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TNJPHMR

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Letter from the Editor's Desk

With every edition of TNJPHMR, spectrum of articles from different disciplines are started pouring in, touching the lives of Public through academic lens from different perspective. This is the biggest advantage of public health approach, where we are open up for the every possible options for betterment.

This particular issue touches upon the environmental surveillance of virus, regulation of circadian rhythm by nuclear receptors, challenges in making the children wearing the spectacles, impact of pre pregnancy BMI and weight gain on the outcome in the new-born.

The article on factors influencing the place of delivery needs to acknowledged with suitable health system change. The article on alternative vaccine carrier system highlight the innovation in the field.

The comprehensive tool on ranking primary health centres covering the entire spectrum of services will go a long way in improving the service provision for the community and it is being articulated in this edition.

Our editorial team striving to improve further to serve you better..

Dr. T.S.Selvavinayagam MD., DPH., DNB.,

Director of Public Health & Preventive Medicine

Tamil Nadu Journal of Public Health and Medical Research

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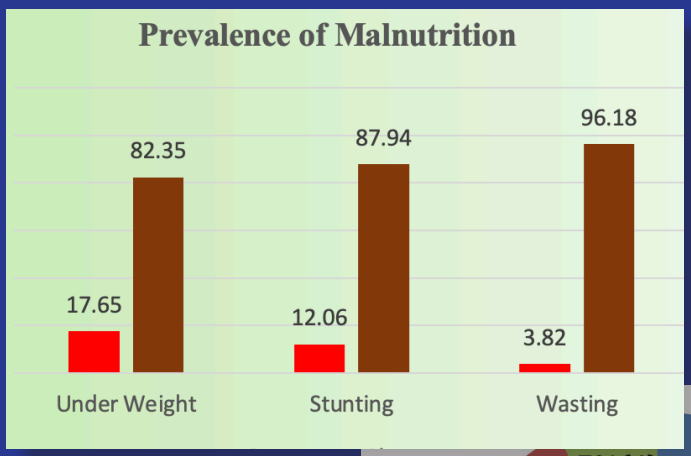

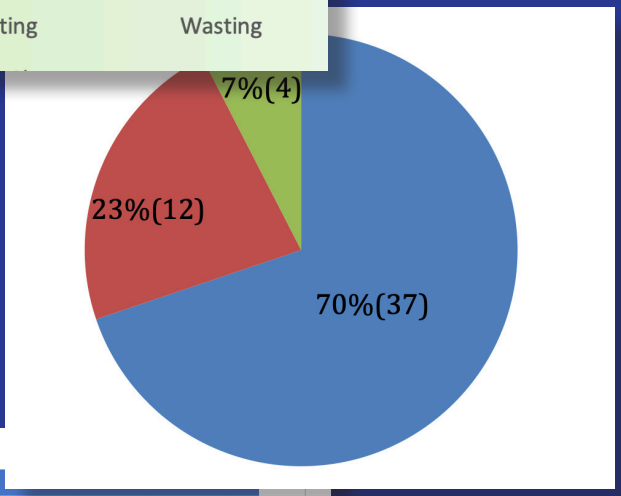

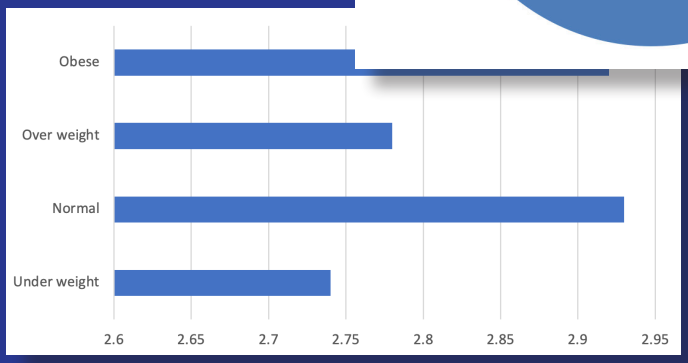

RESEARCH IS TO SEE WHAT EVERYBODY ELSE HAS SEEN, AND TO THINK WHAT NOBODY ELSE HAS

ORIGINAL ARTICLE - PUBLIC HEALTH

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FACTORS INFLUENCING THE CHOICE OF PLACE OF DELIVERY IN TAMIL NADU – A CROSS SECTIONAL STUDY

Selvavinayagam T S [(1)], Somasundaram A [(1)],
Sudharshini Subramaniam [(2)], Chitrasena S [(1)], Karunya M [(2)]

(1) Directorate of Public Health and Preventive Medicine
(2) Institute of Community Medicine, Madras Medical College

Abstract

BACKGROUND: Maternal healthcare services in Tamil Nadu are provided both by public and private sector. The changing pattern in the place of delivery over years is influenced by multitude factors. This includes personal preferences, family choices, and other system related factors. This study aims at determining the factors that influence choice of delivery among women who delivered in the year 2022 in Tamil Nadu.

METHODS : Quantitative study using descriptive design was done among mothers who delivered in the last 1 month (August 2022) in Tamil Nadu. One Urban and rural PHC was randomly selected from each Health Unit District excluding Chennai. All women who delivered in the month of August 2022 was obtained from PICME irrespective of the outcome of delivery in the selected PHC area. Mothers who did not give consent to participate in the study and those who were not available even after three attempts were excluded from the study. The mothers were approached by the Mobile Medical Unit of the respective block and the women interviewed using semi-structured questionnaire.

RESULTS : A total of 1143 mothers were approached, out of which 865 women consented to participate in the study. Among the 865 study participants, 538 (62% -95% CI -58.8- 65.4%) had delivered at a public facility ,in particular more than 25% of the deliveries happened in medical college hospital and10% in PHC. Among the various demographic factors, 75% of rural women delivered in public facility compared to only 50% in urban slum and non-slum area. There is also difference based on religion, caste, education level, economic status on place of delivery. Public health facilities are sought after for registration and getting antenatal services. The place of delivery is chosen predominantly based on distance, familiarity with the facility and availability of skilled personnel and medicine.

CONCLUSION : The choice of place of delivery is defined by the socioeconomic and demographic factors. As the population moves up in the social ladder, preference for private facilities is higher. Public facilities can be assigned specific roles and referral linkage shall be strengthened with regard to maternal care to increase its efficiency, with PHCs performing antenatal and postnatal care services, the higher centres shall focus on providing intrapartum care.

KEYWORDS : Place of delivery, Choice of Place of Delivery care

INTRODUCTION

Maternal health refers to a woman's health during pregnancy, childbirth, and postpartum. Maternal mortality significantly contributes to deaths among women in the reproductive age group. World Health Organisation (WHO) estimates that every day in 2017, 810 women died due to preventable and treatable causes related to pregnancy and childbirth.[1] These deaths can be prevented or treated by providing quality maternal care. WHO states that skilled care before, during, and after delivery can save the lives of women and newborns.[1] A key strategy to ensure skilled care is that all births occur in health facilities where obstetric complications can be treated, which is called institutional deliveries.[2] However, institutional deliveries don't always translate into skilled quality care, as many facilities do not have adequately trained manpower or sufficient equipment and other infrastructure to manage complications.[2,3] In a recent study by HY Lee et al found that institutional deliveries in India have a meaningful survival advantage only where the quality of maternal care services is higher.[4] This signifies the importance of improved quality in the institutions to provide the intended effect.

India with the current maternal mortality ratio of 103/ 1 lakh live births in 2017-195 has adopted 100% institutional delivery as a key strategy to reduce maternal mortality. The government has incentivized institutional delivery through the "Janani Suraksha Yojana" program since 2005. Built on the success of JSY, a newer scheme, "Janani Shishu Suraksha Karyakram" was launched by the central government to ensure no expense childbirth, including free transport, free diet, free drugs, and diagnostics. All these schemes have made progress in institutional deliveries, as is evident from the National Family Health Survey data 40.8% in 2005-06(NFHS-1) to 88.6% in 2019-20(NFHS-5).

The maternal mortality ratio in Tamil Nadu is 54 per one

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Corresponding Author: Sudharshini Subramaniam
e-mail : sudharshini.subramaniam90@gmail.com

lakh live births and has attained the Sustainable development goal of reducing the MMR to < 70/ 1 lakh live births.[5] Tamil Nadu is the only State having 99.9 percent of institutional delivery with 66.9 percent of institutional deliveries occurring in public sector.[6] Maternal healthcare services in Tamil Nadu are provided both by public and private sector. The public sector provides services through the health Subcentres (HSCs) and PHCs in the rural areas and the urban health centres in the urban areas at the primary level. District and subdistrict hospitals provide care at the secondary-level and teaching institutions and their attached hospitals at the tertiary level. Secondary and tertiary-level hospitals function as referral hospitals. Women have direct access to all levels of health facilities for birthing care. Services are provided free of charge in the public facilities. The private facilities range from small nursing homes, corporate hospitals to NGO run hospitals and private medical college hospitals, which charge user-fees. As on 2022, 40% of the child birth happened in Private institutions, 50% in secondary and tertiary hospitals, 10% in PHCs. Prior to 2006, around 43% of the deliveries were conducted in the private institutions, 42% in the secondary and tertiary-level public hospitals, 7% each in the PHCs and HSCs, and a little above 5% had domiciliary deliveries. An analysis of institutional deliveries by sector from 2006 onwards showed a different picture. While HSC and domiciliary deliveries declined to less than 1%, a four-fold increase was observed in PHCs, marginal decline in secondary and tertiary hospitals and, surprisingly, deliveries in the private sector declined by 10 points.

The changing pattern in the place of delivery over years is influenced by multitude factors. This includes personal preferences, family choices, and other system related factors. Schemes like Muthu Lakshmi Reddy Maternity Benefit Scheme insist on delivering in a government institution for the mother to be eligible for the conditional cash benefit of Rs.14000 and kind benefit of Rs.4000. However, factors determining the choice of place of birth among different public health institutions not clear and needs to be studied. This study aims at determining the factors that influence choice of delivery among women who delivered in the last 1 year. The findings from this study will help health planners and other stakeholders formulate policies aimed at enhancing the utilization of various health facilities by pregnant women thereby reducing maternal morbidity and mortality.

METHODS AND MATERIALS

STUDY DESIGN : Quantitative study using descriptive design was used to find the factors which determine the place of childbirth among mothers who delivered in the last 1 year in Tamil Nadu.

STUDY POPULATION : Mothers who delivered in the last 1 month (August 2022) in Tamil Nadu

EXCLUSION CRITERIA : Mothers who do not give consent to participate in the study and those who are not available even after three attempts were excluded from the study.

SAMPLE SIZE : The study was conducted among 1% of women who delivered in the month of August 2022 in Tamil Nadu.

SAMPLING METHOD : The list of PHCs (including UPHCs) in Tamil Nadu was obtained. From the list 1 Urban PHC and 1 rural PHC was randomly selected from each Health Unit District excluding Chennai. All women who delivered in the month of August 2022 was obtained from PICME irrespective of the outcome of delivery in the selected PHC area. PICME registry is used as the sampling frame because it ensures 100% registration as it is linked with Civil Registration System of births and deaths. These women were approached by the concerned Mobile Medical Unit(MMU).

STUDY VARIABLES : The details of the study were explained by the MMU to the study participant and informed written consent was obtained. Data was collected using a semi-structured questionnaire using Google forms. The questionnaire was administered by the medical officer of the MMU in the local language.

The study tool included variables which have been identified as potential factors which determine the choice of place of childbirth from various other studies. (Table 1)

Table 1 : Potential factors which determine the choice of place of childbirth from various other studies.

Socio demographic factors
Maternal age, Marital status, Sex of household head, Religion, Caste, Maternal education, Husband education, Perceived wealth class, Ownership of means of transportation, Decision making.
Obstetric factors
Birth order of last child, Adverse birth outcomes during delivery preceding the last pregnancy, Regular ANC visit during the last pregnancy, Time of the first ANC visit, Number of total ANC visits during the last pregnancy, Any pregnancy related problem during the last pregnancy, Previous antenatal and delivery history
Health system related factors
Availability of health facilities, Accessibility in terms of distance, Satisfaction with services

The questionnaire was prepared and reviewed by experts in the field of maternal care and necessary modifications made. The modified questionnaire was translated to local language and pilot tested among 20 women who delivered before the study period. Based on the feedback from the pilot study, necessary changes were made.

If the approached women were not available on the 1st visit, she was contacted through phone and details regarding the study were explained to her. She was invited to participate in the study. On her willingness to participate in the study, a suitable time and place for interview was fixed. If the selected woman was not available even after 3 attempts, the mother was excluded from the study. Institutional ethics committee clearance was obtained from Directorate of Public Health and Preventive Medicine.

All the Medical officers of MMU team was trained on the questionnaire and the study protocol.

STATISTICAL ANALYSIS PLAN : Descriptive statistics like frequencies and proportions was used to summarise categorical data, while continuous data expressed as means and standard deviation. For skewed data, median and interquartile range was presented. To assess the determinants of place of delivery, the outcome was dichotomised into public health facility and private health facility. Statistical Package of Social Sciences version 21 was used for data analysis.

RESULTS

A total of 1143 mothers were approached, out of which 865 women consented to participate in the study. Of the 865 mothers, 379 (43.8%) were from rural areas, 406 (46.9%) were from urban non-slum areas, and the rest 80 (9.2%) were from urban slum areas. The mean age of the study participants was 25 years(+ 4.4 SD) and almost all, i.e., 864 (99%) of the study participants were married/cohabiting with their partners.

It can be observed from Table 2 that majority of the participants, 720 (83.2%), had a formal education of higher secondary and above and 751 (86.8%) of them were unemployed. Among the study participants, 613 (70.9%) responded the key decision maker in the family was their husband, while 127 (14.7%) said it was the woman herself, and the rest 125 (14.5%) said it was any of the other members of the family (parents, in-laws, grandparents)/friends.

Among the 865 study participants, almost half, i.e., 400 (46.2%) women were primiparous, and the rest 465 (53.75%) were multiparous. From these 465 women, the antenatal and natal history of their previous pregnancy was obtained (Table 3).

Further, details of the current/latest pregnancy and place of delivery were obtained from all study participants. Out of the 865 participants, 538 (62% -95% CI -58.8- 65.4%) had delivered at a public facility while the rest 327 (38%) had delivered at a private facility (Figure 1). Among women who got delivered in public facilities, a larger proportion happened in medical college hospital, followed by sub-district hospital.

Table 2 : Sociodemographic profile of the mothers who delivered in the last 1 month – August 2022 (N=865)

Table 2: Sociodemographic profile of the mothers who delivered in the last 1 month – August 202 (N=865)

Variable	Frequency n(%)	Variable	Frequency n(%)
Age of the mother		**Religion**	
< 18 years	10 (1.2%)	Hindu	717 (82.9%)
18 to 35 years	839 (97%)	Christian	41 (4.7%)
> 35 years	16 (1.8%)	Muslim	107 (12.4%)
Caste		**Socio-Economic status***	
Backward caste	391 (45.2%)	Upper Middle (II)	122 (14.1%)
Most backward caste	207 (23.9%)	Lower Middle (III)	265 (30.6%)
Scheduled caste	199 (23%)	Upper Lower (IV)	475 (54.9%)
Scheduled tribe	22 (2.5%)	Lower (V)	3 (0.3%)
Not preferring to say	46 (5.3%)		
Mother's education		**Spouse's education**	
None	7 (0.8%)	None	11 (1.3%)
Primary (1-5th std)	19 (2.2%)	Primary (1-5th std)	27 (3.1%)
Middle School (6-8th std)	65 (7.5%)	Middle School (6-8th std)	101 (11.7%)
Higher secondary (9-12th std)	313 (36.2%)	Higher secondary (9-12th std)	300 (34.7%)
Diploma	57 (6.6%)	Diploma	364 (42.1%)
Degree	293 (33.9%)	Postgraduate	62 (7.2%)
Postgraduate	111 (12.8%)		
Mother's occupation		**Spouse's occupation**	
Unemployed	751 (86.8%)	Unemployed	6 (0.7%)
Unskilled worker	17 (2%)	Unskilled worker	164 (19%)
Semi-skilled worker	17 (2%)	Semi-skilled worker	196 (22.7%)
Skilled worker	31 (3.6%)	Skilled worker	204 (23.6%)
Clerical/shop/farm	9 (1%)	Clerical/shop/farm	130 (15%)
Semi-profession	3 (0.3%)	Semi-profession	48 (5.5%)
Professional	37 (4.3%)	Professional	117 (13.5%)

*-Modified Kuppuswamy Classification.

Table 3 : Previous obstetric history of the mothers who delivered in the last 1 month – August 2022

Variable	Frequency n(%)	Variable	Frequency n(%)
Pregnancy outcome (n=465)	424 (91.2%)	**In case of abortion, visit to any health facility (n=36)**	28 (77.8%)
Live birth	2 (0.4%)		8 (22.2%)
Still birth	3 (0.6%)	Yes	
Intrauterine death	36 (7.7%)	No	
Abortion			
Place of delivery (n=429)	266 (62%)	**Facility approached for abortion (n=28)**	10 (35.7%)
Public facility	163 (38%)	Public facility	18 (64.3%)
Private facility		Private facility	
Public facility where delivery was conducted(n=266)	54 (20.3%)	**Public facility where abortion was conducted (n=10)**	2 (20%)
PHC	4 (1.5%)		1 (10%)
CHC	46 (17.3%)	PHC	1 (10%)
SDH	41 (15.4%)	CHC	1(10%)
DH	106 (39.8%)	SDH	5 (50%)
Medical college hospital	15 (5.6%)	DH	
Central government hospital		Medical college hospital	
Mode of delivery (n=429)	223 (52%)	**Complications during delivery (n=465)**	46 (9.9%)
Normal vaginal delivery	204 (47.6%)	Yes	419(90.1%)
Caesarean Section	2 (0.5%)	No	
Assisted Vaginal delivery			
Note:			
PHC – Primary Health Centre		SDH – Sub-district Hospital	
CHC – Community Health Centre		DH – District Hospital	

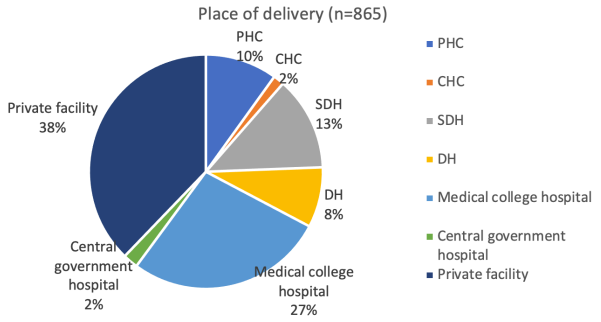

Figure 1: Place of delivery of current/latest pregnancy

Among the study participants, 806 (93.2%) participants said they had a planned pregnancy and 844 (97.6%) participants had sought antenatal care services from a health facility in the same area that they were residing in. At least 696 (80.5%) of the study participants visited or sought care from the location of delivery at some point during the antenatal period and 414(47.3%) of them gave birth at the same facility where they had their usual antenatal care services provided. Majority of the survey participants, 761(88%) reported that the local health worker paid at least one home visit during their entire antenatal period. Other significant sociodemographic factors and obstetric history have been summarized in Table 4 and 5.

Table 4 : Sociodemographic profile of mothers based on place of delivery

Variables		Place of delivery				Chi-square value	P value
		Public facility		Private facility			
		N	%	N	%		
Type of locality	Rural	289	76.3	90	23.7	56.940[a]	<0.001
	Urban non slum	210	51.7	196	48.3		
	Urban slum	39	48.8	41	51.3		
Religion	Hindu	482	67.2	235	32.8	46.802[a]	<0.001
	Christian	19	46.3	22	53.7		
	Muslim	37	34.6	70	65.4		
Caste	Backward caste	191	48.8	200	51.2	86.959[a]	<0.001
	Most backward caste	129	62.3	78	37.7		
	Scheduled caste	169	84.9	30	15.1		
	Scheduled tribe	22	100.0	0	0.0		
	Not preferring to say	27	58.7	19	41.3		
Age of the mother	<18 years	10	100.0	0	0.0	6.153[a]	<0.001
	18 to 35 years	518	61.7	321	38.3		
	>35 years	10	62.5	6	37.5		
Mother's education	Primary (1-5th std)	20	76.9	6	23.1	64.055[a]	<0.001
	Middle School (6-8th std)	51	78.5	14	21.5		
	Higher secondary (9-12th std)	234	74.8	79	25.2		
	Diploma	36	63.2	21	36.8		
	Degree	149	50.9	144	49.1		
	Postgraduate	48	43.2	63	56.8		
Mother's occupation	Unemployed	476	63.4	275	36.6	32.269[a]	<0.001
	Unskilled worker	15	88.2	2	11.8		
	Semi-skilled worker	11	64.7	6	35.3		
	Skilled worker	19	61.3	12	38.7		
	Clerical/shop/farm	7	77.8	2	22.2		
	Semi-profession	2	66.7	1	33.3		
	Professional	8	21.6	29	78.4		
Socio-Economic status	Upper Middle (16-25)	31	25.4	91	74.6	149.319[a]	<0.001
	Lower Middle (11-15)	129	48.7	136	51.3		
	Lower (<110)	378	79.1	100	20.9		
Gravida	1	245	61.3	155	38.8	3.373[a]	0.643
	2	234	61.9	144	38.1		
	3	47	68.1	22	31.9		
	=>4	12	66.7	6	33.3		

Table 5 : Obstetric history of the current/latest pregnancy

Variable		Place of delivery		Chi-square value	P-value
		Public facility (n=538)	Private facility (n=327)		
Registration of current pregnancy was done at	Public facility	538 (100%)	287 (88%)	69.001[a]	<0.001
	Private facility	0	40 (12%)		
If registered in a public facility, type of public facility	Health subcentre	101 (18.8%)	40 (14%)	13.782[a]	0.032
	PHC	389 (72.2%)	228 (79%)		
	CHC	30 (5.6%)	19 (7%)		
	SDH	2 (0.4%)	0		
	DH	2 (0.4%)	0		
	Medical college hospital	13 (2.4%)	0		
	Central government hospital	1 (0.2%)	0		
Received ANC services from	Public facility	526 (98%)	150 (46%)	320.803[a]	<0.001
	Private facility	12 (2%)	177 (54%)		
If in a public facility, type of public facility	PHC	452 (85.9%)	131 (87.3%)	13.529[a]	0.019
	CHC	31 (5.9%)	17 (11.3%)		
	SDH	8 (1.5%)	0		
	DH	7 (1.3%)	1 (0.7%)		
	Medical college hospital	25 (4.8%)	1 (0.7%)		
	Central government hospital	3 (0.6%)	0		
Time of first visit to the health facility	First trimester	424 (78.8%)	258 (79%)	0.838[a]	0.658
	Second trimester	101 (18.8%)	64 (19.5%)		
	Third trimester	13 (2.4%)	5 (1.5%)		
Total number of visits to a health facility	1 to 5	45 (8%)	38 (11.6%)	242.248[a]	<0.001
	6 to 10	345 (64%)	120 (36.7%)		
	11 to 20	132 (25%)	32 (9.8%)		
	More than 20	4 (1%)	0		
	Not Applicable	12 (2%)	137 (41.9%)		
Complications during pregnancy	GDM	14 (2.6%)	30 (9.2%)	18.195[a]	<0.001
	PIH	37 (6.9%)	29 (8.9%)	1.144[a]	0.285
	Severe Anaemia	43 (8%)	8 (2.4%)	11.275[a]	0.001
	Hypothyroid	42 (7.8%)	27 (8.3%)	0.056[a]	0.813
	Multiple pregnancy	7 (1.3%)	6 (1.8%)	0.391[a]	0.532
	Cervical Incompetence	1 (0.2%)	1 (0.3%)	0.127[a]	0.722
	Conceived out of infertility treatment	5 (0.9%)	10 (3.1%)	5.409[a]	0.020
	Other medical complications	9 (1.7%)	6 (1.8%)	0.031[a]	0.860
	Previous Caesarean Section	79 (14.7%)	60 (18.3%)	2.025[a]	0.155
	None	298 (55.4%)	175 (53.5%)	0.288[a]	0.591
	Others	48 (8.9%)	28 (8.6%)	0.033[a]	0.856
History of any hospitalization during antenatal period	Yes	63 (12%)	27 (8%)	2.602[a]	0.107
	No	475 (88%)	300 (92%)		
History of any blood transfusion during antenatal period	Yes	24 (4%)	2 (1%)	10.337[a]	0.001
	No	514 (96%)	325 (99%)		

Note: GDM – Gestational Diabetes Mellitus
PIH – Pregnancy Induced Hypertension

Among the 465 multiparous women, almost half of them, i.e., 226 (48.6%) had delivered at the same facility as any of their previous deliveries while the other half, i.e., 239 (51.3%) delivered at a different facility. Out of the 226 participants, 134(59%) delivered at a public facility, [PHC – 27 (20.1%), CHC - 1 (0.7%), SDH – 30 (22.4%), DH – 14 (10.4%), Medical College/Hospital – 59 (44%) and Central Government hospital – 3 (2.2%)] and 92(41%) delivered at a private facility. 438 (50.6%) of the 865 participants agreed that at least one of their family members/relatives had delivered at the same place as their current/latest place of delivery.

Further, 226 (26.1%) participants had gone to another facility [196 – Public facility, 28 – Private facility and 2 – NGO] for delivery before visiting the current place of delivery. The reasons that influenced the choice of place of delivery of all the study participants have been analysed and displayed in Figure 2a and 2b and the outcomes of the current pregnancy have been summarized in Table 6.

