessary for genomic characterization)	Within 7 days	All FR cases in the interval of 7 days between onset of rash and notification, (N=6137)	24 (0.39%)	-

c.Adequacy of Virological sample collection: While blood samples are sufficient to confirm or discard the suspected cases, conducting genotyping characterization of these viruses is also necessary to analyze the transmission chains. Therefore, clinical specimens such as throat swab and nasopharyngeal swab need to be collected from sporadic cases and also from suspected outbreaks. MoHFW recommends that throat swab or nasopharyngeal swab be collected within 7 days of onset of rash. Among the 6,588 FR cases, 6,137 (93.15%) cases were in the interval of 7 days between onset of rash and notification. Among these cases within the 7 days interval, throat swab has been collected in 5,236 (85.32%) cases and Nasopharyngeal Swab has been collected in 24 (0.39%) cases. (Table 1)

d.Timeliness of specimen transport and laboratory reporting: Out of 6,588 FR cases, blood sample has been collected for a total of 6,571 (99.74%) of FR cases with 3 cases sample taken after 28 days. Of these, 6,019 (91.6%) samples have been received in lab and the status of the remaining 552 (8.4%) samples are not updated in the portal at the time of evaluation. Out of 6,019 samples received, 5,999 (99.67%) samples were received in good condition.

All the samples collected has to be received in the

WHO accredited lab within 5 days of collection. Out of 6,571 blood samples collected, with 6,019 samples received in lab, about 5,416 (89.52%) samples have been received in lab within 5 days of collection.

From the time of receipt of blood sample in laboratory, reporting of the result should be done within 4 days. Of the 6,019 samples received in laboratory, results were reported within 4 days of receipt for 2673 (44.41%) of samples. Target for the timeliness in laboratory reporting is 80% according to MoHFW. However, this shows that around 35% gap in timeliness of laboratory reporting (Table 2).

Table 2: Timeliness of specimen transport and laboratory reporting of
suspect MR cases, Tamil Nadu, Jan 2023-Dec 2023

Sample transport/Lab Reporting	Timeline	Eligible denominator	Performance	Target set by MoHFW
Serology Specimen Transport	Samples to be received in laboratory within 5 days of collection	6,571 blood specimens collected	5416 (89.52%)	>80%
Serology specimen laboratory reporting	Results to be reported within 4 days of samples received	6,019 samples received in lab	2,673 (44.41%)	>80%

e. Outbreak investigation: Suspected Measles outbreak is to be flagged with an outbreak ID when there are a) five or more suspected Measles cases in the past 4 consecutive weeks in a block or in an urban ward or planning unit or b) five or more suspected cases in an area bordering multiple contiguous blocks/urban wards/planning units in the past 4 consecutive weeks or c) one or more suspected Measles death/s in a block or in an urban ward/planning unit⁶. Totally, 172 outbreak IDs have been generated. All the outbreaks have been investigated, which meets the 100% target for Outbreak investigation according to MoHFW Surveillance guidelines. Preliminary search is conducted to ascertain if the cases fit into suspected Measles case definition, clustering of suspected cases in the past 4 weeks in the affected area or if there is any Measles related death. Preliminary search must be initiated within 72 hours of flagging an outbreak. Out of the 172 flagged outbreaks, result of preliminary search warranted house-to-house search for 7 Outbreak IDs. All the 7 outbreaks have been classified as Measles outbreaks.

f.Classification of cases: Regarding the classification of 6,588 FR cases, status of 665 (10.09%) cases were pending and the remaining 5,923 (89.91%) cases has been updated. Among these classified FR cases, 4,705 (79.44%) cases have been discarded as they did not meet the lab confirmed or clinical compatible case criteria. Laboratory confirmed Measles cases were 1,137 (19.19%), 65 cases (1.1%) were lab confirmed Rubella cases and Clinically compatible Measles were 16

cases (0.27%) (Fig.1). Target Non- Measles and Non-Rubella (NMNR) Discard rate is ≥ 2 per 1,00,000 total population. NMNR discard rate for Tamil Nadu for the year 2023 was 6.13/1,00,000 population which is above the target.

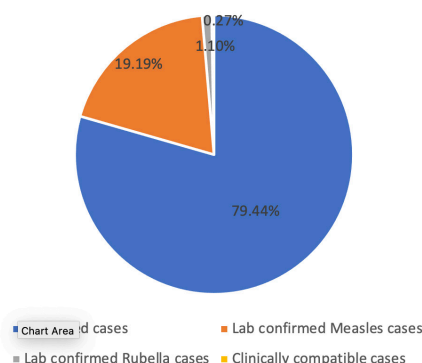


Fig 1 : Adequacy of sample collection among the eligible suspect cases,

MR Surveillance, Tamil Nadu, Jan 2023-Dec 2023

g.30 day follow up: Thirty-day follow-up examination is recommended for lab confirmed cases, epidemiologically linked cases, clinically compatible cases and case results showing equivocal. In this list, lab confirmed Measles, lab confirmed Rubella and clinically compatible Measles cases together contributed to 1218 cases. Among them, follow-up was done in 1,170 (96.1%) cases. Among the 65 lab confirmed Rubella cases, 1 was a pregnant woman. No congenital defects were reported in the newborn.

DISCUSSION

About 6,588 reported cases were analyzed. Immediate reporting/notification of the suspect cases is recommended to initiate further course of action, like sample collection, flagging outbreaks, conducting preliminary search and active case search. Type of clinical specimen depends on the interval between date of onset of rash and notification. Most of the cases were notified by Government health systems. This has to be further strengthened including performance of private sector RUs as Measles and Rubella elimination will require efforts from all sectors.¹

Timeliness of sample collection within 28 days for serology and sample transport within 5 days of collection are in line with Surveillance guidelines. However, there is a difference between the number of samples collected and samples received in laboratory, that is the status of 8.4% the sample collected are not updated in the portal at the time of evaluation.

Timeliness of laboratory reporting of the result is only 44.41% and there is a gap of approximately 35% gap in comparison to 80% set by Surveillance Guidelines, that is time between the receipt of blood sample and result reported

by the WHO accredited laboratory should be within 4 days. Therefore, DIOs, District Epidemiologists, and laboratories need to be sensitized on the importance of timely lab reporting. Additionally, the underlying factors causing delays in reporting should be investigated.

Outbreak investigation is essential to contain the spread of this highly contagious disease. All the outbreaks need to be flagged and preliminary investigation to be conducted within 72 hours of flagging an outbreak. Out the 172 flagged outbreaks, result of preliminary search warranted house-to-house search for 7 Outbreak IDs. All the 7 outbreaks have been classified as Measles outbreaks. These Outbreak Response activities are vital as it will help to contain this outbreak and prevent further outbreaks.

In 2018, India's Non-Measles Non-Rubella (NMNR) discard rate, a key measure of surveillance sensitivity, was 0.6 per 100,000 population, far below the global standard of 2.0 per 100,000 population. However, with consistent efforts, the NMNR discard rate of the country during 2023 was 5.61⁸, while the NMNR discard rate of Tamil Nadu during 2023 is 6.13/1,00,000 population, which is above the national level.

Tamil Nadu is performing fairly aligned with the MR surveillance guidelines by MoHFW, thus paving way for achieving the strategic priority of Immunization agenda 2030.

CONCLUSION

This study offers an evaluation of key performance indicators in Measles Rubella surveillance, providing insights into the effectiveness of the surveillance system. From the analysis, it is noted that all the reported FR/Suspected MR cases were appropriately investigated. Over 90% of the cases were investigated in a timely manner and collection and transport of samples to WHO accredited laboratory is also functioning effectively. However, timely reporting of the results from the laboratory, will help in enforcing the public health measures. All the outbreaks flagged were investigated and final classification completed. Non-Measles and Non-Rubella (NMNR) Discard rate exceeds the target set by MoHFW. In accordance with the surveillance guidelines, pregnant woman who was found positive for Rubella has been followed up for congenital defects in the newborn. Overall, the performance of Tamil Nadu in MR surveillance aligns well with MR Surveillance guidelines, indicating good progress towards Measles elimination.

However, gaps identified, in particular, less reporting from private health facilities, status of samples between collection and receipt in laboratory not updated in , samples

not received in good condition in laboratory and delayed reporting from laboratory need to be further investigated to strengthen the surveillance system in ensuring the nation's progress towards Measles elimination.

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DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE- PUBLIC HEALTH

STRATEGIC COMPETENCY FRAMEWORK FOR DIGITAL INDIA HEALTHCARE: QUALITATIVE RESEARCH ON STAKEHOLDERS' PERSPECTIVE OF THE POST-IMPLEMENTATION PHASE OF ADMINISTRATIVE APPLICATIONS IN A STRUCTURED PUBLIC HEALTH SETTING, TAMIL NADU

Jabarethina G ⁽¹⁾, John K C ⁽¹⁾, Tanya Sruti I ⁽¹⁾, Anitha R ⁽¹⁾

(1) ICSSR Research Program Sri Ramachandra Faculty of Management Sciences, Sri Ramachandra Institute of Higher Education and Research (Category-I Deemed to be University), Chennai, India.

ABSTRACT

INTRODUCTION : Healthcare personnel can monitor and record patient health data in different ways through technological efforts such as hospital information systems. The Central and state governments have released several applications to help patients and users. The primary aim of the study is to investigate how programmatic software, including HMIS and PICME, can be successfully integrated into everyday activities to enhance the quality of healthcare provided by the public health system.

METHODS : A qualitative study using constructivist grounded theory methodology was carried out per the Standards for Reporting Qualitative Research (SRQR) Guidelines. The samples were selected using the purposive sampling technique. A sample of urban and rural Primary Health Centers from the selected districts of Tamil Nadu comprised 53 Healthcare professionals and staff who use healthcare applications as respondents for the study.

RESULTS : The study's findings are categorized into three main sections: advantages, difficulties encountered when utilizing healthcare applications, and suggestions for improving their effectiveness.

CONCLUSION : The synthesis of study outcomes provides a comprehensive strategic framework for using healthcare applications. This research highlights the importance of healthcare applications and the necessity for stakeholders to focus on four main areas: User acceptability, operational effectiveness, human resource development, and healthcare technology infrastructure to enhance healthcare delivery.

KEYWORDS : Qualitative Research, Grounded theory, Healthcare Technology

INTRODUCTION

Today, every industry including healthcare must undergo digital transformation. Doctors and other healthcare workers are shouldering a reasonable amount of responsibility as the workload at hospitals grows. This includes managing medical facilities and all associated tasks and activities. Patients and physicians no longer have to endure laborious, time-consuming consultation procedures and everyday treatments. This is a result of the increased effectiveness and delivery of healthcare brought about by new digital initiatives. The COVID-19 pandemic has also shown the value of innovative technology initiatives in the fight against health issues. Technology has been paving the way in the healthcare field by monitoring the work of healthcare professionals and patients. With the advancement of technology, patient records can now be accessed from anywhere. The Government has implemented various digital tools such as Pregnancy and Infant Cohort Monitoring and Evaluation (PICME), Health Management Information System (HMIS), Ayushman Bharat (AB) Portal, and eSanjeevani to improve data entry and

patient care. A hospital information system is a computerized or manual system (on paper) intended to fulfill all hospital information requirements. This covers a variety of data sets (heterogeneous information), including patient data, billing, finance and accounting, staffing, scheduling, ordering from pharmacies, managing prescriptions, supplies, inventory, maintenance, order management, laboratory diagnostic reports, patient monitoring, and decision support (Sanjuluca et al., 2022). The ultimate purpose of health information systems is to increase data quality to facilitate effective and efficient decision-making, which will subsequently improve the standard of healthcare services (Alipour et al., 2019).

Research in areas such as health, education, and



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Corresponding Author: John K C

e-mail : kc.kc.john@gmail.com

justice can benefit greatly from the use of administrative data, which is information that is regularly gathered by organizations for operational purposes (Mc Grath-Lone et al., 2022). The patient data created by medical encounters is stored in administrative healthcare databases (Ulrich et al., 2021). The healthcare personnel and experts who create patient data are now storing patient data digitally. To improve the delivery of healthcare, it is necessary to take into account their perspective and experience.

Many healthcare applications have been in practice to monitor and document healthcare data. This study focused on two major healthcare applications: PICME, a milestone activity developed by the Tamil Nadu Government and HMIS a web-based monitoring information system established by the Ministry of Health & Family Welfare (MoHFW), Government of India. Healthcare workers devote a significant amount of time to uploading data that their supervisors review, leading to discussions on possible enhancements in healthcare services. However, literature on public health research studies involving user perspectives on the implementation of health administrative software is scarce. This study identifies the research gap and emphasizes the need to evaluate users' viewpoints.

The primary focus of this study is to explore how administrative applications like PICME and HMIS can be effectively integrated into daily operations to improve healthcare services. The study seeks to answer two research questions: What operating difficulties do District Health Officers (DHO), Block Medical Officers (BMO), Medical Officers (MO), Community Health Nurses (CHN), Sector Health Nurses (SHN), Village Health Nurses (VHN), Staff Nurses (SN), Mid-Level Health Providers (MLHP), Women Health Volunteers (WHV), and Data Entry Operators (DEO) face while using these applications? What is needed to increase the effectiveness of healthcare delivery?

Pregnancy and Infant Cohort Monitoring and Evaluation (PICME): One of the most important aspects of women's reproductive health is pregnancy registration, as it serves as a gateway to various care services, including institutional delivery, postnatal care, and prenatal care. Pregnancy registration enhances maternal healthcare usage, reducing adverse health impacts on mothers and infants (Mondal et al., 2023). PICME, deployed by the Tamil Nadu government, tracks all pregnant women and ensures continuous delivery care services for pregnant or lactating mothers and children. Each expectant mother must register with PICME to receive a unique PICME number, enabling tracking by the Public Health Department. Those enrolled

can benefit from the Dr. Muthulakshmi Reddy Maternity Benefit Scheme (MRMBS) if they meet financial criteria. PICME 3.0 registration aims to lower maternal and infant mortality rates and identify high-risk mothers for immediate assistance.

Weekly Work Schedule and Usage of the PICME

Application: The Village Health Nurse (VHN) will enter all data for pregnant women from a specific village. Each day of the week is dedicated to specific tasks: meeting expectant mothers on Monday, examining them on Tuesday, immunization visits on Wednesday, school visits on Thursday, Anganwadi visits on Friday, and uploading patient details on Saturday. Sundays are reserved for housekeeping at the headquarters. The Sector Health Nurse (SHN) at the PHC will verify and supervise the data, which will then be reviewed by the Community Health Nurse (CHN) before being sent to the Deputy Director's office.

National Health Mission – Health Management

Information System (NHM-HMIS): A Health Management Information System (HMIS) is a web-based monitoring system facilitating Government-to-Government (G2G) communication, introduced in 2008. Its primary purpose is to track the National Health Mission and other health programs, providing valuable insights for policy development and targeted interventions. HMIS data assists with planning, management, and decision-making based on numerous indicators at block, state, and federal levels. Currently, 2.25 lakh health institutions across all States and UTs upload data on infrastructure, training, and service delivery to the HMIS web platform annually (Ministry of Health and Family Welfare, 2024).

Work Schedule and Usage of the HMIS

Application: In the first week of each month, staff nurses will enter all PHC patient data from the previous month into HMIS. Healthcare workers record information in various registers to prepare consolidated reports. VHN will supply HSC data to the SHN, who will verify it with PICME entries. The data entry operator will combine and cross-check PHC and HSC data. The CHN is responsible for compiling all SHN reports and completing the HMIS report, which will be used in review sessions and decision-making. HMIS 2.0 requires full OP patient details daily. HMIS and HMIS 2.0 operate through separate online links, with plans to link Taluk GH hospitals for streamlined patient identification and reduced paperwork.

Administrative setup of Primary Healthcare

Centers: The hierarchical structure given in Figure 1 shows the well-organized setup of PHC. Each Health Unit District

(HUD) has one Deputy Director (DD) and the designation is now revised as District Health Officer (DHO). Each HUD is further administratively divided into Blocks and Blocks further as Additional PHCs for administrative and service delivery convenience. The block PHC will be called the upgraded PHC also called Community Health Centre. The rationale behind CHC is its integration of numerous Central Government initiatives and its acquisition of national quality assurance certifications. Each block has one medical doctor who is called Block Medical Officer (BMO). BMO is responsible for Primary Healthcare Center and Urban Health Care and Health Sub centers. Medical officers will be the charge of PHC/UPHC and they will report to BMO. SHN and staff nurse will report to MO. Each HSC consists of VHN, MLHP, and WHV. The VHN will report to SHN and SHN will report to CHN

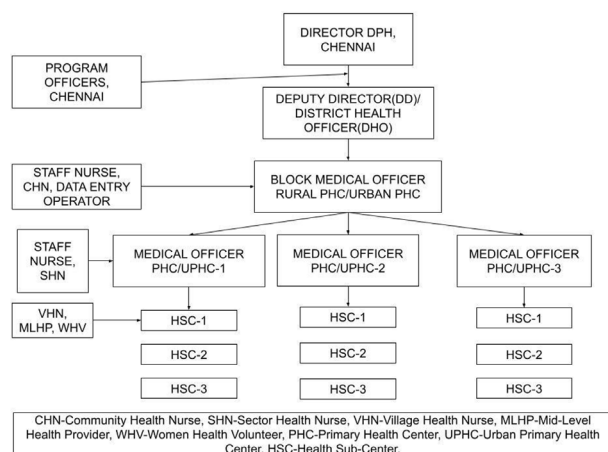


Figure 1 Primary Healthcare Hierarchical Infrastructure of one Block of Tamil Nadu

The description of each cadre who actively used the administrative software and reported to DHO, BMO, and MO are described below:

Community Health Nurse (CHN): Every block will have a community health nurse engaged to collect SHN reports from every PHC and UPHC. CHN will confirm the consolidated record, obtain authorization, and forward the necessary documents to the DD office.

Sector Health Nurse (SHN): The SHN will monitor the village health nurses' performance. She must deliver the report to the Block Medical Officer after verifying and confirming the correctness of the information and documents obtained from VHN.

Village Health Nurse (VHN) and Urban Health Nurse (UHN): Every VHN community has a fixed number of families. She knows every detail about every household's health. The village health nurse will be looking after the

immunization and the antenatal mother. The VHN conducts weekly home visits, monitors pregnant mothers, and records the information in the administrative database. VHN and the UHN utilize the Health sub-center and will take care of the OP at the PHC level. They will create the patient's record.

Staff Nurse (SN): Every SN will work in PHC or UPHC. She will enter the details of the patient and the information related to the disease in HMIS. She will make the call to the Medical Officer (MO) during the eSanjeevani process. In most cases, she will handle based on her experience by using the MO username and password.

Mid-level Health Provider (MLHP) Worker: Nursing and diploma holders need to finish the government-provided MLHP course to work in the community on a contract basis. MLHP employees will enter the OP case numbers in the Ayushman Bharat (AB) portal along with demographic information also in numbers and handle the eSanjeevani portal. She will meet the patient at their house and make the call between 9.00 am to 4.00 pm. She has a login ID enters the details and makes the call. Most of the time, she uses the direct contact number and tries to solve the issue, and for any query, the MLHP will visit the block.

Woman Health Volunteers (WHV): The WHV utilizes Makkalai Thedi Maruthuvam (MTM) to carry out its therapeutic procedures. WHV will concentrate on diagnosing and monitoring two important illnesses, such as diabetes and blood pressure. She visits and tests every member of the household determines their health status, and reports back to the medical officer of the specific supplementary PHC.

Data Entry Operator (DEO): The data entry operator will consolidate the PHC and HSC details. He or she will assist the staff nurse and SHN in generating reports and assist the field workers in entering data into the HMIS. They will assist the medical officer in submitting all Google forms and supply the information requested by the DD office. They will confirm the details with PICME, and HMIS software data, reporting any discrepancies to the staff nurse, MO, and SHN for correction.

METHODS

The application of qualitative methodologies in health-related research has led to an increased understanding of the hurdles to changing healthcare practice and the views of health professionals toward lay participation in care. In the social sciences, the grounded theory approach is a popular qualitative technique for inductively developing or discovering a theory from the data (Al-Busaidi, 2008).

The real implementation of PICME and HMIS health care applications in Tamil Nadu in PHC's were examined through a qualitative study employing the Grounded Theory technique. Following Grounded Theory, a researcher will develop a theory based on information that was jointly developed with participants, usually through interviews (Metelski et al., 2021). The results were reported per the Standards for Reporting Qualitative Research (SRQR) guidelines. Many stakeholders who use the healthcare administrative software participated in this study. Data was gathered and examined concurrently after a semi-structured interview guide was created. Interviews and observation were used to verify the interconnectivity. Constant comparison analysis compares data with data, codes with codes, and occurrences with incidents to establish categories and characterize them. The use of theoretical sampling to gather additional data needed to accurately establish the properties of a particular category.

