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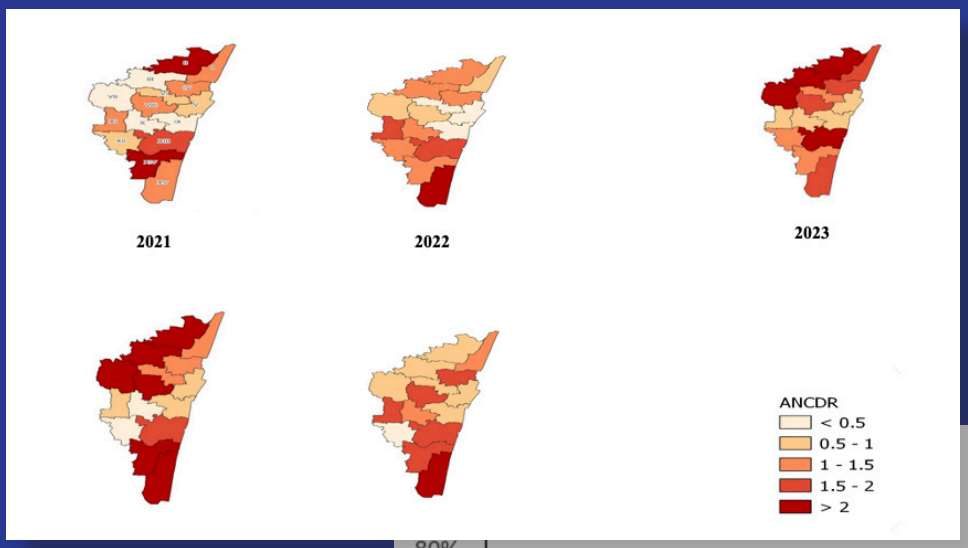