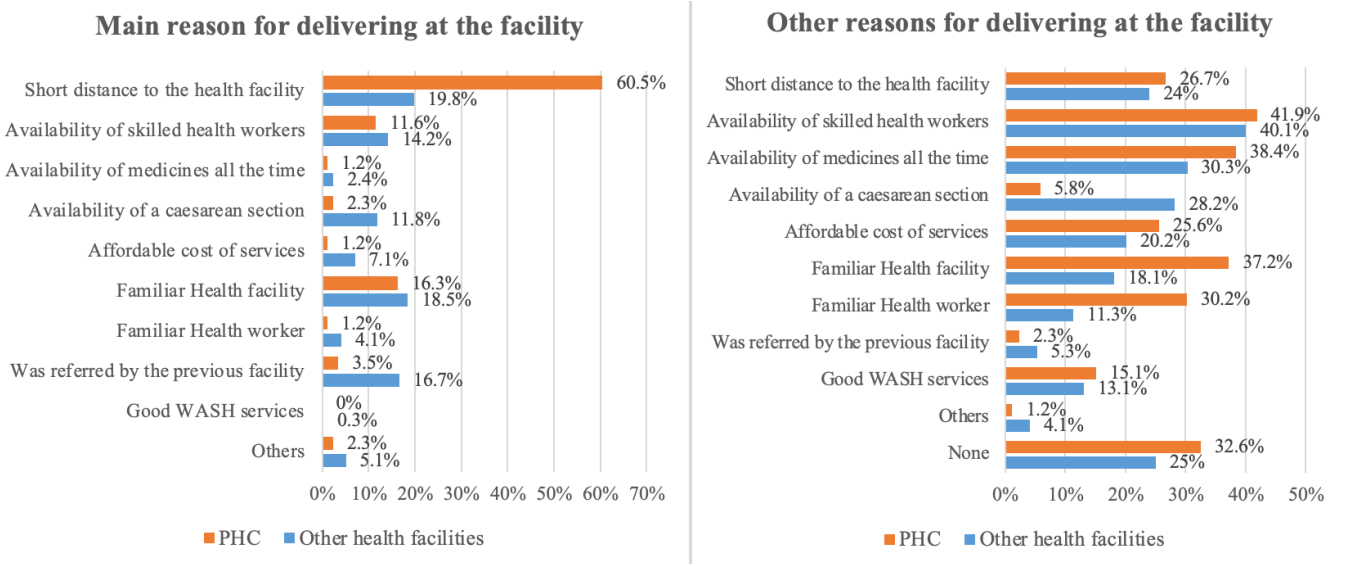

Figure 2a : Reasons for delivering at the facility - PHC (86) Vs Other health facilities (779), n=865

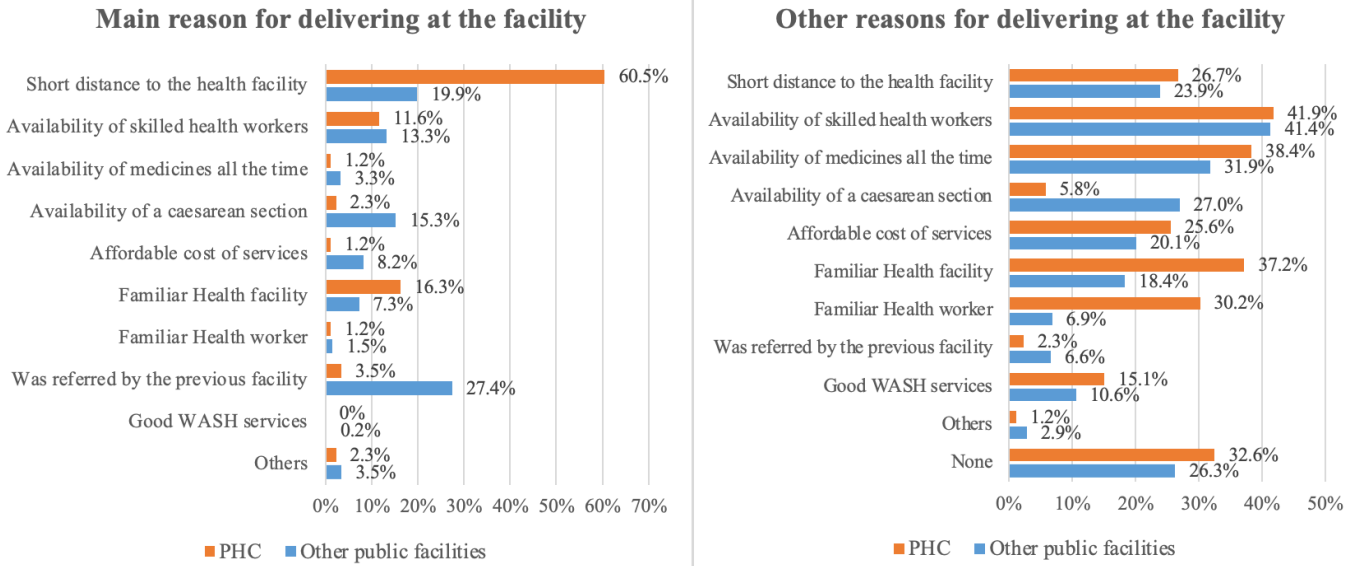

Figure 2b : Reasons for delivering at the facility - PHC (86) Vs Other public facilities (452), n=538

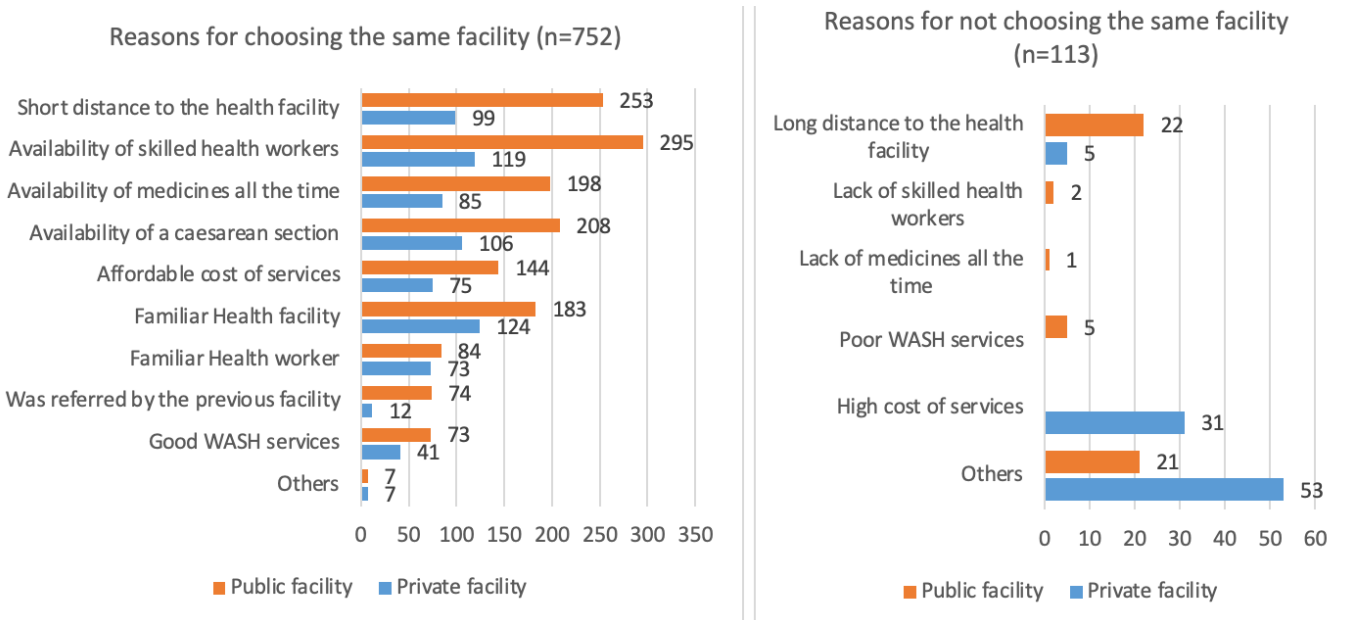

Figure 3 : Reasons for choosing/not choosing the same health facility for subsequent deliveries

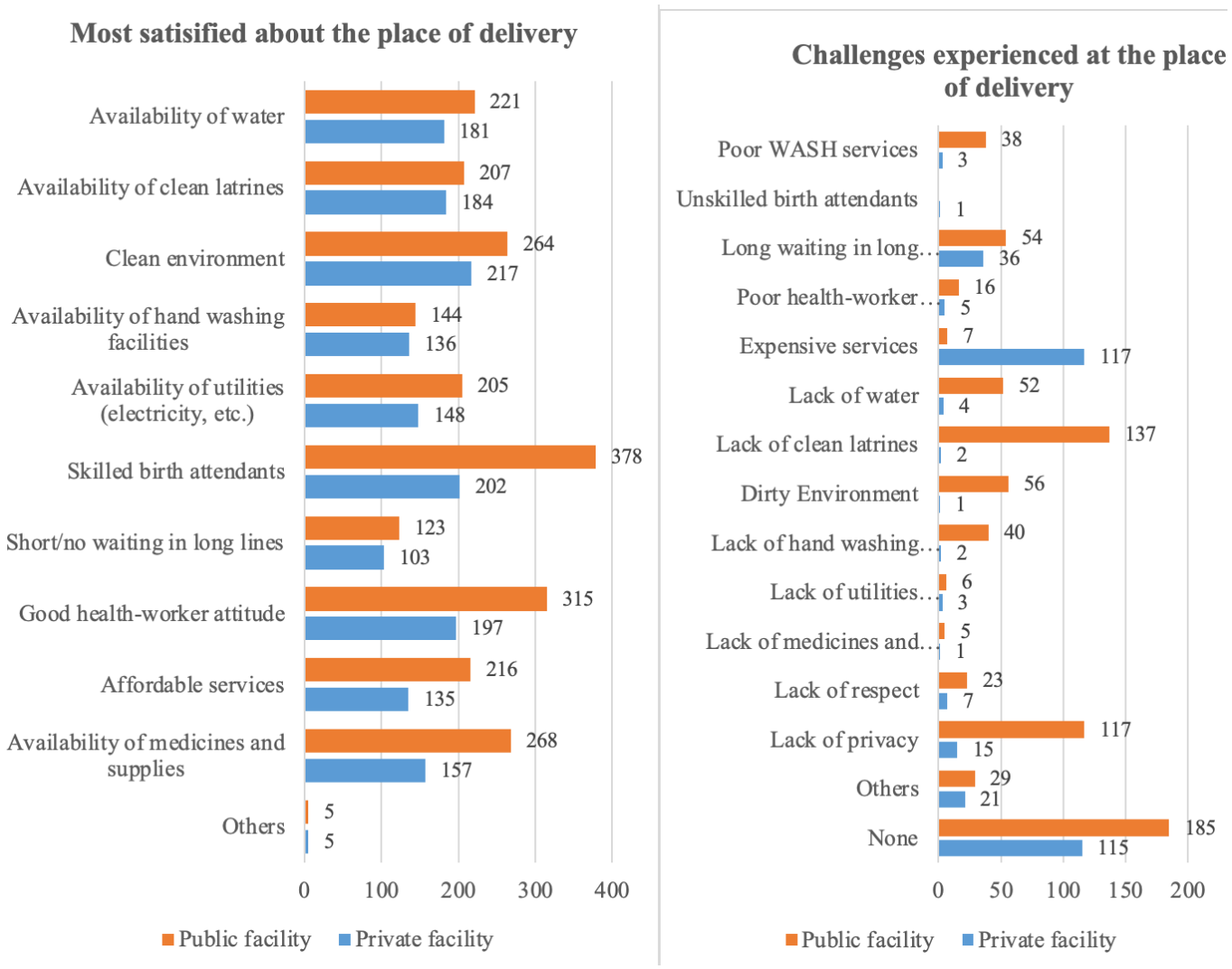

Figure 4 : Satisfactory and challenging factors experienced at the place of delivery (n=865)

Table 6 : Outcome of current/latest pregnancy

Variable		Place of delivery		Chi-square value	P-value
		Public facility (n=538)	Private facility (n=327)		
Outcome of delivery	Live birth	532 (98.9%)	323 (98.8%)	0.811[a]	0.847
	Still birth	1 (0.2%)	1 (0.3%)		
	Intrauterine death	1 (0.2%)	0		
	Abortion	4 (0.7%)	3 (0.9%)		
Mode of delivery	Normal vaginal delivery	314 (58.8%)	97 (38%)	69.348[a]	<0.001
	Caesarean Section	218 (40.8%)	221 (60%)		
	Assisted Vaginal delivery	2 (0.4%)	6 (2%)		
Sex of the baby	Male	295 (55%)	167 (52%)	1.173[a]	0.279
	Female	238 (45%)	157 (48%)		
Birth weight of the baby	</= 1.50 kg (Very LBW)	4 (0.7%)	0	6.380[a]	0.095
	1.51 kg to 2.50 kg (LBW)	127 (23.6%)	74 (22.6%)		
	2.51 to 3.50 kg	387 (71.9%)	230 (70.3%)		
	> 3.50 kg	20 (3.7%)	23 (7.03%)		
Complications during delivery	Yes	49 (9%)	32 (10%)	0.110[a]	0.740
	No	489 (91%)	295 (90%)		

Note: LBW – Low Birth Weight

When the participants were asked if they would deliver at the same health facility as the current/latest pregnancy if they were to deliver another child, majority of them, i.e., 731 (84.5%) participants, agreed that they would, while the rest denied it. Of the 731 that agreed, 492 (67.3%) participants had delivered at a public facility [PHC – 81 (16.5%), CHC – 13(2.6%), SDH – 105 (21.3%), DH – 62 (12.6%), Medical College/Hospital – 217 (44.1%) and Central Government hospital – 14 (2.8%)] and the other 239 (32.7%) had delivered at a private facility. The reasons substantiating their answers have been displayed in Figure 3. Furthermore, when enquired if they would recommend the health facility to other mothers to seek delivery services from the same facility, 752 (87%) of the 865 women were affirmative while the rest 113 (13%) said that they would not recommend it.

The study participants were also enquired if they had made any payment to the health facility for the delivery, for which around 329 (38%) women agreed to have made a payment. Of the 329 participants, about 32 (9.7%) had delivered at a public facility and had spent not more than Rs. 30,000, while the other 297 (90.3%) who had delivered at a private hospital made payments ranging from Rs. 2500 up to a maximum of Rs. 2,00,000. Details regarding the mode of transport used to reach the place of delivery, time taken to reach the facility

and payments made (if any) for transport were elicited from all the 865 participants. 142 (16.4%) had utilised the 108 ambulance services to reach the health facility, and the rest 723 (83.6%) had used their own vehicles/taxis/private ambulances. 657 (76%) of the participants had reached the facility in less than 30 minutes, 157 (18.2%) took between 30 minutes to 1 hour, 32 (3.7%) of them took between 1 hour to 2 hours and 19 (2.1%) of the participants had taken more than 2 hours to reach the health facility from their residence. Lastly, the study participants were asked about the most satisfactory aspects and the challenges experienced at the place of delivery of their current/latest pregnancy (Figure 4) to help us draw meaningful conclusions about the factors that ultimately influence a mother in choosing a place to deliver her child.

DISCUSSION

The study revealed that 62% (95% CI – 58.8% - 65.4%) of the mothers delivered in any of the public facility, in particular more than 1/4th of the deliveries happened in medical college hospital. One in 10 deliveries happened in PHC. This is conforming to the NFHS - 5 report. Tamil Nadu, a state which has a vision of having one medical college hospital in each district has the largest number of government medical college hospitals. Hence, medical college hospitals are more accessible for the patients to get delivered, avoiding anticipation of any further referral. Ten percent of the deliveries happened in PHC. There are no deliveries in Health Subcentres. PHC deliveries in Tamil Nadu, over a period of time has shown a declining trend from 28.3% to 10.1% as per the government records.

Among the various demographic factors, 75% of rural women delivered in public facility compared to only 50% in urban slum and non-slum. This could be because of the stronger primary health infrastructure available in rural areas including reaching out to the mothers at their door steps through field staff. However, in urban areas the primary health infrastructure is yet to be strengthened and the role of field functionaries is limited to urban slum, and this is coupled with easily accessible private facilities in the urban areas which pushes them to avail services from private sector. While the primary care infrastructure in urban areas is still inadequate, the secondary and tertiary care facilities of public sector are available in urban areas. Despite this, almost half of urban population chose private providers for delivery. These finding throws speculation regarding the choices made, as in rural areas the private providers are low in numbers making their choices limited and hence rural population had to depend only on available public resources. Whereas in urban areas, they have multiple options to choose from. There is also difference based on religion, the reason for which needs to be explored. With regards to caste, larger proportion of women belonging to historically deprived caste community like Most backward caste, scheduled caste and scheduled tribe delivered in public health facility. A larger proportion of people belonging to SC /ST are living in rural areas (65% of SC live in rural areas and 83% of ST live in rural areas), which again provides them with limited choices of health care providers and are highly dependent on the public providers. Similarly, women with lower education status and lower income group, delivered in public facilities. Based on demographic profile, it is very evident that mothers belonging to poor socio-economic group delivered in public facilities. This could be because of their ability to pay, as all government health facilities provide maternal health services free of cost, women with lower paying capacity opted for public health facility. Alternatively, women with high purchasing power had more choices of health care providers and of the various choices, they opted for delivering in private facilities. Based on socio- demographic profile, it is evident that non- availability of competing private providers and low purchasing power of people, determine their choice of place of delivery. As the state is currently urbanising at a faster rate, there are possibilities that the private providers would increase in numbers and people might have enough choices to make.Also with improving socio- economic development, the purchasing power of the people would improve. As it is evident from this study, with increasing purchasing power, there would be an inclination towards private care providers for delivery care.

Almost 80% of the women had sought antenatal care at least once in the place of delivery and 50% had delivered in the same centre where they received antenatal care. With regards to antenatal care, 95% of the registration of pregnancy happened in public health facilities, among which PHC were the most sought over followed by Health Sub-centre. Among mothers who delivered in private facilities, 46% had availed ANC services at some point in public facilities, and almost 98% of them had been to a PHC/CHC for their antenatal visits. This requires further exploration using qualitative methods to understand the push and pull factors which led them to decide on availing private services despite visiting public facilities. It is also found that most of the mothers have had almost 6-10 antenatal visits, while the recommended minimum number of antenatal visits are 4. However, increased number of antenatal visits doesn't

translate into better antenatal care, but also increases the out-of-pocket expenditure incurred towards these visits. Hence, any pregnancy after registration should plan for ideal number of visits during the antenatal period and fixed services in each visit should be planned well. As PHCs are the key antenatal service provider, enough planning should be done for each antenatal visit. As component of the antenatal care services, the expectant mothers can be escorted to the nearest comprehensive obstetric management centre by the field workers of the PHC. This gives familiarity for the mother regarding the higher centre and there is also a strong referral linkage between facilities. Since most of the women had visited a PHC during their AN Visits, their idea about delivery care services in public facilities will be restricted to only about PHC. Escorting the expectant mothers on a tour to such higher centres, will let them know regarding the services that are available in Public sector. This can also be used as an opportunity for screening by a specialist.

Among mothers with various complications, larger proportion of those with Gestational Diabetes delivered in private facility, (9.2% in private versus 2.6% in public facility). Similarly, mothers who conceived out of infertility treatment, a significantly higher proportion delivered in private facility (3.1% vs 0.9% in public facility). Whereas among mothers with anaemia, a significantly larger proportion delivered in public facility (8%) compared to private (2%). This was correlating with blood transfusion history. This shows that public facilities are approached for the purpose of registration. Anaemia, a nutritional deficiency disorder is common among mothers who seek public health facilities. Conception after treatment for infertility is largely sought by people who have ability to spend, as the facility for such procedures is currently lacking in public health facilities.

With regards to outcome of pregnancy, almost 99% were live births. There was a significant difference in the mode of delivery between public and private facility. Sixty percent of the deliveries in public facility were vaginal delivery, compared to 60% of caesarean in private facilities. This is correlating with the NFHS - 5 finding of Tamil Nadu. As it is expected to have an increase in deliveries in private facilities, with improving socio- economic status, the role of government in protecting the welfare of its citizens should be well defined. The government should take up regulatory role rather than provider role, to ensure the mothers safety is protected. Government should be performing regular audits like maternal death audits, near miss death audit, caesarean audits etc to ensure regulations.

The main reason quoted by the mothers for choosing public health facility was short distance to reach the facility, and the 2nd most common quoted was referral by health facility. Whereas among private users, the most common reason was familiarity of the health facility. The other reasons for choosing public or private facility for delivery was availability of skilled health workers especially specialists, availability of essential medicines all the time. This could also be the reason for choosing medical college facilities over PHC.

Among mothers who delivered in public facility, 91.4% of the mothers opined to choose the same facility for any subsequent deliveries. The most common reason quoted was availability of skilled health workers and short distance. Among those who did not prefer the current facility for future deliveries, lack of water sanitation and hygiene was the most common reason among public facility users compared to cost of services among private users.

Women who delivered in public health facility were satisfied with the facility for availability of skilled health personnel whereas among women who delivered in private facility, the most common satisfying reason was clean environment. Similarly, the most common challenges faced by women who delivered in public health facility was lack of clean latrines and water and lack of privacy, while private users felt the expensive services as the predominant challenge.

CONCLUSION

Public health facilities are sought after for registration and getting antenatal services. However, only 2/3rd of deliveries is happening in public health facilities and these facilities are commonly sought by women belonging to poor socio-economic status. The place of delivery is chosen predominantly based on distance, familiarity with the facility and availability of skilled personnel and medicine. Lack of clean environment and privacy should be addressed in public facilities to increase the coverage in public facilities which in turn can cut down the out-of-pocket expenditure incurred towards intrapartum care.

The roles of facilities at each level should be well defined. With increasing preference to deliver in a higher centre or in private facility, PHCs role in antenatal care should be planning and promoting planned antenatal visits and facilitating referral linkage with higher centres, while the higher centres should be focusing on intrapartum care and managing high risk pregnancies. Such role delegation will enable efficient use of resources and improve the public health performance further.

CONFLICT OF INTEREST : Nil

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ORIGINAL ARTICLE - PUBLIC HEALTH

UTILITY OF SKIMMED MILK FLOCCULATION TECHNIQUE FOR ROUTINE SURVEILLANCE OF SARS COV-2 IN WASTEWATER SAMPLES -PRELIMINARY FINDINGS FROM A LONGITUDINAL STUDY

Deodatt Madhav Suryawanshi [(1)], Anupriya Manivelan [(2)], Satish Raghavan [(3)], Suguna A [(1)], Divya Rajaseharan [(1)], Vallab Ganesh [(2)]

(1) Department of Community medicine, SRM Medical College hospital and Research centre, Trichy

(2) Department of Microbiology, SRM Medical College hospital and Research centre, Trtichy

(3) Directorate of Public Health and Preventive Medicine

Abstract

INTRODUCTION : Ongoing pandemic of coronavirus disease (COVID-19) caused by a new beta coronavirus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has warranted a global responsibility for its prevention and control. The use of an environmental approach called wastewater-based epidemiology (WBE) for virus detection has proved to be an additional tool to support COVID-19 prevention activities. Among the several methods available, skimmed milk flocculation method has proven to be simple and effective in low-resource settings.

METHODS : In the study period between 11 July – 12 September 2022, 227 wastewater samples from 40 different samplings sites from 4 zones of Trichy City were analyzed using the Skimmed milk flocculation technique. The isolation and detection of SARS COV-2 in wastewater were done by the COSARA kit using Open System real-time PCR.

RESULTS : Out of the 227 samples,92 (40.5%) tested positive for SARS COV-2 virus RNA. Mean Ct values for the RdRp gene were 35.5 and 34.2 for the E gene. Samples collected from all 4 zones and 37 (92.5%) wards showed positivity. There was no significant difference observed between the SARS Cov-2 waste water positivity (p=0.6) and mean Ct values of RdRp (p=0.9) and E Gene(p=0.1) between different zones of the city.

CONCLUSION : Skimmed milk flocculation technique used in the present study had advantages like yielding faster results, ease of use, and non-requirement of robust laboratory infrastructure which matched well with its use in other settings further validating its utility in low resource settings and as a routine surveillance measure.

KEY WORDS : Surveillance, wastewater surveillance, SARS-CoV-2, COVID-19, Wastewater-Based Epidemiological Monitoring, Skimmed milk flocculation.

INTRODUCTION

A global pandemic of coronavirus disease (COVID-19) caused by a new beta coronavirus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is currently ongoing. The outbreak, first detected in Wuhan (China) in December 2019 spread rapidly to 213 countries/ territories causing massive loss of life, economies, and livelihoods.[1] Globally, till January 11 2023, there have been 660,378,145 confirmed cases of COVID-19, including 6,691,495 deaths, reported to WHO.[2]

Though the respiratory route has been the primary mode transmission of SARS-CoV-2 infections, multiple studies have demonstrated high levels of viral RNA in stools of infected patients, more so in children giving rise to possibilities of even a faeco–oral mode of transmission. [3,4,5]

This faecal shedding of the virus was quantified since the start of the COVID-19 pandemic through quantitative Polymerase Chain Reaction (RT qPCR) as a routine public health surveillance measure in various countries.[6,7] Detection of SARS-CoV-2 in faeces and early shedding demonstrated by virus detection in faeces has resulted in the use of an environmental approach called wastewater-based epidemiology (WBE), an additional tool to support COVID-19 prevention and control actions in several regions.[7]

In the context of COVID-19, an effective public health surveillance can be defined as a process of, systematic, continuous, collection, analysis, and interpretation of relevant epidemiological data which could predict rise of COVID-19 cases. An effective disease surveillance system is thus imperative to detect impending disease outbreaks before they spread and cause significant morbidity and mortality lives.[8,9,10]

Though an integral part of surveillance systems, wastewater surveillance (WWS) is less explored and tracked by authorities.[11,12] In a study conducted in the US, the wastewater SARS COV-2 viral titres were consistent and appeared to

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Corresponding Author : Anupriya Manivelan
email : priyamanivelan@gmail.com

precede, clinical COVID-19 surveillance indicators and daily new cases.[13] Several studies have shown that SARS-COV 2 is detectable in wastewater 3 weeks before an impending outbreak.[13-17] This presence of SARS-COV-2 in wastewater could be exploited for routine environmental surveillance by public health authorities. This routine surveillance could not only help predict an upcoming COVID wave but also prove a useful tool for monitoring SARS CoV-2 virus elimination in the future.