We employed triangulation, which offers multiple perspectives on the same phenomenon and strengthens the validity and confidence of the study's conclusions. We contrast various viewpoints held by different individuals. The perspectives of DHOs, BMOs, MOs, CHNs, SHNs, VHN staff nurses, MLHPs, WHV, and data entry operators are compared to identify commonalities and differences which supported by reasonable explanations, could greatly enhance the reliability and validity of the results.

The study's focus was PHC/UPHC in each district of Tamil Nadu. The sample was selected using the purposive sampling approach. The rationale behind purposive sampling is to enhance the study's rigor and reliability of the data and findings by more closely aligning the sample with the research's goals and objectives (Campbell et al., 2020). Participants who have worked on documentation, verification, data uploading, data downloading, consolidated report downloads, and data reviews in PHC and HSC have been contacted.

Due to scheduling restrictions and the recommendation of the Institutional Ethics Committee (IEC), the researchers focused on four districts in the northern and southern areas of Tamil Nadu. The respondents' identities were kept confidential per informed consent requirements and the norms of the IEC. This investigation involved 53 health professionals in total: DHO(4), BMO (5), MO (8), CHN (3), SHN (6), VHN (10), SN (9), MLHP (4), WHV (2) and DEP (2). A thorough description of every participant is given in Table 1.

Table 1: Characteristics of Study Respondents

APPENDIX

S.No.	Location of PHC	Code	Year of Experience
1	District -1	District Health Officer (DHO)-1	13
2	District-2	DHO-2	14
3	District -3	DHO-3	12
4	District-4	DHO-4	10
5	Rural-PHC	Block Medical Officer (BMO)-1	23
6	Rural-PHC	BMO-2	21
7	Urban-PHC	BMO-3	25
8	Rural-PHC	BMO-4	19
9	Urban-PHC	BMO-5	21
10	Rural-PHC	Medical Officer (MO)-1	12
11	Urban-PHC	MO-2	11
12	Rural-PHC	MO-3	17
13	Rural-PHC	MO-4	12
14	Rural-PHC	MO-5	7
15	Urban-PHC	MO-6	14
16	Urban-PHC	MO-7	6
17	Rural-PHC	MO-8	14
18	Urban PHC	Community Health Nurse (CHN)-	38
19	Rural PHC	CHN-2	36
20	Rural PHC	CHN-3	37
21	Rural PHC	Sector Health (SHN)-1	31
22	Rural PHC	SHN-2	30
23	Rural PHC	SHN-3	32
24	Rural PHC	SHN-4	34
25	Urban PHC	SHN-5	33
26	Urban PHC	SHN-6	29
27	Rural PHC	Village Health Nurse (VHN)-1	25
28	Rural PHC	VHN-2	26
29	Rural PHC	VHN-3	22
30	Urban PHC	VHN-4	21
31	Urban PHC	VHN-5	23
32	Rural PHC	VHN-6	25
33	Rural PHC	VHN-7	21
34	Rural PHC	VHN-8	19
35	Rural PHC	VHN-9	22
36	Rural PHC	VHN-10	24
37	Urban PHC	Staff Nurse (SN)-1	5
38	Urban PHC	SN-2	6
39	Urban PHC	SN-3	4
40	Rural PHC	SN-4	6
41	Urban PHC	SN-5	7
42	Rural PHC	SN-6	10
43	Urban PHC	SN-7	6
44	Rural PHC	SN-8	2
45	Rural PHC	SN-9	8
46	Rural PHC	Mid-Level Health Provider	2
47	Rural PHC	MLHP-2	2
48	Rural PHC	MLHP-3	1
49	Urban PHC	MLHP-4	3
50	Rural PHC	Women Health Volunteer (WHV)-	2
51	Rural PHC	WHV-2	1
52	Urban PHC	Data Entry Operator (DEO)-1	16
53	Rural PHC	DEO-2	14

We contacted each district's DHO for their input on digital health services. Based on their guidance we approached the BMO of each block after obtaining approval from the DHO of each district and informed them of the purpose of data collection from May 2023 to January 2024.

Data were collected from DHOs in April-June 2024 to verify the operational state and acquire current information. After interacting with BMO, we interviewed CHN, SHN, VHN, staff nurses, MLHP, WHV, and data entry operators. Since everyone's jobs are interconnected, we can relate each person's workload and obligations to healthcare applications. We were granted permission to visit six districts in Tamil Nadu. We went to both urban and rural PHCs in

each district. We regularly had our queries answered and cross-verified one district process with another district. We proceed to the next district and repeat the process there until we achieve theoretical saturation. We observed the procedures, activities, and processes. Each respondent verbally consented after being told about the goals and parameters of the study. We addressed every question they posed regarding the reasons behind doing this research. Nobody was forced to take part in this research. We had no control or influence on the respondents.

After getting consent from the healthcare personnel and professionals, in-depth semi-structured interviews were used to gather data. Depending on how open the participants were to offer information, the length of each interview ranged from thirty to forty-five minutes. A small number of interviews were recorded with the participants' permission. The interviews that were audio recorded were transcribed and added to a Word document. Since most respondents did not want their interviews to be audio recorded, the research assistant and associate took notes during the interviews and then double-checked and verified the material with the respondents. After the interview, memos were written to move on to the next round of interviews with another district. The administrative software work process is interconnected with multiple stakeholders, allowing us to readily relate to their points of view. The data collection was discontinued after theoretical saturation was reached.

To comprehend the data more abstractly, coding was applied. Concurrent analysis of the interview transcripts and the data collection process were required by Grounded Theory. The authors' interview transcripts were examined to conduct open coding. Using axial coding, the gathered codes were arranged into categories. The codes were examined and authorized by the study team. The data analysis process has employed a constant comparison method.

This study obtained Scientific Advisory Committee approval (DPHPM/SAC/2023/131, R.No.011575/HEB/A2/2023) and complied with the requirement of Institutional Ethics Committee of Directorate of Public Health and Preventive Medicine, Chennai (IEC No. DPHPM/IEC/2023/109) and Institutional Ethics Committee of Sri Ramachandra Institute of Higher Education and Research (IEC-NI/23/APR/86/13).

RESULTS

Stakeholders' perspective of benefits of using healthcare applications: According to user descriptions of healthcare applications, healthcare delivery is gradually

moving towards digital technology. Healthcare professionals have adapted to using digital applications. Their opinions were comprehended and presented in Figure 2. The theoretical sampling revealed that there are two major benefits of using PICME and HMIS (i) Data storage and analysis and (ii) Patient support and progression.

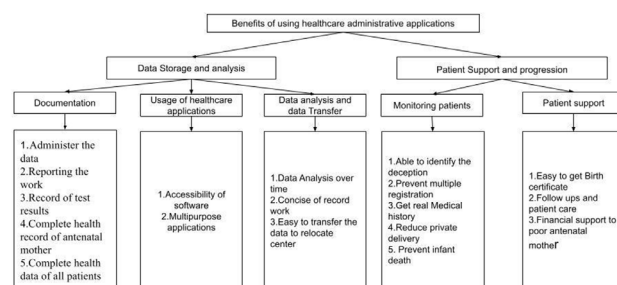


Figure 2: Benefits of using healthcare administrative applications
(authors' elaboration)

(i) **Documentation:** Documentation is the main benefit of using healthcare applications.

- It helps in administering, reporting, and recording patient health data. The respondents' views are given below:

Administer the data: Data management must be methodical and meticulous due to the creation of huge data in primary healthcare.

- VHN4 expressed: very easy for officers at the District Level and State Levels to administer the data. VHO3 stated: I will get all the details through the dashboard and very easy to administer the data. DHO2 stated: I can quickly inspect the records and confirm the early registration or late registration. Report the work: VHN4 declared: PICME is very useful for us for reporting related work.

- Record test results: PICME has the facility to record all these test results and serology report results etc (SHN4).

Complete health records of antenatal mothers: The goal of digital healthcare is to obtain a patient's whole medical history and utilize it in the future. VHN5 stated: PICME we can know the full history of a mother. BMO 1 expressed: I checked the early history and was able to know the registration of PICME. All the data will be available over there.

- Complete health data of all patients: VHN6 explained: that all health-related data can be extracted from the PICME and HMIS. CHN1 expressed: We will provide the consolidated health data of the patients report to higher officials (CHN1)

(ii) **Usage of healthcare applications:** The usage of healthcare applications has the benefit of accessibility of software and multipurpose applications. The HMIS is employed in maintaining IP & OP case details of patients, evening cases

are maintained as causality cases and the PICME application helps in maintaining mother and child care services. Accessibility to software is the basic requirement for using the healthcare application. VHN4 stated that she could able to access the software anywhere. DHO-4 expressed: HMIS allows us to gather data from healthcare facilities and use it to enhance the quality of healthcare services. Through this system, I can identify high-performing centers and provide support to those in need. Additionally, I closely monitor medication usage and take proactive measures to ensure effective and safe treatment.

The healthcare applications are used for multiple reasons. VHN 5 declared: We employ PICME for mother and child care, Tamil Nadu Population Health Registry (TNPHR) for OP and IP case details, and HMIS, a hospital-based program that displays morning cases as OP and afternoon cases as causality cases.

(iii) Data analysis and data transfer: It benefits in creating analysis reports from the initial phase of registration itself and it helps in the easy transfer of patient records in case of patient relocation. Data can also be retrieved and analysed over time. BMO1 explained: Initially, if there is an infant death or maternal death at that time only we will be using or verifying the PICME software. But nowadays we are starting to verify in the registration period. Data can be stored in concise form not necessary to maintain too many notebooks. VHN 1 declared: We had 32 records which has been decreased to 12 records. DHO2 explained: We are using manual entry because, in certain cases, if someone enters a lengthy entry on the portal, they can cross-check it with the notebook and enter the correct entry on the portal.

Healthcare applications offer the advantage of easily transferring data to the new center. VHN4 expressed: if the mother has relocated to another city for work or for some other reason when she is registered, she doesn't need to come to us to get reports. The village health nurse in the relocated city applies a re-locate in the system itself, and then all the information will be transferred.

Patient support and progression: The other major benefit of health applications is patient support and progression, which is categorized into two such as monitoring patients and patient support.

(i) Monitoring Patient: Monitoring pregnant mothers could be done effectively using PICME3.0. The statements made by the respondents revealed some of the monitoring system's results.

- Able to identify the deception: Some patients may provide false information about the pregnancy. The software can

identify the deception. VHN5 stated: Some mothers will deceive us that the child will be their fifth child but will deceive us that this is their second child but after PICME every patient has an ID.

- Prevent multiple registrations: Once the registration is done through PICME then that will be final. RCHID is a unique number that aids in preventing duplicate registration. VHN5 stated: I can't register anything else, only one time when we re-register; it said 'Already Exists.'

- Get a real medical history: VHN7 indicated: Sometimes some mothers have serial abortions for example a mother is fifth gravida has hypertension but doesn't have any child in her hand if she goes to any other city she will tell others that this is my first child no one knows that she has four children abortions before this and no one knows she has hypertension.

- Reduce private delivery: Each VHN is in charge of the pregnant mother in the village that they have been assigned. The private delivery practices have been taken over by the government. Treatment for the pregnant mother cannot be provided by anyone without receiving RCHID. The government looked after the expectant mother and the unborn child by setting a target for VHN. BMO4 asserted: Out of a hundred deliveries in a month why can't they do 25 deliveries in government is that any more wrong in that? Target fixing is not an offense. To reduce the private delivery they are fixing the target. The motto of the government is to bring all the delivery.

- Prevent infant death: VHN5 PICME registration is a good scheme because all the details of the mother will be in that software so anyone can supervise or check that. This scheme has reduced the infant death (VHN5).

(ii) Patient Support

Patient support describes helping the patient to obtain the assistance they require. VHN2 expressed: When a woman in our village becomes pregnant, I will care for her as if she were one of my daughters because we have duties that go beyond our jobs. I will always be there for them and keep in touch with them. Through Healthcare applications getting a health certificate becomes very easy. VHN5 mentioned that birth certificates can be obtained easily after we register everything on the website, they even go to the call center and ask for a number. Follow-ups and patient care can be done through the healthcare application. VHN3 stated: When we see a high-risk mother, we will follow them or not. Antenatal care is good. Financial support to poor antenatal mothers can be monitored effectively through healthcare applications. VHN6 communicated: People are below the poverty line so they will be receiving Dr. Muthulakshmi Reddy benefits, The

village health nurse registers directly the beneficiary should get the amount. VHN1 expressed: I will keep monitoring the patient because they are dependent on me for their well-being and cannot act without my consent.

Challenges of using healthcare administrative applications

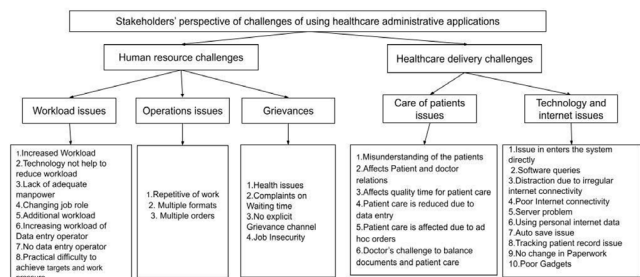


Figure 3 Stakeholders' perspective of challenges of using healthcare administrative applications (authors' elaboration)

Figure 3 shows the challenges faced by the stakeholders while using healthcare administrative applications. The theoretical sampling revealed that there are two major challenges of HMIS (i) Human resource challenges and (ii) Healthcare delivery challenges. The details of the codes are given in Appendix Table 2.

(i) Human Resource Challenges

The human resource challenges are related to workload issues. This consists of increased workload, technology not helpful in reducing workload, lack of adequate manpower, changing job role, additional workload, increased workload of data entry operator, no data entry operator, practical difficulty to achieve targets, and work pressure. SN2 expressed: first of all we need a data entry operator, staff nurses are here to care for the patient not for entering the data. Another issue is operational issues and the related supporting codes are repetitive work, multiple formats, and multiple orders. The data is entered in multiple formats and it time time- consuming which makes it difficult for the nurses to attend to the patients and this in turn leads to long queues.

The third issue is the grievances and the related supporting codes are health issues, complaints about waiting time, no explicit grievance channel, and job insecurity. SN4 expressed: Patients will call the helpline and they complain about us because of the data entry antenatal mother waiting time is increased. There is no proper channel of grievances for the employees. Hence they find it difficult to approach the higher officials.

(ii) Health delivery challenges

Healthcare delivery challenges are related to the care of patients' issues. The supporting codes consist of misunderstanding of the patients, affect the doctor-patient relationship, affect the quality time for patient care, patient care is affected due to data entry and ad-hoc orders, and doctor's challenge to balance documentation and patient care. BMO1 stated: that the patient and the doctor relationship is getting reduced due to administrative work and monitoring digital data. DHO has different perspective on using healthcare technology for healthcare delivery. DHO1& DHO3 expressed: 80–90% of healthcare workers are familiar with digital apps. Everything is based on mindset and uniqueness. It is not too hard to adopt after we go through the procedures. Adaptability and acceptance are mentalities. It is essentially feasible for people of any age.

Another issue is technology and internet issues and the related supporting codes are issues in entering the system directly, irregular & poor internet connectivity, server problems, usage of personal data, auto-save issues, tracking patient record issues, poor gadgets, and increased paperwork. Poor technological resources and unavailability make the work a burden to the staff involved in patient care.

Stakeholders' suggestion

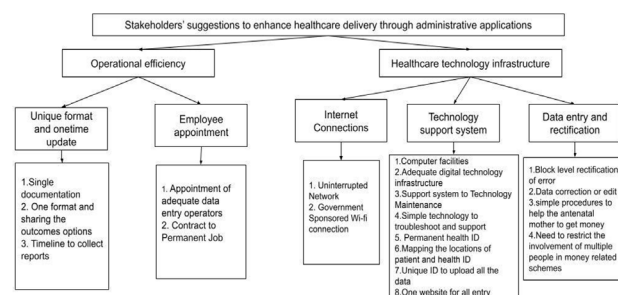


Figure 4 Stakeholders' suggestions to enhance healthcare delivery through administrative applications (authors' elaboration)

Figure 4 shows the suggestions by the stakeholders to enhance healthcare delivery through administrative applications. The major suggestions are to improve the operational efficiency and healthcare technology infrastructure. The coding details are given in Appendix Table 3.

(i) Operational efficiency

Operational efficiency is categorized into two themes such as (i) unique format and one-time update and (ii) employee appointment. In unique format and one-time update, the staffs suggest that the data can be entered in

either written or online format instead of doing both. This will increase the efficiency of work by reducing repetitive tasks. The supporting codes are single documentation, one format and sharing the outcome options, timeline to collect reports. Likewise reports can be submitted during a specified timeline. MO7 expressed: There should be a standard timeline to send Google forms and demand reports.

Regarding the other issue of employee appointment, the staff suggests appointing adequate manpower to perform the designated tasks and issuing permanent contracts to the employees instead of holding them on a temporary contract basis. The supporting codes are appointment of adequate data entry operators, contract to permanent job.

(ii) Healthcare Technology Infrastructure

Healthcare technology infrastructure is categorised into three themes which are (i) internet connection (ii) technology support system and (iii) data entry and rectification. To address Internet connection issues employees suggest, uninterrupted Wi-Fi connectivity with government aid. (supporting codes: uninterrupted network and government-sponsored Wi-Fi connectivity) SN3 expressed: we need Wi-Fi which should be recharged annually by the government.

The other issue of the technology support system is suggested with building adequate infrastructure, availability of computers, technology maintenance system, creating permanent health ID, improving the trouble-shoot system, single website source for all data entry, generating unique ID to upload all data to reduce redundancy. The third issue of data and rectification, the key suggestion for this issue is to maintain block level error rectification system. MO4 expressed: If the rectification was done among the health workers that will lead to misuse of data. So the rectification permission can be given among the block level. Involvement of multiple employees in monetary schemes should be limited, single manhandling should be implemented to reduce error.

DISCUSSION

All healthcare professionals convey in their unique ways, enabling us to recognize the digital transformation. Nobody said that applications are useless. Circulars from the government offering guidelines for new programmes or new technologies were distributed. They have worked quite hard to integrate the modifications into the current system. It is necessary to confirm whether the implementation of technology has changed current procedures, people, or

strategies. The results of the study indicated the areas on which we should concentrate to accomplish our goals to enhance the use of administrative applications. The synthesis of the outcome of the study is given in Figure 5.

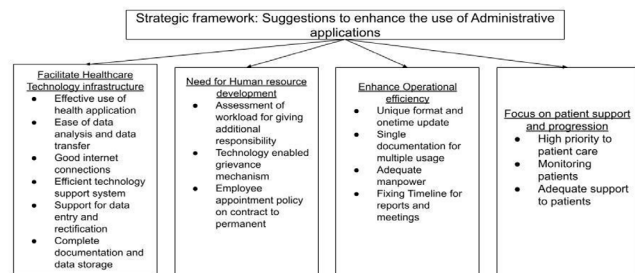


Figure 5 Strategic framework: Suggestion to enhance the use of administrative applications (authors' elaboration)

Primary healthcare facilities in both urban and rural areas actively utilize PICME, a state government application, and HMIS, a central government application, to serve a variety of purposes. The application can be accessed from anywhere with a mobile phone; the only limitations faced by healthcare personnel are server problems or intermittent internet connectivity. They expect to use wi-fi or that the government will give them resources to use for mobile data usage connected to work, therefore they don't want to spend their mobile data in this manner.

Following their prior practices, the healthcare professionals and staff are maintaining several records and submitting information to the portal. Once more, the data was submitted using a Google Form for their regular decision-making process. Information about a single patient needs to be submitted to multiple applications for a variety of reasons. It was anticipated that a centralized uploading system would be required and that data could be retrieved and used for any reason. Their rapport with patients and the amount of time they spend with them are affected when they use their valuable time to complete the same activity repeatedly. Every user of a healthcare application stated that uploads and paperwork had taken precedence over patient care.

The health professionals and staff stated that the current system does not enable them to fix errors by following easy steps. To fix it, they must go to the deputy director's office, which interferes with their normal workflow. In the event of erratic internet connectivity, they advise turning on the auto-save feature for editable forms to avoid having to type everything again.

Nurses are devoting valuable time to tracking, confirming, investigating, and resolving problems with

the Dr. Muthulakshmi Reddy Maternity Benefit Scheme (MRMBS). They suggested restricting the number of heads involved in the problem-solving process. Additionally, they requested for the funding process to be streamlined.