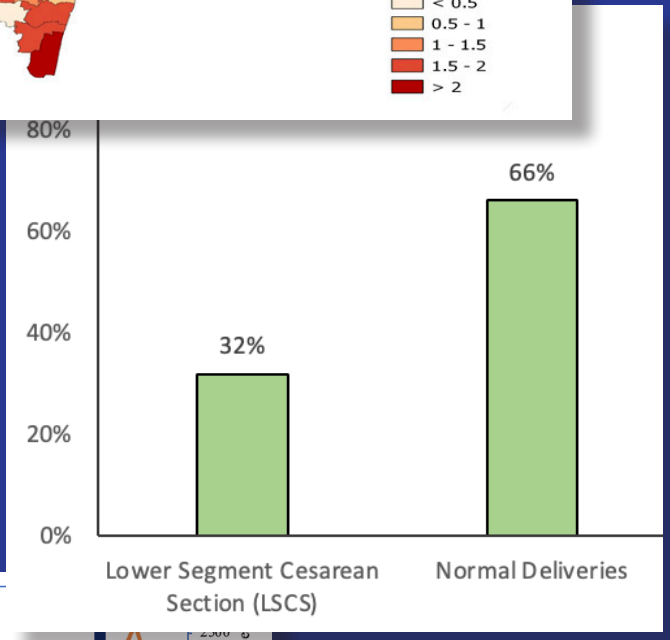

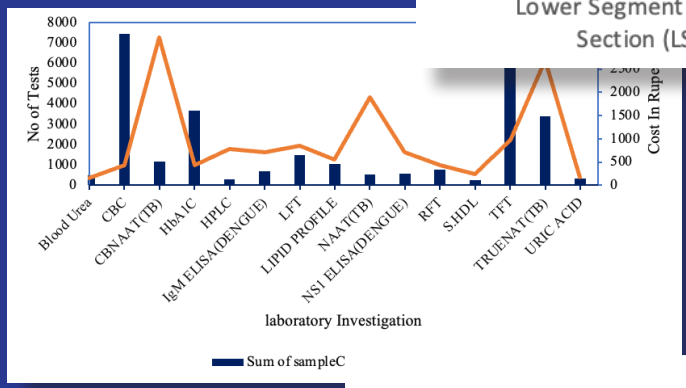

RESEARCH IS TO SEE WHAT EVERYBODY ELSE HAS SEEN, AND TO THINK WHAT NOBODY ELSE HAS

Vol 5 | Issue 3 | July - September | 2025

ORIGINAL ARTICLE

RE-EMERGENCE OF PERTUSSIS : A CASE REPORT WITH PUBLIC HEALTH RESPONSE

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ABSTRACT

INTRODUCTION : Pertussis (whooping cough) pose a public health challenge, particularly in infants, who are at high risk for severe disease and complications. Early diagnosis in neonates is often difficult due to atypical clinical presentation. A 15-day-old male child presented with symptoms consistent with pertussis, including cough, breath-holding spells, and cyanosis. Diagnosis was confirmed by PCR test, which was positive for the IS481 and ptxS1 genes of Pertussis. The child showed clinical improvement after azithromycin treatment, and chemoprophylaxis was given to close contacts. Public health interventions like active case search, vaccination drives, and health education, were implemented to control pertussis transmission. No additional cases were identified during the active case search. This report emphasizes the need for healthcare providers to consider pertussis as a differential diagnosis in neonates with cough and breathing difficulties, and highlights the effectiveness of prompt treatment and public health interventions in controlling pertussis transmission.
KEYWORDS : Vaccine Preventable Diseases (VPDs), Whooping Cough, Public Health Interventions, Vaccination.

INTRODUCTION

Pertussis, or whooping cough, is a striking reminder that diseases considered rare or historical can still emerge unexpectedly and demand continuous vigilance. In 2018, the World Health Organization (WHO) reported 151,074 pertussis cases globally. Based on 2008 data WHO estimated that there were 89,000 deaths. An estimated 24.1 million pertussis cases and 160,700 deaths in children younger than 5 years have been reported worldwide.

Despite its well-documented history, pertussis remains a pertinent diagnosis in contemporary medicine. When assessing patients with cough, clinicians typically focus on common causes like allergies or any common infections to severe problems like tuberculosis, or malignancies. Pertussis often gets overlooked.

Considering pertussis as one of differential diagnosis, facilitates prompt identification and treatment, highlighting the need for broad consideration of potential aetiologies and sustained clinical awareness. Infants under one year of age have the highest incidence of pertussis, with the majority of severe cases and complications occurring in this age group.[1]

Available evidence highlighted the importance of monitoring pertussis trends and implementing control strategies to protect vulnerable population.[1] As reported incidence of Pertussis among new born was rare, we considered possibility of documenting the case study.

CASE REPORT

This 15-day-old male neonate presented with cough and breathing difficulty. A comprehensive history was obtained from the parents, relatives, Village Health Nurses (VHNs), other field staff, and healthcare workers from the hospital where the child was born. In addition, the obstetrician and pediatrician who attended the delivery were interviewed.

The child was initially treated with cough suppressants at multiple private hospitals in Karaikudi. Despite treatment, the condition worsened with recurrent episodes of cough, breath-holding spells, and cyanosis. The neonate was subsequently referred to a medical college hospital and later admitted to a private hospital in Madurai, where he was treated for ten days. Due to persistent symptoms, the child was referred to the Institute of Child Health (ICH), Egmore, Chennai, for specialized management.

The antenatal history was uneventful. The child was delivered at term by caesarean section due to fetal distress. Birth-dose vaccinations were administered, and developmental milestones were appropriate for age. There

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was no history of contact with tuberculosis or pertussis cases and no significant travel history. During the same month, 40 deliveries occurred at the birth hospital. Five neonates were referred to higher centers for non-respiratory conditions. None of the other new born developed respiratory symptoms. Among 30 healthcare workers, none reported symptoms suggestive of pertussis or required sick leave.