The strength of the wastewater surveillance technique could depend upon various factors predominantly, the sensitivity and specificity of the concentration method, the sample type, the sample volume, sample processing time, and the availability of cost-effective laboratory equipment.[18]

The Centres for Disease Control (CDC) has evaluated that various sample concentrations methods like ultrafiltration, filtration through an electronegative membrane with sample pre-treatment by addition of $MgCl_2$ or acidification, polyethylene glycol (PEG) precipitation, and Skim milk flocculation technique can yield the detection SARS COV-2 in wastewater.[18]

In a comparative study of various wastewater sample concentration methods like the bag-mediated filtration system (BMFS), polyethylene glycol (PEG) precipitation, ultrafiltration, and sludge extraction, the Skimmed milk flocculation extraction method showed consistent results over time and between various treatment places.[19]

Here in this communication, we attempt to elucidate the process of skimmed milk flocculation method for wastewater SARS-COV-2 (WW SARS-CoV-2) extraction that can be used in public health laboratories for routine environmental surveillance.

SUBJECTS AND METHODS :

The present communication is part of an ongoing study on the development of an early warning system for COVID-19. Below we describe the methods of only the wastewater sample collection method and analysis using Skimmed milk flocculation technique.

1. PROCEDURE FOR SAMPLE COLLECTION :

In the study period between 11 July 2022 – 12 September 2022, a total of 227 waste samples water samples were collected. Every week 42 samples were collected from a total of 41 different sites in the city, 40 from the ward outlets and 2 from the sewage treatment plant (STP). The 40 different sites for wastewater sample collection were selected from sewage outlets of the specific ward after consultation with the sanitary inspector of the ward.

Samples were collected 4 days a week ,1 sample each from every ward =10 samples /day .So from 4 days ,data collection 40 samples were collected from the wards outlets and 2 samples were collected in the week from Sewage treatment plant

The sampling points were selected such that they would be at the confluence of major sewer outlets representing the outflow of the particular ward (Insert Figure 1) The sample collection for every zone /ward was done on a particular day to confer uniformity in the collection of the sample and reporting of results. Wastewater samples were collected during the early morning hours between 7 am – 10 am, as this time represents the maximum sewer outflow.

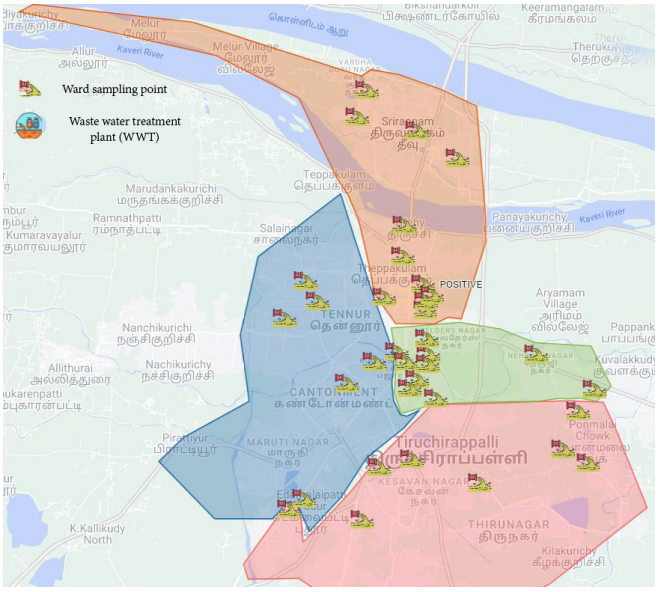

Figure 1: Sampling points over the city

A health worker was trained in the method of wastewater sample collection under the guidelines laid down by the Central pollution control board of India.[20] In the present study, the investigator used the manual sampling method for wastewater sample collection. One litre grab sample of sewage was collected by lowering a bucket in the flowing sewage water. The investigator used multiple grabs (3 times) to increase the yield of sample.[21] Of the 1 litre grab, the health worker collected 200 ml of wastewater sample under universal safety precautions in a wide-mouth polypropylene bottle and transported it to the laboratory at a temperature of <4oC, to ensure virus viability.[21] The investigator ensured that the samples reached the laboratory within 2 hours of the first collected sample.18 Materials used for sample collection were sterilized using an autoclave in the laboratory.

2. SAMPLE PROCESSING FOR VIRAL CONCENTRATION :

As the concentration of SARS-CoV-2 from wastewater is a bioaerosol-generating process, the procedure was carried out in the Biosafety Level 2 (BSL2) facility with unidirectional airflow. All BSL-2 precautions, including respiratory protection and a designated area to don on and don off personal protective equipment, were followed. The laboratory waste from wastewater samples that may contain SARS-CoV-2 was autoclaved and managed by BSL2 biosafety guidelines.[18]

In the present study, the following steps were followed for estimating the presence of SARS COV-2 in wastewater samples using the skimmed milk flocculation method (Insert Figure 2 here). [22]

Step 1. Pretreatment of wastewater sample and reagent preparation.

a. Reagent Preparation of 5% pre-flocculated Skim Milk:

i. To make a 5% pre-flocculated skim milk solution (w/v), 5 g skimmed milk powder was dissolved in 100 ml MilliQ water.

ii. The solution was autoclaved for 15 minutes at 115°C, 18 psi, and then allowed to cool at room temperature.

iii. The prepared skim milk solution was stored at 4°C for up to three days.

b. Pre-treatment:

a. For the virus concentration assay, a total of 200 mL of wastewater was collected, and divided into two aliquots (100 mL).

b. To each 100 mL sample, 1 mL 5% pre-flocculated skim milk was added and the pH was adjusted to 3.5-4.0 by the addition of 1 M HCl.

c. The samples were placed on a horizontal shaker and incubated at 200 rpm for 2 hours at room temperature to allow the floccules to form.

d. After incubation, the floccules were allowed to sediment by centrifugation at 3500 x g for 30 min at 4°C using a swinging bucket rotor.

e. The supernatant was removed carefully from the tube without disturbing the bottom and the pelleted virus suspend with buffer.

f. 1 set of pellets was used for RNA extraction using the QIAamp viral RNA mini kit by suspending it with the lysis buffer provided in the kit.

g. Another aliquot was dissolved in 1.5 mL of sterile 1x PBS (pH 7.4) and vortex both suspensions for 5-10 minutes at maximum speed to completely dissolve the pellet.

h. The final viral concentrates were stored at -80 °C until further processing.

Step 2. RNA Extraction

a. Isolation and Detection of SARS-COV-2.

The isolation and detection of SARS COV-2 in wastewater samples were done by the COSARA kit using Open System Real-time PCR. The detection is based on the amplification of the RdRp and E gene (RNA-dependent RNA polymerase enzyme, and Envelope gene) sequence and the measurement of fluorescence increase. The mechanism of duplex targeting ensures maximum sensitivity and specificity and enables the detection of the virus in a sample before seroconversion. The presence of SARS-COV-2 is indicated by the increased FAM fluorophore fluorescence. An internal Control (IC), which is a part of the PCR kit, is used as a control for the whole diagnostic process, i.e. RNA extraction efficiency, reverse-transcription step efficiency (transcription of RNA into cDNA), and PCR amplification efficiency (PCR inhibition). The IC positive amplification is detected in the Cal Red fluorophore fluorescence channel. The PCR kit is designed for in-vitro diagnostics for both qualitative and quantitative detection and it utilizes the "hot start" technology minimizing non-specific reactions and ensuring maximum sensitivity. Ready to Use Master Mix contains uracil-DNA-glycosylase (UDG) which eliminates possible contamination of the PCR with amplification products.

b. Viral RNA Extraction.

140µl of the sample was collected in a 2ml Collection tube and 560µl of Carrier RNA – Lysis Solution (HRL) was added to the cell-free sample. It was incubated for 10 minutes at room temperature (15-25°C). These samples were Centrifuged for 10 seconds to remove any droplets formed inside the cap of the collection tubes. 560µl of ethanol (96-100%) was added to the sample and mixed well by gentle pipetting. The samples were then centrifuged for 10 seconds to remove any droplets formed inside the cap of the collection tubes. The lysate thus obtained was transferred onto the Hi Elute Miniprep spin column. It was then Centrifuged at 8000 rpm for 1 minute. The flow-through was discarded after the spin. The previous step was repeated with the remaining sample. First, wash -Add 500 µl of wash (WS) solution, and centrifuge at 8000rpm for 1 minute. Discard the flow-through. Reuse the collection tube

Second Wash – Add another 500µl of wash solution (WS) onto the column. Close the tube gently and centrifuge for 3 minutes at 14000 rpm to wash the column. Discard the flow-through. Reuse the collection tube, and centrifuge for 1 minute at 14000 rpm to dry the membrane. Discard the flow-through. Reuse the collection tube, and centrifuge for 1 minute at 14000 rpm to dry the membrane. Close the tube gently and centrifuge for 1 min at 8000rpm. Transfer the elute to a new capped 1.5ml collection tube for long-term storage.

Storage of the elute with purified RNA:

The elute contains purified RNA, and it is recommended to be stored at a lower temperature (-80° C). Utmost care was taken to avoid repeated freezing and thawing of the sample which may cause denaturing of RNA.22

3. Step 3. RNA amplification SOP – PCR (COSARA).

a. Master Mix:

Master Mix was thawed on a frozen tray/ Ice Vortex and centrifuged for 3 seconds; it was then placed on a frozen tray/ Ice. PCR tubes were placed on the frozen tray for carrying out a reaction. Aliquot 5µL of Master Mix into desired wells. Tighten the strip tube caps and transfer them to the Template addition passage.

b. Template addition:

Vortex and centrifuge purified RNA for a few seconds. Add 5µL of Purified RNA sample to each well using a new tip between each sample. Thaw Positive control on ice. Vortex and centrifuge Positive control for a few seconds. Add 5µL of Nuclease-free water (NTC) in the appropriate well. Add 5 µL of Positive control to the appropriate well. Place caps on the PCR tubes and ensure proper fitting.

The Reaction tubes were loaded in a real-time PCR machine and the run was started.

Table 1 : Thermal Cycling set up.

Temperature	Time	Cycles	Capture
45°C	15 min	Hold	N/A
95°C	2 min	Hold	N/A
95°C	03 sec	45	N/A
55°C	32 sec		Green (FAM), Yellow (Cal Fluor 560), Orange (Cal Fluor Red 610), and Red.

Ensure that the Run file is saved and select Run. Label the good position according to wells loaded in Real-time PCR. If controls pass, then interpret the sample results. If controls fail, then the run is invalid, and all should be repeated.

Table 2 : Interpretation of Results.

RdRp Gene	E Gene	Internal Control	Result
No Amplification	No Amplification	Amplification	Negative
No Amplification	Amplification	Amplification	Positive
Amplification	Amplification	Amplification	Positive
Amplification	No Amplification	Amplification	Positive
Any result	Any result	No Amplification*	Invalid

*Repeat extraction, the absence of IC amplification indicates that there is no nucleic acid material in the reaction. The results will be interpreted as the presence or absence of SARS COV-2 RNA with Ct values.

In our surveillance system, we found skimmed milk flocculation useful as it can be easily used in low-resource settings, and yields faster results.

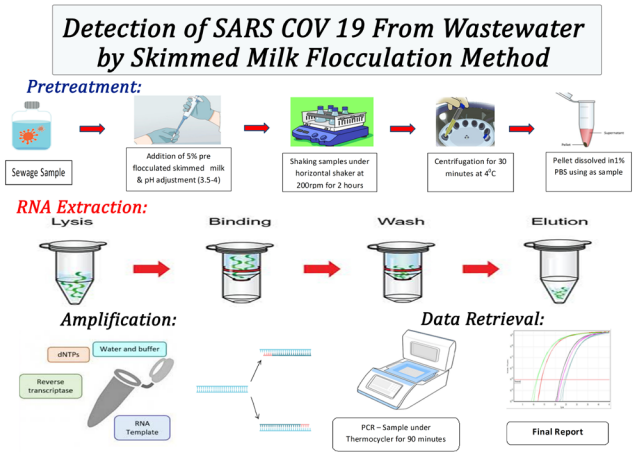

Figure 2 : Procedure of Skimmed Milk Flocculation technique

Data management and statistical analysis.

The data regarding SARS-COV-2 positivity was shared by the Laboratory technician in an application (app) developed by the investigator for the surveillance named WAP. The app generated a unique ID. Following the testing of samples, the sample data with Unique ID regarding sample positivity and Ct values for the RdRp gene and E gene were entered in the app. The data entered in the app was accessed by the investigator on a dashboard constructed for surveillance purposes. A line list of all the sample data was accessed from this dashboard and summarized. The data obtained were analyzed using SPSS v21. According to the manufactures instruction (COSARA -Saragene), a Ct value < 40 was considered positive. Means and standard deviation were calculated for Ct values of positive samples. Correlation statistics (r) were used to find out the relationship between daily wastewater SARS-COV-2 sample positivity and daily COVID-19 reported cases. The chi-square test was used to find the significant difference between the wastewater SARS CoV-2 positivity between the four zones. ANOVA statistics were used to find out the significant difference between CT values of RDRP and E gene between all 4 zones.

RESULTS

A total of 227 wastewater samples were collected and analyzed from the 40 wards during the study period. Out of the 227 samples,94 samples (40.5%) tested positive for SARS COV-2 virus RNA. (Insert Table 3 here). (Insert Fig 3 here). Mean Ct values for the RdRp gene were 35.5 with an (sd=2.0, maximum = 40 and minimum =28) and for the E gene 34.2 (sd=1.5, maximum 37 and minimum =31.)

Samples collected from all 4 zones and 37 (92.5%) out of the 40 wards showed SARS-COV2 positivity. There was no significant difference observed between the wastewater SARS Cov-2 positivity among different zones (X2, df=3, p=0.60.

Table 3 : SARS COV-2 wastewater sample positivity among different zones.

Zone	Negative	Positivity	Total samples analysed	Positivity (%)	P value
Zone 4	29	25	54	46	0.6
Zone 3	30	15	45	33	
Zone 2	31	23	54	43	
Zone 1	45	29	74	39	
Total	135	92	227	41	

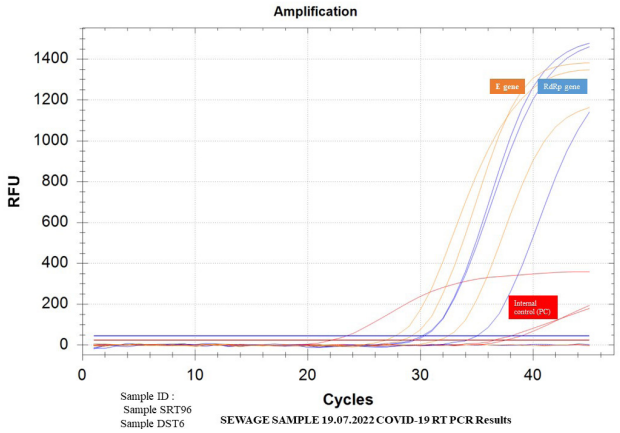

Figure 3 : Gene Amplification Results

ANOVA suggests that there were no significant differences observed in the mean Ct values of the RdRp gene (F3, 90 = 9.24, p =0.9) and E gene (F3, 30 = 2.06, p =0.1) between the various zones of the city.

Table 4 : Comparison of CT values of RdRP gene and E gene between different zones.

Ct Values	Zone	N	Mean	Std. Deviation	Tests of homogeneity of Variances		ANOVA	
					Levenes statistics	Sig.	F	Sig.
Ct-RdRP Gene	Zone 1	29	35.5	2.5	1.945	0.123	9.24	0.9
	Zone 2	23	35.7	1.8				
	Zone 3	16	35.3	2.7				
	Zone 4	26	35.7	1.3				
	Total	94	35.5	2.1				
Ct -E gene	Zone 1	14	34.1	1.9	5.036	0.006	2.06	0.13
	Zone 2	8	33.4	0.9				
	Zone 3	6	35.0	0.9				
	Zone 4	6	35.0	1.3				
	Total	34	34.2	1.5				

The COVID-19 cases and the wastewater SARS COV-2 showed a significant positive correlation (r= 0.86, p<0.01). (Insert Figure 4 and Figure 5 here).

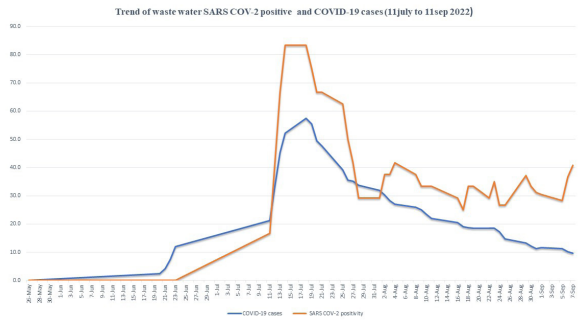

Figure 4 : Trend of Waste water SARS COV-2 and COVID-19 cases.

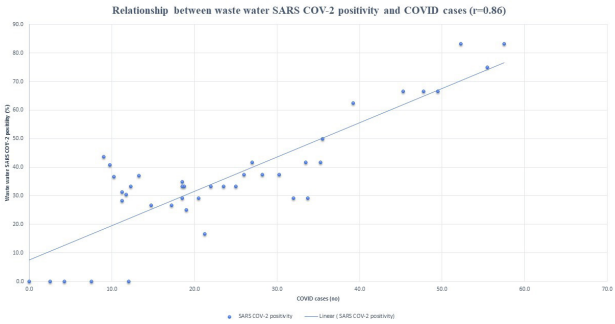

Figure 5 : Relationship of waste water SARS COV-2 and COVID-19 cases.

DISCUSSION

The present discussion regarding the standardization of skimmed milk flocculation (SMF) technique used in the present study has to be viewed in the context of the limited availability of comparable evidence in global and Indian settings as a routine surveillance method. An epidemiological approach to monitoring wastewater systems may be relevant for the early detection, which allows public health administrators to respond on time and eliminate a potential catastrophe.[23] Monitoring of centralized wastewater thus allows the detection of intentional, natural, or accidental contamination events.

The direct examination of wastewater for SARS COV-2 is difficult due to the low and fluctuating nature of concentrations of the organisms. Concentration procedures are usually organism and/or matrix specific and most techniques employed have high or unknown variability parameters.18 Alternative methods of SARS-COV-2 detection have been tried out globally.

Javier Martin et al in a study in South-East England isolated SARS-CoV-2 RNA in wastewater samples using a novel nested RT-PCR.[1] Diana M. Toledo et al her study

in Northern New England using reverse transcriptase-quantitative PCR (RT-qPCR) and reverse transcriptase-droplet digital PCR (RTddPCR) detection methods, detected SARS-CoV-2 RNA in samples from all 9 municipalities tested, including cities and small towns within this region, and showed wastewater positivity as an early indicator of active case count increases.[17] Both the above methods require robust laboratory infrastructure and seem unsuitable for routine environmental surveillance.

In a study conducted by Sharma DK et al in Mumbai, a two-phase PEG-dextran method was effectively used to concentrate SARS-CoV-2 from domestic wastewater. Viral RNA was detected in sewage samples collected during the ongoing COVID-19 pandemic in all six locations.[21] In this method, the phase separation takes around 16 hrs making it more time-consuming and laborious and thus less suitable for day-to-day surveillance in low resource settings.[21]

Of all the methods described by the Centre for Disease Control, studies had concluded that the skimmed milk flocculation (SMF) technique is an efficient method to concentrate viruses in all types of environmental water matrices such as river water, seawater, groundwater, and wastewater.[19,22,24,25]

Sarah E. Philo et al in her study compared multiple methods for concentration and recovery of SARS-CoV-2, concluding that skimmed milk flocculation without vertrel extraction performed consistently over time and between different treatment places.[19] Further, it was observed that the skimmed milk flocculation technique is easy, less time-consuming; and can be carried out in low-resource settings with minimal laboratory infrastructure.[19]

A study conducted by the same author Sarah E Philo for validation of the skimmed milk pellet extraction protocol for SARS-CoV-2 wastewater Surveillance concluded that the method reduced time spent per sample and more samples could be run at a single time making it a viable method for quick turnaround of wastewater data for public health interventions.[25]

ADVANTAGES OF SKIMMED MILK FLOCCULATION TECHNIQUE OVER OTHER METHODS

In the present study, the investigator emulated the method developed by Sarah E Philo for wastewater SARS COv-2 surveillance.[25] There was consistency in the positive reporting of samples from various zones and wards of the city. There was no significant difference observed in the wastewater positivity of samples in different zones, which proves that the results were valid and consistent. As the role of any early warning system is to be timely, in our study we observed that the SARS COV-2 extraction by skimmed milked protocol is simple, less time-consuming, and doesn't need any costly laboratory equipment.

In the present study, we analyzed a total of 227 samples for 2 months duration,6 samples per day with a mean extraction time of approximately 8 hrs. (sample processing started at 8 am and results were out by 4 pm). This fast processing of samples helped us in the daily reporting of results which contributed to the dynamic early warning COVID-19 surveillance system that further assisted health administrators for efficient decision-making.

CORRELATION OF WASTEWATER SARS COV-2 AND CLINICAL COVID-19 CASES

In the present study, we observed that the rise of waste water SARS CoV-2 positivity shows a positive linear relationship with the daily rise in COVID-19 cases daily.
This finding is similar to the studies from various parts of the world which showed a strong positive correlation when comparing wastewater data to daily new clinical cases.[15-17,26]

CONCLUSION

The present study concludes that the skimmed milk flocculation technique for waste water SARS CoV-2 is easy, feasible, less resource intensive can be used for daily environmental COVID-19 surveillance by public health department.

ACKNOWLEDGMENT

The authors acknowledge the support provided by Indian Council of Medical Research (ICMR). The authors would like to thank the Department of Public Health, Tamil Nadu for their administrative support.

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CONFLICT OF INTRESTS

All authors disclose that there are no conflicts of interest.

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ORIGINAL ARTICLE - PUBLIC HEALTH

A CROSS-SECTION STUDY ON ASSOCIATION OF PRE-PREGNANCY BODY MASS INDEX AND GESTATIONAL WEIGHT GAIN ON NEONATAL OUTCOME IN THE REGION OF TAMILNADU

Nagarajan J [(1)], Uma Maheswari R [(1)], Damodran V [(1)]

(1) Institute of Community Medicine, Madras Medical College, Chennai

Abstract

BACKGROUND : Pre-pregnancy body mass index (PP-BMI) and weight gain during pregnancy play important roles in determining the pregnancy outcome. Gaining desirable gestational weight is considered to be effective in supporting the growth and development of the fetus and it may also influence the body composition in childhood and later life. The purpose of this retrospective study is to determine whether a women's PP-BMI and the maternal weight gain affects the neonatal outcomes from women accessing care from Primary health Centre.

OBJECTIVES : To estimate the association of pre-pregnancy Body Mass Index and weight gain during Pregnancy on neonatal outcome among women seeking PHC in the region of Tamilnadu.

METHODS : A cross sectional study was conducted from July to September 2021 among 105 mothers, whogave birth to newborn in the year2019 in Arakkonam Block using a pretested, semi structured, self-administered questionnaire. Data were entered in Excel and analyzed using SPSS version 21.

RESULTS : Only 29.5% of women gained weight as per the recommendations. Caesarean deliveries are seen more among women, whose pre-pregnancy BMI is Underweight and normal (57% and 65.4% respectively) than compared to overweight and obese (33% and 35% respectively). Obese women who gained weight less than recommended had high risk of giving birth to low birth weight babies(p< .05).

CONCLUSION : Excess weight gain as well as low weight gain during pregnancy could advance to adverse pregnancy outcomes. The need for gaining adequate weight during pregnancy is highlighted. Especially for overweight and obese women, Preconception counseling on Lifestyle modifications to avoid excess weight gain and its impacts could be beneficial in Tamilnadu women.

KEYWORDS : Pre-pregnancy body mass index, Gestational weight gain and Neonatal outcome.

INTRODUCTION

The "Continuum of Care" for reproductive, maternal, newborn and child health (RMNCH) include integrated service delivery for mothers and children from pre-pregnancy to delivery, the immediate postnatal period, and childhood. RMNCH+A encompasses health problems across the life course from adolescent girls and women before and during pregnancy and delivery, to newborns and children. An important conceptual framework is the continuum-of-care approach in two dimensions. One dimension recognizes the links from mother to child and the need for health services across the stages of the life course. The other is the delivery of integrated preventive and therapeutic health interventions through service platforms ranging from the community to the primary health center and the hospital.[1]

The Anemia Mukt Bharat launched in March 2018, similar to continuum of care (RMNCH), concentrate on reproductive age group. It has been designed to reduce prevalence of anemia among women in the reproductive age group (15–49 years) and pregnant mothers, thereby improving the maternal and neonatal outcome.[2]

Neonatal outcome is determined by several factors such as, maternal age, parity, pre-pregnancy BMI, weight gain during pregnancy, gestational age, and neonatal gender. Pre-pregnancy body mass index (BMI) and weight gain during pregnancy play important roles in determining the pregnancy outcome.[3] According to National Family Health Survey-4 (NFHS, 2015-16), 22.9% of women in childbearing age in India are underweight (BMI <18.5kg/m^2), whereas a rise has been observed from 12.6% (NFHS-3, 2005-06) to 20.7% among overweight/obese (BMI-≥25kg/m^2) women (NFHS-4).[4] Pre-pregnancy underweight (UW) has been shown to increase the risk of preterm birth and low birth weight (LBW) whereas pre-pregnancy overweight/obesity is a risk factor for gestational diabetes mellitus (GDM), gestational hypertension (GHTN), preeclampsia and

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Corresponding Author : Nagarajan J
email : nagarajankutty@gmail.com

neonatal outcome with increased birth weight (large for gestational age), macrosomia, abnormal APGAR score and admission to neonatal intensive care unit (NICU).[5]

Gaining desirable Gestational weight is considered to be effective in supporting the growth and development of the fetus and it may also influence the body composition in childhood and later life. In recent years, maternal pre-pregnancy body mass index (BMI) has increased, which reflects the overall hike in the prevalence of obesity. High pre-pregnancy BMI and/or excessive gestational weight gain (GWG) leads to negative implications and puts health of both mother and the infant at risk.