Healthcare personnel can manage patient information, record test findings, maintain patient and antenatal mother histories, and turn in tasks on time by using healthcare software. They can easily transfer any file with the strategic method, which helps them analyze the data over time. The statistics are typically determined by the individual entering the data into the system; however, by using a permanent health ID, this process can be streamlined to aid in accuracy and minimise repetition.

Healthcare professionals and staff need to be oriented when they use modern methods of delivering treatment and adhere to conventional grievance redressal practices. Therefore, management must make use of digital applications to facilitate the simple resolution of their grievances.

The digital-based stable work environment will enable them to deliver higher-caliber services. Both MLHP and the staff nurse have degrees and are awaiting employment confirmation. Their comments and the quality of the healthcare they receive indicate job insecurity, which can be taken into account when determining employee welfare policies.

The district health officers have reported that healthcare software has been developed and is currently in the process of being modified to better meet the needs of the end users. Any difficulties faced by the users will lead to necessary modifications. All digital-related issues will be directed to the technical personnel for updates and upgrades. With time, it is expected that the software will become fully functional.

LIMITATIONS

The managerial features of PICME and HMIS applications in healthcare were considered in this study. The clinical features of applications are outside the purview of the research. The selection of respondents was governed by procedures and permission, and the demographic analysis was restricted to particular respondent cadres. Therefore, only those who are available and willing can be included in the permitted research field. The themes and strategic framework were constructed based on a user-centric approach. Future research can take into consideration the patient-centric approach to healthcare application, which is not included in this study. The researchers analyze stakeholder comments

and develop codes by focusing just on managerial aspect responses. The clinical implications of managing healthcare applications were not covered in the study.

CONCLUSION

The technology has been embraced and is being used efficiently by district health officers, medical officers, nurses, staff, and other health workers. The authorities are examining the data and making the necessary corrections. Everyone is putting forth great effort to meet the goal set for that specific time frame. There are frequent meetings, training sessions, visits, inspections, and circulars. Everything for the management of healthcare is evident when we closely examine their activities. Their emphasis has been progressively shifting from a patient-centric to a digital-centric approach.

Any healthcare technology should never override the utmost priority in patient care. Physicians and nurses, the primary healthcare providers and data creators, must play an integral role in the documentation process. It is crucial to protect the involvement of doctors and nurses in healthcare delivery, ensuring that patient care remains uncompromised despite the operational challenges posed by digitization. To fully capitalize on the digital transformation of healthcare, it is imperative to assign the right individual to oversee the data input process as and when required.

DECLARATION OF INTEREST

The authors declare no conflicts of interest. The funders had no role in the study design; collection, analyses, or interpretation of data; writing of the manuscript; or decision to publish the results.

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DECLARATION OF INTEREST

The authors declare no conflict of interest

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APPENDIX

Table 2 Challenges for using administrative software: PICME and HMIS

Themes	Axial Coding	Initial Coding	Extracts
Workload issues		Increased Workload	The workload increased because everything we used to record on pen and paper, we now double-check, making our work busy. (VHN2)
		Technology does not help to reduce the workload.	After the intervention of Technology, the workload has been increased. We will be entering the note very soon. But for printing it takes time. From this, we can say the technology will not help the workers within the PHC (MO8)
		Lack of adequate manpower	The manpower for work available over here is very low. If we rectify that it will be easy for us (SN6)
		Changing job role	First of all, we need a data entry operator, staff nurses are here to care for the patient not to enter the data (SN2)
		Additional workload	We will update the private hospital entry (VHN1)
		The increasing workload of Data entry operator	For each block, there will be one data entry operator so that the workload of the data entry operator will be increased (MO3)
		No data entry operator	There is no data entry operator in our PHC (MO3)
		Practical difficulty in achieving targets and work pressure	For secondary care, we will be referring them to a tertiary care center or Medical College. At that time target fixing will give pressure. Setting a target in pregnancy will have a negative impact. Out of 10 pregnancies we will be sending some of the high-risk pregnancies to the medical college at that time the remaining cases will be 4 to 5 only (MO1)

Human Resource Challenges	Operations issues	Repetitive of work	In the morning, we have to enter all the data in the notes in the afternoon we have to enter all the data in the computer mostly takes around 2:30 p.m. We will be entering every data twice a time nowadays (SN2)
		Multiple formats	We are entering the same data in many formats (BMO1)
		Multiple orders	Many patients will call the higher official or Helpline if not they will call the president of the village sometimes, they will call the block medical officer telling them that we are asking them to wait for a long period. But none of them will know the numerical order we are maintaining and following (SN4).
	Grievances	Health issues	Will be taking care of the administrative software and have to perform everything; I am having neck pain from doing all this work (DET 2)
		Complaints about Waiting time	When we enter on the spot, it takes so much time. The patient called the helpline and they complained about us because of the data entry antenatal mother waiting time is increased (SN4).
		No explicit Grievance channel	We don't have a grievance channel. On the grievance day we met the Deputy Director and talked about our grievance and the Deputy Director said he would be taking some action (SN4)
		Job Insecurity	Nowadays everyone is having an insecure feeling due to targets and maternal death (BMO1)
	Health care	Misunderstanding of the patient	Patients will think that we are simply using mobile phones for social media and not taking care of them but the actual reason is we will be entering all of the details in the software (SN4)
Technology and Internet issues		Affects Patient and doctor relations	The patient and the doctor's relationship is getting reduced due to administrative work and monitoring digital data (BMO1)
		Affects quality time for patient care	We are spending time entering the data, and find it difficult to spend quality time for patient care (SHN 5)
		Patient care is reduced due to data entry.	The patient care is getting reduced due to the data entry the staff nurse and the other health nurse are saying that they are requesting us that they want to do their job and they are asking for a data entry operator to do this entry work (MO2)
		Patient care is affected due to frequent report request	While we are concentrating on online entry patient care is getting affected. For example, They will be asking for some reports or other documents within 11:00 a.m. So that we will be concentrating on the report not the patient care (MO7)
		Doctor's challenge to balance documents and patient care	For that, there must be a separate person medical officer or doctor should not sit and enter those data whatever the stages. If a patient is coming and I am entering all the data then it will be a disadvantage for the patient and I cannot do my job (MO5)
		The issue enters the system directly.	However, you are unable to use PHC's software system alone if you have a separate data entry operator. The data entry operator needs to record all of the medical advice that I provide before uploading. (MO5)
		Software queries	We were struggling to troubleshoot the queries in that software initially (VHN1)
		Distraction due to irregular internet connectivity	We will be constantly checking that internet connectivity and entering the data (SN2)
		Poor Internet connectivity	Data will be entered within 5 minutes but it takes 1 hour because of the low internet connectivity (SN2)
		Server problem	Another issue is that PICME always has some server problems in it. Due to the multi-users, the server is getting down (MO4)
		Using personal Internet data	During the house visits, I make calls with my internet data to obtain clarity from MO. (MLHP1)
			The government gave us data cards for free three years that service was also stopped so we are using our money for recharging (VHN 3)
		Autosave issue	If the data of a patient is entered correctly again in the next week we have to enter that new (SN2)
		Tracking patient record issue	Most of the patients forget their notes and some say which mobile number they gave, so tracking the patient record is very difficult (SN7).
		No change in Paperwork	BMO will check only the hard copy we carry (SN7)
		Poor Gadgets	The government gave me a laptop but it's not working anymore it was working for days after that it did not, everyone will use their accessory for example I will use my computer in my home young VHNs use to update their mobile phones (VHN1)

Table 3: Challenges for using administrative software: PICME and HMIS

Themes	Axial Coding	Initial Coding	Extracts
Enhance operational efficiency	Unique format and one-time update	Single documentation	We have to either enter the note in the written format or enter it in the software (SN3)
		One format and sharing the outcomes options	We are entering the same data in many formats is there any solution that must be one format from state to Central which makes the job easier? My opinion is, that we can give it to the state they can forward it to the central (BMO1)
		Timeline to collect reports	There should be a standard timeline to send Google forms and demand reports (MO7)
	Employee appointment	Appointment of adequate data entry operators	The system needs a separate person to enter the data known as the data entry operator. A separate person for entering the data is appointed it will be fine (MO2)
		Contract to Permanent Job	I worked as a contract employee for ten years; many others were in the same situation as me. We request that the government issue an order and employ us permanently (SN6)
	Internet Connections	Uninterrupted Network	The only issue is the network though we raised our voice against the issue and waiting for the action (VHN1)
		Government Sponsored Wi-fi connection	We need Wi-Fi which should be recharged annually by the government (SN3)

Healthcare technology infrastructure	Technology support system	Computer facilities	All the Primary Health Centre must get a computer facility with an internet connection (MO2)
		Adequate digital technology infrastructure	There is no computer in our block; our staff must manually enter the information. Need to get adequate computers to enter the data. (BMO4).
		Support system to Technology Maintenance	The government needs to provide a hardware support system to maintain the computers (BMO4)
		Simple technology to troubleshoot and support	Simple step to be followed to track the delay and help the antenatal mother get the amount (VHN6)
		Permanent Health ID	Entering the health ID for access service becomes mandatory to access, provide service, or know the history of the patient (MO3)
		Mapping the locations of patient and health ID	Mapping is to locate the areas based on the ration card location, for example, they will segregate the villagers belonging to this primary health center or health ID. It is still in the process of implementing (MO3)
		Unique ID to upload all the data	A Universal number can be given to the patient it is a Central Government program they have a Universal code number. It does not matter whether private or government doctors any doctor can upload. If you have a good internet system and data entry operator you can upload everything (MO5)
		One website for all entry	A significant issue arises from the fact that officials demand that we finish applications or Google Forms within an inconceivable time frame. The team finds it extremely difficult to update the data at a precise time and date. (BMO3)
	Data entry and rectification	Block-level rectification of error	If the rectification was done among the health workers that would lead to misuse of data. So that the rectification permission can be given among the block level (MO4)
		Data correction or edit	If we enter any data, the system can permit us to edit within a period, based on the immediate hierarchy without wasting our time anymore (VHN3)
		Simple procedures to help the antenatal mother get money	There are many problems with the entry because of the Dr.Muthulakshmi Reddy maternity scheme then everyone will be thinking the staff will fix the eligibility criteria. Nowadays, the amount is also entered into village health nurse entry. My opinion is the village health nurses are going to the field and doing patient care so that they can observe and write everything in the notes and give them to the data entry operator.
		Need to restrict the involvement of multiple people in money-related schemes	If all the entry work is given to the data entry operator then the village health nurse's role will be affected (BMO2)

ORIGINAL ARTICLE- PUBLIC HEALTH

ASSESSMENT OF ROUTINE IMMUNIZATION PROGRAMME AT RURAL PRIMARY HEALTH CENTRES IN THOOTHUKUDI HEALTH UNIT DISTRICT, TAMIL NADU, 2023-24

*Porchelvan S⁽¹⁾, Mathivanan I⁽¹⁾, Bharathi Thasan S⁽¹⁾, Amutha G⁽¹⁾, Sheik Mohamed A⁽¹⁾**(1) o/o District Health Office, Thoothukudi***ABSTRACT**

INTRODUCTION : For successful implementation of Routine Immunization (RI) services, all its components such as planning of immunization sessions, cold-chain and logistics management, documentation, monitoring and supervision need to be evaluated from time to time. The objective of this study is to evaluate the process of Routine Immunization in Primary Health Centers in Thoothukudi Health Unit District, Tamil Nadu during April 2023 to March 2024.

METHODS : A descriptive cross-sectional facility-based study was conducted in 14 out of 28 rural PHCs selected by convenience sampling, during April 2023 to March 2024. A checklist adapted from the guidelines in Immunization Handbook for Medical Officers 2018 manual released by Government of India was used.

RESULTS : Of the 14 PHCs, 12 (85.71%) PHCs had the list of estimated beneficiaries, and 13 (92.86%) PHCs had the updated logistics estimation. All the PHCs had their Ice Line Refrigerators (ILR) and Deep Freezers (DFs) with functional thermometers inside. Twice daily recording of temperature in logbook and the supervisory countersign by Medical Officer was observed in all the PHCs. Availability of all vaccines in adequate quantity was observed in only 13 (92.86%) PHCs.

CONCLUSION : Overall, microplanning, logistics management and supervision were better. Few gaps observed in Cold Chain Equipment (CCE) functioning like inadequate defrosting, not maintaining record of power failure and record of defrosting signal that cold chain handlers have to be periodically be sensitised and reviewed.

KEYWORDS : Routine Immunization, Cold Chain management, Vaccine and logistics

INTRODUCTION

Immunization stands as one of the most cost-effective health investments and a major success story for global health and development. Vaccination has consistently proven to reduce morbidity and mortality from numerous infectious diseases, cancers and other chronic diseases, globally. Over the years, various strategies have been implemented globally to ensure that vaccines are available to all individual, including the most hard-to-reach and vulnerable populations to minimize mortality and morbidity. The benefits to the individual include not only the prevention of disease and disabilities but also the opportunity for a healthier and a more productive life.¹

The World Health Organization (WHO) launched the Expanded Program on Immunization (EPI) in 1974 globally with focus on prevention of six Vaccine Preventable Diseases in children by the year 2000.¹ EPI was introduced in India in 1978, which was expanded in 1985 as Universal Immunization Program (UIP) and implemented in phased manner across all districts in the country by 1989-90. Further, a national socio-demographic goal was set up in National Population policy (NPP) 2000 – to achieve universal immunization of children against all vaccine preventable diseases by 2010. India's UIP is one of the world's

largest health programs and was considered as one of the five 'National Technology Missions' in 1986 bringing it under the scope of the Prime Minister's Office's 20-point program then.¹ The Ministry of Health and Family Welfare (MoHFW), Government of India, launched Mission Indradhanush (MI) in December 2014 as a special drive to vaccinate all unvaccinated and partially vaccinated children under UIP with 7 vaccines, by utilizing the learnings from polio eradication to improve full immunization coverage. This was further expanded as Intensified Mission Indradhanush (IMI) and the recent expansion was IMI 5.0, with a special focus on improving Measles and Rubella vaccination coverage.² Around 1.3 crore Routine immunization (RI) sessions are planned annually in India. Tamil Nadu State started the immunization programme as EPI against six vaccine preventable diseases in 1978. Under the UIP, Tamil Nadu provides 11 Vaccines to around 9.14 lakh newborns and 10 lakh pregnant women against 12 Vaccine Preventable



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Corresponding Author: Porchelvan S

e-mail : dphtut1@gmail.com

Diseases. About 6.75 lakh RI sessions are conducted every year in the State. Dedicated public health staff with their efforts have contributed to a consistent Immunization coverage of over 98% in the State with an average coverage of 1.4 Crores vaccine doses per year. In Tamil Nadu, nine phases of IMI have been conducted since 2015 to 2023 and 2.58 lakh pregnant women and 9.27 lakh children were identified and vaccinated.^{3,4}

Recent years have witnessed developments in Immunization like introduction of new vaccines in National Immunization Schedule, strengthening of VPD surveillance, strengthening of AEFI reporting mechanisms, innovations like eVIN and U-WIN. However, the core and basic functioning like microplanning and implementation of immunisation sessions still remain the cornerstone. Primary Health Centres remain the key player in planning and implementation of the immunisation services.

All the vaccines are sensitive biological products, some being sensitive to freezing, while some are sensitive to heat and others to light. Vaccine potency is ability of the vaccine to adequately protect the vaccinated persons, which can diminish when the vaccine is exposed to inappropriate temperatures. In order to maintain the quality of vaccine products, the process of Cold Chain has to be ensured. Cold Chain is a system of storing and transporting vaccines at recommended temperatures from the point of manufacture to the point of use. PHCs occupy an important position in the cold chain system, with Cold Chain Equipment (CCE) and designated Cold Chain Handlers (CCH).

For successful implementation of routine immunization services, all its components such as planning of immunization sessions, cold-chain and logistics management, documentation, monitoring and supervision need to be evaluated from time to time. Hence, this study is attempted to evaluate the process of Routine Immunization of Primary Health Centers in Thoothukudi HUD, Tamil Nadu during April 2023 to March 2024.

METHODS

A descriptive cross-sectional facility-based study was conducted during April to Aug 2024 in rural PHCs of Thoothukudi Health Unit District (HUD). Thoothukudi HUD has totally seven Block Primary Health Centers, with 28 Rural PHCs and 8 Urban PHCs. Convenience sampling strategy was adopted and two PHCs were selected from each Block. Thus, 14 PHCs out of 28 Rural PHCs were included for the study and were evaluated regarding Routine Immunization Program for the period April 2023 to March

2024.

A checklist adapted from the guidelines in Immunization Handbook for Medical Officers 2018 manual released by Government of India was used for the evaluation. The checklist consists various aspects of Immunization process like program management, cold chain management, injection safety, quality of record keeping, supply and stock etc.

The selected PHCs were visited by District Health Officer (also the designated District Immunization Officer) on Wednesdays which is usually Fixed as Routine Immunization Day. Data was collected by observations of the details in the registers, inspection of equipment and the process. All the data collected was then entered and analyzed using Microsoft Excel. Qualitative variables were presented as proportions.

RESULTS

All the PHCs were evaluated in aspects of immunisation services such as microplanning, Cold Chain management, logistics management and biomedical waste management.

a. Microplanning process of the PHCs: Microplanning is the basis for delivery of Routine Immunization services. Table 1 depicts an overview of the microplanning process in selected PHCs. Availability of complete and updated microplanning is a demonstration of preparedness for delivering quality services. Defining the area and the population covered is displayed as catchment area. For an effective microplanning, availability of catchment area is the crucial indicator as this will guide in fixing the demarcation of population catered by Sub Centers, fixing outreach session sites, estimating the beneficiaries, procuring vaccines and consumables, maintaining buffer stock, etc. Out of the 14 PHCs taken for the study, 13 (92.86%) had the catchment area map prepared.

Estimation of beneficiaries will provide accurate information on the number of children and pregnant women due for vaccination and when to receive vaccines. Of the 14 PHCs, 12 (85.71%) PHCs had the list of estimated beneficiaries. The next component in micro-plan is to estimate the requirement of vaccines and logistics with due consideration of wastage factor. Out of the 14 PHCs, 13 (92.86%) PHCs had the updated logistics estimation. All the 14 PHCs had the session plan. Supervision plan was available in 13 (92.86%) PHCs. Joint review meeting headed by District Immunization Officer (DIO) has been scheduled and conducted as planned in 11 (78.57%) of the PHCs with the Medical Officer (MO), Block Medical Officer (BMO), District Epidemiologist, District Training Team Medical

Officer (DTTMO), District Maternal and Child Health Officer (DMCHO), Sector Health Nurse (SHN), Village Health Nurse (VHN) and Pharmacist every month, which was not conducted in 3 (21.43%) PHCs in one particular month during the study period.

Table 2 : Overview of RI Microplanning process of the Rural PHCs, Thoothukudi HUD, Tamil Nadu, April 2023 to March 2024, N=14

Activities for RI microplanning	n	%
Availability of map of catchment area	13	92.86
Estimation of beneficiaries	12	85.71
Estimation of logistics	13	92.86
Availability of Session Plan	14	100
Availability of Supervision Plan	13	92.86
Joint review meeting conducted in last calendar month	11	78.57

b. Cold chain process: Cold Chain Equipment (CCE), both electrical and non-electrical is used for storing and/or transporting vaccines at appropriate temperatures. Ice-Lined Refrigerator (ILR) and Deep Freezer (DF) are used to store vaccines and freezing ice packs respectively in PHCs. Ensuring optimal functioning of the cold chain equipment in the recommended standards is critical in ensuring efficacy of the vaccines administered. Table 2 depicts the Cold Chain Equipment functionality/preventive maintenance checklist. ILR/DF should be placed on wooden platform. Of the 14 PHCs, 13 (92.86%) had fulfilled this criterion. Vaccines lose their potency due to exposure to heat (temperature above +8°C), cold (temperature below +2°C) and light, hence ILR temperature to be maintained between +2°C to +8°C, which was fulfilled by all the selected PHCs. Temperature of DF to be maintained between -15°C to -25°C, which was fulfilled by 12 (85.71%) PHCs. Icepacks has to be arranged vertically in a crisscross pattern with space for air circulation in DF, which was observed in 12 (85.71%) PHCs. Thickness of the frost formation should not be more than 5 mm in ILR and DF. All the PHCs had this criterion fulfilled in ILRs, but in DF, only 11 (78.57%) PHCs had maintained this condition.