On admission to the private hospital in Madurai, the neonate was alert with stable vital signs. Bilateral crepitations were noted on chest auscultation. Laboratory investigations revealed mild leukocytosis with lymphocytic predominance, while renal and liver function tests and serum electrolytes were within normal limits. Imaging showed mild aspiration pneumonitis and a patulous gastroesophageal junction. The child was provisionally diagnosed with pathological gastroesophageal reflux disease with breath-holding spells, and airway anomalies such as laryngomalacia and tracheoesophageal fistula were considered. The child was referred to ICH, Egmore

At ICH, a multidisciplinary team evaluated the child. Tuberculosis and structural airway abnormalities were ruled out. Pertussis was subsequently suspected, and two nasopharyngeal swabs were collected and tested at the State Public Health Laboratory. Polymerase chain reaction (PCR) testing confirmed Bordetella pertussis, with positivity for the IS481 and ptxS1 genes.

The child was treated with azithromycin and showed clinical improvement, with reduction in cough severity, stable vital signs, and adequate weight gain. Four household contacts received azithromycin as chemoprophylaxis. The 45-day routine immunization was administered at ICH. The child was discharged with advice for exclusive breastfeeding, regular weight monitoring, completion of chemoprophylaxis for contacts, and follow-up at the Vaccine Preventable Diseases outpatient department after one month.

Public Health Investigation and Response

An active case search was conducted in Kandramanikam village, the child's place of residence, by ten teams comprising VHNs and Mid-Level Health Providers (MLHPs). House-to-house surveys, school surveys, and Anganwadi surveys were carried out to identify suspected pertussis cases.

The case definition used was cough lasting more than two weeks with or without paroxysms of coughing, inspiratory whoop, post-tussive vomiting, or apnoea in any age group. Information regarding locked houses was obtained from neighbours, and revisits were scheduled. Permanently locked houses (locked for more than one month) were excluded. Children under seven years of age were line-listed, and vaccination status was verified using Mother and Child Protection Cards.

On April 13, 2025, a total of 215 households across five streets were surveyed, covering 116 children under 16 years of age. No additional suspected pertussis cases were identified during house-to-house, school, or Anganwadi surveys. A vaccination drive was conducted in the village, during which 39 children under seven years of age received the DPT vaccine and were observed for 30 minutes post-vaccination. Chemoprophylaxis with azithromycin was administered to 20 close contacts for five days, and completion of the course was ensured. Health education sessions focusing on cough etiquette, hand hygiene, and prevention of respiratory infections were conducted in the community, schools, and Anganwadi centers.

DISCUSSION

This case report highlighted the importance of considering pertussis in infants with cough and breathing difficulties, particularly in those under one year-old. The 15-day-old child presented with symptoms. The symptoms presented, including cough, breath-holding spells, and cyanosis, were consistent with those reported in other studies and were specific for infants according to WHO guidelines.[6]

The findings of this case are consistent with observations reported in several earlier studies describing pertussis in young infants. Castillo et al. reported that infants younger than one year constituted the majority of laboratory-confirmed pertussis cases requiring hospitalization, with apnea and cyanosis being common presenting features rather than classical whooping cough (4). Similar clinical patterns were observed in this case, where apnea and cyanosis were prominent and led to multiple referrals before definitive diagnosis.

Del Valle-Mendoza et al. documented that pertussis in hospitalized infants was frequently misdiagnosed during the early phase of illness, often being attributed to bronchiolitis, pneumonia, or gastroesophageal reflux disease.[5] This mirrors the clinical course in the present case, where the neonate was initially managed for pathological gastroesophageal reflux and breath-holding spells before pertussis was suspected.

Nasopharyngeal samples from the child tested positive for the IS481 and ptxS1 genes, confirming Bordetella pertussis infection. Previous studies have demonstrated that real-time polymerase chain reaction (PCR) is a rapid and highly sensitive diagnostic method, particularly in patients

with cough illness of ≤3 weeks' duration. Although bacterial culture remains the diagnostic gold standard due to its high specificity, PCR offers superior sensitivity and faster turnaround time. Both culture and PCR have been shown to exhibit reduced sensitivity beyond the second week of cough onset.[7] The diagnostic specificity of IS481 and IS1001 PCR targets has been extensively evaluated, with no reported cross-reactivity outside the Bordetella genus, underscoring the reliability and accuracy of PCR-based diagnosis.[8]

The public health interventions implemented in this investigation including active case search, vaccination drives, and community health education were consistent with World Health Organization recommendations and played a critical role in preventing further transmission.[3] Vaccination efforts helped protect vulnerable populations, particularly infants and young children, while health education reinforced the importance of cough etiquette, hand hygiene, and respiratory infection prevention measures.