The pre-pregnancy BMI and weight gain will serve as a useful reference for prenatal services. Yet, there has been limited research on the gestational weight gain related to neonatal outcome from women accessing care from Primary Health Centre. The purpose of this retrospective study is to determine whether a women's BMI and the maternal weight gain affects the neonatal outcomes from women accessing care from Primary health Centre.

OBJECTIVE

To estimate the association of pre-pregnancy body mass index and gestational weight gain on neonatal outcome in the region of Tamilnadu.

METHODOLOGY

A cross sectional study was conducted over a period of three months from July to September 2021 among mothers, who gave birth to newborn in recent year 2019 inArakkonam Block.The sample size was calculated to be 105, considering the prevalence rate of the mothers giving birth to normal weight newborn to be 50%, absolute precision of 10%,10% to account for non-response rate. Ethical clearance was obtained from the Institutional Ethics Committee, Madras Medical College. Out of 45 HUD's Blocks in Tamilnadu, Arakkonam block was selected by simple random sampling method. Official permission to conduct the study was obtained from Directorate of Public Health and Preventive medicine, Deputy Director of Health Services, Ranipet District for conducting the study. All the mothers, who gave birth to newborn in the year 2019 in Arakkonam block were included in the study after obtaining written informed consent by universal sampling method.

METHODOLOGY

Study was conducted Among the 105 participant mothers, mean age of the participant was 24.50 ± 4 years.

Table 1 : Depicting socio demographic parameters among study participant(n=105)

S.NO	SOCIO DEMOGRAPHIC PARAMETERS		FREQUENCY	PERCENTAGE (%)
1	AGE	**<25**	**64**	**61**
		>25	41	39
2	EDUCATION	Primary school	9	8.6
		Middle school	5	4.7
		High school	28	26.7
		Higher secondary school	**35**	**33.3**
		Graduate	28	26.7
3	OCCUPATION	Employed	30	28.6
		Unemployed	**75**	**71.4**
4	SOCIO-ECONOMIC STATUS CLASS	Upper middle	9	8.5
		Lower middle	**59**	**56.2**
		Upper lower	37	35.3

Table (1) showing socio demographic parameters of the study participant. 60% of the study participant have completed either higher secondary school or degree. 28.6% of them were employed and all of them quit their job before reaching third trimester. Their socio-economic status was determined by modified Kuppuswamy's scale, 35.3% were belong to upper lower class, 56.2% were belong to lower middle class and 8.5% belong to upper middle class.

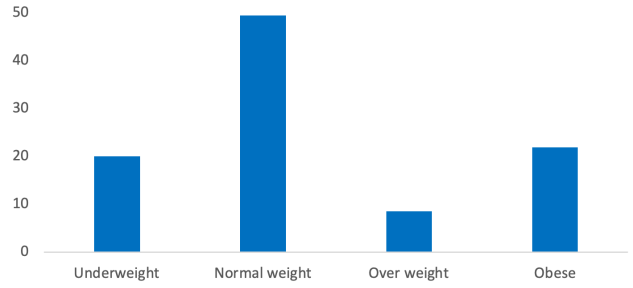

Figure 1 : Classification of body mass index based on Asia Pacific guidelines

Mean BMI was 21.96 ± 4.3 kg/m 2, and mean weight gain during pregnancy was 7.6 ± 2.6 kg. 49% of women were primipara, and 51% were multipara. Figure(1) shows 20 % (n = 21) were underweight, 49.5 % (n = 52) normal weight, 8.6 % (n = 9) overweight, and the rest 21.9% (n = 23) were obese.

Table (2) shows the clinical characteristics and pregnancy outcomes of the women categorized based on their BMI at first booking. Obese and overweight women were significantly older (26.04+3.4 and 26.2+3.2 years) than normal weight, and underweight women (24.8+6.2 and 23.1+3.5 years, P< 0.05, respectively). The mean birth weight of the infants born to normal weight, overweight, and obese women was found to be higher than birth weight of infants of underweight women (2.93+0.30, 2.78+0.38, 2.93+0.35 and 2.74+0.29 respectively). LSCS rates are higher in overweight and obese women(66.6% and 65.2%) than underweight and normal weight women (42.9% and 34.6%),P<0.05 respectively.

Table 2 : Showing the clinical characteristics and pregnancy outcomes of the

CLINICAL PARAMETERS	UNDERWEIGHT (N=21)	NORMAL (N=52)	OVERWEIGHT (N=9)	OBESE (N=23)
Age	23.1±3.5	24.8±6.2	26.2±3.2	26.04±3.4
Weigh at booking	41.4±4.2	50±4.8	53.6±2.9	68.2±7.7
Weight gain during pregnancy	8.4±2.9	7.7±2.8	6.8±2.7	6.9±1.7
BMI at booking	16.9±1.4	20.7±1.2	23.8±0.8	28.7±2.5
Mean birth weight	2.74±0.29	2.93±0.30	2.78±0.38	2.93±0.35
Preterm deliveries	1(4.8 %)	3(5.8 %)	2(22 %)	1(4.3 %)
Caesarean delivery	9(42.9 %)	18(34.6 %)	6(66.6 %)	15(65.2 %)
Low birth weight	4(19 %)	5(9.6 %)	2(22 %)	3(13 %)

Figure (2) shows weight gain during pregnancy across the different BMI categories. It was seen that 14% of underweight, 11.5% of normal weight, 11.1% overweight, and 95.7% obese women met the recommendations for weight gain.

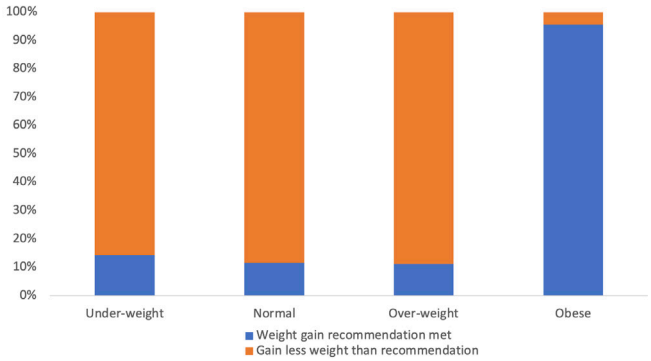

Figure 2 : Comparison of Gestational weight gain across different BMI categories

While majority of underweight (86%), normal weight women (88.5%), and overweight women (88.9%) gained weight less than recommended, among obese women 4.3% of them gained less than the recommended weight.Overall, only 29.5% women met the recommendations for weight gain.

Figure(3) showing the mean birth weight of the infants born to normal weight, overweight, and obese women was significantly higher than birth weight of infants of underweight women (2.93 ± 0.30 kg, 2.78 ± 0.38 kg, 2.92 ± 0.35 kg, and 2.74 ± 0.29 kg; P = 0.007, respectively).

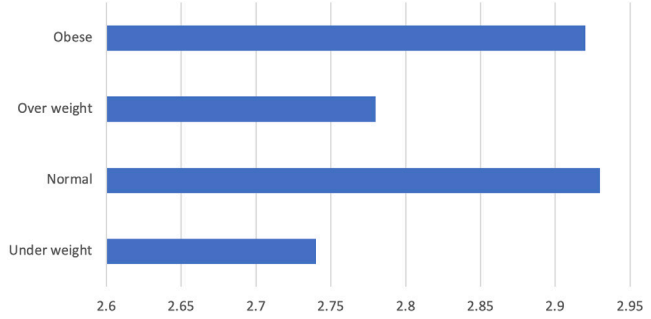

Figure 3 : Mean birth weight of the infant born to different BMI categories

INFERENTIAL STATISTICS

Using univariate analysis- Chi Square test was done and the association between Pre-pregnancy BMI and gestational weight gain with type of delivery underwent, presence of meconium stain in amniotic fluid, birth weight and admission in NICU. P value < 0.05 was taken as significant.

Table 3 : Association of Gestational weight gain with pregnancy outcomes: in women with unsufficient weight gain

Parameter	Underweight		Normal		Overweight		Obese	
	OR	*P*	OR	*P*	OR	*P*	OR	*P*
Caesarean delivery	1.457 (.509 – 4.173)	.482	0.419 (.160 – 1.101)	.075	2.733 (.601 – 12.439)	.180	NA	.223
Low birth weight	1.567 (.413 – 5.945)	.505	0.366 (.104 – 1.293)	.110	1.867 (.329 – 10.593)	.475	NA	**.022**
Meconium-stained liquor	2.039 (.314 – 13.246)	.448	0.907 (.142 – 5.8793)	.918	NA	.420	NA	.786
NICU admission	0.963 (.094 – 9.856)	.975	0.591 (.078– 4.450)	.606	3.000 (.274 – 32.875)	.347	NA	.810

From the above Table 3, the risk of giving low birth weight by a women, whose pre-pregnancy BMI under Obese category and gestational weight gain is not met as recommendation is significant (P<.05).

DISCUSSION

Only 29.5% of women gained weight as per the recommendations. Caesarean deliveries are seen more among women, whose pre-pregnancy BMI is overweight and obese (66.6% and 65.2% respectively) than compared toUnderweight and normal (42.9% and 34.6% respectively). Obese women who gained less weight than recommended had increased risk of giving birth to low birth weight.

The initial guidelines by the IOM in 1930 recommended that pregnant women should gain 6.8 kg irrespective of weight status.[7] Subsequently, with increasing prevalence of obesity and an increasing trend in birth of macrosomic infants, these guidelines were revised in 1990 and 2009.[8,9] With overweight and obesity significantly contributing to the growing prevalence of large for gestational age infants and increasing the risk of pregnancy-related complications,10 the IOM published new guidelines in 2009.[8] This new recommendation was based on WHO BMI categories and included a more restrictive range for weight gain for obese women. These guidelines took into account the risk of small for gestational age infants and preterm birth with inadequate GWG and increased risk for large for gestational age infants and cesarean section. Following the 2009 IOM publication, several studies were published supporting less weight gain,

especially in overweight and obese women.[11,12,13,14] Studies from less developed Asian countries validating these guidelines are emerging, with very few studies from India.[7]

However, the WHO BMI categories that have been used to classify Europeans may not be appropriate for Asia Pacific population.[15] This is because while in the Asian population, the prevalence of obesity may be lower than in Europe; the health risks associated with obesity occur at a lower BMI in Asians than compared to the West, thereby making WHO BMI categorization, less relevant to the Asian population.

Hence, in 2000, the Regional Office for the Western Pacific of WHO, the International Association for the Study of Obesity, and the International Obesity Task Force together released, the Asia-Pacific Perspective for redefining obesity suggesting diagnostic criteria to identify overweight and obesity in the Asian population.[15] Hence, in this paper, we have employed the WHO Asia Pacific BMI criteria to classify pregnant women in our study. However, in the absence of national guidelines for weight gain recommendations during pregnancy, we have assessed the usefulness of the IOM weight gain recommendations for our population by studying the adverse pregnancy outcomes in women who gained weight above and below the recommended guidelines.

Maternal obesity is a risk factor for several pregnancy-related complications which may have adverse effects on both the mother and her infant. Obese women are at an increased risk of undergoing cesarean sections.[16] Fetal overgrowth also is another major concern in obese women. Several other studies have also shown an association between increasing BMI, cesarean section, and macrosomia.[17, 18] Moreover, the risk for macrosomic infants was found to be consistently higher in obese women who gained more weight, whereas the risk decreased when weight gain was below the recommended values.[14]

Cesarean section is usually influenced by several factors, such as practice behavior of the obstetrician or other pregnancy complications in obese women may necessitate the need for cesarean section. Results from our study show that overweight and obese women who gained weight as recommend were at a significantly(P<.05) higher risk of cesarean delivery. In contrary, Edwards et al.[19] and Graham et al.[20] found that when stratified by maternal weight gain, there was no significant association between obesity and cesarean section

Underweight women are known to deliver preterm infants.[21] In addition, underweight women gaining less weight than recommended were shown to be at two-fold risk of delivering low birth weight infants than those who met the recommendations.[22] Our results showed that though the risk for low birth weight in underweight women was high, it was not statistically significant. This could be because the number of underweight women studied is less. The other important finding in this study is that though a major proportion of normal weight and overweight women gained less weight than recommended, the less weight gain had a less risk for cesarean sections which is in contrast with previous studies which showed that these women had increased risk for such complications.[12,23] This difference could be attributed mainly due to the different BMI criteria used.

CONCLUSION

Excess weight gain as well as low weight gain during pregnancy could advance to adverse pregnancy outcomes. The need for gaining adequate weight during pregnancy is highlighted. Especially for overweight and obese women, Preconception counseling on Lifestyle modifications to avoid excess weight gain and its impacts could be beneficial in Tamilnadu women.

LIMITATION

BMI classification should be based on pre-pregnancy weight ideally as seen in several studies and data are not available in routine AN records. In our study, we have used weight recorded in the antenatal records in early pregnancy which was the only feasible option for obtaining reliable information. Due to the retrospective design of the study, there was a massive amount of data missing which has decreased the size and power of the study.

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ORIGINAL ARTICLE - PUBLIC HEALTH

AN OBSERVATIONAL STUDY ON THE IMPACT OF KANNOLI KAPPOM THITTAM IN PARAMAKUDI, TAMILNADU

Mangaiyarkarasi H [(1)], Prathapkumar P [(2)]

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

Abstract

BACKGROUND : Providing correction spectacles is the simplest way to improve quality of life in children with decreased visual acuity due to refractive error. Under "Palli Sirar Kannoli Kappom Thittam" (KKT) Scheme of Tamil Nadu government, nearly 75 lakhs students studying from class 6 to class 12 are screened and checked annually, and students with refractive error are provided with free corrective spectacles.

AIM : The aim of this study is to assess continuous wear of spectacles, product status and subjective improvement in academic performance of scheme beneficiaries under KKT scheme in Paramakudi Health Unit District.

METHODS : A Cross-sectional study was conducted among Palli Sirar Kannoli Kappom Thittam beneficiaries in Paramakudi Health Unit District. Multistage random sampling method was used to select Parthibanur block among 6 blocks and Parthibanur Government Higher Secondary School among 37 schools in the block. Data was collected from 53 beneficiary students under KKT scheme by self-administered questionnaire and the results were analysed.

RESULTS : Most common refractive error was myopia present in 96% beneficiaries and astigmatism in nearly 4%. Around 20% of participants reported continuous wear of more than 14 hours, 41% wearing for 6 to 14 hours and 39% wearing less than 6 hours. Subjective academic performance improved in 92.3%. Children who disliked spectacle wear were 30.1%, among whom nearly 75% cited personal dislike and 25% cited peer mockery as reasons for dislike.

CONCLUSION : Awareness among children to promote continuous wear of spectacles is necessary. IEC to improve continuous use and monitoring spectacle wear by teachers and parents are required. Steps need to be taken in school and home environment to prevent peer mockery of students wearing glasses.

KEY WORDS : Refractive error, Kannoli Kappom Thittam, Continuous wear.

INTRODUCTION

Refractive error is a phenomenon that happens when the eye fails to concentrate light rays from objects onto the retinal plane, resulting in blurred image.[1] Myopia or short sightedness, hypermetropia or long sightedness and astigmatism with no single point of focus in the eye are the three types of refractive errors in children. Anisometry is a condition in which the refractive powers of two eyes differ[1]. Refractive error is one of the most common causes of vision impairment, accounting for 47% of all cases of vision impairment in high-income countries. In developing countries, refractive error has a substantial impact, resulting in decreased economic productivity.[2] Refractive error affects people's lives, including children and adults, causing difficulties in performing regular tasks, decreasing their vision, and eventually causing blindness. It affects people of all ages, but its impact is found to be greater in youngsters due to delay in detection and correction.[2]

The Right- to- Sight initiative, Vision 2020, was started in 1999 with the goal of eliminating avoidable blindness by prioritizing a few important causes of vision impairment and blindness based on their distribution, impact on the community, management potential, and affordability.[3] One of the five priority issues addressed is refractive error. According to World Health Organisation, annually 12.8 million children between the ages of 9 and 15 suffer from refractive error related visual impairment.[4]

Children are reported to be the most vulnerable segment of the population, with many suffering from vision impairment throughout their life. According to Refractive Error Study in Children conducted by NCBI, prevalence of refractive errors in urban and rural India is 7.4% and 4.7% respectively.[5] The prevalence of myopia in Indian children is 5.3% whereas hypermetropia and astigmatism is 4% and 5.4% respectively. Correction of refractive errors among school going children is being given priority as it limits their academic potential and if left unaddressed leads to long term effects like amblyopia.[6] Children try to compensate for their vision problems by sitting closer to the blackboard, pinching their eyes hindering their academic performance. Refractive error is one of the most common eye diseases related to regular absenteeism.[7] Visual impairment can progress to amblyopia if untreated. Visual impairment also affects the social, professional, and developmental aspects of

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Corresponding Author : Mangaiyarkarasi H
email : mangaineyveli@gmail.com

the affected children. Compliance towards spectacle-wearing in children is comparatively difficult than adults, owing to not understanding the importance of spectacle wearing. It is estimated that approximately 7-30% of blindness in children can be corrected and avoided.[8]

The most cost-effective treatment modality for correction of visual impairment associated with refractive error is wearing spectacles.[9] Wearing spectacles along with being the most effective treatment modality for correcting refractive error is also an economic treatment modality aiming to improve eye, vision, function, and productivity in children.[10] Spectacles apart from being inexpensive are also non-invasive and simple to use. Under "Palli Sirar Kannoli Kappom Thittam" Scheme of Tamil Nadu government, around 75 lakhs students studying from class 6 to class 12 are screened annually and free spectacles are issued for RE correction. However, the efficacy and success of such a scheme is largely governed by the compliance of the wearers.[11]

Various studies have assessed the compliance towards spectacles wearing in children. Low compliance rates were seen even in older children and in subjects where free spectacles were given.[12] Factors responsible were self-esteem, safety concerns, peer pressure, perception of subjects and parents, forgetfulness, loss, breakage, and/or poor follow-up. Studies assessing the compliance of Kannoli Kaapom Thittam (KKT) beneficiaries are limited. Hence, the present study was conducted to assess the compliance to wearing spectacles – duration of wear, product status and subjective improvement in academic performance of scheme beneficiaries under KKT scheme in Paramakudi Health Unit District.

METHODOLOGY

The study was conducted as a cross-sectional study. Sampling method used was multistage random sampling. Among 6 blocks in Paramakudi health unit district, Parthibanur block was chosen by simple random sampling. Parthibanur block has total 37 government schools, of which Parthibanur government higher secondary school was selected by simple random sampling. Students of class 6 to class 12 who have received corrective glasses under the Kannoli Kaapom Thittam during the year 2021-2022 were included for the study. Students suffering with strabismus, amblyopia, glaucoma, cornea or lens or retinal disorders, conjunctivitis and with cognitive impairment were excluded.

Out of total 1095 students studying in 6th to 12th class there were 137 beneficiaries who have received corrective glasses under Kannoli Kaapom Thittam during the year 2021-2022 in the school. Out of 137 beneficiaries, 33 students have passed out to college education after completing 12th class, 27 students have changed schools after class 10, 20 absentees were not contactable after 2 recall visits and 1 student was not willing. Students with strabismus were 3, who were excluded. All available 53 students were included in the study and data collected using a self-administered questionnaire. Questionnaire with basic demographic variables, spectacle condition at the time of study, duration of continuous wear, improvement in subjective academic performance and interest to wear spectacles was administered. Type of refractive error was assessed from health record. Results were collected and data was analyzed. The study was conducted after obtaining ethical committee clearance of Directorate of Public Health and Preventive Medicine. Permissions were obtained from school education department and consent of parents obtained before the conduct of the study.

RESULTS :

Out of 53 participants, about 57% (n=30) were males and 43% (n=23) were females. Median age of the participants is 15 years with minimum age 12 years and maximum age 18 years. Distribution of participants by age is given in table 1.\

Table 1 : Age Distribution of participants

Age (Years)	Frequency (n)	Percentage (%) (N=53)
12	1	1.9
13	2	3.8
14	28	53.8
15	1	1.9
16	13	25
17	7	13.5
18	1	1.9

Table 2 : Compliance to Spectacles Wear

Duration of spectacle wear	Frequency (n)	Percentage % (N=53)
< 6 hours	20	38.7
6 - 14 hours	22	41.5
> 14 hours	11	20.8

Among the study participants corrective spectacles have been prescribed for myopia in 96.2% (n=50) and

for astigmatism in 3.8% (n=3) children. No participant had hypermetropia. All the 53 participants reported their spectacles being in good condition. Compliance to spectacles wear as hours of glass wear in a typical day is reported in table 2. Around 20% (n=11) reported as wearing for more than 14 hours a day while nearly 40% (n=20) reported as wearing less than 6 hours a day.

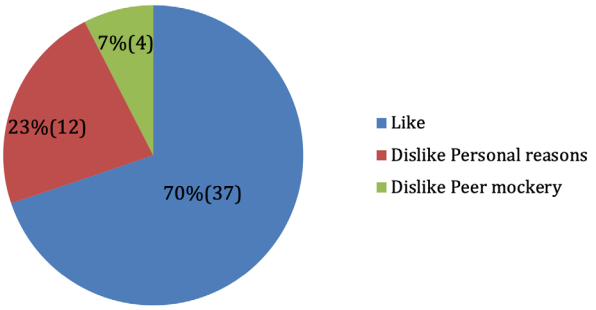

Figure 1. Spectacle wear interest

Subjective improvement in academic performance was reported by 92.3% (n=48) of participants. No improvement in academic performance was reported by 5 participants. Among participants, students reported interest to wear spectacles is 70% (n=37). Among the remaining 16 students who reported not liking to wear spectacles, 12(75%) students reported as personal dislike and 4(25%) students reported peer mockery as reason for dislike for spectacle wear as in fig 1.

INTERPRETATION

Myopia was the most common refractive error in school going children. Majority of the children were irregular wearers, personal dislike and peer mockery were the reasons reported. Academic performance improved for the beneficiaries. Product quality was good.

DISCUSSION

Almost all students who were prescribed corrective glasses is for myopia while no student had hypermetropia, indicating myopia is the most common refractive error among children. While all the students were expected to wear the spectacles throughout the day, only 20% reported wearing it for more than 14 hours per day. According to national center for Health Statistics, 35.3% Indian children between 12 to 17 years had continuous wear of spectacles. Majority of the students in this study reported irregular use of less than 14 hours per day, among whom half of them reported wearing less than 6 hours per day and remaining wearing spectacles for 6 to 14 hours per day. Subjective improvement in academic performance after wearing spectacles was reported by most of the students. Despite academic performance improvement in majority of students, continuous wear of spectacles was less. Nearly a third of the students reported dislike to wear spectacles and few of them reported peer mockery as the reason for dislike to wear spectacles. Students in adolescence may seek peer agreeability and cosmetic appeal could be an important reason for personal dislike to wear spectacles hindering compliance to continuous wear of prescription spectacles.

CONCLUSION

KKT scheme ensured the accessibility to spectacle correction to school children, still adherence to continuous wear was poor. The effectiveness of this program can be improved by providing a greater choice of spectacle frames, educating the benefits of correction to students and their parents and involving the teachers to improve compliance. Real benefit of the scheme can reach the beneficiaries only by continuous use of the spectacles provided.

RECOMMENDATIONS

Along with providing free prescription glasses, providing awareness among children for regular use of spectacle will be beneficial. Providing IEC activities using personal communication strategies and group counseling methods while providing spectacles is required. Monitoring and supporting the students to promote continuous glass wear and steps to prevent peer mockery in domestic as well as school environment is needed. Teachers and parents have to be sensitized towards this problem and promote continuous spectacles wear. Class teachers can play a vital role in this regard.

LIMITATIONS

The present study has a few important limitations including inadequate sample size and cross-section nature. Academic performance was assessed subjectively. Compliance to glass wear may be required to be elicited from teachers and parents. Study with larger sample size with adequate power and prospective study to assess the variables will be needed.

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ORIGINAL ARTICLE - PUBLIC HEALTH

A CROSS – SECTIONAL STUDY ON PREVALENCE OF MALNUTRITION AMONG UNDERFIVE CHILDREN AT ANGANWADIS IN POONAMALLEE HUD

Kavitha M [(1)], *SenthilKumar M* [(1)]

(1) Institute of Public Health, Poonamallee

Abstract

BACKGROUND : In India, malnutrition in children under the age of five is a major public health issue. Notwithstanding India's economic prosperity, the undernutrition-related infant mortality rate remains high in both urban and rural areas.
OBJECTIVES : To ascertain the prevalence of malnutrition among young children (under the age of five).
METHODOLOGY : A cross-sectional study was undertaken on children under five at Anganwadis in Poonamallee, Tamil Nadu. The study used multi-stage sampling. Socio-demographic profiles of mothers with under-five children and a structured knowledge questionnaire assessed mothers' nutritional awareness. WHZ, WAZ, and MUAC were determined from anthropometric measures of children under five. Growth charts were retained after evaluations. The data was entered into MS EXCEL and analyzed with SPSS Version 16. Continuous variables were defined by mean, median, and mode, while categorical variables were described by proportion.
RESULTS : 17.65 percent of the 340 children that were evaluated were found to be underweight, 12.06 percent were found to be stunted, and 3.82 percent were found to be wasting. Underweight and stunting were statistically linked. The child's age and birth order were statistically significant predictors of underweight in this study. The stunting scores of children under five were statistically associated with their age ($\chi 2 = 11.96$, $p < 0.001$). This study found that wasting scores were significantly affected by age and birth order.
KEYWORDS : Prevalence, Malnutrition, Under-five children, Anganwadi

INTRODUCTION

Malnutrition in children is a major public health issue. In 2020, it was thought that 149 million children under 5 years old would be stunted (too short for their age), 45 million would be wasted (too skinny for their height), and 38.9 million would be overweight.[1] Both policymakers and researchers are concerned about the high prevalence of child undernutrition in India and its slow rate of decline. The country has failed to meet its child undernutrition targets set by the Millennium Development Goals despite implementing and maintaining the Integrated Child Development Scheme (ICDS), the largest intervention of its kind in the world.[2]

While health has improved in India over the past few decades, such improvement has not been uniform or fair. The poor are disproportionately affected by malnutrition, especially in urban settings where poverty-related health problems are more severe than in the suburbs or even the countryside. Residents of urban slums have a higher risk of death than the general population, are more likely to be malnourished and have less access to health care for themselves and their children.[3] A proper diet is crucial for a child's immune system health and physical and mental growth. So, it is vital to focus on nutrition. Undernutrition or malnutrition simply refers to an inadequate diet. Malnutrition contributes significantly to global childhood mortality.[4] Typically, underdeveloped and developing nations confront nutritional issues.[5] The United Nations Children's Fund (UNICEF) has identified food instability, an unhealthy environment, inadequate care, and a lack of access to healthcare as the leading causes of child malnutrition.[6]

A child's dietary status may also be affected by other factors such as their family's socioeconomic situation, parental education level, and familiarity with available healthcare resources.[7] More than half of the world's malnourished children are found in India, Pakistan, and Bangladesh, making this problem a significant burden on these countries.