All the vaccine vials to be arranged in the ILR based on the heat or freeze sensitivity. The T series/Hepatitis B vaccines which should be placed in the top of the ILR and the correct placement of all vaccines, fulfilled in all the PHCs. Record of the power failure to be maintained at PHCs, which was maintained at only 4 (28.57%) of the PHCs. All the PHCs had their ILR and DFs with functional thermometers inside. Twice daily recording of temperature in logbook and the supervisory countersign by Medical Officer was observed in all the PHCs.

Table 3: Checklist for preventive maintenance of ILR/DF at Rural PHCs, Thoothukudi HUD, Tamil Nadu, April 2023 to March 2024, N=14

S. No	Checklist	n	%
External			
1	ILR & DF placed on wooden stand	13	92.86
2	ILR & DF placed 10cm away from the wall	14	100
Internal			
1	ILR Temperature between +2°C to +8°C	14	100
2	DF Temperature -15°C to -25°C	12	85.71
3	Correct placement of Ice packs inside DF	12	85.71
4	All vaccine vials arranged correctly (heat/freeze sensitivity) inside ILR	14	100
5	All vaccine vials placed inside labeled cartons	12	85.71
6	No T series and Hepatitis B vial placed at the bottom of ILR	14	100
7	Diluents placed inside ILR at least 24 hours before distribution	14	100
8	Thickness of frost formation not more than 5 mm inside ILR	14	100
9	Thickness of frost formation not more than 5 mm inside DF	11	78.57
Technical			
1	Connected through functional voltage stabilizer	14	100
2	Functional thermometer inside ILR	14	100
3	Functional thermometer inside DF	14	100
4	Twice daily recording of temperature in log book	14	100
5	Record of power failure	4	28.57
6	Record of defrosting	13	92.86
7	Signature of MO in temperature log book	14	100

c. Logistics management of immunization in PHCs:

Availability of vaccines in adequate quantity is the primary requirement for conducting immunization sessions. During the visit, adequate stock was observed in 13 (92.86%) PHCs. Inadequate stock of IPV vaccine was observed in one PHC during the study period. However, timely monitoring was done through eVIN and vaccines supplied adequately. This is reflected through the issue of all vaccines for each session from all PHCs. Stock register to be updated at the end of each session, which was lacking in 2 PHCs (14.29%). Discrepancy between the stock in eVIN and the actual stock was observed in 1 PHC (7.14%), as stock was not updated in eVIN. Record of diluents was updated in all PHCs, however the record of Auto Disabled syringes was updated in 13 (92.86%) PHCs (Table 3).

Table 4: Logistics management of immunization at Rural PHCs,

Thoothukudi HUD, Tamil Nadu, April 2023 to March 2024, N=14

S.No	Components	n	%
1	All vaccines available at adequate quantity	13	92.86
2	Stock Register updated	12	85.71
3	Data discrepancy observed in stock	1	7.14
4	All vaccines issued for each session from PHC	14	100
5	Record of Auto Disabled syringes updated	13	92.86
6	Record of diluents updated	14	100

d. Steps to ensure safe disposal of biomedical waste:

Immunisation wastes include sharps like used needles and broken vials, non-sharps like used syringes without needles and unbroken vaccine vials and general wastes packaging and swabs. The Central Pollution Control Board (CPCB) has outlined the guidelines for safe disposal of biomedical wastes generated during immunization under the Universal Immunization Programme. All biomedical wastes to be segregated in colour coded bins and biomedical waste collection register to be maintained in all PHCs. This was observed in all PHCs.

Overall, the PHCs had performed fairly aligned with the guidelines. Microplanning aspects and biomedical waste handling were better. Certain gaps in CCE like not placing ILR and DF on wooden platform, not maintaining the recommended temperature in DF, not defrosting the DF periodically, not maintaining record of power failure and record of defrosting. With timely monitoring, the stocks are adequately supplied, but documenting of stock status needs to be improved.

DISCUSSION

This study evaluates the immunisation programme of PHCs. For efficient functioning of the RI programme, certain key responsibilities are designated to the DIOs and MOs such as planning and reviewing, implementation, maintaining beneficiary line list at PHC/ Block level, Supervision and Monitoring, Cold chain and logistics management and monitor tracking of new-borns and dropouts.¹

The major activities to be fulfilled by PHCs are: availability of map of PHC showing the SC/ANM area demarcation, Compiled RI micro-plans from all SC/ANM area, Supervision plan, Cold Chain contingency plan, Immunization waste disposal plan and ANM work/roster plan¹. A good micro-plan ensures that a) all boundaries of the catchment area are identified, b) all health workers are aware and have line list of their catchment areas and that no villages/urban area or high-risk population pockets or unserved areas have been left out, c) all beneficiaries have been identified and information is available on who has to

be vaccinated and with which antigen d) Adequate planning of sessions as per injection load for all identified areas using fixed/ outreach/ mobile sessions is done e) ANM roster is developed.¹

Availability of map depicting catchment area was available in 13 (92.86%) PHCs, which has to be updated in the remaining PHC as this is the first step in microplanning. Conducting head count survey is an important step in RI microplanning process, which will ensure enrollment of all beneficiaries in an area.

Thus, having an estimation of beneficiaries is an indirect way of evaluating the process of head count survey. Estimation of beneficiaries is the basis for calculating the required vaccines, what vaccines and when to be vaccinated. However, this was available in only 12 (85.71%) PHCs and lacking in 2 PHCs. Regarding logistics, 12 (85.71%) PHCs had estimated the required logistics in terms of vaccines, auto disabled syringes, etc. All the selected PHCs had the session plan, in line with the recommended guidelines.

The CCE in PHC are ILR, DF, vaccine carrier and cold box. In the present study, ILR/DF were assessed. ILR/DF should be placed on wooden platform and their positioning should be 10 cm away from the wall. Of the 14 PHCs, 13 (92.86%) PHCs had fulfilled the criterion of placing ILR/DF over the wooden platform and all the PHCs had placed the ILR/DF 10 cm away from the wall.

Frozen icepacks are to be stored only up to half of the height of large compartment in the DF, unfrozen ice packs to be placed above the frozen ice packs. About 20 to 25 dry and unfrozen icepacks has to be arranged vertically in a crisscross pattern with space for air circulation.

In the present study, 12 (85.71%) PHCs had placed the Ice packs as recommended in DF, while Pradeep et al⁵ had reported that only 66% had fulfilled this criterion. Patel N6 had reported that crisscross ice packs arrangement was present in 76.7% of total ILRs. As per the recommendation, T series/Hepatitis B vaccines should be placed in the top of the ILR, which is fulfilled in all the PHCs.

Vaccine diluents should be stored in the ILR. The diluents may be stored outside the cold chain if there are space constraints in ILR. However, diluents must be kept in ILR at least 24 hours before use or issuing to sessions to ensure that vaccines and diluents are at same temperature (i.e., +2°C to +8°C) during reconstitution, to thermal shock that is, the death of some or all the essential live organisms in the vaccine. All the PHCs had fulfilled this criterion.

Every CCE (ILR and DF) must be connected to an individual functional voltage stabilizer. The function of

the voltage stabilizer is to monitor and stabilize the range of fluctuations in the main incoming voltage to safeguard equipment from excessive voltage variation.

Voltage stabilizers prevent excessive voltage variation, providing specified constant stabilized voltage to CCEs (ILRs & DFs) for its desired optimum operation and to protect vaccines. Bypassing a voltage stabilizer can damage the CCE. In the present study, all the PHCs had the CCEs connected to functional voltage stabilizer.

Alcohol stem thermometers are very sensitive and more accurate than dial thermometers. This is the most commonly used temperature monitoring device under UIP. Each CCE should contain at least one functional thermometer and should always be placed along with the vaccines. Twice-daily readings from the stem thermometer must be entered in the individual temperature logbooks on all days including Sundays and holidays. Temperature logbooks have to be reviewed by Medical Officer (MO) every day. In the present study, all the PHCs had fulfilled the three criteria- functional thermometer in ILR, functional thermometer in DF and twice daily recording of temperature in logbook, signed by MO. However, there were certain gaps observed in CCE like not placing ILR/DF on wooden platform, not maintaining the recommended temperature in DF, not defrosting the DF periodically, not maintaining record of power failure and record of defrosting. However, most of these issues were in DF and not in ILR. These deficiencies signal that cold chain handlers have to be periodically sensitised and reviewed.

At the PHC level, the requirement of vaccines and logistics has to be estimated compiling the micro plan of all the Health Sub-Centres (HSCs) and considering the buffer stock and wastage rates. Availability of all vaccines in adequate quantity was observed in only 13 (92.86%) PHCs.

However, this inadequacy in vaccine stock is because of the higher number of doses per vial in IPV, leading to increased wastage and early stock out. But this is timely monitored through eVIN and supplies ensured adequately. All the required vaccines for immunisation sessions were issued by all PHCs. Digital innovation and upgradation through eVIN have facilitated adequate vaccines stock supply and availability.

CONCLUSION

The present study has provided meaningful insights on the completeness and gaps of RI services in PHCs.

Components of microplanning of Immunization services aligns with guidelines recommended. Biomedical waste disposal was also done according to the set standards. The gaps observed in CCE functioning like inadequate defrosting, not maintaining record of power failure and record of defrosting signal that, cold chain handlers have to be periodically sensitised and reviewed. Logistics management like not updating stock registers need to be closely monitored. This study has also reiterated the role of digital technologies in monitoring and ensuring timely availability of vaccines stock.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE- PUBLIC HEALTH

ENABLERS AND BARRIERS IN ESTABLISHING AN AUDIT SYSTEM FOR STILLBIRTHS AT PALANI HEALTH UNIT DISTRICT, TAMIL NADU, INDIA, 2023-2024

*Sridhar Lakshmipathy⁽¹⁾, Madhan Raj Kalyanasundaram⁽²⁾, Dilip Kumar Rajendran⁽²⁾,
Anitha Rajmohan⁽³⁾, Aravindh Krishnan Mayavel⁽⁴⁾*

(1) Upgraded primary health centre, Mannavanur, Kodaikanal, Palani Health unit District

(2) ICMR School of Public Health, ICMR-National Institute of Epidemiology, Chennai, Tamil Nadu, India

(3) District Health Officer, Palani Health unit District, Dindigul, Tamil Nadu, India

(4) Block Medical officer, Kodaikanal, Palani Health unit District, Tamil Nadu, India

ABSTRACT

INTRODUCTION : Among the estimated two million stillbirths globally, two thirds happen in Asia and Africa and India alone records one tenth of it. India enacted 'Every Newborn action plan', proposed by 'World Health Organization' to count every newborn and measure cause specific mortality and action in 2014-15. Although states like Tamil Nadu is good in health indicators, it lacks stillbirth auditing. Various stakeholders in Health Unit Districts like Palani wanted to explore the perceived enablers and barriers in establishing stillbirth audit system.

METHODS : We did an exploratory qualitative study in Palani Health Unit District, Dindigul district, Tamil Nadu during January-April, 2024; interviewing various stakeholders in health department and mothers. We did a purposive sampling with analytical framework approach using six steps of the mortality audit cycle developed by World Health Organisation. We did In-Depth Interviews (IDI)s and Focus Group Discussions (FGDs); audio recorded, transcribed and thematic analysis was done to identify the perceived enablers and barriers after obtaining necessary ethical and administrative approval.

RESULTS : We conducted 12 interviews, with 24 participants of median age 39 years. There were 9 IDIs and 3 FGDs. Majority, were women participants. Enablers identified are the availability of established system processes and the availability of a system with audit steering committee and mechanisms which are routinely doing maternal and infant death audits which included established communication mechanisms, emotional connections with families, existing workforce, and supportive web-based systems. Barriers included neglected notifications, cultural impediments, anger from grieving families, information suppression, accusatory attitude, and lack of system commitment. Every stakeholder interviewed wanted stillbirth to be audited.

CONCLUSION : Our study demonstrated the perceived need for stillbirth auditing among stakeholders and highlighted that existing audit mechanisms for maternal and infant mortality can be efficiently utilized to include stillbirth auditing in the district. The study also identified gaps in the existing auditing system, particularly in the approach to conducting audits, and emphasized the need for an attitudinal shift and soft skills training for the authorities conducting the audits.

KEYWORDS : Stillbirth, Death Audit, Grounded theory

INTRODUCTION

A baby who dies after 28 weeks of pregnancy, but before or during birth, is classified as a stillbirth. One stillbirth happens every 16 seconds, amounting to two million every year, with two thirds occurring in Asia and African nations.¹ Ten percent of these are in India.² Stillbirth audit system, is one of the established strategy to reduce the burden of stillbirths.³ Many developed nations adopted stillbirth audit systems, and have demonstrated its impact on reduction of stillbirths⁴ and this strategy was successfully implemented in some of the African countries as well.¹

The WHO's 'Every Newborn Action Plan',⁵ which India embraced in 2014-15 as INAP (Indian Newborn Action Plan),⁶ recommends stillbirth auditing as one of the strategies

to enhance the health of mothers and children. Although, the Registration of Births and Deaths Act of 1969 mandates stillbirth registration; however, it is not enforced.⁷ Even though studies indicate that stillbirth audits are feasible⁸ and have the potential to prevent 60% of stillbirths, they are not being implemented in Indian states including Tamil Nadu, which has a well-functioning public health system and the health indicators of the state are comparable to the developed



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Corresponding Author: Sridhar Lakshmipathy

e-mail : Sridhar.1.dr@gmail.com

nations. Tamil Nadu's stillbirth rate (6.1/1000) is lower than the rest of India (10.6/1000) as per Health management information system data (HMIS) and by adopting stillbirth audit, there is further scope to reduce the stillbirth rate in the state.

As part of an academic activity in the Dindigul district, Tamil Nadu, we evaluated the Pregnancy Infant Cohort Monitoring and Evaluation (PICME), Health information system.

During this evaluation, we discovered that while the system documents the number of stillbirths, it does not record their causes also, there were instances where early neonatal deaths might be mistakenly documented knowingly or unknowingly as stillbirths to escape infant death auditing. This gap in information prompted discussions with key stakeholders, during which the need for establishing a stillbirth audit system became apparent.

To address this need, it is crucial to explore in detail the perspectives of stakeholders regarding the enablers and barriers to developing such a system.

We also found that there is an existing auditing mechanism for maternal and infant deaths, somehow, we had a question on why stillbirths are not audited with the same existing mechanisms or system. We conducted this study with the objective to explore the perceived enablers and barriers in establishing an audit system for stillbirths among the stakeholders at Palani health unit district, Tamil Nadu, India, 2023 – 2024.

METHODS

We conducted an exploratory qualitative study in Palani health unit district from January to April 2024. The study participants included key stake holders involved in audit system for infant and maternal deaths of Palani health unit district.

They are district audit chair persons, block administrative persons, block level community health workers and mothers who suffered stillbirths and mothers who suffered infant deaths in the past one year. For the stakeholders, except for the mothers, we included minimum work experience of six months within the health unit district or within the district as the inclusion criteria.

Purposive sampling with maximum variation based on demographic profile and expert sampling as applicable were used for identifying the various key stakeholders involved in the audit process of infant and maternal deaths within the health unit district. (Table 1)

Table 1: Sampling technique used to interview study participants at Palani Health unit District, Tamil Nadu, India

Category of stakeholder	Qualitative method used	Total interviews/ discussions	Sampling technique used
District audit steering committee members	IDI	4	Expert sampling
Block administrators & supervisors	IDI	3	Expert sampling
Mothers	IDI	2	Purposive sampling
Sector health nurses	FGD	1(six participants)	Purposive sampling
Village health nurses	FGD	1(five participants)	Purposive sampling
Urban auxiliary nurse midwives	FGD	1(four participants)	Purposive sampling

We used a framework analysis approach for interviewing the stakeholders involved in the auditing process. The research team adopted six steps involved in verbal autopsy mortality audit cycle for auditing stillbirths and perinatal deaths which was developed by the World Health Organization(WHO) as the operational framework to guide the qualitative interviews and the analysis of the qualitative data.⁹

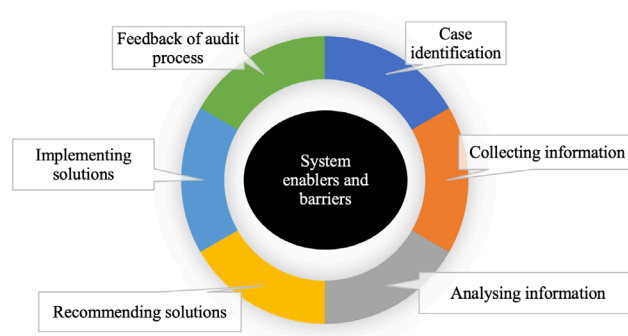


Fig 1. Framework for analysis using the six steps of verbal autopsy mortality audit cycle developed by World Health Organisation (WHO) starting with case identification to feedback of audit process.

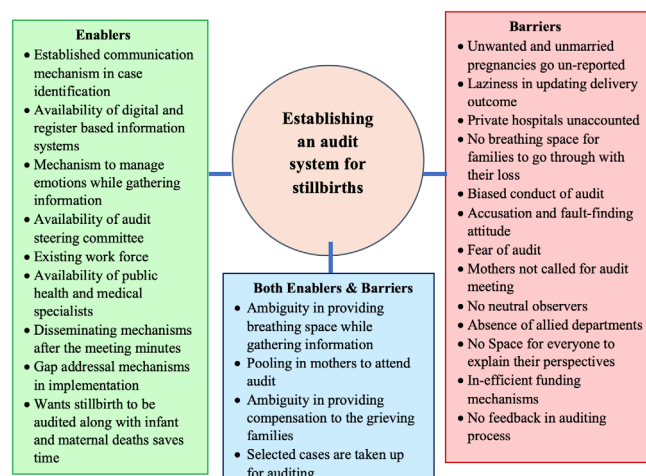


Fig 2: Flow chart describing the enablers and barriers in establishing an audit system for stillbirths at Palani health unit district, Tamil Nadu, India, 2023-24.

Table 2. Thematic analysis on enablers and barriers in establishing a stillbirth audit system, at Palani health unit district, Tamil Nadu, India, 2023-24

S.No.	Theme/ Domain	Sub-themes/ Categories	Codes
1	Case identification-Enablers	Established communication mechanisms	Social connectedness between field workers and community; Rapport between field staff and allied departments; Link staffs in government facilities; family will convey to field staff; cross notification system; other district field staff convey; Utilising social media; Digitally updating the delivery outcome
		Emotional Connect	Field staff providing emotional support; Visiting the family at hospital; Explaining it to the family; Emotional connectedness of family with the staff
	Case identification-barriers	Neglected notification	Link staff fail to convey; Delay in updating delivery outcome real time; Some private facilities not communicating; affluent mothers not communicating to the staff; systematic flaw in supervising private facilities;
		Cultural impediments	Unwanted & unmarried pregnancies; Migrant and nomadic communities; Language; affluent families; social values; geographical terrain
		Projected anger towards the system	Anger towards the entire health system
		Existing workforce	VHN is the initial inquiry person; on-site support by supervisory staff and medical officers; doing home visits to gather information
	Collecting information-Enablers	Validation mechanisms for information collected	Multiple cadres involved; co-relating with records; mother's notebook; sending back for corrections
		Sharing sorrow	Visiting at facility and home; being with family; spending more time with family; frequenting visits; Families trust VHN's more
		Utility of web based and register based information systems	Registers are useful & trusted in outreach sites; Registers have flexibility; digital portals promote information transparency; suggested inter-linkage of multiple web portals; suggested VA form to be added in web portals; incorporating stillbirth component with existing infant & under 5 mortality form;
		Collecting information - Barriers	Information suppression
2	Collecting information - Barriers	emotional road-blocks in gathering information	Possibility to hide; if all decided to hide; vacancy; Collective decision to falsify and hiding, fudging case sheets
			Mothers scolding due to anger; Angry with whole department due to some fault during management; Greif due to loss and not co-operating; Not interested in auditing; No cooling period to go through loss
		Hurdles in health information systems	Delay in getting case sheets from hospitals; Falsifying information entered in case sheets; In-adequate documentation in private facilities; Limited private facilities are provided with login access; Falsifying information entered; Contradicting guidelines; No real time data entry; Multiple web portals; Overburdened due to repetition; Inadequate information in web portals;
		Audit review panel	Chair members in CEMONC audit; Attendees in audit committee; Medical officer presenting the case; Pooling in private facilities for auditing;
	Analysing information-Enablers	Perceived need for change in audit conduct	Perceived there should be un-prejudiced view; Perceived that relative of deceased to attend audit; Perceived that space for everyone to explain; Perceive that stillbirth to be audited; Mother's perceived that that other's should not be affected in same way; Perceived that soft skill training is needed
		Lack of system commitment	No funding mechanism for conduct of audit; Travel & convenience allowance for relatives of the deceased not provided
	Analysing information-Barriers	Lack of emotional intelligence	No neutral observers in audit meeting; 108 co-ordinators not attending audit meeting; blood bank medical officers not attending audit meeting; Ambiguity to bring relatives to audit; discussion with relatives will lose trust among the community; Staff can't work in that area again; Doctors and staff are made to stand during audit meeting along with mothers; Treating badly at audit meeting; Only select infant deaths are taken up for auditing; Perceive that no soft skill training provided to conduct audit

4	Recommending solutions- Enablers	Synergistic approach	Medical specialists; Public health specialists; Perceive that review based on lacunae and deviation from guidelines; Managing conflicts; conducive environment across chair members
			Documenting & disseminating insights
			Documenting meeting minutes; disseminating meeting minutes; utilizing social media to disseminate information.
	Recommending solutions-Barriers	Disagreements & insensitivity	Loss compensation mechanisms
			Perceived that compensation to be given for the loss; suggested that Insurance based mechanisms for compensation
			Conflicts across directorates; Relatives perspective un-accounted; in-sensitive to a problem
	Implementing solutions - Enablers	Strategic planning & problem addressal	Accusations and engagement/motivation waning
			Blaming; fault finding; biased conduct of audit; Partiality to medical college doctors; crying and emotional because of accusation; losing interest
			action plan after audit meeting periodically; addressing ground level difficulties; Addressing case specific issues; Monitoring the implementation; Innovative ideas; Monitoring near miss cases
5	Implementing solutions - Barriers	Innovative ideas	Introduction of epi-collect application to monitor high risk categories; EDD control room at district level; holistic problem addressal for each case
			In-efficient funding mechanisms
			Timely distribution of funds not done; hindrance in training to address gaps; inadequacy in infra-structure for training
	Feedback in audit process - Enablers	Perceived need for feedback	Perceived that opinions should be obtained periodically
			Hierarchical feedback
			Hierarchical addressal of the problem; some conflicts hindering scaling up of the problem
6	Feedback in audit process - Barriers	Lack of existing feedback system	No opinions asked like that until now

Data were collected using open-ended interview guide. Topic guides were developed based on the research team's operational framework; with separate guides for various stakeholders. Probing techniques were used to avoid distractions. Participants were assured orally that findings will only be shared in summary form. The primary author, conducted FGDs and IDIs, had a formal training in qualitative research (three-weeks module) as a part of the MPH training program. Interviews and discussions were voice recorded in the local language using an Android device, after getting written informed consent. The topic guide was dynamic and modified based on ongoing interviews and discussions.