A limitation of this case report is the inability to identify the probable source of infection, which restricted insights into transmission dynamics. Nevertheless, this case emphasizes the need for healthcare providers to consider pertussis in the differential diagnosis of neonates presenting with cough and respiratory distress, enabling timely diagnosis, appropriate management, and effective public health response.

CONCLUSION

This case highlights the importance of maintaining a high index of suspicion for pertussis in neonates presenting with cough and respiratory distress. Early recognition, laboratory confirmation through PCR, and prompt initiation of antibiotic therapy are essential to reduce morbidity and prevent severe complications. Chemoprophylaxis of close contacts and active case finding play a critical role in limiting household and community transmission. Vaccination remains the most effective preventive strategy; ensuring timely completion of the primary DPT series protects infants from severe disease. Additionally, maternal vaccination during pregnancy can provide passive immunity to neonates, offering protection during the vulnerable early weeks of life. Strengthening routine immunization programs, implementing catch-up vaccination, and conducting outbreak-response immunization campaigns are vital components of pertussis control. Combined with health education on cough etiquette, hand hygiene, and infection prevention, these measures are crucial to safeguard infants and reduce the public health burden of pertussis.

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ORIGINAL ARTICLE

DETERMINANTS OF RETENTION, REDUCED USE, AND RELAPSE IN TOBACCO CESSATION CENTRES IN VILLUPURAM, TAMIL NADU, 2023-24

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ABSTRACT

INTRODUCTION : Tobacco use remains a major preventable cause of morbidity and mortality globally and in India. Retention in tobacco cessation programmes is critical for sustained abstinence, yet follow-up and relapse remain major challenges. This study assessed determinants of retention, reduced tobacco use, and relapse among tobacco users enrolled in Tobacco Cessation Centres (TCCs) in Villupuram district, Tamil Nadu, during 2023–24.

METHODS : A prospective cohort study was conducted between December 2023 and April 2024 among tobacco users attending non-communicable disease clinics across 65 primary health centres and the TCC at Villupuram Medical College. Tobacco dependence was assessed using the Fagerström Test for Nicotine Dependence. Participants with low dependence received behavioural counselling at PHCs, while moderate and high dependence users were referred to TCCs for behavioural counselling with nicotine replacement therapy (NRT) or medications. Participants were followed at 2 weeks, 4 weeks, 6 weeks, and 3 months. Incidence rate ratios (IRR) for reduced use and relapse were estimated.

RESULTS: Among 438 enrolled tobacco users, 74.2% demonstrated reduced tobacco use and 39.5% experienced relapse during follow-up. Overall retention declined from 77% at 2 weeks to 35% at 3 months. Male participants had higher reduced use (aIRR 1.7; 95% CI: 1.1–2.8) and higher relapse risk (aIRR 2.3; 95% CI: 1.2–4.4). Participants receiving counselling with NRT showed significantly lower relapse risk (aIRR 0.2; 95% CI: 0.1–0.3). Median time to reduced use was 2 weeks, while median time to relapse was 10 weeks. Shorter distance to TCCs and later age of tobacco initiation were associated with better retention.

CONCLUSION: Retention in tobacco cessation programmes declines substantially over time despite early reduction in tobacco use. Strengthening follow-up systems, improving accessibility to cessation services, integrating pharmacotherapy, and targeted interventions for high-risk groups may improve long-term cessation outcomes.