The National Health Survey found that the incidence of stunting was 30–40% and the prevalence of wasting was 14% in Pakistan.[8]

In India, a significant portion of children under the age of five suffer from a condition known as malnutrition. This is demonstrated by the fact that the percentage of children in India who are underweight is nearly twice as high as the

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Corresponding Author : Kavitha M
email : i.kavitha@yahoo.com

percentage of children in Sub-Saharan Africa, making it one of the highest rates in the world. It has also been found that the issue of malnutrition in India is a concentrated phenomenon. This means that a relatively small number of states, districts, and villages are responsible for a large share of the burden of malnutrition. In fact, only five states and fifty percent of villages are responsible for approximately eighty percent of the problem.[9]

Every year, malnutrition kills about 2.3 million children in developing countries between the ages of 6 and 60 months. This is about 41% of all deaths in this age group.[10]

A recent study of children aged 3 months to 3 years old, conducted in 130 districts across 53 countries using Demographic and Health Surveys from 1986 to 2006, discovered that — variance in mild under-weight has a larger and more robust correlation with child mortality than variance in severe under-weight.[11]

The study indicated that the frequency of moderate underweight among preschool-aged children in emerging nations merits further attention as a relevant indicator of changing public health conditions. In order to design and implement timely interventions at the community level, it is crucial for the health system to diagnose malnutrition early on.

OBJECTIVES

1. To determine the prevalence of malnutrition among children under the age of five.
2. To explore the association between Malnutrition and various demographic factors.

METHODS

A cross-sectional study was conducted on children under the age of five at Anganwadis at Poonamallee of Tamil Nadu. Sample size was calculated based on Naresh etal previous study prevalence of underweight 24% among under five children, with 99% confidence limit and 25% of relative precision of estimate using the following formula N =(z)2x(1-p)/(p) x(e)2 Sample size (N) = (2.58)2x(1-0.24)/0.24x(0.25)2 . The sample size was determined to be 340 children under the age of five. The Institutional Ethics Committee at the Directorate of Public Health and Preventive Medicine in Chennai gave their approval for the study to be done. Prior permission for the study was obtained from the parents or guardians of the child enrolled in it, as well as informed consent. The present study is based on a cross-sectional survey that was conducted at Poonamallee. The study participants were selected via a multi-stage sampling procedure, resulting with children aged underfive at 208 Anganwadi centres at Poonamallee, Nemam, Thirumazhisai, and Sorenchery area. There are roughly 50 anganwadi centres spread across each areas. From these four areas children enrolled in anganwadi centres were selected. The tool included socio-demographic profiles of mothers with under-five children, and a structured knowledge questionnaire was used to assess mothers' awareness of malnutrition. Anthropometric measurements for children under the age of five were taken, and the Weight for Height (WHZ), Weight for Age (WAZ), and Mid-Upper arm circumference (MUAC) were calculated using this information. Following these evaluations, growth charts were kept. The data was entered into MS EXCEL and analyzed with the Statistical Package for Social Sciences (SPSS) Version 16. Continuous variables were described using descriptive statistics (mean, median, mode), while categorical variables were described using proportion.

RESULTS

Table 1 : Demographic information for Under-five Children (N = 340)

S. No	Demographic information		F	%
1.	Age of the child	< 1 years	45	13.24
		1-2 years	68	20.00
		2-3 years	127	37.36
		3-4 years	54	15.88
		4-5 years	46	13.53
2.	Gender	Male	161	47.35
		Female	179	52.65
3.	Mother age	21-25 years	116	34.12
		26-30 years	147	43.24
		31-35 years	77	22.65
4.	Type of family	Nuclear family	170	50.00
		Joint family	162	47.65
		Extended family	8	2.35
5.	Religion	Hindu	302	88.82
		Christian	27	7.94
		Muslim	11	3.24
6.	Locality of Residence	Rural	123	36.18
		Semi-urban	79	23.24
		Urban	138	40.59
7.	Order of birth	1st	163	47.94
		2nd	148	43.53
		3rd & above	29	8.53
8.	Occupation of father	Skilled Worker	166	48.82
		Unskilled Worker	66	19.41
		Unemployed	11	3.24
		Technical Professional	97	28.53
9.	Education of Mother	Post graduate	43	12.65
		Degree	93	27.35
		Higher secondary	184	54.12
		Non formal education	20	5.88
10.	Monthly family income	Below Rs.5000	57	16.76
		Rs.5001-10000	132	38.82
		Rs.10001-15000	109	32.06
		Rs.15001-20000	42	12.35
11.	Vaccination Details	Yes	340	100.00
		No	0	0.00
12.	Have you given Iron syrup | tablets to your child as per schedule	Yes	340	100.00
		No	0	0.00

Table I presents the demographic statistics for mothers with children under the age of five. Of 340 children, 127 (37.36%) were between the ages of 2 and 3 and 68 (20%) were between the ages of 1 and 2 years. There were 54 people in the age bracket of 3 to 4 years (15.88%). The gender distribution of the children indicates that 179 (52.6%) of them were females, while 161 (47.35%) were males. Regarding the age of the mothers of the children, 147 (43.24%) were between the ages of 26 and 30. There were 116 individuals between the ages of 21 and 25 (34.12%), and 170 (50.0%) of the children came from nuclear families. 162 (47.65%) of children belonged to a nuclear household. Around 302 children in this study were Hindu (88.82%) and 27 were Christians (7.94% of the population). The locality of residence of the children in the survey revealed that the majority, 123 (36.18%), were from rural areas, while 138 (40.59%) were from urban areas. Around 163 (47.94%) of the children were born first. 148 (43.53%) of the samples were from second birth order. Regarding the occupation of the fathers of the children, 48.82% of 166 fathers were skilled workers. There were 97 technical professionals (28.53%). Almost 184 (54.12%) of the mothers of children who participated in the survey had completed their high school education. 93 (27.35%) of the moms had a bachelor's degree or higher. The monthly household income of the bulk of children, 132 (38.82%), was between Rs 5001 and Rs 10000. 109 families with a monthly income between Rs 10,001 and Rs 15,000 had a monthly income of Rs 10,001 to Rs 15,000 (32.06). Each of the 340 samples (100%) had been vaccinated. Regarding the consumption of iron syrup/ tablets, the schedule indicates that all 340 children (100%) had it.

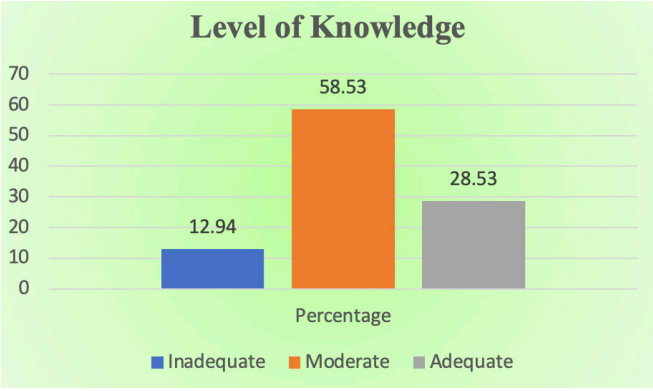

Figure 1 : Percentage of Knowledge of Mothers among Under-five Children regarding Malnutrition

In general, 12.94% of mothers have a score that indicates they have an inadequate level of knowledge, 58.53% of mothers have a score that indicates they have a moderate level of knowledge, and 28.53% of mothers have a score that indicates they have an acceptable level of knowledge.

Table 2 : Level of Underweight, Stunting and Wasting Among Under Five Children (N = 340)

Malnutrition Indices	-3		-2		-1		MEDIAN		1	
	n	%	n	%	n	%	n	%	n	%
WAZ - Underweight	12	3.53	48	14.12	97	28.53	178	52.35	5	1.47
HAZ - Stunting	8	2.35	33	9.71	78	22.94	218	64.12	3	0.88
WHZ - Wasting	8	2.35	5	1.47	5	1.47	319	93.82	3	0.88

The above table illustrates the prevalence of underweight, stunting, and wasting among children under five years old. On the Malnutrition index WAZ (Underweight), the majority of children, 178 (52.35%), were in the Median weight range (Normal). 48(14.12%) of the samples were below -2.0 (undernourished). Those with a BMI <-3 accounted for 12 (3.53%) of the malnourished.

Among 340 children with HAZ (Stunting), 218 (64.1%), were judged normal. 33 (9.71%) of the sample population was malnourished. Eight (2.55%) of the samples were below –3 (severely malnourished).

Similarly, with regards to Wasting, WHZ reveals that the vast majority of children (319, 93.82%) had a normal nutritional status, whereas 8 (2.35%) were extremely malnourished.

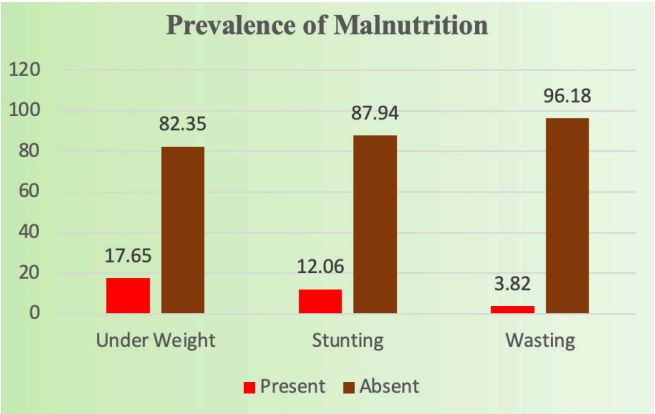

Figure 2 : Prevalence of malnutrition among children under the age of five

From Figure 2, it was understood that 17.65 % of the 340 children screened were underweight, 12.06% were stunted, and 3.82% were wasted.

Table 3 : Mean Height, Weight and MUAC of Under Five Children (N = 340)

S. No	Variables	Mean ± S.D
1.	Height	88.17 ± 9.57
2.	Weight	11.38 ± 2.49
3.	Mid -Upper Arm Circumferences	13.90 ± 0.75

The mean and standard deviation values of the children's height, weight, and mid - upper arm circumferences are

shown in Table III. Height had a mean and standard deviation of 88.17 + 9.57. Similarly, the weight was 11.38 + 2.49, and the mean and standard deviation scores for the mid-upper arm circumference were 13.90 + 0.75.

Table 4 : Age Wise Association between Level of Malnutrition among Under-five children (N = 340)

S. No	Age of children (0-5) yrs.		Malnutrition		Normal		Chi square test	P value
			Malnutrition					
			n	%	n	%		
1.	Underweight	< 1 years	3	5.00	42	15.00	21.93	0.001***
		1-2 years	3	5.00	65	23.21		
		2-3 years	25	41.67	102	36.43		
		3-4 years	14	23.33	40	14.29		
		4-5 years	15	25.00	31	11.07		
2.	Stunting	< 1 years	0	5.00	42	15.00	11.96	0.02*
		1-2 years	6	5.00	65	23.21		
		2-3 years	19	41.67	102	36.43		
		3-4 years	6	23.33	40	14.29		
		4-5 years	10	25.00	31	11.07		
3.	Wasting	< 1 years	0	5.00	42	15.00	4.21	0.30^{NS}
		1-2 years	2	5.00	65	23.21		
		2-3 years	4	41.67	102	36.43		
		3-4 years	0	23.33	40	14.29		
		4-5 years	7	25.00	31	11.07		

Table 5 : Association between level of underweight score and mothers Demographic variables (n = 340)

Demographic variables		Underweight score				Chi square test	P Value
		Malnutrition		Normal			
		n	%	n	%		
Age of the child	< 1 years	3	6.67	42	93.33	**21.92**	**0.001*** **
	1-2 years	3	4.41	65	95.59		
	2-3 years	25	19.69	102	80.31		
	3-4 years	14	25.93	40	74.0		
	4-5 years	15	32.61	31	67.39		
Gender	Male	30	18.63	131	81.37	0.21	0.65^{NS}
	Female	30	16.76	149	83.24		
Mother age	21-25 years	15	12.93	101	87.07	2.72	0.26^{NS}
	26-30 years	30	20.41	117	79.59		
	31-35 years	15	19.48	62	80.52		
Type of family	Nuclear family	36	21.18	134	78.8	3.60	0.16^{NS}
	Joint family	22	13.58	140	86.42		
	Extended family	2	25.00	6	75.00		
Religion	Hindu	55	18.21	247	81.79	0.86	0.65^{NS}
	Christian	3	11.11	24	88.89		
	Muslim	2	18.18	9	81.82		
Locality of Residence	Rural	21	17.07	102	82.93	0.05	0.95^{NS}
	Semi-urban	14	17.72	65	82.28		
	Urban	25	18.12	113	81.88		
Order of birth	1st	21	12.88	142	87.12	**6.82**	**0.05***
	2nd	30	20.27	118	79.73		
	3rd & above	9	31.03	20	68.97		
Occupation of father	Skilled Worker	28	16.87	138	83.13	1.26	0.74^{NS}
	Unskilled Worker	11	16.67	55	83.33		
	Unemployed	1	9.09	10	90.91		
	Technical Professional	20	20.62	77	79.38		
Education of Mother	Post graduate	5	11.63	38	88.37	1.41	0.71^{NS}
	Degree	16	17.20	77	82.80		
	Higher secondary	35	19.02	149	80.98		
	Non formal education	4	20.00	16	80.00		
Monthly family income	Below Rs.5000	12	21.05	45	78.95	1.83	0.61^{NS}
	Rs.5001-10000	20	15.15	112	84.85		
	Rs.10001- 15000	22	20.18	87	79.82		
	Rs.15001-20000	6	14.29	36	85.71		

The table above illustrates the Age Wise Association between Level of Malnutrition among Under-five children. Underweight ($\chi 2 = 21.93$, p 0.001) and stunting ($\chi 2 = 11.96$, $p = 0.02$). had a statistically significant association.

The preceding table depicts the relationship between the demographic characteristics of samples and the prevalence of underweight scores among children under the age of five. In this study, the child's age ($\chi 2 = 21.92$, $p < 0.001$) and birth order ($\chi 2 = 6.82$, $p < 0.05$) were found to be statistically significant in association to the underweight scores of children under the age of five.

Table 6 : Association between level of stunting score and mothers demographic variables (N = 340)

Demographic variables		Stunting score				Chi square test	P value
		Malnutrition		Normal			
		n	%	n	%		
Age of the child	< 1 years	0	0.00	45	100.00	**11.96**	**0.001*** **
	1-2 years	6	8.82	62	91.18		
	2-3 years	19	14.96	108	85.04		
	3-4 years	6	11.11	48	88.89		
	4-5 years	10	21.74	36	78.26		
Gender	Male	25	15.53	136	84.47	3.47	0.06^{NS}
	Female	16	8.94	163	91.06		
Mother age	21-25 years	13	11.21	103	88.79	0.47	0.79^{NS}
	26-30 years	17	11.56	130	88.44		
	31-35 years	11	14.29	66	85.71		
Type of family	Nuclear family	24	14.12	146	85.88	1.41	0.49^{NS}
	Joint family	16	9.88	146	90.12		
	Extended family	1	12.50	7	87.50		
Religion	Hindu	33	10.93	269	89.07	3.38	0.18^{NS}
	Christian	6	22.22	21	77.78		
	Muslim	2	18.18	9	81.82		
Locality of Residence	Rural	14	11.38	109	88.62	2.84	0.24^{NS}
	Semi-urban	6	7.59	73	92.41		
	Urban	21	15.22	117	84.78		
Order of birth	1st	14	8.59	149	91.41	**8.52**	**0.01** **
	2nd	19	12.84	129	87.16		
	3rd & above	8	27.59	21	72.41		
Occupation of father	Skilled Worker	17	10.24	149	89.76	2.99	0.39^{NS}
	Unskilled Worker	12	18.18	54	81.82		
	Unemployed	1	9.09	10	90.91		
	Technical Professional	11	11.34	86	88.66		
Education of Mother	Post graduate	6	13.95	37	86.05	2.77	0.42^{NS}
	Degree	7	7.53	86	92.47		
	Higher secondary	26	14.13	158	85.87		
	Non formal education	2	10.00	18	90.00		
Monthly family income	Below Rs.5000	5	8.77	52	91.23	4.77	0.19^{NS}
	Rs.5001-10000	14	10.61	118	89.39		
	Rs.10001- 15000	19	17.43	90	82.57		
	Rs.15001-20000	3	7.14	39	92.86		

The above table illustrates the association between sample demographics and the prevalence of stunting in children under the age of five. In this study, the age of the children was found to be statistically significant ($\chi 2 = 11.96$, $p < 0.001$) in association to the stunting scores of children under the age of five.

The preceding table depicts the association between the demographic characteristics of samples and the prevalence of wasting scores among children under the age of five. In this study, the child's age ($\chi 2 = 3.88$, $p< 0.05$) and birth order ($\chi 2 = 5.74$, $p < 0.05$) were found to be statistically significant in association to the wasting scores of children under the age of five.

Table 7 : Association between level of wasting score and mothers demographic variables (N = 340)

Demographic variables		Wasting score				Chi square test	P Value
		Malnutrition		Normal			
		n	%	n	%		
Age of the child	< 3 years	6	2.22	234	97.78%	**3.88**	**0.05***
	4-5 years	7	8.70	327	91.30		
Gender	Male	6	3.73	155	96.27	0.01	0.93^{NS}
	Female	7	3.91	172	96.09		
Mother age	21-30 years	8	3.04	255	96.96	1.93	0.16^{NS}
	31-35 years	5	6.49	72	93.51		
Type of family	Nuclear family	9	5.29	161	94.71	1.99	0.16^{NS}
	Joint/extent family	4	2.35	166	97.65		
Religion	Hindu	12	3.97	290	96.03	0.17	0.68^{NS}
	Christian/Muslim	1	2.68	37	97.32		
Locality of Residence	Rural	4	3.25	119	96.75	1.47	0.22^{NS}
	Semi-urban/Urban	9	6.52	129	93.48		
Order of birth	1st	2	1.22	161	98.78	**5.74**	**0.05***
	2nd& above	11	6.21	166	93.79		
Occupation of father	Skilled Worker	13	3.95	316	96.05	0.87	0.35^{NS}
	Unemployed	0	0.00	11	100.00		
Education of Mother	Literate	13	2.33	307	97.67	1.61	0.20^{NS}
	Non formal education	0	0.00	20	100.00		
Monthly family income	Below Rs.10000	8	5.26	181	94.74	0.19	0.66^{NS}
	Rs.10001-20000	5	2.38	146	97.62		

Table 8 : Association between level of knowledge score and mothers demographic variables (N = 340)

Demographic variables		Knowledge score				Chi square test	P Value
		Inadequate/moderate		Adequate			
		n	%	n	%		
Age of the child	< 1 years	38	84.44	7	15.56	12.56	0.13^{NS}
	1-2 years	42	61.76	26	38.24		
	2-3 years	87	68.50	40	31.50		
	3-4 years	39	72.22	15	27.78		
	4-5 years	37	80.43	9	19.57		
Gender	Male	118	73.29	43	26.71	0.80	0.67^{NS}
	Female	125	69.83	54	30.17		
Mother age	21-25 years	88	75.86	28	24.14	5.38	0.25^{NS}
	26-30 years	99	67.35	48	32.65		
	31-35 years	56	72.73	21	27.27		
Type of family	Nuclear family	111	65.29	59	34.71	**11.03**	**0.02***
	Joint family	124	76.54	38	23.46		
	Extended family	8	100.00	0	0.00		
Religion	Hindu	210	69.54	92	30.46	7.58	0.11^{NS}
	Christian	22	81.48	5	18.52		
	Muslim	11	100.00	0	0.00		
Locality of Residence	Rural	77	62.60	46	37.40	**10.30**	**0.05***
	Semi-urban	60	75.95	19	24.05		
	Rural	106	76.81	32	23.19		
Order of birth	1st	114	69.94	49	30.06	8.18	0.08^{NS}
	2nd	105	70.95	43	29.05		
	3rd & above	24	82.76	5	17.24		
Occupation of father	Skilled Worker	110	66.27	56	33.73	**8.20**	**0.05***
	Unskilled Worker	49	74.24	17	25.76		
	Unemployed	8	72.73	3	27.27		
	Technical Professional	80	82.47	17	17.53		
Education of Mother	Post graduate	26	60.47	17	39.53	**10.61**	**0.01****
	Degree	58	62.37	35	37.63		
	Higher secondary	144	78.26	40	21.74		
	Non formal education	15	75.00	5	25.00		
Monthly family income	Below Rs.5000	39	68.42	18	31.58	9.97	0.13^{NS}
	Rs.5001-10000	103	78.03	29	21.9		
	Rs.10001- 15000	68	62.39	41	37.6		
	Rs.15001-20000	33	78.57	9	21.43		

The preceding table depicts the demographic characteristics of samples and the knowledge scores regarding malnutrition among the mothers of under five children. In this study, type of family ($\chi2 = 11.03$, $p < 0.02$), locality of residence ($\chi2 = 10.30$, $p < 0.05$), occupation of father ($\chi2 = 8.20$, $p < 0.02$) and education of mother ($\chi2 = 10.61$, $p < 0.01$) were found to be statistically significant in association to the knowledge scores regarding malnutrition among the mothers of under five children.

DISCUSSION

The results of the present study, which was carried out in anganwadis in Poonamallee HUD, were interpreted using a module of the World Health Organization's (WHO) child development guidelines for the interpretation of nutritional status indicator.

The overall prevalence of underweight was found to be 17.65% among 340 children. The prevalence of stunting among children under the age of five was 12.06%, and the level of wasting was 3.82%. According to a study conducted by Murarkar S et al, (2020) with the goal of assessing the prevalence and determinants of Malnutrition in children under five in Maharashtra, India, the overall prevalence of stunting was 45.9%, wasting was 17.1%, and 35.4% of children were underweight. Wasting, stunting, and underweight were more prevalent in an urban slum than in a rural area.[12]

Wasting could be the result of insufficient food intake or a recent bout of illness that caused weight loss. India bears the greatest burden of wasting, with over 25 million (20%) wasted children. This burden is greater than the combined burden of the next nine high-burden countries.13 Stunting is a symptom of chronic malnutrition, so UNICEF is focusing on stunting in children under the age of five.14 According to the Comprehensive National Nutrition Survey Report (2016-2018), rural areas had a higher prevalence of stunting (37%) than urban areas (27%).[15] The results of this study were in contrast to those of a cross-sectional study that included 563 kids and looked at the prevalence of underweight in kids under five in a rural area of Tamil Nadu, India's Kancheepuram District. That study found an estimated prevalence of 52.9%. IAP determined that 30.9% of people had moderate malnutrition and 47.1% had mild malnutrition. 7% of people had severe malnutrition.[16]

In the present study, results revealed height had a mean and standard deviation of 88.17 + 9.57. Similarly, the weight was 11.38 + 2.49, and the mean and standard deviation scores for the mid-upper arm circumference were 13.90 + 0.75. Areekal B et al. (2014) determined the prevalence of malnutrition among children under the age of five in the Ettumanoor block of Kerala. To reach the sample size, 20 children were drawn from 30 different clusters. Height was measured with

a measuring tape with a sensitivity of 0.5cm, and weight with a weighing machine with a sensitivity of 100grams for children under 2 years old and 500grams for older children. Malnutrition was measured using Z scores from the WHO reference. The mean z height for age was -0.91 with a standard deviation of 1.3 (95% confidence interval) (-1.67 to1.69). Again, the majority of children are below the 50th percentile, and it can be seen that the prevalence of stunting increases up to the 12-24 months category before decreasing, as with underweight. The study population's mean z weight for height was -1.08 with a standard deviation of 1.15 (95% C.I = -2.23 to 0.07), indicating that the majority of children are below the 50th percentile. In this case, the prevalence of wasting increases for 12-24 months before decreasing.[17]

In this study, with regard to Age wise association between level of malnutrition shows Underweight ($\chi 2$ = 21.93, p 0.001) and stunting ($\chi 2$ = 11.96, p = 0.02) had a statistically significant association. In this study, the child's age and birth order were statistically significant predictors of underweight scores in children under five. This study demonstrated a statistically significant association between stunting scores of children under five and age ($\chi 2$ = 11.96, p < 0.001). In this study, the child's age and birth order were statistically significant factors in wasting scores in children under five.