The audio files were transcribed in Tamil using verbatim transcript and was translated to English as edited transcript, with care taken to avoid any loss in the context and meaning. Participant confirmation was ensured with the transcribed data, by reading out it to two of the participants to ensure its correctness.

We followed a hybrid approach to qualitative thematic analysis, incorporating both deductive a priori themes derived from the research questions and operational framework (the six steps of the mortality audit cycle, enablers and barriers under each of the steps) and a data-driven inductive approach carried out following data collection. After data collection, we used an inductive approach in data coding and applied the principles of thematic analysis as described by Clark and Braun,¹⁰ which had six stages.

The first stage was data familiarisation, which required us to become familiar with the data through

repeated readings of the interview transcripts. We also began to note our initial observations during this stage.

Next was the process of coding. Three transcripts were initially coded independently by the primary author and it was reviewed by the research team. After independently coding these three transcripts, we created a codebook and added codes that inductively derived from the interviews.

Any differences in coding were discussed and resolved. The remaining transcripts were then coded using this codebook. New issues identified in these interviews relevant to our study were given new codes and added to the codebook, and were organized according to the operational framework.

In the third stage, we examined our coded data, assessing how well they fit and whether they addressed our research questions. In the fourth stage, we began to formalise our sub-themes and categories of analysis, reflecting on whether these sub-themes and categories were convincingly and credibly related to our data.

In the fifth stage, we labelled and defined each sub-theme and category, describing in detail what each signified. In the sixth stage of the analytic process, we brought forth a coherent explanation of our study findings. The perceptions emerged from the different group of stakeholders triangulated to ensure its validity. Finally, we sorted and selected quotes and placed them under the appropriate themes and sub-themes.

The study was conducted after obtaining approval from institutional ethical committee clearance of ICMR-NIE. Participants were provided information in local language about the purpose of the study, confidentiality, and their rights to withdraw at any time. Informed consent was sought from all the study participants.

RESULTS

We conducted 9 in-depth interviews from the block administrators, obstetricians, district second level staff involved in maternal and child health services, and audit steering committee members/district administrators. The 3 focus group discussions were from field staff such as Sector Health Nurses, Village Health Nurses and urban Auxiliary Nurse Midwives. The median age of the 24 study participants is 39 years and inter-quartile range is from 33-49 years. Among the 24 participants, only 2 were men leaving the rest 22 participants were women, as more women are empowered in maternal and child health services. We had a priori themes derived and relevant categories as sub-themes emerged are organized under the priori themes.

Theme/Domain 1: Case Identification

Enablers for case identification:

1.1 Established communication mechanisms: Participants highlighted the availability of established communication mechanism for effective case identification. Case identification was facilitated by good rapport between field personnel and affiliated departments, such as Anganwadi workers. By using social media, link-staff in government facilities maintained smooth information flow. Transparency was increased and fewer cases were overlooked because of digital updates on delivery outcomes.

‘People in that area will inform about the incident, when we go there. it may be a boy or a girl or an adolescent girl or any person whom we were interacting earlier’ – PKFV1V3, 39Years/F/VHN

‘If the patient is gone to some other place, we should give cross notification. That particular village health nurse (from the cross notified area) will call us and inform.’ – PKFU2U6, 33Years/F/ANM

1.2 Emotional connectedness: Stakeholders re-iterated the importance about their emotional connection between field staff and the families. They visit the hospital to provide emotional support, they act as a bridge between the hospital and family. This encouraged trust on the field staff, as they are interacting with the families from the ante-natal registration period and following them up.

‘If we get the information, we will be visiting the hospital, if it is nearby. We will give a psychological support to the mother. We will visit her daily until she gets discharged from hospital. We will be explaining to the families.’ – PKFU1U23, 32Years/F/ANM

‘We are interacting with the family and the mother right from the date of antenatal registration. So, whatever the outcome of the delivery will be known to us by them. they won't hesitate to inform us’ - PKP1V4/31Years/F/VHN

Barriers for case identification

1.3 Neglected Notification: Link-staff failing to communicate, delay in updating delivery outcomes, un-cooperation from private facilities hampers case identification in time. Rich moms frequently kept their delivery status ignoring to inform institutions. Identification of cases was further complicated by systematic shortcomings in private facility supervision.

‘There is a systematic flaw in monitoring private facilities, the level of care that they give and un-cooperation in updating us is always there’ – PDIDA4, 47Years/F/DHO

‘At some houses, they will close the gate and they will not let us in. There will be dogs in front of the house. we can't enter those houses. I gave the number and why are you frequently

disturbing us at home' – PTICF6,59Years/F/CHN

1.4 Cultural impediments: The social stigma associated with teenage pregnancies and unplanned or unmarried pregnancies hindered reporting. Communication was hampered in migrant and nomadic populations by language & cultural obstacles. After an incident, wealthy families avoided government employees due to social norms.

'If there is a teenage accidental pregnancy, the family and the girl might hide it. In these circumstances, if they go and reach out to any untrained persons, there is a possibility that stillbirth might go undocumented.'- PKFS2S3,60Years/F/SHN

1.5 Projected anger and frustration: The grieving families were not co-operating to the audit process, as they were not satisfied with the treatment given in hospitals and directed anger towards the health system as a whole.

'If the family finds that the baby died due to some fault in treatment, they will not only be angry with the hospital, they will be angry with the system as a whole. They will scold our field staff also and send them away'- PDIT12, 38Years/M/DMO

Theme/Domain 2: Collecting information

Enablers for collecting information

2.1 Existing work force: Participants stated that existing work force is sufficient to gather information. Village Health Nurses were the first point of contact, supported by medical officer and supervisory staff. They visited mother's house to get information.

'There is an infant death. We will send FIR with in twenty-four hours to the office. Later within seven days we will visit the mother's home; MO, SHN, VHN will go together to visit' – PKF2S4S11,60Years/F/SHN

2.2 Validation mechanisms for information collected: Involvement of multiple staff cadre, medical records, web-portals and mother's treatment note books aid in credibility of information collected. The forms were returned back for corrections if found discrepancies.

'We are writing in a notebook which will be given to the patient about all the visits done at every health facility. So, the date and time of visit at every health facility is documented both in the patient's notebook and in the facility registers' - PDI2B6,47Years/F/DHO

'We have a supervisory tire. We have the VHN who will be supervised by the SHN followed by the CHN and the MO of the PHC. Secondly, we have the DMCHO as the nodal person for this.' – PDI3C14,38Years/M/DMO

2.3 Sharing sorrow: Emphasis was placed on showing empathy by spending time with families in hospitals and

in their homes, paying them regular visits, and showing sympathy for their loss.

'If a baby dies, we will be with them until handing over the baby. We will be spending time with the family for another two to three days. So, we will be there with them to support emotionally and psychologically.' – PKF1U1U34, 32Years/F/ANM

2.4 Utility of web based and register based information systems: The benefits of web-based and register-based information systems were emphasised by the participants. In outreach situations with weak signal reception, paper-based registers were flexible, while digital portals provided transparency. Adding verbal autopsy forms and connecting several web portals could increase the effectiveness of data collecting.

'We are maintaining registers. We will fetch reports from those registers only. In the PICME portal, we (ANM) will enter the information about delivery outcome except a few private facilities' – PKF1U1U11, 32Years/F/ANM

'This (verbal autopsy form) shall be added in the PICME portal, so that it is easily retrievable' – PKF2S5S10,60Years/F/SHN

Barriers in collecting information

2.5 Information suppression: Suppression of information was a problem since field employees might collectively conceal information. The accuracy of the data was compromised by staff vacancies and data fabrication, including faking case sheets.

'If that VHN is very close to the supervisor tire, then there is a possibility that they may hide few information. This is going to be a challenge' – PDI3C14,38Years/M/DMO

2.6 Emotional road-blocks in gathering information: Anger with the healthcare system and the lack of a 'cooling period' to allow families to grieve their loss before interacting with the staff acts as a great barrier in gathering information 'If we give a breathing space and it will be nice' - PDI3C16,38Years/M/DMO

2.7 Hurdles in health information systems: On the health information system front, obstacles include incomplete documentation in private clinics, information fabrication, and delays in receiving case sheets from hospitals. They were overburdened due to repetitious data entry across several web portals and a lack of real-time data entry.

'There will be a contradiction within us (paediatrician & obstetrician) in this regard. The baby delivered normal, we saw the baby cry, suddenly there is a desaturation; likewise, we will explain our point. He (paediatrician) will simply say that this is severe birth asphyxia and I could say this is a

stillbirth.’ – DK17G38,38Years/F/MO

3.3 Theme/Domain 3: Analysing information

Enablers in analysing information

3.1 Audit review panel: The participants identified availability of dedicated audit review committee in place for infant and maternal deaths as an enabler., they also described about all the attendees in the audit committee.

‘The district audit team is headed by district collector followed by the DD, JD and Dean. These are the top secretaries for that audit, then the HOD’s such as obstetrics and paediatrics will be present. Then at the bottom of stage, which ever facility is involved in that particular incident; then the entire team of doctors and field staff from those facilities will be present.’ - PDI3C19,38Years/M/DMO

3.2 Perceived need for change in audit conduct: Participants desired family members of the deceased to attend meetings, and they felt that audit conduct needed to improve. Participants recommended adding stillbirths to the current audits and emphasised the need of allowing everyone to voice their ideas. Mothers were eager to take part in audit sessions in order to shield others from going through similar difficulties. It was also suggested that audit conductors receive soft skills training.

‘The persons who are at the top should see it properly on whose fault is this. Either it could be village health nurse, staff nurse or any government hospital.’ – PKF1F4F88,32Years/F/ANM

‘This is because we are visiting the families in the field. It was known to the patient’s family. Since they are not attending the audit meeting, the entire blame is put on the field staff.’ - PKF3F2V19,43Years/F/VHN

‘I would like to come and attend the meeting, if called by the collector, (with tears in her eyes), no mother should suffer the same fate, it is difficult to explain’ – PKI8H9,25Years/F/M
Barriers in collecting information

3.3 Lack of commitment from health system: A major obstacle was the lack of commitment, which was exacerbated by the absence of important stakeholders such as mother’s who lost their babies, a lack of a specific financing system and restricted resource allocation. Also, audit meetings were not supervised by impartial observers.

‘The family of that deceased person, should be brought to the audit meeting. This is especially for maternal death. So, we have to bear all those expenses. The transportation expenses of the family member, the food expenses.’ – PKF3V1V40,38Years/F/VHN

‘No such (neutral audience such as NGOs, lawyers) persons.’ – PKI1B34/40Years/M/BMO

3.4 Lack of emotional intelligence: Participants were worried that questioning family members in audits in front of staff and doctors might erode public confidence in the medical field. Staff were disrespected during audits and feared returning to work in the area again. Lack of training in soft skills affected auditors’ ability to communicate and empathise inter-human respect.

‘If the higher officials are questioning in front of the attender, it would create a mindset that this doctor has made some fault. They do not understand our routine discussions. They did some mistake and because of this the baby died. This perception will break the trust of the medical community with the public’ - DK17G28,38Years/F/MO

‘Personally, I feel that there should be some soft skill managerial training to be given to all the district administrators and specialists for the way audit has to be conducted’ – PDI2B13,47Years/F/DHO

Theme/Domain 4: Recommending solutions

Enablers for recommending solutions

4.1 Synergistic approach: Participants perceived a synergistic approach which emphasizes collaboration between medical specialists and public health specialists. They also perceived that reviewing audits should be based on identified gaps (lacunae) and deviations from established guidelines.

‘That is if the Collector, JD, DD and the Dean are in the same frequency; We will be providing a conducive and environment to sort out the MCH indicators’ – PDI2B13,47Years/F/DHO

4.2 Documenting and disseminating insights: Participants identified diligently documenting key points from audit meetings through meeting minutes. These meeting minutes will then be disseminated to relevant stakeholders through e-mail and social media, ensuring everyone is informed about the meeting minutes.

‘We will be documenting the minutes. For each death, these are the gaps. These are the action to prevent each death will be documented. We will share these minutes; Other than that, we will be discussing it during the monthly review meetings.’ - PDD4D27/49Years/F/MCHO

4.3 Loss compensation mechanisms: Participants suggested that, offering some form of compensation to families who experienced deaths; focused on insurance-based mechanisms, potentially offering financial support to go through their difficult times.

‘If it is especially maternal death, if some compensation is given, it will be useful for her babies. That should be some kind of insurance that could be managed.’ PKF3V1V36/38Years/F/VHN

‘If there is a maternal death, her babies may be given some

money through insurance schemes.' - PKF3V3V36,36Years/F/VHN

Barriers for recommending solution

4.4 Disagreements and insensitivity: Participants emphasized disagreements and conflicts between different departments within the healthcare system hindering the audit process. Additionally, the participants said that the perspectives of relatives of the deceased were often disregarded,

'There will be some conflict of interest during the process of audit meeting; if there is a problem with our staffs; we won't allow other directors to put an allegation on them. Also, it is a coordination and teamwork across the directorates.' - PDI2B13,47Years/F/DHO

'We sent the mother in 108 Ambulance. The vehicle stopped after 20 Km. Later the mother died in a medical college. The patient's relatives got suspicious, and they even spoke about it in the audit meeting. No body cared about it and went to the next question.' - PKF1U2U88, 32Years/F/ANM

4.5 Accusations and motivation waning: Participants revealed that blaming and accusation culture within the audit process directed towards field staff served as a significant barrier. Participants also perceived the audit as biased, favouring medical college doctors over others. This accusatory environment led to emotional responses from staff, including crying and a general loss of interest overall towards work.

'In this audit meeting, one thing that has to be changed is find faulting. As she has treated that mother on that particular day, it doesn't mean that she alone is responsible for that' - DKI7G25,38Years/F/MO

'During the last audit meeting; the medical college doctors did not even attend the audit meeting. Even if they come, they are not questioning them' - PKF1F4F70,32Years/F/ANM

Theme/Domain 5: Implementing solutions

Enablers for implementing solution

5.1 Strategic planning and problem addressal: After every audit meeting, action plans were approved and then periodically reviewed. It was crucial to find customised solutions to address both case-specific problems and ground-level challenges in an integrated manner. It was also included to audit "near-miss" incidents in discussions.

'We will take up all the deaths that has happened during the particular period say for example April to December and we will present an action plan. This action plan implementation will be reviewed every month on month' - PDI3C19/38Years/M/DMO

'The JD proposed to discuss the near miss cases also and to

address those gaps also' - PDI5E25/47Years/F/DMO

5.2 Innovative ideas: The participants revealed the utility of innovative technological solutions such as introducing 'epi-collect' application; additionally, the establishment of an expected date of delivery (EDD) monitoring control room at the district level was introduced; both were used to monitor high-risk pregnancy categories.

'We have created form in epi-collect application. We have trained all the staff nurses to use. They have to update details about the mothers in this application on a daily basis. We will in-turn ask the VHN to visit the mother and update the situation.' - PDI5E5,47Years/F/DMO

Barriers for Implementing solutions

5.3 In-efficient funding mechanisms and sequelae: Fund distribution delays made it more difficult to close found gaps. Initiatives to increase capacity were hampered by the lack of timely resources, which also had an impact on infrastructure and targeted training programmes.

'Challenges again will be on funds. If we have to ready the staff nurse quarters; funding is needed. We have to think of their food and other expenses for training them' - PDI3C23,38Years/M/DMO

Theme/Domain 6: Feedback of audit process

Enablers for feedback for audit process

6.1 Perceived need for feedback: Participants suggested that; their opinions and experiences should be solicited periodically to ensure the effectiveness of the audit system.

'It would be nice if there is a periodic feedback opinion obtained across all departments for smoother conduct of audit. A lot of things can be changed, if you ask me about it' - DKI7F34/38Years/F

Barriers for feedback of audit process

6.2 Hierarchical feedback: The hierarchical structure, where feedback goes through a chain of command, was seen as a potential barrier. Participants expressed that conflicts within the hierarchy could hinder the ability to scale up of the issue. 'The VHN should discuss the issue with SHN; if she can't solve that issue; this may proceed to the CHN and so on., If these are not happening due to some personal agendas and egos; then the issue will not get scaled up. There will be a communication gap.' - PDI3C22/38Years/M/DMO

6.3 Lack of existing feedback mechanism: One of the obstacles found in the audit process was the total lack of a structured feedback system.

No, they are not asking us any opinion. No one has ever asked about it until now. - PKF2F3F36,58Years/F/SHN

DISCUSSION

Tamil Nadu is one of the front runner states in maternal and child health care. All stakeholders perceived the need for establishing the audit system for stillbirths as this might enhance the completeness in documenting the infant deaths as well as stillbirths thereby leaving no gaps. If stillbirths are audited there is a potential to reduce 60% stillbirths thereby improving the life expectancy at birth. This is one lacunae which we have identified on discussion with various stakeholders before the start of the study. If stillbirths are audited there is a chance of rationalising the quality of documentation of both stillbirths and early neonatal deaths. Also, there are several studies which shows stillbirth auditing is feasible. Therefore, we intended to explore the perceived enabling factors and barriers in establishing an audit system for stillbirths.

We conducted a qualitative study to explore the stakeholder's perspectives on establishing stillbirth audit system in Palani HUD, Tamil Nadu. The key enablers identified were; the availability of established communication mechanisms aiding in case identification and the presence of social and emotional connect between the field staff and community (community health workers). There were link-staff system and aided by social media and information systems to gather information. The stakeholders perceived that utilizing the existing workforce and adding stillbirths to existing auditing mechanisms for maternal and infant death component saves time and feasible. They also perceived that there is availability of existing disseminating mechanisms after the audit meeting and support monitoring systems for implementing the solution that has been given in the existing audit committee.

The barriers identified were the cultural impediments with Indian societal system, wherein, the families like to hide on instances such as teenage pregnancies and unmarried pregnancies. There were instances where stakeholders perceived the anger and aggression towards health system as a whole, due to mis-happenings in the hospitals which hampered collecting information for audit process. The fault-finding and the accusatory attitude towards obstetricians, primary health centre doctors and field workers with biased conduct favoring doctors in tertiary care by the chair members in the committee shows lack in soft skill managerial training for the members.

The findings align¹¹ with the emotional connect of the field workers and the community, where the school of thought objectively sees the phenomenon, the need for emotional connect established between the field workers and

the mother and her family is crucial for gathering accurate information and managing the emotional perspectives like sharing sorrow and fostering psychological support.

This study is also in line with ¹² Cetin.et.al, 2022 wherein participants experienced fear of punishment and blame and the way that audit process is conducted. This attitude makes them feel depressed and prone to escape mechanism to falsify information. There were also some coping strategies such as hiding information about the death of the baby or the events which lead to the death; hampering documenting accuracy.

The participants expressed the perceived need for feedback, periodically on the conduct of audit process, as in line with ¹³ Gondwe.et.al, 2021, enables scope for improved audit conduct and better reporting. This includes soft skill managerial training for the audit chair members to promote non-accusatory attitude and addressing gaps based on the deviations and lacunae from the existing guidelines.

The participants perceived the need for adding verbal autopsy forms in the digital health information systems which may promote transparency and reducing logistical challenges(14). They also perceived the inadequacy regarding the chain of events leading to death in these systems. This explains the need for updating the health information systems as narrated by Epizitone.et.al, 2023.

LIMITATIONS

Few stakeholders in the Government Medical College Hospitals were not willing to take part in the interviews, which might potentially alter the study findings. Few Participants might have answered against what was in their mind due to fear and anxiety about the system.

CONCLUSION

To conclude, our study demonstrated the perceived need for stillbirth auditing among stakeholders and highlighted that existing audit mechanisms for maternal and infant mortality can be efficiently utilized to include stillbirth auditing in the district. The study also identified gaps in the existing auditing system, particularly in the approach to conducting audits, and emphasized the need for an attitudinal shift and soft skills training for the authorities conducting the audits.

RECOMMENDATIONS

Based on our findings, we recommend that district administrators pilot a stillbirth audit utilizing the existing

infant and maternal mortality audit system. Additionally, a soft- skills training program should be arranged for the audit committee members, emphasizing a problem-solving approach rather than a fault-finding or accusatory approach.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE- PUBLIC HEALTH

PREVALENCE AND SEVERITY OF ANAEMIA AMONG ADOLESCENTS IN TAMIL NADU: INSIGHTS FROM A YEAR-LONG HEALTH CAMP INITIATIVE, MAY 2023 TO MARCH 2024

Shinu Priya R⁽¹⁾, Shanmuga Sundaram V⁽¹⁾, Selvavinayagam T S⁽¹⁾⁽¹⁾ Directorate of Public Health and Preventive Medicine, Government of Tamil Nadu, India.**ABSTRACT**

INTRODUCTION : Anaemia is a significant global public health issue, particularly in low and middle-income countries, where nutrient deficiencies result in low haemoglobin levels. Adolescence (ages 10-19) is a crucial growth period, with 1.2 billion adolescents worldwide, many in developing nations like India, which has the largest adolescent population. According to NFHS -5 Tamil Nadu, prevalence of anaemia among adolescent girls is 52.9% and among boys is 24.6%. Our objective was to estimate the prevalence of anaemia among adolescents aged 10 to 19 years by gender, location and severity in Tamil Nadu between May 2023 and March 2024.

METHODS : This cross-sectional study utilized secondary data from the Directorate of Public Health and Preventive Medicine (DPHPM), Tamil Nadu, based on health check-up camps held from May 2023 to March 2024 at 2,286 Primary Health Centres (PHCs) where samples were mobilised from schools and tested using gold standard tests like cell counters for haemoglobin estimation. Following Anaemia Mukth Bharat Operational Guidelines, severity of anaemia was classified as mild, moderate, or severe. Data analysis was performed using Microsoft Excel and SPSS (version 24), with protocols in place to ensure confidentiality.

RESULTS : The overall prevalence of anaemia among adolescents was 48.3%, with 54.4% among females and 41.0% among males. Prevalence among adolescents identified in Trichy was 84%, while in Dindigul it was 70%. In terms of classification, severe anaemia accounted for 1.6%, moderate anaemia for 44.4% and mild anaemia for 54.1% of cases.

CONCLUSION : The study highlights a significant prevalence of anaemia among adolescents in Tamil Nadu, particularly among females and in districts like Trichy and Dindigul. With mild and moderate cases being predominant, there is an urgent need for targeted interventions particularly for the severe anemia cases immediately. Addressing nutritional deficiencies is crucial for improving adolescent health outcomes in the region.

KEYWORDS : Adolescent health, Anaemia, Nutritional status

INTRODUCTION

Anaemia is a global public health concern, particularly in low and middle-income countries, where nutrient deficiencies lead to reduced haemoglobin levels in the blood ($Hb < 12 \text{ g/dL}$).^{1,2} The term "Anaemia" originates from the Greek word meaning "no blood". Anaemia is not a specific disorder, it is a condition caused by insufficient red blood cells or haemoglobin due to one or more vital nutrient deficiencies.^{3,4} Anaemia poses serious health risks, including maternal mortality, weakened physical and cognitive capacity, increased susceptibility to infections, and poor pregnancy outcomes.⁸

Adolescence, defined by the World Health Organization (WHO) as the age range of 10 to 19 years for both sexes, represents a critical period of growth and development. Globally, there are 1.2 billion adolescents, with a significant portion residing in developing countries.⁵ India has the largest adolescent population in the world, accounting for 21% of its total population.⁶ In India, adolescent girls are particularly vulnerable to anaemia due to factors such as poor

nutrition, early marriage, and pregnancy, which exacerbate the risk of anaemia.⁹ Ensuring adequate iron status during adolescence is critical for reducing anaemia in pregnancy and improving maternal and child health outcomes.¹⁰

National Family Health Survey (NFHS) 5, (2019-2021), reported a national prevalence of anaemia as 59% for adolescent girls and 31% for boys whereas in Tamil Nadu, the prevalence of anaemia is 52.9% in adolescent girls and 24.6% in adolescent boys which is comparatively lesser than the national prevalence.⁷

However, previous studies on anaemia among adolescents in Tamil Nadu have been limited in scope, often confined to specific regions or smaller populations. These studies frequently focus on adolescent girls or particular



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Corresponding Author: Shinu Priya R

e-mail : shinupriya08@gmail.com

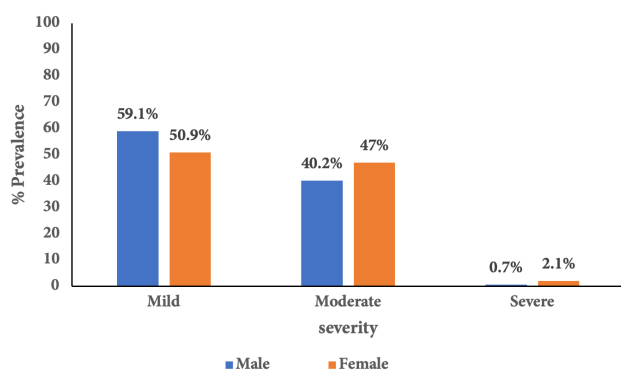


Figure 3: Prevalence of anaemia among adolescents by severity, Tamil Nadu, May 2023-March 2024 (N=19,15,072)

Figure 4 presents the prevalence of anaemia severity among adolescent males across various Health Unit Districts (HUDs), categorized into mild (11-11.9 g/dL), moderate (8-10.9 g/dL), and severe anaemia (<8 g/dL). Severe anaemia remains relatively uncommon, with only a few districts reporting rates above 1%, such as Kovilpatti (2%) and Tiruvallur (2%). Moderate anaemia was notable in several areas, with Ariyalur (66%) and Kallakurichi (54%) showing high rates. The higher percentage of mild anaemia was noted in districts like Kanyakumari (90%) and Pudukkottai (74%).

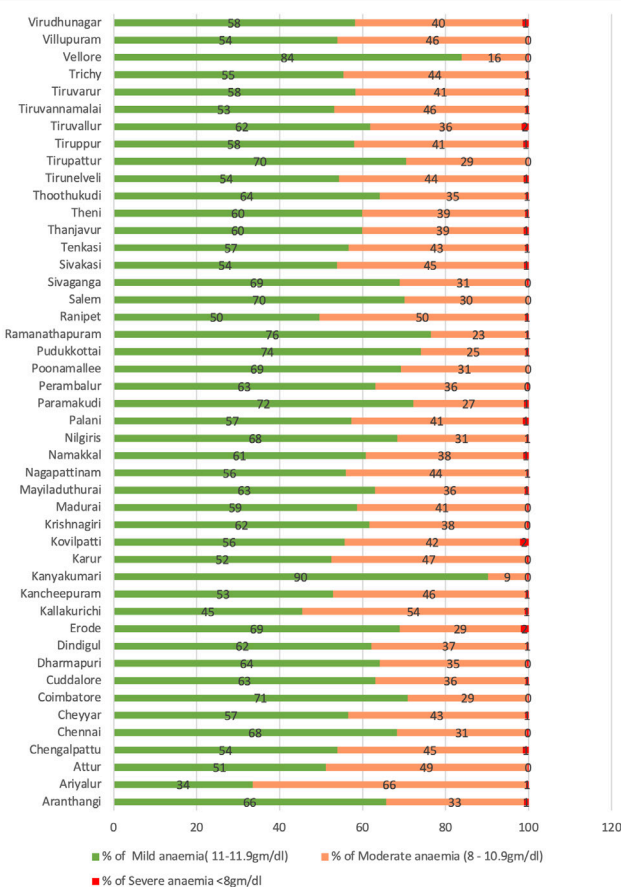


Figure 4: Prevalence of anaemia by severity among adolescent males by Health Unit Districts (HUD) in Tamil Nadu, 2023-2024 (N= 8,71,634)

Figure 5 presents the distribution of anaemia severity among adolescent females across various Health Unit Districts (HUDs), categorized into mild, moderate, and severe anaemia based on haemoglobin levels. Prevalence of severe anaemia (<8 g/dL) was comparatively lesser than moderate and mild forms, with the highest rates observed in Tiruvallur (6%) and Kovilpatti (5%), though overall, these percentages were low across the districts, with many reporting only 1-2%. Moderate anaemia was notably high, particularly in Ariyalur (71%) and Attur (62%). The prevalence of mild anaemia is higher in several districts, specifically in Cuddalore (74%) and Kanyakumari (73%) reporting the highest percentages.

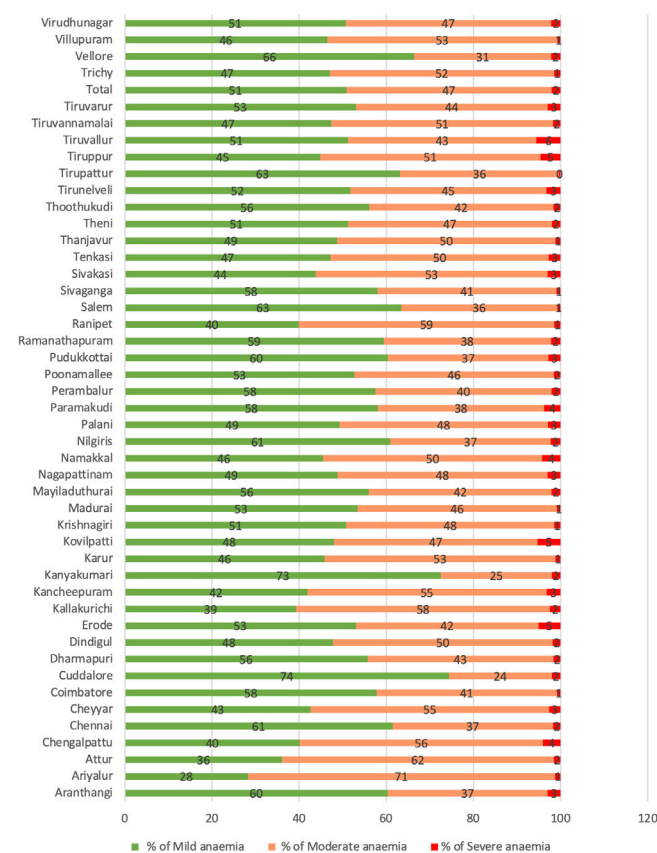


Figure 5: Prevalence of anaemia by severity among adolescent females by Health Unit District (HUD) in Tamil Nadu, 2023-2024 (N= 10,43,438)

DISCUSSION

According to the World Health Organization (WHO), anaemia is a significant global public health issue, affecting 30% of non-pregnant women and 37% of pregnant women aged 15–49 years, with children and adolescents also at elevated risk. In Tamil Nadu, our study found a 48.3% prevalence of anaemia among adolescents, with higher rates among females (54.4%) compared to among males (41%). This prevalence is higher than the global average for developing countries, reflecting the significant burden of anaemia in this region.⁶

When compared to the National Family Health Survey (NFHS) 5 data (2019-2021), which reported a national prevalence of 59% for adolescent girls and 31% for boys, our findings indicate a lower overall prevalence of 48.3%. However, it is important to note that the prevalence among females in our study (54.4%) is slightly higher than Tamil Nadu-specific NFHS 5 data (52.9%) and lower than the national average (59%). Conversely, the reported prevalence among males (41%) is significantly higher than both the national average (31%) and Tamil Nadu-specific data (24.6%), suggesting a higher burden of anaemia among adolescent males in the surveyed regions.⁷

The WHO attributes the higher prevalence in low and middle-income countries to nutritional deficiencies, particularly iron deficiency, as well as infections like malaria and parasitic infestations. While our study did not explore the aetiology of anaemia, the high prevalence in females suggests a strong link to iron deficiency due to menstrual blood loss and inadequate dietary intake, a finding that is consistent with global data.⁶

Our findings align closely with previous Tamil Nadu-based studies, such as Chandrakumari et al. (2019), which reported a prevalence of 48.63% among adolescent girls, reflecting a regional consistency in anaemia rates.² However, Sunitha K (2024) reported a slightly lower prevalence of 37.2%, indicating possible geographical variations within the state.¹² On a national level, Singh A et al. (2021) observed a prevalence of 42% in Jharkhand, while a meta-analysis by Daniel RA et al reported a higher pooled prevalence of 65.7% across India, indicating that Tamil Nadu may have a somewhat lower overall burden of anaemia compared to other regions.^{13,14}

Globally, our prevalence findings are comparable to studies conducted in Bangladesh, where Kundu S et al. (2023) reported a prevalence of 46.8%. This suggests that anaemia remains a persistent issue across South Asia.¹⁵ However, the rates found in Tamil Nadu are still lower than those reported in high-prevalence regions, such as West Bengal, where Chakrabarty M et al. (2023) documented a significant increase in anaemia prevalence from 54.2% to 58.9% in recent years.¹⁶

Our study's gender-specific findings highlight the increased vulnerability of adolescent girls to anaemia, with a prevalence of 54.4% compared to 41% for boys. Similar research, such as Singh A et al. (2021) and Shettar D et al. (2024), corroborates these findings, emphasizing the need for gender-specific interventions.^{13,17} Notably, our research also identified a significant prevalence of anaemia

among adolescent males (41%), showing the importance of comprehensive interventions that address anaemia in both genders.

Geographical disparities in anaemia prevalence within Tamil Nadu are evident, with Tiruchirapalli exhibiting the highest rates (87.3) among females and 80.8% among males compared to regions like Nilgiris, which had a much lower prevalence (13%). These findings highlight the necessity for localized public health interventions, especially in high-burden areas such as Trichy along with Kallakurichi, and Dindigul which also have higher prevalence.

Our study found that mild anaemia constituted the majority of cases (54.1%), followed by moderate anaemia (44.4%) and severe anaemia (1.6%). This distribution aligns with other regional studies, such as Chandra Kumari et al. (2019), which also found mild anaemia to be the most prevalent.²

The high prevalence of anaemia among adolescents in Tamil Nadu emphasizes the urgent need for targeted public health interventions. Given that most cases are classified as mild to moderate, implementing iron supplementation programs, nutritional education, and school-based health initiatives could significantly alleviate the burden of anaemia among adolescents. Furthermore, the observed gender disparity necessitates focused programs aimed at improving menstrual health management and dietary iron intake among adolescent girls.

Thus, our study emphasizes the critical need for comprehensive strategies to combat anaemia in Tamil Nadu, particularly in high-prevalence districts. Addressing the nutritional and health needs of adolescents is essential for reducing anaemia prevalence and improving overall health outcomes in this vulnerable population.

LIMITATIONS

The data collected is specific to Tamil Nadu, which may limit the generalizability of the findings to other regions or countries, as different demographic and environmental factors could influence anaemia prevalence elsewhere.

CONCLUSION

The study emphasizes the prevalence of anaemia among adolescents in Tamil Nadu, showing a higher rate in females than in males. Trichy has the highest prevalence, followed by Dindigul and Kallakurichi. In terms of severity, mild anaemia is more common than moderate and severe anaemia. Among males, mild anaemia is the most prevalent, while females exhibit higher rates of both moderate and

severe forms of anaemia. It highlights the need for targeted interventions in addition to Weekly Iron Folic Acid Supplementation (WIFS) and National deworming day (NDD) especially for adolescent girls and high-prevalence districts, to address this significant public health issue. Additionally, adolescent anaemia in males is also significant and must not be overlooked, as it can lead to long-term health consequences. Addressing anaemia in both genders is essential for promoting overall adolescent health. Future studies should explore the root causes of anaemia more deeply and assess the effectiveness of implemented health programs to ensure sustainable progress.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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NARRATIVE REVIEW - PUBLIC HEALTH

BRIDGING THE GAP: A NARRATIVE REVIEW OF BARRIERS TO CERVICAL CANCER SCREENING IN INDIA

*Arjuhn R ⁽¹⁾, K Poonkodi ⁽²⁾**(1) District Program Officer- Non Communicable Disease, Directorate of Public Health and Preventive Medicine, Namakkal**(2) District Health Officer, Directorate of Public Health and Preventive Medicine- Namakkal***ABSTRACT**

INTRODUCTION : Very few women undergo cervical cancer screening, therefore this narrative review aims to identify barriers among women to screening in India which can in turn aid in better delivery of ongoing screening programs. The objective of this study is to understand the barriers faced by women to uptake cervical cancer screening in India.

METHODS : We did a narrative review, for which nine articles obtained after thorough search from database with appropriate search strategy and data extraction. Data are analysed in an inductive thematic analysis approach under two components

RESULTS : The barriers faced by women in cancer screening were grouped into two main themes. The first theme highlighted a lack of awareness about symptoms and disease and women not feeling at risk for the disease, the second theme included barriers such as loss of pay, lack of family support and social stigma, particularly in rural areas. However, most studies indicated that education positively correlates with increased cancer screening uptake.

CONCLUSION : Addressing barriers to cervical cancer screening requires a multi-pronged approach. Public health campaigns should raise awareness about cervical cancer, its symptoms, and the benefits of early detection, especially in rural and low-income communities. Culturally sensitive interventions can tackle social stigma and engage family members in preventive healthcare. Training healthcare providers to address fears and build trust is also crucial. Shifting to HPV-based screening from Visual Inspection with Acetic acid (VIA) can overcome many barriers as it is painless, encouraging participation, and self-sampling enhances compliance. HPV testing offers greater sensitivity and specificity, enabling accurate risk assessment and motivating regular screenings which is recommended by the World Health Organization.

KEYWORDS : Cervical cancer, Screening, Barriers, India

INTRODUCTION

Cervical cancer ranks eighth in terms of incidence and ranks ninth in terms of mortality globally.¹ In India, cervical cancer incidence is estimated to be 1,27,526 and mortality is estimated to be 79,906 which is approximately one fifth of global incidence and mortality from the disease.² Cervical cancer accounts for 17.7% of the total cancer burden in the country and contributing to 8.7% of the overall mortality burden in India (2). Moreover, India is projected to add 1.5 million Disability-Adjusted Life Years (DALYs) by 2025.³ Therefore, detection of Cervical cancer at the earliest is of paramount importance especially in a country like India. Screening programs are underway in India from 2010 under National Programme for Prevention and Control of Non-Communicable Diseases [NP-NCD].⁴ Three different modes of cancer screening are available like HPV based screening, Visual inspection using acetic acid/Lugol's iodine (VIA/VILI) and Pap based screening, even though some methods may be superior to others.^{5,6} All methods are effective in reducing morbidity and mortality and India screening programs largely use VIA/VILI. Unfortunately, screening uptake is still poor with only 1.9% of women between the ages of 30 and

49 have ever had a cervical cancer screening. This is 2.2% in urban areas and 1.7% in rural areas.⁷

This narrative review seeks to synthesize existing literature on the barriers to cervical cancer screening in India, providing insights that could inform targeted interventions and appropriate changes to improve screening efforts and overall women's health outcomes in the country. Addressing these barriers is essential, as the consequences of inaction not only impose a significant financial strain on healthcare systems but also lead to considerable loss of life. The objective of this study is to understand the barriers faced by women to uptake cervical cancer screening in India.