The study's conclusions mirrored those of the papers listed below. Murarkar S et al. (2020) conducted a community-based cross-sectional study in 16 randomly selected clusters in two districts of Maharashtra state, India, and found that birth order has always been a significant predictor of undernutrition. In rural areas, children with birth orders of less than two were more likely to be stunted than those with birth orders of two or more (adjusted odds ratio = 2.11, p 0.05).[12]

CONCLUSION

Mothers of under-5s can identify "at-risk" children in the malnourished community by knowing SAM risk indicators. Underweight was more prevalent than stunting and wasting in the study population. To understand malnutrition and improve health policies, detailed investigations on its causes, aggravators, and associated factors are needed. So, governments and NGOs must address this issue and improve these children's nutrition. Children now will live tomorrow. Hence, kid nutrition is crucial. The first six years are the most important, laying the foundation for cognitive, social, emotional, language, physical, motor, and cumulative lifelong learning. The most vulnerable to the vicious cycles of starvation, sickness, infection, and disability are children under three years old. Child malnutrition is a major cause of child mortality in India and other nations. So, ruling out the nutritional status of high-risk groups would allow the health care delivery system and policymakers identify the core cause of malnutrition and intervene to prevent it.

RECOMMENDATIONS

Regular surveys and home visits should be conducted to monitor and improve the food intake of severely malnourished children. During in-home visits, professionals should educate parents of malnourished children on the necessity of feeding their children well, spacing apart youngsters, and practicing good cleanliness habits.

CONFLICT OF INTEREST Nil

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ORIGINAL ARTICLE - PUBLIC HEALTH

IMPACT OF PANDEMIC ON MORTALITY TRENDS IN TAMIL NADU 2019-2022

Abishek Stanislaus [(1)], Selvavinayagam T S [(1)], Somasundaram A [(1)], Sumathi Veerappan Rajamanikkam [(1)]

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

Abstract

INTRODUCTION : Mortality statistics are needed to estimate the measures of health among the population. It helps to understand differentials in population health among different sub groups in the population (1). The trend of mortality is liable to change during a pandemic and there was increase in number of deaths due to COVID-19. This study is done to determine the mortality trends noted in Tamil Nadu from 2019-2022.

OBJECTIVES : The objectives is to determine the trend in all-cause mortality among total population from 2019-2022 and to determine whether there is any difference in mortality among different age groups, genders and among districts for the years 2019-2022

METHODOLOGY : It was descriptive study from the Civil Registration System data of Tamil Nadu from 2019-2022. Data were collected in excel sheet and calculated mortality rates for total population, both genders, different age groups and by districts for the year 2019-2022.

RESULTS : We analysed all mortality records from 2019-2022. A peak in the all-cause mortality (11.44/1000 population) was noted during the COVID-19 Pandemic (2021) which started to decline Post COVID-19 in 2022 (9.07/1000 population), although the mortality was slightly higher compared to Pre COVID-19 period (2019). Similar pattern was observed in both gender. Male mortality was higher than Female mortality in all four years. Among Age groups, there was a drastic increase of mortality in 60 plus age group during COVID-19 (57/1000 population). All-cause mortality was high in Thanjavur district (10.2/1000 population) during 2019 while the mortality was high in Coimbatore during 2021 (14.4/1000 population) and 2022(11.6/1000 population).

CONCLUSION : All-cause mortality had a significant increase in COVID period and the effect is noted in Post COVID period. Gender specific mortality trend is higher in male compared to Female population in Tamil Nadu. Age specific mortality is higher in 60+ age group and it peaked up during 2021 which might be due to the effect of Pandemic. District specific mortality is noted to be higher in Coimbatore during and following COVID-19.

KEY WORDS : Pandemic, Covid19, Mortality

INTRODUCTION

Mortality statistics are needed to estimate the measures of health among the population. It helps to understand differentials in population health among different sub groups in the population.[1] The global burden of disease assessment begins with precise estimation of the number of deaths in each age and sex group. The data of mortality at different age groups is an important catalyst for public policy action.[2] The mortality rates have increased during the COVID-19 period especially in 2021. In 2021, there were about 8.72 deaths per 1,000 persons worldwide.[3] In India the first case of COVID-19 was reported on 27th January 2020.[4] In Tamil Nadu the first case of COVID-19 was reported on 7th March 2020.[5] There was scarce studies noted assessing the mortality of region or country or state before and after a pandemic. Analysing the mortality trends by age groups, gender and district may give valuable insights for public health interventions. This study is done to determine the mortality trends noted in Tamil Nadu from 2019-2022.

OBJECTIVES

To determine the trend in all-cause mortality among total population from 2019-2022. To determine whether there is any difference in mortality among different age groups, genders and among districts for the years 2019-2022.

METHODOLOGY

The study design was a descriptive study of the mortality in Tamil Nadu State for the period 1st January 2019 -31st December 2022. The study population taken for this study is all registered deaths in Civil Registration System (CRS) of Tamil Nadu. We included all deaths reported in Civil Registration System during the 2019-2022.

OPERATIONAL DEFINITIONS : We defined all-cause

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Corresponding Author : Abishek S
e-mail : abishek299300@gmail.com

mortality rate as deaths during data period (2019-2022) due to all causes divided by total enumerated population

We defined gender specific mortality rate as deaths during data period (2019-2022) due to all causes of the particular gender divided by enumerated population of the same gender

We defined age group specific mortality rate as deaths during data period (2019-2022) due to all causes of the by total enumerated population

We defined district specific mortality rate as deaths during data period (2019-2022) due to all causes of the by total enumerated population of the district

SAMPLE SIZE : We considered all deaths reported during the study data periods for analysis.

DATA COLLECTION PROCEDURE : We collected the mortality data from Civil Registration System software from State Bureau of Health intelligence & population data maintained at statistical division of Public Health Department as enumerated from Census 2011. Both data collected and compiled using excel sheets.

DATA ANALYSIS : We calculated all-cause mortality, gender specific mortality, Age group wise mortality & district wise mortality using proportions for each category of mortality. We used Excel Software for analysis

HUMAN SUBJECT PROTECTION

Our study got approved by Institutional Ethics Committee of Tamil Nadu Public Health department; we maintained privacy and confidentiality in such a way that no personal data was used or revealed during analysis or report preparation & presentation

RESULTS

All-cause mortality rate of total population was 8.42/ 1000 population in 2019 which peaked to 11.44 / 1000 population in 2021 during Covid-19 Pandemic is statistically significant and started decreasing to 9.07 per 1000 population in 2022. The same peak is noted in gender specific mortality rate for both male (13.38/1000 population) and female (9.50/1000 population) during 2021 same as all-cause mortality while it is slightly higher for Male compared to Female. (Table 1)

Age group specific mortality of 0-18 years was almost 1/1000 population for all three years (2019,2021 &2022) which had a slight decrease in 2020 0.9/1000 population. Age group specific mortality of 19-45 years was 2.5 /1000 population on 2019,2020 & 2022 and 2.9 /1000 population on 2021. Age group specific mortality of 46-60 years was 10/1000 population on 2019, 11.2/1000 population on 2020 & 10.5/1000 population 2022 and 13.9 /1000 population on 2021. Age group specific mortality of above 60 years was 40.4/1000 population on 2019, 44.1/1000 population on 2020 & 45/1000 population on 2022 and 57 /1000 population on 2021(Chart 1).

Table 1 : All-cause mortality of total population and both genders

Year	Total Mortality rate		Mortality rate by gender	
	Mortality rate	Confidence Intervals	Mortality rate (Male)	Mortality rate (Female)
2019	8.42	8.40 - 8.44	10.02	6.81
2020	9.08	9.06 - 9.10	10.79	7.36
2021	11.44	11.42 - 11.47	13.38	9.50
2022	9.07	9.06 - 9.10	10.61	7.54

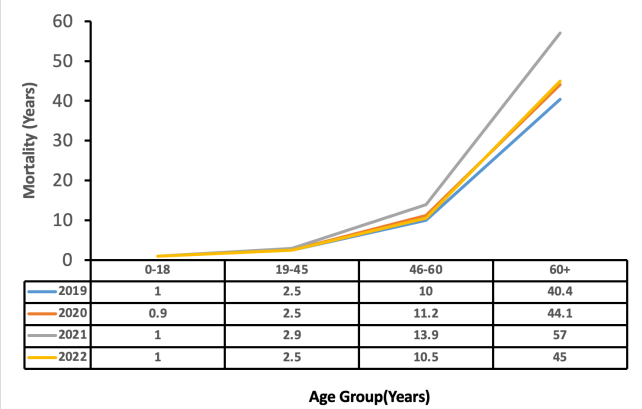

Figure 1 : Mortality rate among various age groups

All-cause mortality in districts was high in Thanjavur district (10.2/1000 population) followed by Madurai(9.9/1000 population), Tiruchirapalli (9.8/1000 population), Perambalur & Coimbatore (9.7/1000 population) in 2019. The mortality was lowest in Thiruvallur (5.6/1000 population) followed by Chengalpattu (6.0/1000 population) & Tiruppur(6.5/1000 population) in 2019. All-cause mortality in districts was high in Madurai district (10.7/1000 population) followed by Tirunelveli (10.5/1000 population), Perambalur & Thanjavur (10.4/1000 population) in 2020. The mortality was lowest in The Nilgris (6.4/1000 population) followed by Tiruppur (7.6/1000 population) &Thiruvallur(7.7/1000 population)in 2020.All-cause mortality in districts was high in Coimbatore (14.4/1000 population) followed by Madurai (13.6/1000 population) & Erode (12.8/1000 population) in 2021. The mortality was lowest in Nilgris (8.1 /1000 population) followed by Thiruvallur (8.8/1000 population) & Nagapattinam (9.4/1000 population) in 2021. All-cause mortality in districts was high in Coimbatore district (11.6/1000 population) followed by Tirunelveli

(11.1/1000 population), Vellore (10.8/1000 population) & Madurai (10.7/1000 population) in 2022. The mortality was lowest in Thiruvallur (7.3/1000 population) followed by Nilgris (7.4/1000 population) & Krishnagiri (7.6/1000 population) in 2022. (Table 2)

Table 2 : Mortality rate among districts

District	Mortality Rate by Districts			
	Years			
	2019	2020	2021	2022
ARIYALUR	9.7	9.9	11.5	9.1
CHENGALPATTU	6.0	9.8	12.1	8.7
KANCHEEPURAM				10.4
CHENNAI	9.5	8.7	12.6	9.3
COIMBATORE	9.7	10.0	14.4	11.6
CUDDALORE	6.8	7.9	9.6	7.8
DHARMAPURI	8.1	8.2	10.0	8.1
DINDIGUL	9.1	9.0	11.5	8.9
ERODE	9.5	9.6	12.8	10.4
KANNIYAKUMARI	7.8	8.0	10.6	9.2
KARUR	8.8	9.4	12.1	9.6
KRISHNAGIRI	6.7	7.8	9.6	7.6
MADURAI	9.9	10.7	13.6	10.7
MAYILADUTHURAI	7.3	8.3	9.4	8.1
NAGAPATTINAM				8.0
NAMAKKAL	8.2	8.4	10.6	8.5
PERAMBALUR	9.7	10.4	12.2	9.2
PUDUKKOTTAI	9.0	9.3	11.0	8.8
RAMANATHAPURAM	7.9	8.5	10.1	8.3
SALEM	8.5	9.1	12.7	9.4
SIVAGANGA	9.2	9.9	12.1	9.6
TIRUNELVELI	9.6	10.5	11.7	11.1
TENKASI				9.0
THANJAVUR	10.2	10.4	12.7	10.3
THE NILGIRIS	7.0	6.4	8.1	7.4
THENI	8.5	9.4	11.5	9.4
THIRUVALLUR	5.6	7.7	8.8	7.3
THIRUVARUR	9.5	9.6	11.6	9.0
THOOTHUKKUDI	8.8	8.7	10.7	8.4
TIRUCHIRAPPALLI	9.8	10.1	12.5	9.8
TIRUPPUR	6.5	7.6	10.4	8.5
TIRUVANNAMALAI	8.3	8.8	10.2	8.1
VELLORE	8.1	8.8	11.0	10.8
RANIPET				7.5
TIRUPATHUR				7.1
VILLUPURAM	7.8	8.8	9.5	7.5
KALLAKURICHI				6.8
VIRUDHUNAGAR	9.4	9.4	11.3	9.6

DISCUSSION

The overall mortality is higher (11.44/1000 population) in 2021 during the COVID period and the post COVID effect is also seen as the mortality rate is slightly higher in 2022 (9.08/1000 population) compared to 2019 (8.42/1000 population). The mortality noted in Tamil Nadu follows the pattern seen in most countries, with higher rates of mortality among men than women.[6] A study done in Tamil Nadu also has revealed the same that the mortality is higher among men compared to women.[6] The mortality by age group is higher in above 60 years (57 /1000 population) especially during the COVID period (2021) and it is the one age group which has increased drastically during the COVID period and the post COVID effect is also seen in 2022 (45 /1000 population) compared to 2019 (40.4/1000population). It was noted in a study that People less than 65 years old have 16–100 fold lower risk of COVID-19 deaths than older people.[7] Among district specific mortality it was noted that during 2019 it was high in Thanjavur (10.2/1000 population), 2020 it was higher in Madurai district (10.7/1000 population), 2021 it was higher in Coimbatore (14.4/1000 population) &2022 it was higher in Coimbatore district (11.6/1000 population). The pattern is almost same in most of the districts. The mortality has peaked in 2021 and started to decrease in 2022 with post COVID effect. Coimbatore district is having the highest mortality compared to other districts during 2021-2022.

CONCLUSION

All-cause mortality had a significant increase in COVID period and its effect is noted in Post COVID period. Gender specific mortality trend is higher in male compared to Female population in Tamil Nadu and the trend has been same during COVID-19. Age specific mortality is higher in 60 plus age group and it peaked up during 2021 which might be due to the effect of Pandemic. District specific mortality is noted to be higher in Coimbatore during and following COVID-19 and it is lower in the Nilgris district during COVID-19

RECOMMENDATION

Cause specific mortality analysis has to be done for these four years to identify the specific causes specifically for mortality among elderly and other age groups. Gender specific Cause of death must be analysed especially in male gender to identify the specific reasons for increased male gender mortality. The districts with higher mortality rates are to be analysed more to identify the reasons for increased mortality.

LIMITATIONS

The data was taken from deaths registered in Civil Registration System. There might be a variation in the district specific mortality as the deaths which are registered might be from the same residence or another residence.

CONFLICT OF INTEREST

Nil

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NOTES FROM THE FIELD - PUBLIC HEALTH

EFFECT OF COMPREHENSIVE PRIMARY HEALTHCARE RANKING SYSTEM ON THE PERFORMANCE OF PRIMARY HEALTH CENTRES IN TAMIL NADU, INDIA

Vidhya Viswanathan [(1)], Manikandanesan Sakthivel [(2)], Banumathi Rajagopalan [(1)], Naveen Paul Pugal Mani [(1)], Sathish Govindaraj [(1)], Sangeetha Ramanujam [(1)], Dakshayini Sivakumar [(1)], Sumathi Veerappan Rajamanikkam [(1)], Suresh K S T [(1)], Selvavinayagam T S [(1)]

(1) Directorate of Public Health and Preventive Medicine

(2) South Asia Field Epidemiology and Technology Network, Inc (SAFETYNET), India

Abstract

BACKGROUND : There is always a need for a multidimensional approach to performance evaluation in health sector. Directorate of Public Health developed a multi-dimensional comprehensive primary healthcare ranking system to monitor the performance of PHCs in the state with twenty crucial programmatic indicators – 15 at PHC level covering institutional and community services and 5 at Health Unit Distirct level for NCDs. Each PHC was scored on each indicator as the percentile of a maximum score of 10, which is given for the best-performing PHC among the PHCs of the same type – Upgraded PHC, Urban PHC, or Additional PHC. We compared the median scores of each of the fifteen PHC level indicators during September 2022 and May 2023 by the type of PHC, to understand whether the new ranking system used during the review meetings improved the performance and documented our experiences. Overall, eight out of the 15 PHC level indicators showed an increase in the median (IQR) score, four showed no difference, and three showed a decrease in the median score. Based on our experiences, the new ranking system helped the administrators to concentrate on the weak domains by type of facilities and by districts, understand the challenges in the implementation of those domains and rectify them as required. It was also observed that during the review meetings, the district officials were able to articulate better on the reasons for low scores and helped them to get much involved and motivated to improvise focusing on the weaker domains.

KEYWORDS : Health Services Administration, India, Primary Health Care, "Quality Assurance, Health Care"

MAIN ARTICLE

The increase in complexity of health organisations, the increase in health expenditure after the COVID-19 pandemic, the prioritisation of programs and the importance of efficiency and effectiveness of the services provided have made performance evaluation of health centres a time-bound need for policymakers.[1] The World Health Organization (WHO) made the first effort to evaluate the performance of health systems in 2000 among 191 countries.[2] A timely management of the performance and, monitoring and evaluation of the programs guarantees the continuous improvement of programs and the reduction of inequalities in health outcomes.[3]

The performance evaluation of health programs seems to be a simple endeavour, starting with what to measure, identifying the proper measures along with their respective data sources, and conducting analysis, aggregation, understanding, and dissemination of the results. However, as simple as it may seem, the difficulty lies in the details. There is always a need for a multidimensional approach to performance evaluation in the health sector.[4] Several countries use performance evaluation as an important indicator for prioritization of the expenditure of funds.

The Directorate of Public Health & Preventive Medicine (DPH&PM), Tamil Nadu, India, administers public health activities and health programs in the state through 45 Health Unit Districts (HUDs), each headed by a Deputy Director of Health Services (DDHS). The primary health care in urban areas is delivered through urban primary health centres (UPHCs) for every 50,000 population and in rural areas by Upgraded Primary Health Centres (UGPHC) and Additional PHCs for every 100,000 and 30,000 population respectively. The PHC areas are further divided into sectors in urban areas and Health Sub Centres (HSCs) in rural areas with 10,000 and 5000 population each as per IPHC standards.[5] Overall, Tamil Nadu state has 2127 PHCs, of which 424 are UGPHCs, 1379 are Additional PHCs and 324 UPHCs.

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Corresponding Author : Vidhya Viswanathan
e-mail : vidhyaviswanathan5210@gmail.com

Additional Directors and Joint Directors who are the State program managers of different health programs and domains and the Director of Public Health (DPH) review the performance of 2127 PHCs in 45 HUDs every week and month by online meetings and in-person review meetings respectively among the DDHS. However, the performance of each domain (e.g., maternal and child health, non-communicable diseases) was reviewed separately. In August 2022, DPH developed a multi-dimensional comprehensive primary healthcare ranking system to monitor the performance of primary health centres (PHCs) in the state with inputs from the state-level program managers managing different domains under the DPH.

The ranking system was based on twenty crucial programmatic indicators from the major domains covering both institutional and community services of PHCs – Eight Maternal and Child Health (MCH) care services, four Non-Communicable Diseases (NCDs), and three general institutional services. Eight MCH indicators selected were based on Antenatal (AN) registration, early AN registration, Iron & Folic Acid (IFA) supplementation to pregnant women, institutional deliveries conducted, immunisation coverage, and sterilisation procedures done and, two negative indicators – higher order birth and low birth weight reported. Four NCD indicators were based on new hypertension, diabetes and cancer cervix and breast cases detected through screening in the PHCs among the eligible population. Three general institutional indicators were based on outpatient, inpatient and laboratory services. The remaining five indicators were on the diagnostic gap for NCDs - hypertension, diabetes, both hypertension & diabetes, cervical cancer and breast cancer which were assessed at the level of HUDs. The details and data source for all the twenty indicators are explained in Table 1 and 2. Data for all indicators were acquired from various Digital Health Platforms run by both the State and Government of India.

In the new ranking system, each PHC was scored on each indicator as the percentile of a maximum score of 10, which is given for the best-performing PHC for that indicator among the PHCs of the same type - UGPHC, UPHC, or Additional PHC. Ranking done among the same type was because of the difference in the population catered, services delivered and availability of resources. Thus, each PHC could get any score between zero to ten for each indicator. The total score for each PHC was the addition of scores from all the indicators. The maximum score for the fifteen indicators was 150 for UGPHCs and 140 for UPHCs and additional PHCs. The five HUD level indicators on the diagnostic gap for NCDs were given any score between zero to five for each indicator, and the scores obtained by the HUD for these five indicators will be added on to each of the PHCs in the respective HUD consolidating to a maximum score of 175 for UGPHCs and 165 for UPHCs and Additional PHCs. The lower maximum score for UPHC and Additional PHCs is because the sterilization services are provided only at UGPHCs with availability of operation theatres. Finally, the Health Unit District score was calculated as the total score of all the PHCs in that HUD. The HUDs were then ranked based on the average score.

This ranking system provided a birds-eye view of the performance of each HUD on all the domains and the overall performance of each HUD compared with other HUDs during review meetings. The review of HUDs based on the new ranking system started in September 2022. The statistics department of the Directorate of Public Health & Preventive Medicine analysed the data from different sources every month to calculate the scores and ranks, which the Director and Joint Directors used to review on the performance of HUDs. The same ranking system was also used for the high-level health department review meetings by the hon'ble Health minister, Chief Secretary and Health Secretary of the state.

Table 1 : Fifteen Indicators at PHC level used in implementation of the comprehensive primary health care ranking system, Tamil Nadu.

Domain	Sl.No	Indicator	Indicator definition	Data Source
MCH Indicators	1	Percentage of Antenatal (AN) Registration	Proportion of estimated target pregnant mothers registered in PICME portal	PICME Portal(State)
	2	Percentage of Early AN Registration	Proportion of estimated target pregnant mothers registered in their 1st trimester in PICME portal	
	3	Percentage of Iron & Folic Acid supplementation (IFA) to AN mothers	Proportion of registered pregnant mothers given IFA supplementation	
	4	Percentage of Fully Immunized Children	Proportion of estimated infant target fully immunized	
	5	No. of Low birth weight reported *(Negative Indicator)*	No. of Low birth weight babies delivered	
	6	No. of Higher Order Birth reported per month *(Negative Indicator)*	No. of pregnant mothers with three or more children	
	7	No. of Institutional Deliveries conducted in PHC	No. of deliveries conducted in PHC per month	TNHMIS portal(State)
	8	No. of Sterilization procedures performed in functional Operational Theaters	No. of sterilization done per month	
NCD Indicators	9	New Hypertension cases diagnosed among target to be screened per month	Proportion of estimated screened individuals diagnosed with hypertension per month	NCD-MTM portal(State)
	10	New Diabetes cases diagnosed among target to be screened per month	Proportion of estimated screened individuals diagnosed with diabetes per month	
	11	New Cervical Cancer cases diagnosed among target to be screened per month	Proportion of estimated screened women diagnosed with cervical cancer per month	
	12	New Breast cancer cases diagnosed among target to be screened per month	Proportion of estimated screened women diagnosed with breast cancer per month	
General Institutional services	13	Outpatient services	Average outpatient per Medical Officer per day in PHC	TNHMIS portal(State)
	14	Inpatient services	No. of Inpatient per month in PHC	
	15	Laboratory tests done	No. of Lab tests done per month in PHC	IHIP Portal(Government of India) & LMIS portal(State)

PICME – Pregnancy & Infant Cohort Monitoring & Evaluation; TNHMIS – Tamil Nadu Health Management Information System; NCD-MTM - – NCD – Makkalai Thedi Maruthuvam - State flagship programme on doorstep delivery of NCD services; IHIP – Integrated Health Information Portal

In this study, we compared the median scores of each of the fifteen PHC level indicators during September 2022 and May 2023 by the type of PHC, to understand whether

the new ranking system used during the review meetings improved the performance of the PHCs and we documented our experiences in the implementation. The five HUD level indicators were the cumulative performance of all PHCs in each HUDs and hence only the 15 PHC level indicators were taken for analysis.

Table 2 : Five Indicators at Health Unit District (HUD) level used in implementation of the comprehensive primary health care ranking system, Tamil Nadu.

Domain	Sl.No	Indicator	Indicator definition	Data Source
NCD Indicators	11	Diagnostic gap for hypertension (Cumulative)	Proportion of hypertension only cases diagnosed in the HUD out of the expected prevalence as per STEPS 2020 - 23.4%	NCD-MTM portal(State)
	12	Diagnostic gap for diabetes cases (Cumulative)	Proportion of diabetes only cases diagnosed in the HUD out of the expected prevalence as per STEPS 2020 - 7.1%	
	13	Diagnostic gap for both hypertension & diabetes cases (Cumulative)	Proportion of both hypertension & diabetes cases diagnosed in the HUD out of the expected prevalence as per STEPS 2020 - 10.5%	
	14	Diagnostic gap for cervical cancer (Cumulative)	Proportion of cervical cancer cases diagnosed in the HUD out of the expected as per TNCRP CIR - 18 per lakh population	
	15	Diagnostic gap for breast cancer (Cumulative)	Proportion of breast cancer cases diagnosed in the HUD out of the expected as per TNCRP CIR - 25 per lakh population	

TNCRP – Tamil Nadu Cancer Registry Project; CIR – Crude Incidence Rate;
NCD-MTM – NCD – Makkalai Thedi Maruthuvam - State flagship programme on doorstep delivery of NCD services

Overall, eight out of the 15PHC level indicators showed an increase in the median (IQR) score, four showed no difference, and three showed a decrease in the median score after implementing the ranking system. Sterilisation services which are provided at UGPHCs, showed the maximum increase (four points) from 2 (0-7) before to 6 (0-10). The next highest increase (two points) was seen in the immunisation domain, overall from 8 (6-9) to 10 (9-10) and in additional PHCs [8 (6-9) to 10 (9-10)]. Though the immunisation score increased by three points in UPHCs from 6 (3-8) to 9 (8-10) and two points in UGPHCs from 8 (6-9) to 10 (9-10), the highest increase was seen in IFA distribution [five points, 4 (1-9) to 8 (7-10)] in UPHCs and laboratory services in UPHCs [three points, 3 (0-4) to 6 (3-8)] and UGPHCs [two points, 6 (0-9) to 8 (6-10)]. The antenatal registration had the next maximum increase (two points) overall [8 (7-9) to 10 (9-10)], in UGPHCs [6 (4-6) to 8 (6-10)], additional PHCs [4 (2-6) to 6 (3-8)] and UPHCs [7 (6-9) to 10 (9-10)].