METHODS

We conducted a narrative review to explore the evidence on barriers to cervical cancer screening in India. The



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Corresponding Author: Arjuhn R

e-mail : mmcarju@gmail.com

available data were extracted through literature search and analysed using inductive thematic approach. This approach allowed us to identify the specific barriers to cervical cancer screening in India and highlight the gaps in existing research. This review is not registered, and protocol not prepared for this narrative review.

A systematic method was used to identify pertinent studies. We conducted an extensive literature search across PubMed and Google Scholar to find English-language studies related to cervical cancer screening in India from 2004 to 2024 with focus on south Indian articles. A variety of keywords and their synonyms were combined using 'OR' and 'AND' operators to fine-tune the search. The keyword combination that produced the most relevant results with minimal irrelevant hits was selected for the final search. Full details of the keywords used in the PubMed search with title/abstract filters are provided in Annexure 1.

The Population Intervention Comparison Outcome Strategy (PICOS) was applied to select the publications by both authors: (1) population: women and service providers; (2) intervention: cervical screening Pap smear or Papanicolaou test and visual inspection with acetic acid or HPV based screening. (3) comparator: this was not a specific inclusion criterion since studies with and without a comparator group were included; (4) outcomes: The available data were extracted and analysed using a Inductive Thematic analysis.; (5) study design: peer-reviewed English publications to ensure the quality of research; only publications based on research on India population in India and only articles published between 2004 and 2024 .

The same PICOS method was used to exclude the publications with the following characteristics: (1) population: studies on population groups in countries other than India or high-income economies. (2) intervention: unproven methods of cervical screenings (3) comparator: this study need not necessitate Comparator (4) outcomes: no barriers to access reported; (5) studies: editorials, letters and personal views and publications of languages other than English. Figure 1 presents the PRISMA 2020 flowchart for the database search of relevant studies. The selection process occurred in three stages. Initially, titles and abstracts were screened according to the predefined inclusion and exclusion criteria. This step was checked by K.P involved in the review to verify the selection. Next, studies that passed the first screening were subjected to a full-text review in the second stage. Papers excluded at this stage were shared with authors, who provided feedback on the exclusions. In the final stage, the references from the selected studies were reviewed to

identify any additional relevant publications that may have been missed in the original database search, applying same inclusion criteria.

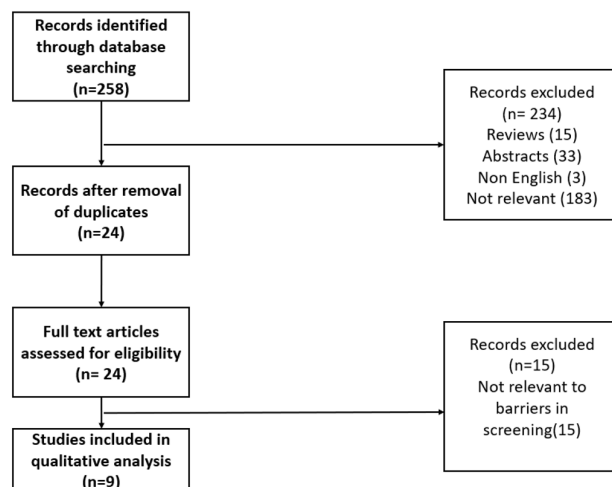


Figure 1: -Showing PRISMA Flowchart

Data extraction involved all the authors performing an Inductive thematic analysis of the selected publications independently. All authors reviewed the selected articles and different codes were generated.

These codes are then analysed by the authors for the possibility of categorization of codes for further analysis. No automated tools used for code generation. Risk of bias was assessed with mixed method appraisal tool by authors independently.

Qualitative study checklist was selected from the tool as it is relevant for this study. It contained two screening questions followed by five qualitative checklist questions with answer options of 'Yes', 'Can't tell' and 'No'. questions with answer 'yes' awarded 1 point, answer 'No' was awarded 0(zero) points and 'can't tell' answers received 0.5 points. Articles received strong score of 5 and some articles received score of 3.5 points whereas lowest score that articles received is 3 points.

RESULTS

Upon searching for appropriate articles from PubMed, Google scholar and going through references in the relevant articles to capture the missed article from database. Nine articles were found that is focused on barriers of Cervical cancer screening in India.

Age group involved were as low as 18 years and as high as 85 years, from rural and urban parts of the country but predominantly rural. Seven out of nine studies used questionnaire/interview type of evaluation and remaining

two had focussed group discussion (Table 1)

Author with year	Setting	Type of population	Sample size	Age group	Information extraction
1. Dsouza JP et al, 2020 ⁽⁸⁾	Community based	General population & service providers	45	30-59	FGD
2. Mahalakshmi S, 2020 ⁽⁹⁾	Community based	General population & Service providers	19	NA	Questionnaire
3. Chandrika, K et al, 2020 ⁽¹⁰⁾	Community based	General population	219	30-65	Questionnaire
4. Vidhubala E et al, 2020 ⁽¹¹⁾	Hospital based	Service providers	15	NA	Interview
5. Shrutti R et al, 2019 ⁽¹²⁾	Hospital based	Service providers	15	NA	Interview
6. Tripathi N, 2014 ⁽¹³⁾	Community based	General population	281	35 and above	Questionnaire
7. S Aswathy et al, 2012 ⁽¹⁴⁾	Community based	General population	809	15-50	Interview based
8. Singh S et al, 2012 ⁽¹⁵⁾	Hospital based	Patients	812	18-85	Questionnaire
9. Basu P et al, 2006 ⁽¹⁶⁾	Community based	General population	496	25-65	FGD

Upon examining the selected articles by the authors individually, different codes were generated based on the naming of the barriers mentioned by the authors of the selected articles. 13 such codes generated. These 13 codes are grouped into 4 categories as given in Table 2 such as 1) Awareness based barriers, 2) Anxiety based barriers, 3) Societal barriers and 4) Economic barriers. Based on the above-mentioned categories of barriers, two themes emerged as in Table 2 such as 1) Women who are not willing for cervical cancer screening comprising of awareness-based barriers and anxiety-based barriers and 2) Barriers to women who are willing for screening comprising of societal and economic barriers.

Table 2 :Results of inductive thematic analysis

Theme 1: - Women who are not willing for cervical cancer screening	
Awareness based barriers	Anxiety based barriers
Lack of awareness of the disease	Fear of pain from screening procedure
Lack of awareness of symptoms	Fear of being diagnosed
Lack of awareness of screening programs	Embarrassment
Not feeling at risk	
Theme 2: - Barriers to women who are willing for screening	
Societal barriers	Economic barriers
Stigma	Loss of pay
Lack of support from family members	Worry about finances, if diagnosed

In the first theme, lack of awareness about the symptoms and disease is the predominant barrier in all studies and accounting for more than 80% in two studies (9,14,16) and second most predominant barrier is women not feeling at risk for disease more than the fear aspect. Whereas loss of pay, not having family approval remained major barriers in the second theme along with social stigma especially in the rural side. But most studies show education positively correlates with cancer screening uptake.

DISCUSSION

In 2010, the Indian government initiated the

National Program for the Prevention and Control of Cancer, Diabetes, Cardiovascular Disease, and Stroke (NPCDCS). It started in 100 districts and expanded to 468 districts by 2012. The program aims to establish Non-Communicable disease clinics at the district level.^{17,18} Even though the infrastructural framework is in place the screening uptake for cervical cancer is low. therefore, it is imperative to know different barriers that women face to further cater the program appropriately to the target population.

The findings of this narrative review highlight several key barriers to cervical cancer screening in India, particularly in rural areas. A significant lack of awareness about cervical cancer and its symptoms emerged as a predominant barrier, with many women either unaware of the need for screening or not perceiving themselves to be at risk, which limits their willingness to participate. This is further compounded by fear of pain during the procedure, distrust in medical processes, and a heightened fear of a cancer diagnosis, which is often associated with fatal outcomes in the minds of these women. Family dynamics, particularly lack of family approval, also play a crucial role, as many women lack the support of their husbands or family members to undergo screening. Social stigma, particularly the association of cervical cancer with sexually transmitted diseases, discourages many women from participating, as they fear being judged by their community. Financial constraints are another major barrier, with many women prioritizing daily income over preventive healthcare. The fear of losing income due to time off work, coupled with the inability to afford treatment if diagnosed, further discourages screening uptake. Despite these challenges, education is a crucial factor, as women with higher education levels tend to participate more in screening programs.

Addressing these barriers requires a multi-pronged approach. Public health campaigns should focus on raising awareness about cervical cancer, its symptoms, and the benefits of early detection, particularly targeting rural and low-income communities. Culturally sensitive interventions are needed to tackle social stigma and engage family members is of importance to preventive healthcare. Additionally, training healthcare providers to address fears and build trust can further improve screening uptake. Overall, comprehensive efforts are necessary to improve access to cervical cancer screening and reduce the morbidity and mortality associated with this preventable disease.

Apart from the above-mentioned measures, one of the most important changes that can be done to overcome most of the barriers is to shift to HPV based screening than VIA which is currently practiced in India. HPV-based

cancer screening is painless, reducing fears of discomfort and encouraging participation. Self-sampling allows women to collect samples privately, which enhances compliance. Moreover, HPV testing offers greater sensitivity and specificity than visual inspection with acetic acid (VIA)¹⁹, enabling more accurate risk assessment. Its high negative predictive value reassures women, motivating regular screenings. Additionally, introducing HPV testing supports targeted education about the virus, raising awareness and reducing stigma. It is also the recommended test by Apex bodies like World Health Organization.²⁰

LIMITATIONS

Limitations of the study includes that there is a temporal bias due to the inclusion of studies from various parts of the country. Additionally, some studies utilized service providers as proxies for the target population, which may not accurately reflect the barriers to screening uptake.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ANNEXURE 1 - Search Strategy

The final keywords chain used in the systematic literature search in PubMed were as follows:

#1 Cervical cancer

#2 Barriers to cervical cancer screening

#3 #1 AND #2

#4 India

#5 Rural

#6 Urban

#7 Tamil Nadu

#8 Andhra Pradesh

#9 Telangana

#10 Kerala

#11 Karnataka

#12 #4 AND #5 OR #6 OR #7 OR #8 OR #9 OR 10 OR #11

#13 #3 AND #12

#14 #13 AND English [Language] AND ("2014" [Date -

CASE REPORT - PUBLIC HEALTH

MULTI DISCIPLINARY APPROACH IN
STURGE-WEBER SYNDROME: A CASE REPORT*Deleepa R ⁽¹⁾**(1) Assistant Surgeon - Dental, Upgraded Government Primary Health centre, Adhanakottai, Pudukkottai HUD***ABSTRACT**

INTRODUCTION : Sturge-Weber Syndrome (SWS) is a rare congenital neurocutaneous disorder characterized by facial capillary malformations and associated neurological complications. This case report details a 24-year-old female with Sturge-Weber syndrome (SWS) who sought cosmetic surgery to address aesthetic concerns stemming from facial disfigurement, including facial palsy and a port-wine stain. Comprehensive evaluation revealed a rash consistent with SWS, alongside a history of seizures. The report emphasizes the need for a multidisciplinary approach to manage both cosmetic and medical challenges while highlighting the importance of understanding the implications of dental procedures in such patients.

INTRODUCTION

Sturge-Weber syndrome (SWS) is a congenital neurocutaneous syndrome defined by the association of a facial capillary malformation in the trigeminal nerve's ophthalmic distribution with vascular malformation of the brain, eye and ipsilateral vascular glaucoma¹. The Sturge-Weber syndrome and port-wine stains are thought to be caused by somatic mosaic mutations that interfere with vascular development². SWS is a rare condition with an incidence of 1 case per 50,000 populations². The presentation of SWS often includes distinctive facial features that may significantly impact an individual's self-esteem and quality of life. This case report details the clinical findings and considerations in managing a 24-year-old female patient with SWS who sought cosmetic intervention to improve her facial aesthetics.

CASE REPORT

A 24-year-old female presented to our Dental OPD with several notable concerns. She exhibited facial palsy on the right side, swollen lips, and a reddish stain that extended from her forehead to her chin on the same side, reaching halfway across her hard palate without crossing the midline. This patient sought to enhance her appearance through cosmetic surgery. Her medical history revealed that she had a rash on the right side of her face since birth, which had progressively enlarged and darkened over the years. Additionally, she had a history of seizure episodes and was currently on anti-epileptic medication.

Upon physical examination, the right side of her face displayed a diffuse, flat reddish-purple rash affecting the areas supplied by the three branches of the trigeminal nerve.

The rash extended from the midline of her forehead, up to the hairline, down to the lower border of her mandible, laterally to the external ear, and medially to the midline of the chin. The discoloured patch had an irregular shape with well-defined margins. The upper lip was notably swollen and everted, showing blanching when pressure was applied. When palpated, the patch felt flat, smooth, non-tender, and warm to the touch, with no visible pulsations detected. Patient visited our dental clinic to improve her facial aesthetics through facio-maxillary and cosmetic surgery. But as any dental procedures in these patients poses challenges due to potential risk of haemorrhage, she was explained about the complications and advised only about maintenance of good oral hygiene.

DISCUSSION

SWS is characterized by leptomeningeal angiomas and port wine stain of the face in the region of the trigeminal nerve's ophthalmic distribution⁴. Other neurological symptoms include seizures, hemiparesis, recurrent headaches, stroke-like episodes, psychomotor retardation, and mental retardation.⁵ SWS may lead to cognitive impairments, visual field deficits, stroke-like episodes, endocrine problems and learning difficulties. Cutaneous manifestation (port-wine stain) in the distribution of ophthalmic and maxillary divisions of the trigeminal nerve



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Corresponding Author: Deleepa R

e-mail : docdendils@gmail.com

is common in SWS. In 90% of patients with SWS, the first manifestation is seizure (focal or generalized) which occurs in the first year of life.

Although the aetiology is not well established, a previous study conducted has shown that a somatic activating mutation in the GNAQ gene is responsible for SWS.³ The persistence of immature sinusoidal vascular channels and underdeveloped superficial venous drainage with compensatory dilatation of venules leading to shunting of blood to deeper veins, stasis and ischemia ultimately resulting in seizures, transient hemiparesis and progressive deposition of calcium salts is the postulated pathogenesis for SWS.⁴

Radiological imaging with the findings of leptomeningeal vascular malformation on contrast-enhanced T1-weighted magnetic resonance imaging (MRI), and cortical and subcortical calcification on head computed tomography (CT) is the basis of diagnosis.⁶ EEG, magnetic resonance spectroscopy and fluorodeoxyglucose-positron emission tomography (FDG-PET) may also help in the evaluation of patients but are not routinely used and are preferred. MRI is the most preferred modality for diagnosis in patients aged above one. CT scan detects calcification, gyriform calcification being the most common feature and described as a "tram-track sign". The use of ionizing radiation in CT scans limits its use.⁶

The treatment modality is generally supportive and symptomatic management using antiepileptics and aspirin is done.⁷ Surgical procedures, which include hemispherectomy, corpus callosotomy, vagal nerve stimulation, focal resection of seizure focus (contraindicated in patients with bilateral involvement), are reserved for people not responsive to medical therapy and patients with glaucoma, refractory seizures and scoliosis. However, most patients achieve seizure control with medications.

A major component of Sturge Weber Syndrome is the significant facial disfigurement caused by soft tissue and bony overgrowth secondary to the associated vascular malformation. The surgical treatment of this deformity, however, has received little coverage in the literature⁸. Even with full patient cooperation, appropriate surgical intervention by reconstructive surgeons to restore normal anatomy and improve quality of life is extremely challenging and requires multi-staged procedures⁹. Patients with Sturge Weber Syndrome may also suffer from significant seizures due to intracranial involvement as well as psychosocial distress related to the disfigurement and resultant social stigmatization.¹⁰

This case provides valuable insights into the clinical presentation and diagnosis, of SWS in a young patient. We learned that any dental procedures might lead to life threatening complications. A multidisciplinary approach might be the solution to improve the facial aesthetics.

A comprehensive understanding of the latest treatment methods and a thorough knowledge of this syndrome are crucial for effectively managing this condition. The clinical observations in this case enhance our understanding of SWS and emphasize the importance of being proactive in early intervention for such cases.

Informed written consent was obtained from the patient regarding, protected health information for scientific presentation and publication purpose. It was obtained after explaining what information will be used, how it will be used, and where it will be published and patient was aware that their anonymity cannot be guaranteed.

LIMITATIONS

Given that this is a single case report, there is a potential for anecdotal fallacy, making it challenging to generalize the findings. Additionally, the patient did not return for follow-up, so we could not obtain further information regarding her progress or the outcomes of her treatment.

CONCLUSION

This case highlights the complexities involved in diagnosing and managing Sturge-Weber Disease, particularly regarding aesthetic concerns and the challenges posed by dental treatment. A thorough understanding of the condition and its implications for dental procedures is crucial for effective patient management.

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SHORT ARTICLE - PUBLIC HEALTH

PERFORMANCE OF REGIONAL TRAINING INSTITUTES IN
CAPACITY BUILDING OF HEALTH CARE PROVIDERS
OF TAMIL NADU, 2021-2024*Vasumathi S⁽¹⁾, Nagarani⁽¹⁾, Vijay Suraj HM⁽¹⁾**(1) Directorate of Public Health and Preventive Medicine***ABSTRACT**

INTRODUCTION : Training plays a key role in any field. It improves skills & knowledge of workers. It helps to improve the productivity of workers. Health care workers need to be continually trained to provide quality health care to public. The objective of this study is to assess the training performance of Regional Training Institutes (RTI) under the Directorate of Public Health and Preventive Medicine (DPH&PM) in Tamil Nadu from April 2021-March 2024.

METHODS : We did a descriptive study and collected data from all 8 Regional Training institutes under DPH&PM. We collected data such as name of training, category of health care worker to be trained, training target, number of workers trained, number of workers yet to be trained in excel sheets for the period of April 2021 – March 2024, last 3 financial years.

RESULTS : In April 2021 – March 2022, Training gap was more in HFWTC, Egmore (61%), less in RTI, Thiruvankulam (1%) and IVCZ, Hosur (1%). In April 2022 – March 2023, training gap was more in HFWTC, Egmore (21%) & HFWTC, Madurai (21%), less in RTI, Thiruvankulam (1%). In April 2023 – March 2024, Training gap was more in HFWTC, Gandhigram (40%), no training gap in HMDI, Salem & IVCZ, Hosur.

CONCLUSION : This study assessed the training performance of Regional Training Institutes under DPH&PM. Training gaps were present in all institutes & necessary action should be taken to address these training gaps. Further studies should be planned at field level to assess the knowledge attitude and practice among health care workers & qualitative study should be planned to know about the specific reasons for training gaps including financial resources among these training institutes.

KEYWORDS : Training in Public Health, Regional Training Institutes, Training Performance.

INTRODUCTION

Training plays a key role in any field. It improves skills & knowledge of workers. It helps to improve the productivity of workers. Health care workers need to be continually trained to provide quality health care to public. Training is essential for field level workers. Field level workers are increasingly being recognized to play a significant role in extending services to 'hard to reach' groups.¹ Evidence supports the significant contribution of field level health care workers in delivering essential health interventions, particularly for maternal and child health.² Systematic reviews studying the factors influencing the performance of field workers have highlighted training & supervision as one of the most neglected intervention related factor.³ Education & training in respect of Public Health is meagre in India.⁴

Directorate of Public Health and Preventive Medicine is responsible for providing primary level of health care to public & implementation of national health programs. There are various category of health care workers working in Tamil Nadu under Directorate of Public Health and Preventive Medicine, from Village Health Nurses (VHN) at grass root level to district health authority. It is the sole

responsibility of Directorate of Public Health and Preventive Medicine to train these diverse categories of health care workers. To cater this purpose, there are 7 Regional Training Institutes functioning in Tamil Nadu under the control of Directorate of Public Health and Preventive Medicine & one autonomous training institute in Gandhigram.

The purpose of the study is to assess the training performance of Regional Training Institutes of Public Health. So far, no study has been conducted to assess training performance of these Regional Training Institutes of public health in Tamil Nadu.