The performance of the low birth weight indicator declined in all types of PHCs – overall [two points, 9 (8-10) to 7 (6-8)],

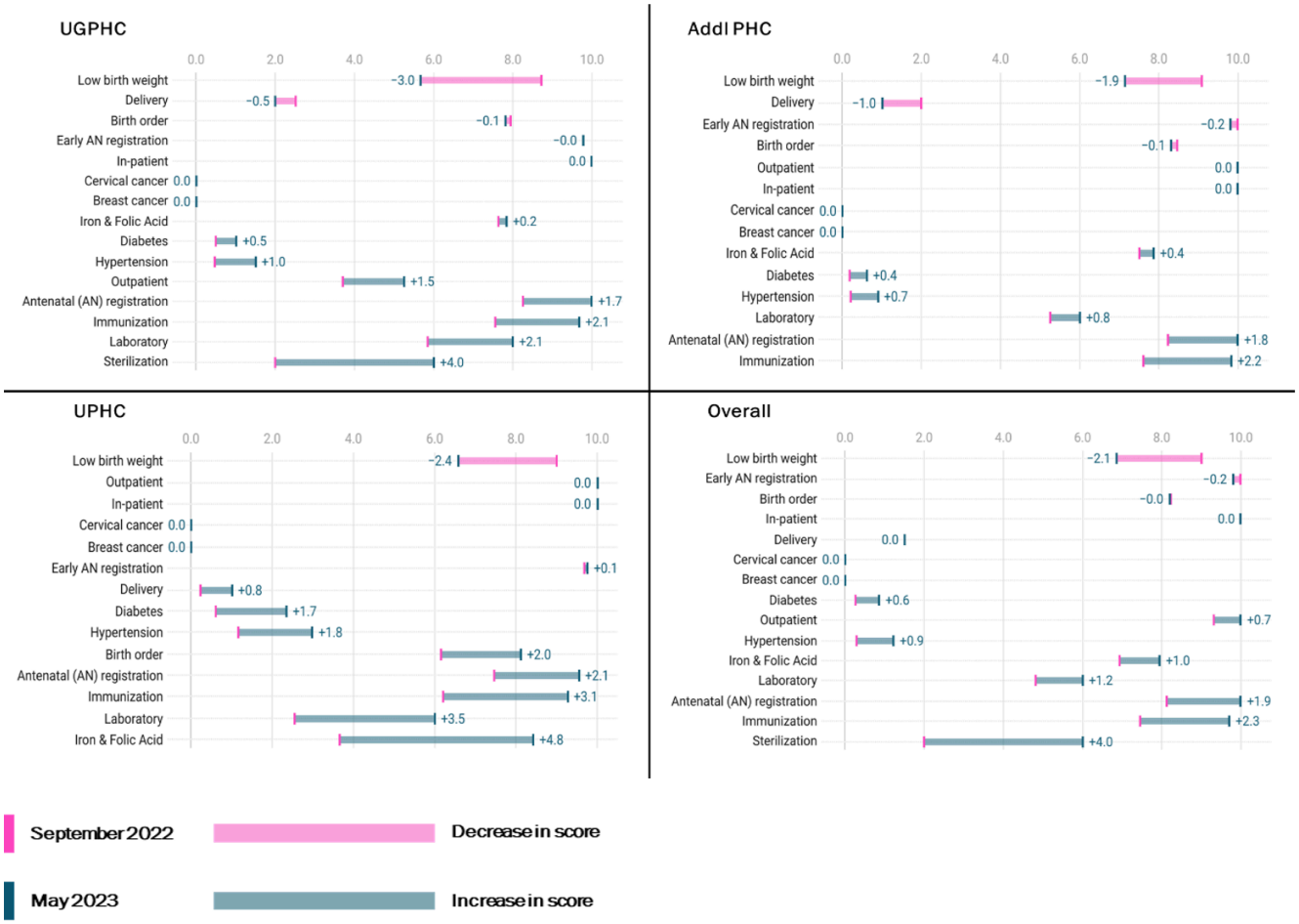

Figure 1 : Median domain scores before (Sep 2022) and after (May 2023) implementation of the comprehensive primary health care ranking system by the type of facility, Tamil Nadu

UGPHCs [three points, 9 (8-9) to 6 (4-7)], Additional PHCs [two points, 9 (8-10) to 7 (6-8)] and UPHCs [two points, 9 (8-10) to 7 (6-7)].

While eight domains improved after implementing the new ranking system, performance of few indicators related to low birth weight decreased in all types of PHCs, and institutional deliveries and birth order related performances decreased in UGPHCs and Additional PHCs.

Based on our experiences, the new ranking system helped the administrators to concentrate on the weak domains by type of facilities and by districts, understand the challenges in the implementation of those domains and rectify them as required. It was also observed that during the review meetings, the district officials were able to articulate better on the reasons for low scores and helped them to get much involved and motivated to improvise focusing on the weaker domains.

Some of the challenges faced while implementing this new ranking system were reporting of extreme values found due to underreporting for the laboratory and cancer services. However, the data quality improved over time with timely reporting and less outliers.

On way forward to improving the ranking system, few more programmatic indicators may be added like adolescent health services and communicable diseases management. Though ranking was done based on the type of PHCs, standardizing by the population catered by each PHC and the human resource availability may also be considered.

We recommend to continue the ranking system; however, we also suggest to interview all the stakeholders to explore the perceived benefits and challenges and unintended consequences. In addition, the reasons why certain indicators didn't improve and why certain indicators declined are to be identified. The quality of this ranking system may also be evaluated by correlating the scores with the vital indicators – MMR, IMR, still birth rate, Under-5 mortality which are determined by the Sample Registration System through surveys.

This ranking system focusses on the basic crucial indicators of the public health programmes, helps in intriguing the PHC team and district officials to get more involved in understanding their performance status and to encourage their efforts to improvise on the weaker areas identified.

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CASE STUDY - PUBLIC HEALTH

USAGE OF ALTERNATE VACCINE CARRIER: BATTERY OPERATED PORTABLE ACTIVE VACCINE CARRIER IN SELECTED 6 DISTRICTS OF TAMIL NADU

Vinay Kumar Krishnamurthy [(1)], Vidhya Viswanathan [(1)], Pradeep Manokaran [(1)], Shikha Srivastava [(2)], Mohini Vijay [(2)], Niranjan Joshi [(2)], Taslimarif Saiyed [(2)], Selvavinayagam T S [(1)]

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

(2) Centre for Cellular and Molecular Platforms (C-CAMP)

Abstract

ABSTRACT : As a part of our Universal Immunization Programme (UIP), we implemented a trial on usage of battery-operated active vaccine carrier in maintaining the vaccines in the recommended temperature for longer duration in outreach sessions and to understand its operational feasibilities and benefits in six districts selected with the aim to cover rural, urban and tribal areas. Active vaccine carriers were found to have the benefit of maintaining vaccines in recommended temperature range for longer durations and the ease of knowing the temperature in the display panel made the HCWs more confident in ensuring the maintenance of recommended temperature at outreach sessions. Issues arising due to improper conditioning of icepacks in the traditional vaccine carriers are eliminated with the usage of active vaccine carriers and this may help to reduce vaccine wastage. These vaccine carriers were found to be best suited for outreach sessions in areas with difficult terrain, hard to reach or inaccessible areas.

KEYWORDS : Mega camps, Mass vaccination, Innovation in Public Health.

INTRODUCTION

One of the essential activities in Public Health is the vaccination of mothers and children through the Immunization programme implemented in India since 1978. In Tamil Nadu, outreach sessions for immunization are being conducted for more than four decades by field staff – Village Health Nurses (VHNs) under the Directorate of Public Health and Preventive Medicine. Proper storage and transportation of vaccines at recommended temperatures from the point of manufacture to the point of use is crucial for successfully implementing the immunization programme. Maintaining the potency of the vaccines, by ensuring they are carried to the session sites in the recommended temperature range is necessary.[1] Utmost importance is given to ensure safe and potent vaccine delivery. Health care workers are adequately trained on the procedures and protocols to be followed while carrying the vaccines from the Cold Chain Points (CCPs) to the outreach session sites. Vaccine carriers play an important part in the successful conduct of outreach immunization sessions by facilitating the transport of vaccines from the Cold Chain Point (CCP) to the outreach session sites. The COVID-19 pandemic has also created a need for mass vaccination and the conduct of frequent, longer outreach camps to improve coverage of beneficiaries.

Passive vaccine carriers with four icepacks, which are currently being used, can hold the vaccines at the recommended temperature range for 36 hours (holdover time), when unopened.[2] But for usage in an outreach session, it is necessary to open the vaccine carrier frequently as per the requirements. Hence the holdover time of vaccine carriers in actual field usage for outreach sessions is reduced to less than 12 hours. Many instances of discarding vaccines due to freezing have been reported worldwide, and preventing vaccine freezing remains one of the biggest barriers in vaccine management.[3] There is currently no vial-level indicator of freeze exposure for vaccines, so health workers worldwide have only the shake test to verify whether vaccines have frozen.[4–6] Unlike heat exposure, where the effect on potency takes from 2 to 30 days at 37 °C, freezing can happen in an instant for freeze-sensitive vaccines.[1]

Active vaccine carriers have notable advantages over traditional vaccine carriers. As the active vaccine carriers have an active cooling system, there is no necessity for icepacks and thereby effects due to improper conditioning

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Corresponding Author : Vidhya Viswanathan
email : vidhyaviswanathan5210@gmail.com

of icepacks like freezing of vaccines, condensation of water around icepacks leading to seepage into open vials are eliminated.

Emvolio is a battery-operated active vaccine carrier developed by Centre for Cellular and Molecular Platforms (C-CAMP) and manufactured by Blackfrog Technologies through the funding support of Hitachi Energy India Limited. The battery-operated active vaccine carrier designed with the WHO specifications and conforming to International Electrochemical Commission (IEC) standards was manufactured with the dimensions of 30cm length, 20cm breadth and 41cm height, 1.8 litres payload capacity and 6.7 Kg weight. It has 311Wh Li-ion battery and requires 4 hours of charging time. The initial cooldown time is 20 minutes. It can maintain vaccines strictly between 2 °C to 8 ° C for more than 12 hours in the field with an accuracy of ±0.5° C in an operating ambient temperature of -20° C to 65° C. The device life claimed is 10 years. The temperature inside the active vaccine carriers can be monitored with the help of a display panel outside, it can be ensured the vaccines are maintained in the recommended temperature range.[6]

As a part of our immunization programme, we implemented a trial from April 2022 to March 2023 on usage of battery-operated active vaccine carrier (Emvolio) in maintaining the vaccines in the recommended temperature for longer duration in outreach sessions and its operational feasibilities and benefits in six districts namely Chennai, Salem, Nilgiris, Tiruchirapalli, Dindigul and Madurai selected with the aim to cover rural, urban and tribal areas. 45 active vaccine carriers were deployed in Primary Health Centres (PHCs) in the six districts. We provided Hands-on training to the Trainer of Trainers (ToT) from the six districts. Site deployment was done followed by training of the respective Health Care Workers (HCW) by the ToT. We have documented our experiences on the daily usage of active vaccine carriers in outreach sessions.

FINDINGS

Totally, 8,674 vaccine vials were carried to the outreach sessions using the active vaccine carriers and 10,550 children and mothers were vaccinated. Around 3,240 vaccine vials were returned to the CCP post immunization session with Vaccine Vial Monitor (VVM) indicating they are in usable state. The daily average usage of active vaccine carrier for nine months from April 2022 to March 2023 in the six districts are shown in Figure 1. The daily usage of active vaccine carriers ranged from 1.51 to 14.26 hours. The maximum average daily usage of active vaccine carrier was recorded in Salem for about 9.28 hours.

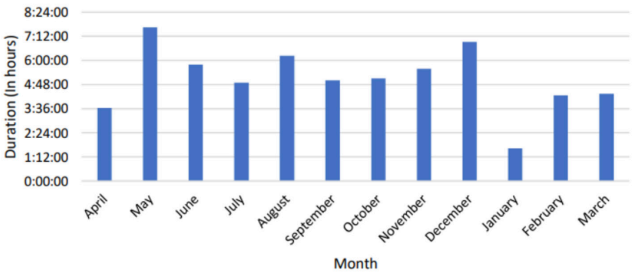

Figure 1 : Month wise Daily average usage of active vaccine carrier for 9 months, Apr,2022-Mar, 2023 in the selected 6 districts, Tamil Nadu

There is no necessity for icepacks and thereby effects due to improper conditioning of icepacks like freezing of vaccines, condensation of water around icepacks leading to seepage into open vials were eliminated. As the temperature inside the active vaccine carriers can be monitored with the help of a display panel outside, HCW found it easier to ensure that the vaccines are maintained in the recommended temperature range. HCWs reported that more vaccine vials were returned efficient to the CCPs after the immunization session than before when using the passive vaccine carriers with four ice packs. With the benefit of maintaining the recommended temperature for longer durations, active vaccine carriers were used in outreach sessions in areas with difficult terrain, hard to reach or inaccessible areas and also areas with extreme high or low temperature ranges. HCWs reported the active vaccine carriers were heavier than the traditional vaccine carriers.

CONCLUSION

Battery operated active vaccine carriers were helpful in maintaining the recommended temperature of the vaccines for conducting longer sessions. The ease of knowing the temperature in the display panel made the HCWs more confident in ensuring the maintenance of recommended temperature at outreach sessions. Issues arising due to improper conditioning of icepacks in the traditional vaccine carriers – like freezing of vaccines, seepage of condensed water in to opened vaccine vials are eliminated with the usage of active vaccine carriers. This may help to reduce the vaccine wastage. These vaccine carriers may be best suited for outreach sessions in areas with difficult terrain, hard to reach or inaccessible areas.

Quantitative studies should be done to compare the maintenance of temperature and vaccine potency between traditional passive vaccine carriers and active vaccine carriers

measuring the parameters like reduction in vaccine wastage, loss of Vaccine Vial Monitor (VVM) and to understand long-term benefits of usage of devices in the field before deploying in larger scale.

CONFLICT OF INTREST

The authors Shikha Srivastava, Mohini Vijay, Manager, Niranjan Joshi, Taslimarif Saiyed are part of the Centre for Cellular and Molecular Platforms (C-CAMP) involved in development of the active vaccine carrier Emvolio.

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CASE STUDY - PUBLIC HEALTH

ELIMINATION IS FEASIBLE IN TAMIL NADU, INDIA- LEPROSY CASE STUDY

Selvavinayagam T S [(1)], Amutha S [(2)], Sudharshini Subramaniam [(3)], Somasundaram A,[(1)] Bhaskaran K [(2)]

(1) Directorate of Public Health and Preventive Medicine

(2) Directorate of Medical and Rural Services (Leprosy)

(3) --

Abstract

BACKGROUND : The goal of public health is eradication and elimination of diseases. Tamil Nadu aims at eliminating 7 diseases namely leprosy, lymphatic filariasis, tuberculosis, malaria, dog mediated rabies, measles, rubella by the year 2025. This article would focus on the status of leprosy in Tamil Nadu and the interventions that are adopted towards eliminating these diseases. Tamil Nadu aims at achieving elimination of leprosy with 90% reduction of new Child cases and 90% reduction of new Grade II deformity cases by the year 2030. Districts are categorized and prioritized based on Annual new case detection rate and grade 2 deformity. District wise leprosy status and the interventions carried out are elaborated in this article. Close monitoring will lead to elimination status in Tamil Nadu.

KEYWORD : Leprosy, elimination, Tamil Nadu

INTRODUCTION

The goal of public health is eradication and elimination of diseases. The Dalhem Workshop's hierarchy of public health interventions for combating communicable diseases includes elimination, eradication, and extinction top in its ladder.[1] Investing in disease elimination should be prioritized because there is mounting evidence demonstrating the socio-economic benefits of eliminating communicable diseases as well as the cost effectiveness of such interventions as a viable solution. Ever since smallpox was eradicated, there have been numerous attempts to eliminate or eradicate various communicable diseases. After evaluating 60 potential diseases, the International task force for disease eradication (ITDFE) shortlisted six diseases for eradication in 1993.[2]

In 1997, WHO passed resolution to eliminate lymphatic filariasis, leprosy, onchocerciasis and Chagas disease as a public health problem.[3]

The history reminds that disease elimination and eradication has not always been successful. The Dahlem workshop on eradication of disease conducted in 1997 developed certain criteria to define indicators of eradicability of disease. The definition of control, elimination as a public health problem, elimination and eradication adapted from Generic framework for control, elimination, and eradication of Neglected Tropical Diseases by WHO is given below (Table 1).[4]

Source - Generic framework for control, elimination, and eradication of Neglected Tropical Diseases

The principal indicators of eradicability are the availability of effective intervention tool to interrupt the transmission of the disease; availability of a valid and practical diagnostic tool which marks the detection of transmission of disease in the community. Elimination of a disease indicates that the intervention is effective. Elimination does not always translate to eradication, as all the intervention which worked in one place may not be effective across everywhere.[1]

Table 1 : Concept of control, elimination and eradication

Concept	Public Health Implications	Acknowledgement process	Risks	Intervention requirement
Control	Reduction of morbidity	None	Increased morbidity and/or mortality	Yes
Elimination as a public health problem	Elimination of morbidity and/or reduction of transmission	Validation	Reintroduction, recrudescence	Yes
Elimination	Interruption of transmission at the national level	Verification	Reintroduction	Yes
Eradication	Global transmission disruption	Certification	Reintroduction	No
Extinction	Complete eradication of a pathogen in nature and in the laboratory		Possibly None	No

Tamil Nadu aims at eliminating 7 diseases namely leprosy, lymphatic filariasis, tuberculosis, malaria, dog mediated rabies, measles, rubella by the year 2023. This article would focus on the current status of leprosy in Tamil Nadu and the interventions that are adopted towards eliminating these diseases.

Leprosy caused by Mycobacterium, is a non- fatal disease, usually affects the skin, peripheral nerves, mucosa of the

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Corresponding Author : Sudharshini Subramaniam
e-mail: sudharshini.subramaniam90@gmail.com

upper respiratory tract, and the eyes. but may be severely disfiguring and disabling. In 1991, WHO set the goal of eliminating leprosy as a public health problem (defined as incidence less than 1/10,000 population) worldwide by 2000, which India achieved by December 2005.[5] All the countries except Brazil has achieved this status. Now WHO has set the Global Leprosy Strategy 2016-2020 with the goal of eliminating leprosy. This strategy coined the term "Towards Zero leprosy" with a long term vision of achieving zero new cases, zero disability and zero stigma due to leprosy across the world, however the target timeframe is not specified.6 The global target for leprosy elimination aims at zero children diagnosed with leprosy and visible deformities; rate of newly diagnosed leprosy patients with visible deformities of less than 1 per million; and absence of legislation allowing discrimination on the basis of leprosy.[6] India has highest leprosy burden (52% of new cases) in the world.[7] The national goal for leprosy elimination is prevalence rate <1 /10000 at block level, newly diagnosed leprosy patients with visible deformities of less than 1 per million; and zero leprosy transmission in the community. Tamil Nadu contributes to 4% of the total cases in India. The epidemiological indicators of leprosy in India and Tamil Nadu is given in Table 2.

Table 2 : Epidemiological indicators for leprosy in India and Tamil Nadu 2021-22

Indicator	India [1]	Tamil Nadu [2]
Prevalence rate (per 1 lakh population)	0.45	0.29
Annual New Case Detection Rate (per 10000 population)	5.52	2.92
Proportion with Multi bacillary leprosy	61%	58.8%
Proportion of leprosy patients who are children	5.76%	9.37%
Proportion of leprosy patients who are women	40%	39.05%
Grade 2 leprosy (per million population)	1.36	1.16
Proportion of leprosy patients with Grade 2 disability	2.48%	4.95%

Source –1- National Strategic Plan and Roadmap for leprosy 2023-2027.; 2. State Leprosy Office, Directorate of Public Health and Preventive Medicine, Tamil Nadu.

The elimination goals for Tamil Nadu to be achieved by 2030 are as follows:

- Elimination of Leprosy with an aim to prevent the occurrence of fresh Leprosy cases in the community.
- 90% reduction of new Child cases
- 90% reduction of new Grade II deformity cases

The epidemiological trend of leprosy in Tamil Nadu is shown in Table 3. The current performance of the State shows that, we have potential to reach elimination. In Tamil Nadu, the indicators are not uniform across the district.

Table 3 : Epidemiological trend of leprosy in Tamil Nadu

Event	Time	Cases under treatment	Prevalence Rate
Start of MDT	May 1983	580281	118
Fully covered by MDT	April 1991	173027	31
Integrated with PHC	August 1997	44289	7
State level Elimination	March 2005	5503	0.85
Dist. Level Elimination	March 2006	3919	0.60
Current Status	March 2023	2310	0.29

Table 4a : Leprosy essential indicators of Tamil Nadu – April -May 2023.

	High ANCDR	Low ANCDR
High Grade 2 deformity	7 **Highest Priority**	10 **High Priority**
Low Grade 2 deformity	4 **Moderate Priority**	17 **Low Priority**

Table 4b : Classification of districts based on priority and interventions carried out

	Highest Priority Districts	High Priority Districts	Moderate Priority Districts	Low Priority Districts
List of districts	Kanchipuram Erode Thiruvallur Villupuram Salem Krishnagiri Chengalpattu	Tuticorin Ranipet Namakkal Cuddalore Pudukottai Kallakurichi Vellore Nagapattinam Thirupathur Trichy	Perambalur Thiruvannamalai Mayiladuthurai Thirupathur	Dharmapuri Theni Virudhunagar Thanjavur Sivagangai Tenkasi Dindigul Ramanathapuram Madurai Karur Ariyalur Kanniyakumari Coimbatore Thiruvarur Thirunelveli Chennai Udagamandalam
Interventions	• LCDC (Twice a year) • PEP • SLAC • G2D Investigation • High intensity IEC • Intensified Surveillance for hidden cases • DPMR	• LCDC (Twice a year) • PEP • SLAC • G2D Investigation • High intensity IEC • Intensified Surveillance for hidden cases and backlog cases • Collaboration for case detection under other programmes • DPMR	• Targeted Active Case Detection • Focussed Leprosy Campaign • PEP • Focused IEC • Sustained Surveillance • DPMR • Validate G2D status	• Targeted Active Case Detection • Focussed Leprosy Campaign • Sustained Surveillance • DPMR • Collaboration for case detection under other programmes • Validate G2D and ANCDR status

Source –State Leprosy Control Unit, Tamil Nadu

LCDC- Leprosy Case detection Campaign; PEP – postexposure prophylaxis; SLAC- Sparsh Leprosy Awareness Campaign; G2D – Grade 2 disability; DPMR- Disability Prevention and Medical Rehabilitation; ANCDR- Annual New Case detection Rate; IEC – Information Education Communication.

India is also now targeting at zero transmission of Leprosy by 2027 through Leprsoy Mukth Bharath (Leprosy Eliminated India) under National Leprosy Eradication Program(NLEP).[5]

It is a centrally sponsored Health Scheme of the Central

Ministry of Health & Family Welfare. NLEP strategies and plans are formulated centrally; the program is implemented by the State Government since 1955. The program is also supported by partners like World Health Organization, International Federation of Anti leprosy Associations (ILEP) and certain Non - Government organizations. The other organizations supporting the program are World Bank., DANIDA, NOVARTIS . The leprosy control in the country as well as globally has gone through a tremendous change over years. When the world had no idea about the disease, the control measure adopted was isolation and restriction of movement. A breakthrough in leprosy control happened when sulfones were discovered in 1940s and Dapsone was found to be effective against leprosy. With the introduction of Dapsone, the country had its program for leprosy called "National Leprosy Control program" since 1955. The strategy then was "Survey, Educate and Treat" (SET strategy) to detect and initiate treatment for leprosy early, through formation of leprosy control units and SET centres with help of paramedical workers.[8] While the world was beginning to celebrate its victory against leprosy, a downfall as resistance to Dapsone monotherapy was observed and there was a resurgence in the 1970's. Multidrug therapy (MDT) with Dapsone, Rifampicin and Clofazamine for leprosy was introduced, which became the cornerstone of leprosy treatment. MDT was introduced in phased manner in India since 1983 and donation of MDT by global agencies was a game changer. With the advent of MDT, the country rechristened the name of the program to National Leprosy Eradication program since 1983. World Health Organization (WHO) distributes MDT Drugs for Free to worldwide Patients. By the year 1991, the state was fully covered with MDT. Five different phases of Modified Leprosy Elimination Campaign were conducted from 1998 to 2004 and India achieved the goal of eliminating leprosy as a public health problem by 2005. The other key change which happened was merging of leprosy program with the general primary health services since 2005. The concept of District Nucleus team was introduced in 2006. There were no separate leprosy units, the existing staff had to take up case finding and follow up along with their regular duties.[8] The current organogram of NLEP in Tamil Nadu is given in Figure 1.

District Nucleus Team (DNT) is the main coordination center for NLEP activities. The District Leprosy Officer is the nodal officer & the team Consisting of Health Educator, Non-Medical Supervisor, Health Inspector, Physiotherapy technician & Lab. Technician. DNT is responsible for overall program planning, implementation, monitoring, supervision, and training. They are also entrusted with the responsibility of validating new child cases and those with deformity. They are responsible for indenting of supplies for MDT, managememt of reaction and complications. They will coordinate cases for RCS and look after transportation and payment of incentives. They are responsible for collection and compilation of reports in the district.

Figure 1 : Organogram of Leprosy program in Tamil Nadu.

District Nucleus Team (DNT) is the main coordination center for NLEP activities. The District Leprosy Officer is the nodal officer & the team Consisting of Health Educator, Non-Medical Supervisor, Health Inspector, Physiotherapy technician & Lab. Technician. DNT is responsible for overall program planning, implementation, monitoring, supervision, and training. They are also entrusted with the responsibility of validating new child cases and those with deformity. They are responsible for indenting of supplies for MDT, managememt of reaction and complications. They will coordinate cases for RCS and look after transportation and payment of incentives. They are responsible for collection and compilation of reports in the district. As such the NLEP programme is under administrative control of DPH.

EFFORTS TAKEN IN TAMIL NADU AS PART OF THE NLEP TO ELIMINATE LEPROSY

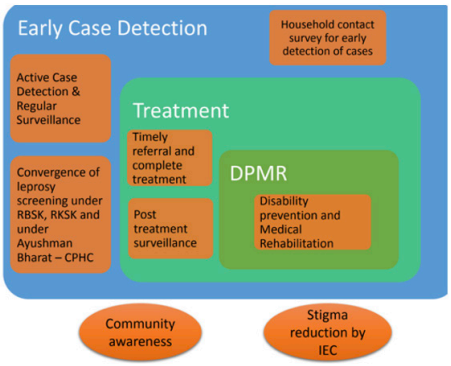

Figure 2 : Strategy to eliminate leprosy

CASE DETECTION

Early case detection through active case detection and regular surveillance- leprosy is now converged with routine health care under Ayushman Bharath and is one of the component of comprehensive primary health care services. Hence screening among children is done as part of Rashtriya Bal Swasthya Karyakram and Rashtriya Kishore Sakthi karyakram. Case detection for leprosy is done through 3 different strategies as mentioned in Table 5.

Table 5 : Case Detection strategy under National Leprosy Eradication Program

Passive Case detection	Public and private facilities should be able to diagnose presumptive leprosy cases
Active Case Detection	Active case detection activities ongoing in NLEP are under following names LCDC (Leprosy Case Detection Campaign), ACDRS (Active Case Detection Campaign), ABSULS (Asha Based Surveillance for Leprosy Suspects), FLC (Focussed Leprosy Campaign), SAP (Special Action Plan) etc. Integrated Case Detection for leprosy cases is also conducted in partnership with other active case finding campaigns under programmes for Tuberculosis / NCD-Non-communicable Diseases / LF lymphatic filariasis / Kala-azar/ COVID-19 etc.
Intensified Case detection	Every patient seeking health services, especially in the high endemic areas should be screened for sign & symptoms of leprosy. To start with, general OPD and Dermatology OPD may initiate this approach

Leprosy Case Detection Campaign (LCDC) is one of the main strategies to achieve Leprosy elimination envisaged by Central Leprosy Division, New Delhi. This will help us in identifying all hidden cases in the community to prevent the transmission of Leprosy in the community. Districts with high G2D cases and high ANCDR are prioritized for LCDC. For the year 2023, LCDC will be conducted in 66 blocks and 12 urban areas in 21 districts of Tamil Nadu.

The current strategy for early case detection involves a multipronged approach, to ensure that cases are not missed out. However the case detection in its present form is highly dependent on clinical suspicion, due to lack of rapid diagnostic technique for diagnosis of leprosy. Slit Skin Smear which supports the diagnosis of leprosy often fails to detect the bacilli when the concentration of bacilli is below 104 bacilli/ml and hence not reliable in patients with low bacillary load. Skin biopsy which is highly reliable is not feasible in field settings. While investing on research and development for newer rapid and valid diagnostics is a global priority, capacity building of all stakeholders involved in screening should be targeted. All stakeholders should be trained on confirmation of diagnosis and classification through nerve function assessment by voluntary muscle testing and sensory testing (VMT/ST). Under the program, every year Medical officers and field health workers are trained through State leprosy Control Program.

MANAGEMENT OF LEPROSY

All patients with leprosy are given free of cost treatment with Multidrug therapy to prevent development of disabilities and deformities. In the year 2021-22, among the patients who were on MDT, the completion rate was 98% for Paucibacillary and 96% for multibacillary in Tamil Nadu. Under disability prevention and medical rehabilitation, reconstructive surgeries(RCS) are performed, protective/ micro-cellular (MCR) rubber footwear, aids and appliances are provided to patients. To provide RCS, 2 government institutions and non-governmental institutions have been recognised in Tamil Nadu. The following aid and appliances are provided to the needy patients: Goggles, Wheel chairs, Walking Sticks, Walkers, Exercise Balls, Plastic Basins, Elbow / Auxiliary Crutches, Artificial Limbs, Upper / Lower limb Splints, Self-care kits, Slings, Hand Gloves, Immobilizers & Hand Grip aid Kits.

All cases during treatment, PB or MB, should be followed up at least once in a month by a health staff through home visit. This home visit should not only ensure the complains to treatment but also screen the case for side effects and incidence of lepra reaction. This home visit will also provide an opportunity for the health provider to screen the household contacts of the leprosy case repeatedly every month.

Institutional services for rehabilitation is provided through Government rehabilitation homes. The state has 10 such rehabilitation homes. The services that are provided through these homes are Medical care, Surgical care, Ulcer Management, Physiotherapy and vocational rehabilitation like Kitchen gardening, Bandage, Tailoring, Mat weaving, Chappal repairing, Broom stick making etc. Apart from such rehabilitation homes, there are 6 Government leprosy Hospitals which provides institutional services for leprosy patients like Outpatient services, in patients admission, referrals in, physiotherapy, ulcer management, treatment for general illness, treatment for leprosy complications and distribution of MCR footwear.

REDUCING INCIDENCE OF LEPROSY

MDT is beneficial for people with the disease, however MDT has reached its peak potential warranting further strategies to reduce the incidence of leprosy. Chemoprophylaxis (Post exposure Prophylaxis) for leprosy contacts with Single Dose Rifampicin(SDR) is the current strategy in place for leprosy elimination. Contact survey should be done for all newly detected cases. In rural areas, the entire village population where new case was detected is covered under screening. In Urban areas, 100 houses on either side of the patient's house is covered. Contacts age ≥ 2 years who have been living

/ working / having social activities for more than 3 months & 20 hours / week with a newly detected case of leprosy in the last 1year are eligible for SDR. As shown in Table 6, for every 1 new case detected, almost 500 contacts are screened and almost 10 contacts were given SDR in Tamil Nadu.

Table 6 : Contact survey among leprosy cases in Tamil Nadu

Year	No of new cases	No of contacts screened	No of new cases detected among contacts	No of contacts eligible for SDR	No SDR administered
2019-20	4252	2731255	211	32011	30124
2020-21	1769	785703	101	14829	13693
2021-22	2434	953605	86	22905	20934
2022-23	3090	1285260	123	31171	29030

Source - State Leprosy Office, Directorate of Public Health and Preventive Medicine, Tamil Nadu

To reduce incidence, post exposure prophylaxis with single dose Rifampicin –hence all contacts are under surveillance. Contact tracing for leprosy is done through different strategies –All types of contacts should be screened within a week of diagnosis of the index case. The other strategies are repeat contact tracing, retrospective contact tracing, reverse contact tracing.

The other strategy under consideration is vaccine against leprosy. Several vaccine options have been under trial in the past 4 decades, of which only BCG is found to be effective. The other vaccines under trial are MIP and LepVax.[9] Vaccine trials are not successful because of the inability to culture M. leprae in artificial media.

SOCIAL SUPPORT FOR LEPROSY PATIENTS

Welfare allowance of Rs 12,000 is given to patients for their reconstructive surgery. Access to social support and rehabilitation including reconstructive surgery, monetary support in the form of monthly pension of Rs 2000 as leprosy cured Maintenance Grant is given for those who have completed treatment but has deformity. The grant is given through differently abled department and locomotor aids is provided to patients with deformity.

PREVENTION OF STIGMA, DISCRIMINATION AND VIOLATION OF HUMAN RIGHTS

SPARSH leprosy awareness campaign is observed fortnightly from January 30 – February 13 to increase awareness and reduce stigma related to disease. To created awareness among school students, leprosy is included as a topic in Science textbook of Class IX. Different media are used for spreading awareness about leprosy and to reduce stigma against leprosy.

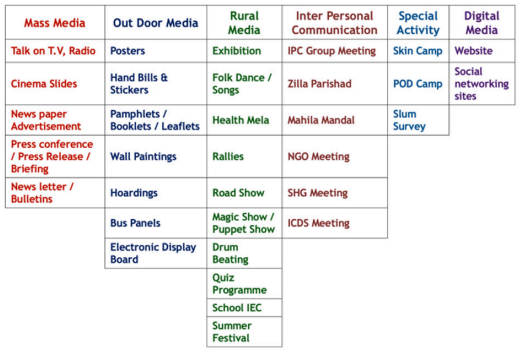

Figure 3 : Various media used for awareness creation in leprosy

Counselling and mental health services is an integral part of Leprosy management. Patients are counselled for Acceptance of disease, Regular Treatment and follow up; family members are counselled to alleviate fear about leprosy and scientific facts about leprosy.

All discriminatory laws, both at the national and sub-national level were repealed. In Tamil Nadu, around 13 acts have been identified which are discriminatory in nature, out of which 8 have been amended and the rest amendment is in process (Table 7).

Table 7 : List of laws amended in Tamil Nadu

Sl.No	Title of the act	Action Taken
Laws Setting up Universities		
1	Alagappa University Act, 1985	Amended
2	Mother Teresa Women's University Act, 1984	
3	Bharathiyar University Act, 1981	
4	Tamil University Act, 1982	
5	Bharathidasan University Act, 1981	
6	Madurai Kamaraj University Act, 1965	
7	Madras University Act, 1923	Under Process
Municipal Laws including Panchayat Raj acts		
8	Coimbatore City Municipal Corporation Act, 1981	
9	Madras Panchayat Act, 1958	
Laws relating to Transport		
10	Chennai Metro Railway (Carriage and Ticket) Rules, 2014	
Beggary laws		
11	Tamil Nadu Prevention of Begging Act, 1945	Under Process
Laws regarding representation in religious institutions		
12	Tamil Nadu Hindu Religious and Charitable Endowments Act, 1959	Under Process
Excise Laws		
13	Tamil Nadu Excise Act, 1971	Amended

STRENGTHENING OF SURVEILLANCE

In Tamil Nadu under Section 62 of Tamil Nadu State Public Health Act, leprosy was declared as a notified disease. Under section 64, every medical practitioner who in the course

of their practice, becomes, cognizant of the existence of any notified disease, give information of the same with the least practicable delay to the local health authority (i.e) Deputy Director of Health services in districts, City Health Officers and Municipal Health Officers or executive authority in Corporations and Municipalities concerned. Under section 134 (1) of Tamil Nadu Public Health Act, 1939 also informed that, failing to notify Leprosy will be liable for a penalty.

Introduction of NIKUSTH - A real time leprosy reporting software across India was introduced as a digital surveillance mechanism under Ayushman Bharat Digital Health Mission. All patients diagnosed with leprosy are continuously under follow up and those released from treatment are under surveillance for a period of 5 years. The contacts of these patients are also under surveillance.

CURRENT CHALLENGES

There are certain impediments which may hinder the process towards elimination of leprosy. The challenges are absence of a fast and point of care diagnostic tool leading to delay in detection of the disease; limited clinical expertise at all levels requiring training and retraining continuously; limited research on newer drugs or vaccine; stigma and discrimination; longer incubation period which requires a long duration follow up for contacts. Urbanization and Migration further poses a challenge for screening and follow Patients are considered cured and released from treatment if they had completed their course of treatment. Since the bacteremia is not tested, there is no assurance if the patient is free from disease and makes the possibility of relapse higher. Longer duration of treatment and adverse effects leading to poor compliance; antimicrobial resistance; potential animal reservoirs making zoonotic transmission a possibility; paper based reporting challenges reporting and surveillance; and stigma & discrimination associated with the disease makes leprosy a poor candidate for eradication.

CONCLUSION

Despite these challenges, leprosy has shown a declining trend. A strong political and other stakeholders commitment with efficient strategies in place, elimination of leprosy with zero new transmission by 2030 is a definite possibility in Tamil Nadu.

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SCIENTIFIC LETTER - PUBLIC HEALTH

CHRONIC KIDNEY DISEASE DATABASE IN TAMIL NADU - NEED OF THE HOUR

Goutham K [(1)], Selvameena M [(2)], Ezhil S [(3)]

(1) Directorate of Public Health and Preventive Medicine
(2) Department of Community Medicine ,Virudhunagar Medical College
(3) Department of Community Medicine, Sivagangai Medical College

Abstract

BACKGROUND : Chronic Kidney Disease (CKD) and Chronic Kidney Disease of Unknown Etiology (CKDu) are in the rising trend in Tamil Nadu especially in rural regions. It not only burdens on the mortality rate but also affects the quality of life of the people. At least Rs 1 of every Rs 10 claimed under the Tamil Nadu Chief Minister Health Insurance Scheme goes for Hemodialysis. . There is a wide knowledge gap in the disease's trend, distribution and other parameters affecting the course of the disease. CKDu is found to have multifactorial etiologies and is prevalent only in certain pockets all over the state. Our regular screening tools could not identify these patients early; hence they seek medical care only during the terminal stages of the disease.Formulating active screening for kidney injury and maintaining a CKD database will help us in the early identification and treatment of the disease. It will also help in identifying CKD Hotspots, which will help in a better understanding of the disease and may even help to formulate a scoring system using the risk factors for CKDu and subsequently design prevention strategies for the disease in a cost-effective manner.

KEYWORDS : Chronic Kidney Disease, Chronic Kidney Disease of Unknown Etiology, Database.

INTRODUCTION

According to recent guidelines of Kidney Disease Improving Global Outcomes (KDIGO, 2013), CKD is defined as abnormalities in kidney function and or structure, present for more than 3 months with implications on health.[1]

In 2017 the global prevalence of CKD was 9.1% (697.5 million cases). The age-standardized global prevalence of CKD was higher in women and girls (9.5%) than in men and boys (7.3%).[2] The CKD prevalence in the Indian population was 10.2% (2018).[1]

CKD is associated with eight to tenfold increased cardiovascular mortality in 35.8 million disability-adjusted life years (DALYs). In 2017, CKD resulted in 1.2 million deaths and was the 12th leading cause of death worldwide.[1]

In recent times CKDu (Chronic Kidney Disease of Unknown Etiology) has been recognised as a separate entity and a major cause of Chronic Kidney Disease besides Diabetes or Hypertension. In the clinical context, a patient is labelled as CKDu after excluding all the known causes of CKD. The clinical features indicated to be consistent with the tubulointerstitial pattern of injury.[2]

Chronic Kidney Disease (CKD) and Chronic Kidney Disease of Unknown Etiology (CKDu) are in the rising trend in the past 20 years or so in various countries like Sri Lanka, Central America and India. It has also been documented or suspected in Nicaragua, El Salvador, Costa Rica, Guatemala, Mexico, Panama, Egypt, Tunisia, Cameroon, Egypt, South Africa, the Philippines, Taiwan, Indonesia, Thailand, the United States, and the United Kingdom.[2]

CKD AND CKDU IN SOUTH INDIA

In India, CKDu was first reported from Uddanam region of Andhra Pradesh in 2018.[1] Despite a long history of CKDu, only recently, studies on CKD were done in Uddanam region, Andhra Pradesh, which showed a prevalence of CKD as 18.3 % and 13% as CKDu. Clusters with high CKD burden have also been reported from other districts in Andhra Pradesh, in particular, Nalagonda, Prakasam, and Nellore, suggesting this problem is likely to be more widespread than was originally assumed.[2] Extensive studies are being conducted in Uddanam region which includes analyzing the water quality, fertilizers, heat stress, and personal behaviours The STOP-CKDu investigators in Uddanam are following up with their cohort studies to estimate the incidence of CKDu as well as its risk factors. Bio-banked samples collected by them allow exploration of additional hypotheses and ancillary studies are in progress. These studies paved way to define CKDu in Indian perspective and classify it as probable, possible and

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definite cases of CKDu for the ease of identification and screening.[3]

CKD AND CKDU IN TAMIL NADU

In Tamil Nadu, CKDu is reported in Villupuram, Cudallore, Vellore, Sivagangai, Virudhunagar, Tutucorin, Ariyalur, Thiruvannamalai, Perambalur. A recent report from a referral center at Puducherry reported 2424 consecutive CKD patients — of whom a disproportionate proportion (56%) came from the districts of Villupuram and Cuddalore in Tamil Nadu and approximately 52% were classified as CKDu. A subsequent community-based CKD screening program in those villages revealed a CKD prevalence of 19%[2]. A recent study in rural area in Virudhunagar district (2022) showed prevalence of CKD as 20.3 % and CKDu as 10.9%. In a study conducted by Tamil Nadu Government in 2022, the CKD prevalence of Tamil Nadu state was only 8.7% with majority in rural regions and most of the cases were silent as only 6.8% reported symptoms.[4] This wide range of CKD prevalence confirms that there are 'CKD hotspots' where CKD prevalence is high in some areas especially rural areas. Hence there is a dire need to identify these hotspots to compare etio-pathological patterns in different hotspots and non hotspot regions.[1]

FINANCIAL BURDEN OF THE DISEASE

The total number of patients relying on dialysis has risen up drastically in the past few years. As per Pradhan Mantri National Dialysis Program (PMNDP), as of June 2023, there are 9410 Hemodialysis machines and around 212.74 lakhs Hemodialysis sessions were conducted in India. Tamil Nadu has the 2nd highest number of functional dialysis machines of 932 next to Kerala which has 1025.[5] At least Rs 1 of every Rs 10 claimed under the Tamil Nadu Chief Minister Health Insurance Scheme goes for Hemodialysis. Between 2017 and 2018 the government approved Rs 1000 each to 216,923 claimants per dialysis cycle.[6] The Indian dialysis market is estimated to be growing at a rate of 31% per annum, compared with 8% in the rest of the world. Payment for dialysis is by a mixture of state funding, employment-based insurance, charity, and self-funding. Most patients pay for dialysis from their own pocket as they are not eligible for state funding and are not covered under insurance. This includes most of the rural population engaged in farming and those working in the unorganized sectors. The high rate of catastrophic healthcare spending, supported by distress financing, that pushes families into poverty is well documented.[7] Considering the cost of renal replacement and the magnitude of the problem it appears that the best way forward for our country would be to adopt the strategy for prevention.[1]

IMPORTANCE OF CKD DATABASE

Sri Lanka is the first country to identify and report CKDu. They have conducted numerous studies regarding CKD, to find out the cause. They have established a CKD registry portal in 2015.[8] Japan has a well-organized CKD database. The use of establishing these databases is very well documented and can be well appreciated with subsequent studies conducted using its data. Using the CKD database we can identify CKDu prevalent and non-prevalent areas and use this data to conduct cohort studies.

A study on Drinking water quality in CKDu prevalent and Non-prevalent areas in Gradurukotte, Sri Lanka (2016), showed significant difference in pH, EC(Electrical conductivity), TDS(Total dissolved solids), Potassium, Chloride and calcium levels between CKDu prevalent and Non prevalent areas.[9] In yet another study done in Sri Lanka (2015), the drinking water quality of four areas namely high CKDu prevalent areas, Low CKDu prevalent areas, CKDu isolated pockets and control areas were examined for Fluorine, Aluminium, Cadmium, Arsenic levels, and hardness of water. It was found that the peculiar distribution patterns of CKDu prevalence pointed to synergic effects of trace elements in water suggesting as probable etiology of the disease.[10] In another study in Sri Lanka in 2020, isotopic samples were collected in CKDu endemic areas, to identify the sources of the pollutants, especially Silica in groundwater. It emphasized the need for frequent sampling to capture the potential pollutants in future groundwater quality studies in endemic CKDu areas.[11] These studies would not have been possible without the proper establishment of CKD database. From these types of studies, we can understand that the CKDu has multifactorial causes like drinking water contamination, exposure to agrochemicals, heat stress, air pollution (not yet received consideration as a contributor to CKD in India, probably due to lack of supporting data), infections like Leptospirosis, and genetic association.[2]

IMPORTANCE OF CKD SCREENING AND CKD DATABASE IN TAMIL NADU

The absence of kidney registries in most of the low- and middle-income countries had made it difficult to understand the true burden of CKD, especially in a developing country like India. Community surveys showed that the number of people with end-stage kidney disease was only tip of the CKD iceberg. Limited financial resources, lack of infrastructure

and inadequate human resources are putting severe strain on existing health policies with respect to increasing burden of CKD and its screening and management.[1]

Since our regular screening tools could not identify CKD patients, they seek medical care only during the terminal stages of the disease. It is clearly evident that the CKD database has much greater use , like identifying the multifactorial causes for CKDu, which can help in better screening, early identification and management and even formulating a scoring system for the same, which can be subsequently used for prevention of the disease in a cost and time effective manner. Hence the need of the hour is to create a CKD database which in addition to identifying new CKD patients, also record co-morbid factors like Diabetes (DM), Hypertension (HT), Obesity and possible etiological factors namely age, sex, socioeconomic status, source of drinking water, type of utensils used, family history for CKD, history of high osmolar drinks, history of dehydration and previous history of kidney injury. With the help of these data, further researches like case-control studies, cohort studies, and experimental studies can be planned for early identification and prevention of the disease.

ESTABLISHING CKD DATABASE USING EXISTING SCREENING TOOLS FOR DETECTION OF NON-COMMUNICABLE DISEASES (NCD) UNDER MAKALAI THEDUM MARUTHUVAM (MTM) SCHEME IN TAMIL NADU.

- Already we have Population Health Register Health (PHR) portal which collects all details of the patient including name, age, sex, ration card number, phone number, NCD details (DM, HT, cancer, Chronic Obstructive Pulmonary Disease), histories suggestive of kidney injury and anthropometric measurements. We also have NCD positive line list portal.
- We can design a kidney injury database by adding a column for serum creatinine value and urine protein value in the PHR portal which calculates eGFR and stage of the CKD. We can also add column for source of drinking water, type of utensils used and family history for CKD.
- From this, we can identify the positive CKD patients (urine protein 1+ or above/ CKD stage 3 or above) and add them to NCD positive line list portal.
- The creatinine / urine protein values along with patient details ration card or phone number should be shared by the lab technician to the concerned MLHP (Mid Level Health Provider) in a weekly basis as shown in the Figure 1. The creatinine values can also be obtained from online LIMS (Laboratory information management system) for authenticity.
- From this, we can calculate the prevalence of CKD, prevalence of probable cases of CKDu and CKD hotspots. This CKD database will be of tantamount importance for enumerating the probable etiological factors for CKDu.

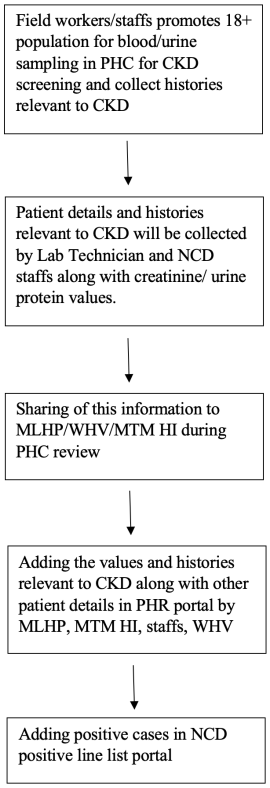

Fig 1. Working model of CKD database

Keywords: PHC- Primary health Centre; NCD- Non-Communicable Diseases; MLHP- Mid level Health Provider; MTM HI- Makalai Thedum Maruthuvam Health Inspector; WHV- Women Health Volunteers; LIMS- Laboratory Information Management System.

CONCLUSION

CKD and CKDu are in a rising trend especially in rural areas all over Tamil Nadu. The alarming fact is that we have poor knowledge of the trend, distribution of the disease and other parameters influencing the course of the disease. To bridge this knowledge gap CKD database is the next best step and it is feasible in an already well established health system we have in Tamil Nadu.

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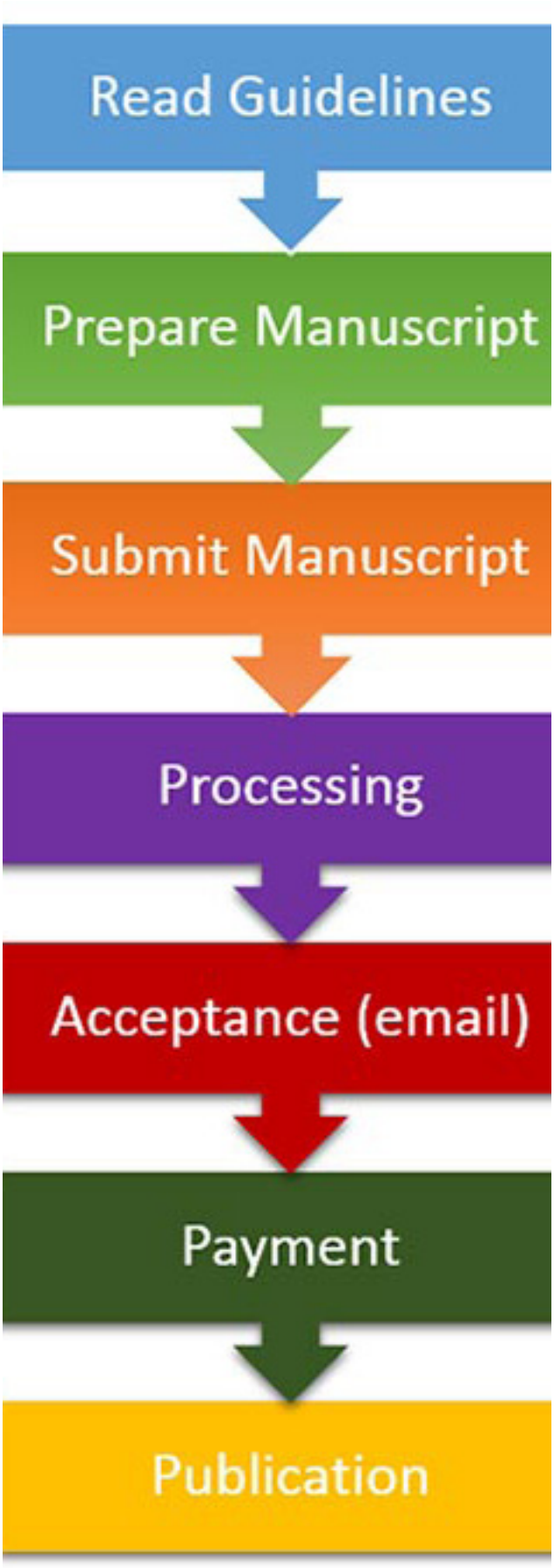

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