METHODS

We did a descriptive study. There are 7 Regional Training Institutes & one autonomous training institute in Gandhigram which trains health care workers in 46 Health



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Corresponding Author: Vasumathi S

e-mail : vasu5491@gmail.com

Unit Districts. For our study purpose, we have collected data from all the following 8 training institutes. 1) Health and Family Welfare Training Centre (HFWTC), Egmore, 2) Health and Family Welfare Training Centre (HFWTC), Madurai, 3) Institute of Public Health, Poonamallee, 4) Health Manpower Development Institute (HMDI), Viluppuram, 5) Health Manpower Development Institute (HMDI), Salem, 6) Regional Training Institute of Public Health, Thiruvananthapuram, 7) Health and Family Welfare Training Centre (HFWTC), Gandhigram, 8) Institute of Vector Control & Zoonosis (IVCZ), Hosur.

Data collected from individual training institutes such as name of training, category of health care worker trained, training target, number of workers trained, number of workers yet to be trained in excel sheets for the period of April 2021 – March 2024, the last 3 financial years with the help of Statistical Assistant & System Manager in the training division of Directorate of Public Health and Preventive Medicine.

RESULTS

From April 2021 to March 2024, Institute of Public Health, Poonamallee has conducted 34 batches for 23 category of trainings and completed the trainings for 79.2% of the HCWs (4,334/5,474) with a gap of 20.8% (1,140). Health Manpower Development Institute (HMDI), Villupuram has conducted 29 batches for 18 category of trainings and completed the trainings for 92.7% of the HCWs (2,279/2,459) with a gap of 7.3% (180). Health Manpower Development Institute (HMDI), Salem has conducted 35 batches for 23 category of trainings and completed the trainings for 96% of the HCWs (2,418/2,520) with a gap of 4% (102).

Regional Training Institute of Public Health, Thiruvananthapuram, has conducted 16 batches for 14 category of trainings and completed the trainings for 96.5% of the HCWs (3,221/3,338) with a gap of 3.5% (95). Health and Family Welfare Training Centre (HFWTC), Egmore, has conducted 51 batches for 33 category of trainings and completed the trainings for 75% of the HCWs (4,688/6,247) with a gap of 25% (1,761)

Health and Family Welfare Training Centre (HFWTC), Madurai, has conducted 35 batches for 32 category of trainings and completed the trainings for 90.8% of the HCWs (5,220/5,751) with a gap of 9.2% (531). Gandhigram Institute of Rural Health & Family Welfare, has conducted 31 batches for 18 category of trainings and completed the trainings for 73.8% of the HCWs (1,821/2,468) with a gap of 26.2% (647). Institute of Vector Control and Zoonosis

(IVCZ), Hosur has conducted 11 batches for 8 category of trainings and completed the trainings for 99.1% of the HCWs (1,843/1,860) with a gap of 0.9% (17).

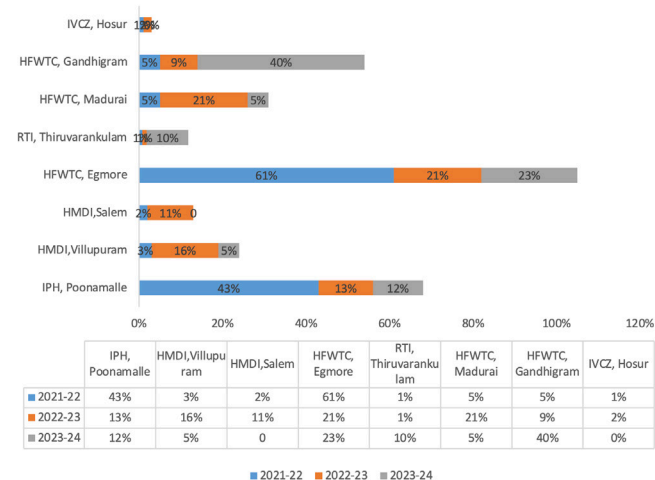


Figure 1: Training gap in the 8 Regional Training Institutes (RTIs), in Public Health, Tamil Nadu, April 2021 to March 2024

DISCUSSION

In 2021-22, training gap was more in HFWTC, Egmore (61%) followed by IPH, Poonamallee (43%). In 2022-23, training gap was more in HFWTC, Egmore (21%) & HFWTC, Madurai (21%). In 2023-24, training gap was more in HFWTC, Gandhigram (40%) followed by HFWTC, Egmore (23%). Major gap noted in 2021-22, the reasons might be because of COVID-19 and many health care workers didn't turn up for training, delay in fund flows, difficulties in finding the resource persons for training.

Other common reasons quoted were many health care providers especially medical officers were on their medical & maternity leave & workers won't turn up because of deficient manpower in their respective HUDs. Previous studies related to human resources in health care in India states that despite having highest number of medical colleges, India has been lagging behind in producing sufficient qualified persons in meeting requirement of the health care services sector in the country to ensure Universal Health Care. So, the medical education & training system of the country has to be tailored/molded in the lines of growing population & its emergent health care needs.⁵

CONCLUSION

This study assessed the training performance of Regional Training Institutes of Public Health. Training gaps were present in all institutes & necessary action should be taken to address these training gaps. Further studies should be planned at field level to assess the knowledge factor including

attitude and practice among health care workers & qualitative study should be planned to know about the specific reasons for training gaps including financial resources among these training institutes.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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ORIGINAL ARTICLE - PUBLIC HEALTH

EPIDEMIOLOGY OF REPORTED MUMPS CASES IN
TAMIL NADU, APRIL 2021 TO MARCH 2024*Narmatha K⁽¹⁾, Abinaya P⁽¹⁾, Sankarmani Ramasamy Mathivanan⁽¹⁾, Logaraj M⁽¹⁾**(1) Directorate of Public Health and Preventive Medicine***ABSTRACT**

INTRODUCTION : Mumps is an acute viral illness caused by a paramyxovirus called the mumps virus. Virus is acquired by respiratory droplet transmission. It replicates in the nasopharynx and regional lymph nodes. Incubation period of mumps is usually 16 to 18 days. Variety of causes have been attributed to the recent spike in mumps cases in India, including changing climatic patterns, elevated pollution levels, inadequate preventive measures and weakened immunity. Our study intends to investigate the burden of mumps cases in the last three years and their trend.

METHODS : Mumps cases reported from April 2021 to March 2024, in IHIP-IDSP portal for Tamil Nadu has been collected from the IDSP-IHIP portal and exported to Microsoft Excel. Statistical analysis was done using SPSS 21.0.

RESULTS : Study reported 8 ± 3.14 years as the average age of the mumps cases. Of the reported cases 56.05% of the cases were female, while 43.87% were male. 31% percent of the cases were reported from Chennai. The incidence per lakh population has increased significantly from 0.07 in 2021 to 1.3 in 2024.

CONCLUSION : We conclude that the number of mumps cases has been steadily increasing over the years, with a significant surge in 2024 to suggest that mumps can be included as a notifiable disease in Tamil Nadu to improve surveillance and control measures.

KEYWORDS : Mumps, paramyxovirus, Vaccine Preventable Disease

INTRODUCTION

Mumps virus, which is a paramyxovirus related to parainfluenza, gets transmitted by respiratory droplets. It multiplies in local lymph nodes and nasopharynx. Characteristic parotitis symptoms and additional complications including orchitis and aseptic meningitis are caused by inflammation in contaminated tissues. Incubation period of mumps usually ranges from 16 to 18 days, while it can even extend up to 25 days. Non-specific prodromal symptoms include headache, low-grade fever, myalgia, anorexia, and malaise. The normal presentation of mumps is parotitis, or swelling of the parotid gland, or other salivary gland enlargement that lasts for around five days. Both unilateral and bilateral parotitis are possible.¹

Globally, the most frequent complication of mumps in post-pubertal males is Orchitis, which affects around 30% of unvaccinated and 6% of vaccinated post-pubertal males. Oophoritis, mastitis, pancreatitis, hearing loss, meningitis, and encephalitis are common additional mumps complication, which can occur with or without parotitis or other salivary glands enlargement.¹ Clinical presentation, particularly the presence of parotitis, usually raises suspicions about the diagnosis of mumps. On the other hand, lab testing ought to be done if the mumps is suspected. Viral culture from buccal/oral or urine specimens, or reverse transcriptase-

polymerase chain reaction (RT-PCR) are the two methods used to confirm mumps.¹

Globally, there is a substantial mumps case burden, particularly among countries where the vaccine is not routinely administered. With 100–1,000 cases per 1,00,000 people reported in countries without routine mumps immunization programs, the mumps incidence worldwide is still rather high. India has a high disease burden, as evidenced by the reports²¹ of both cyclic outbreaks and sporadic cases from every part of the nation. According to reports, as of 2012, the incidence of the mumps dropped by 88-97% in countries that provided a single dose of the vaccine and by 62% in nations where routine mumps vaccines were part of national immunisation programs.²

Between September 2009 and November 2014, India's Integrated Disease Surveillance Program (IDSP) recorded 72 mumps outbreaks, totalling 1,564 cases.³ But because IDSP reporting of the mumps is voluntary, many instances may remain unreported, meaning that the true mumps burden in



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Corresponding Author: Narmatha K

e-mail : nk1674@srmist.edu.in

India is probably underestimated.³ A variety of causes have been attributed to the recent spike in mumps cases in India, including and preventative measures, changing climatic patterns, elevated pollution levels, and weakened immunity.² Our study intends to investigate the burden of mumps cases in the last three years and the trend.

METHODS

A cross sectional study was conducted from April to June 2024. Data on mumps cases reported from April 2021 to March 2024 were obtained from the Integrated Health Information Portal - Integrated Disease Surveillance Program from Directorate of Public Health, Tamil Nadu. Patients' demographic details and clinical data were obtained from the line listing format of the IDSP Portal, which was kept confidential.

According to Integrated Disease Surveillance Program, Clinical Case of mumps is defined as "Acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland, lasting for two or more days and without other apparent cause".

Laboratory Criteria for Diagnosis included seroconversion or significant (at least fourfold) rise in serum mumps IgG titre as determined by any standard serological assay (or) positive serological test for mumps-specific IgM antibodies. Case Classification included **Suspected**: A case with clinically compatible illness or that meets the clinical case definition without laboratory testing or a case with laboratory tests suggestive of mumps without clinical information.

Probable: A case that meets the clinical case definition without laboratory confirmation and is epidemiologically linked to a clinically compatible case.

Confirmed: A case that meets the clinical case definition or has clinically compatible illness, and is either laboratory confirmed or is epidemiologically linked to a confirmed case. All the collected data were entered into a Microsoft Excel spreadsheet. Each year, the incidence of mumps cases in Tamil Nadu has been calculated independently. Number of mumps reported for the three years, was computed and displayed as time-trend curves. All the analysis was performed by using SPSS version 21.0.

RESULTS

In the study period spanning from April 2021 to March 2024, totally, 1,281 presumptive cases of mumps were documented on the IDSP-IHIP digital platform.

Table 1: Age-wise distribution of mumps cases reported in IHIP-IDSP in Tamil Nadu, April 2021 to March 2024, N=1,281

Age group	n	%
< 5 years	418	32.63
6 to 9 years	507	39.58
10-19 years	132	10.30
20-40 years	36	2.81
41-60 years	139	10.85
>60 years	49	3.83
TOTAL	1281	100.00

Table 1 represents the age group wise distribution of the mumps cases reported. 40% of the cases belonged to the age group of 6 to 9 years, followed by the age group of less than 5 years which is 33%.

Table 2: Gender-wise distribution of mumps cases reported in IHIP-IDSP in Tamil Nadu, April 2021 and March 2024, N=1,281

Gender	n	%
Male	562	43.87
Female	718	56.05
Transgender	1	0.08

Table 2 shows the gender distribution of 1,281 mumps cases recorded in Tamil Nadu between April 2021 and March 2024. 56.05% of the cases were among females and 43.87% among males.

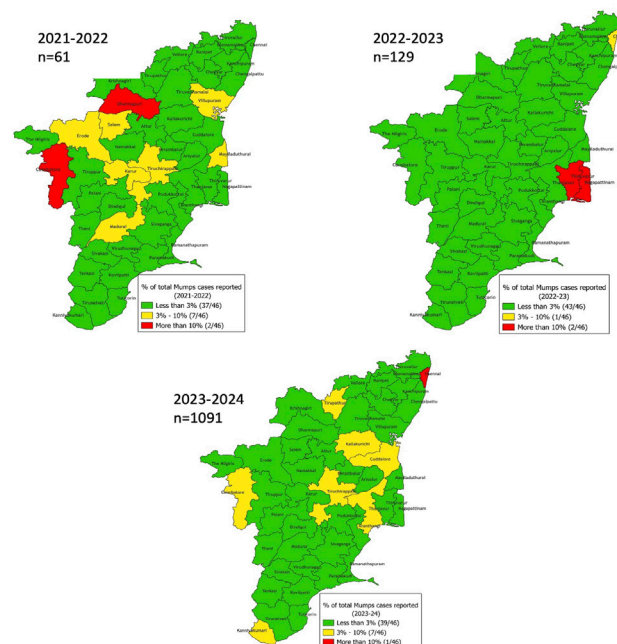


Fig 1: Health Unit District-wise distribution of Mumps cases reported annually in IHIP-IDSP in Tamil Nadu, April 2021 and March 2024, N=1,281

Figure 1 shows that the distribution of mumps cases across districts in Tamil Nadu. In the year 2021 to 2022, totally 61 cases of mumps reported. Coimbatore reported 15% of the total cases and Dharmapuri reported 11% cases. In the year 2022 to 2023, totally 129 cases were reported. Thiruvavur reported 51% of the total cases and Nagapattinam reported 11% of total cases while Chennai reported 4% cases. But there was a sudden surge of 1091 cases in the year 2023 to 2024 with Chennai reporting the highest percentage (27%) and several Health Unit Districts reporting 3 % to 10 % of the total cases.

Table 3: Annual Incidence of Mumps per lakh population in Tamil Nadu as reported by IHIP-IDSP between April 2021 and March 2024, N=1,281

Year	n	Incidence per lakh population
2021-2022	61	0.07
2022-2023	129	0.16
2023-2024	1091	1.30

Table 3 presents data on the incidence of mumps in India from April 2021 to March 2024, highlighting the incidence per lakh population. The incidence per lakh population also reflects this upward trend, increasing from 0.07 in 2021-22 to 1.30 in 2023-24. The incidence rates show a consistent rise, with the most significant jump occurring in 2023-2024.

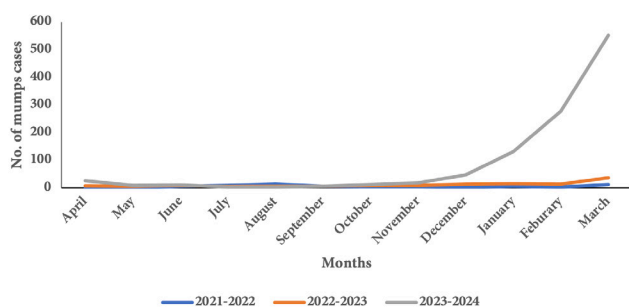


Figure 2: Trends of Mumps in cases reported in IHIP-IDSP in Tamil Nadu, April 2021 to March 2024, N=1281

The graph in Figure 2 displays mumps cases reported from April 2021 to March 2024. In 2021, 2022 and till 2023 the number of reported cases remained quite low, but there was a sharp increase in 2024 which confirms to be an outbreak. The increasing trend and the sharp rise from January to March, 2024 indicate that there may be underlying factors contributing to the higher incidence of mumps, such as changes in environmental conditions, population dynamics, or vaccination coverage which needs to be studied.

DISCUSSION

Mumps is a highly contagious viral disease caused by the mumps virus which exhibits a cyclical trend of outbreaks every 4-5 years, with seasonal variations in incidence with a bimodal distribution.²⁰ Mumps cases are reported daily in real-time on the IDSP-IHIP portal in order to enhance disease surveillance. To comprehend the patterns of mumps in the state of Tamil Nadu, surveillance data was obtained from the IDSP-IHIP site.

Of the 1,281 suspected instances of mumps, the age group with the highest percentage of cases is that of 6 to 9 years old, followed by those under 5 years old. This is in accordance with research conducted in Assam by Sarmah, K. et al.⁹ and in Jaisalmer by Moghe, C.S. et al. (2018).⁵ According to our analysis, more than 50% of the cases reported were females. This is in keeping with research conducted in Odisha by Paul, S. et al. and Rajasthan by Moghe, C.S. et al. However, research from Bhat, U.M. et al. in Kashmir and Raut, C. et al. in Karnataka reveals that men are more frequently affected than women.^{5&11}

Chennai accounted for one-third of the cases reported. This may be because Chennai, the largest and capital city of Tamil Nadu, has a high population density and population migration that can aid in the transmission of disease. This study allows us to observe significant cases recorded between April 2021 to March 2024, may be associated with meteorological elements like temperature and vapor pressure and seasonal behavioural variables which can aid in the spread of the mumps virus, such as higher school attendance and indoor congestion in the summer and increased social interaction during holidays and vacations.¹⁵

According to the search findings, melatonin changes and other seasonal variables may have an impact on human immunological competence and contribute to the seasonal patterns of mumps infections.¹⁶ Summertime's higher temperatures and greater humidity might help the mumps virus survive and spread, increasing the number of cases.¹⁵

During the year 2021-22 only 61 cases of mumps reported in Tamil Nadu. In the year 2022-23, we saw a slight increase with 129 number of cases of mumps. In 2023-24 there was a dramatic increase compared to the previous two years, totally 1,091 cases of mumps were reported during this period. This increase in incidence could be attributed to outbreak of mumps in 2023-24.

This pattern may be suggestive of several of things, including decreasing immunity within the population, inadequate vaccination rates, new viral variants appearing, alterations to the social or environmental elements that

promote the spread of illness.

According to research by Choe, Y.-J., Lee, Y.H., and Cho, S.-I., there was a significant rise in the reported incidence of mumps from fewer than 10 cases per 100,000 to more than 100 cases per 100,000 between 2001 and 2015. During this time, the average yearly percentage change in incidence was 26.8%.¹⁷ According to the European Centre for Disease Prevention and Control, seasonality was more evident in 2016 and 2017, with 1.6 to 2.2 times as many cases recorded in the first half of the year as in the second. In the EU/EEA, there were 2.6 cases of mumps reported for per 100,000 people in 2018.¹⁸ In China, the yearly incidence rate of mumps declined from 199.1 per 100,000 population in 1990-1996 to 45.6 per 100,000 population in 1997-2008 and then reduced to 10.0 per 100,000 population in 2009-2017, according to a study conducted in China by Pang, H., Zhou, Y., Zhao, W., & Jiang, Q.¹⁹ According to study findings, the mumps incidence has exhibited variable trends throughout different time periods and geographical locations. While some places have experienced a notable increase in incidence rates in recent years, others have witnessed decreasing trends. The findings of our study highlights that, there is a significant increase in mumps cases in Tamil Nadu over the past three years, particularly in 2024. The incidence of mumps per 1 lakh population demonstrate a steady increase over the years, indicating a growing public health concern. The gender-wise distribution shows that females are more affected by mumps, while the age-wise distribution indicates that children belonging to the age group of 6 to 9 years were most affected. The study suggests that there may be various factors contributing to the increase in mumps cases, including being a non- Universal Immunization Programme (UIP) vaccine, changes in vaccination coverage with the availability of private vaccines, mutations in the virus, and increased social interaction.

LIMITATIONS

The study relied on a limited dataset of mumps cases in Tamil Nadu from 2021 to 2024. This study analysed data of a particular state in the southern part of India and the findings of which cannot be generalizable to the whole country due to heterogeneity in climatic conditions, vaccination uptake, and socio-economic conditions among different states.

CONCLUSION

In conclusion, the study provides insights into the occurrence of mumps cases in Tamil Nadu over the past three years. The significant increase in mumps cases, particularly

in 2024, highlights the need for enhanced public health measures to control the spread of the disease with particular focus on children aged 6-9 years and the female population who have a considerably higher burden of mumps cases.

RECOMMENDATION

The study recommends that the government may consider making mumps a notifiable disease in Tamil Nadu to improve surveillance and control measures. In order to successfully combat the spread of the mumps component may be added to the UIP schedule as per GOI procedures. There needs to be gender specific interventions with a greater emphasis on health education for women. Preventive measures, such as increased vaccination efforts and public awareness campaigns to educate the public about the importance of vaccination and proper hygiene practices to prevent the spread of mumps should be put into place well before the summer months due to the seasonal peak occurring between June and August, which specifically coincides with Tamil Nadu's summer.

DECLARATION OF INTEREST

The authors declare no conflict of interest

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