INTRODUCTION

Smoking tobacco is responsible for approximately 7.69 million (7.16–8.20 million) deaths and 200 million (185–214 million) disability-adjusted life years (DALYs) globally each year. An estimated 1.14 billion smokers consume about 7.41 trillion cigarette equivalents annually. It is a leading risk factor for death among males, accounting for 20.2 percent (19.3–21.1 percent) of male deaths.[1] Of the 7.69 million deaths, 6.68 million are attributed directly due to smoking due to tobacco.[1] In India, the economic burden of tobacco use is substantial, amounting to approximately 1.04 percent of the nation's gross domestic product (GDP). For every INR 100 received as excise taxes from tobacco products, INR 816 is imposed on society through its consumption.[2] In 2017–2018, the total economic costs attributable to tobacco use for individuals aged 35 years or older amounted to INR 1773.4 billion (US $27.5 billion), with direct costs accounting for 22 percent and indirect costs 78 percent. Men bear 91 percent of the total costs, with smoking contributing 74 percent and smokeless tobacco (SLT) use contributing 26 percent(3). Tobacco use is a major modifiable and preventable factor in many premature deaths due to non-communicable diseases (NCDs).[4] The World Health Organisation (WHO) advocates the Framework Convention on Tobacco Control (FCTC) and MPOWER policy to combat the tobacco epidemic. These policies focus on monitoring tobacco control laws and prevention policies, protecting people from second-hand smoke, offering assistance to quit tobacco, and warning

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people about the dangers of tobacco. As a signatory to the FCTC, India has developed guidelines for the National Tobacco Control Programme, which aims to advocate for the FCTC. Sustainable Development Goal (SDG) 3, which aims to promote good health and well-being by preventing preventable diseases and premature deaths.[5] Currently, 55 percent of smokers and 50 percent of smokeless tobacco users are planning or considering quitting tobacco.[6] India, being a signatory to the WHO FCTC, has implemented a national tobacco control programme since 2007. One of the main thrust areas was the setting up and strengthening of cessation facilities, including the provision of pharmacological treatment. Health situation analysis in Villupuram district identified high tobacco prevalence as a key health priority, with a prevalence of 25.1 percent in men and 8.8 percent in women over 16 years old.[7] A tobacco cessation clinic was established in Villupuram district in 2007. We analyzed the profile and outcomes of tobacco users enrolled in the tobacco cessation centre from 2018 to 2022. We found only 5.5 percent of the 1,394 individuals enrolled in Tobacco Cessation Centers (TCC) had six months of abstinence from tobacco use. Hence, we conducted this study to estimate the retention rate of tobacco users at 2 weeks, 4 weeks, 6 weeks, and 3 months in Villupuram, Tamil Nadu, India, in 2023–24 by engaging primary health care staff involved in non-communicable disease management.

METHODS

A prospective cohort study was conducted in Villupuram, a northern district in Tamil Nadu, between December 2023 and April 2024 covering all the 65 primary health centres and the TCC at Villupuram Medical College. The implementation of the study started with the training workshops during the month of December 2023, which included a detailed plan to train primary health care staff on how to screen, treat, and refer tobacco dependence and give patient-focused, culturally sensitive advice based on the tobacco dependence treatment guidelines.[8] The workshops were conducted for NCD staff from Primary Health centres (PHCs) and psychologists and psychiatrists from Tobacco Cessation Centres (TCCs). Key materials used in the training were paper based data collection sheet, motivation assessment, the Fagerstrom test for nicotine dependence, and referral slips. The training was headed by the District Health Officer (DHO) and conducted by a District Training Team Medical Officer (DTTMO) and psychiatrist from the National Mental Health Programme (NMHP). The workshops were 1-day events held at the district level, organised in four different groups to ensure everyone received proper training. Feedback was collected afterward to evaluate the training's effectiveness and identify areas for improvement. (Table 1) This approach aimed to improve the skills of healthcare professionals in supporting tobacco cessation. Taking into consideration the programme evaluation data (unpublished), which reported an average outpatient for non-communicable diseases of 3000–4000 per month, 30–40 patients were referred from PHC to TCC per year in total. The study population were patients attending the NCD clinics in the primary health centres. During the month of January 2024, patients attending this clinic were screened for tobacco use, and those with low dependence were given behavioural counselling in all 65 primary health centres (PHCs) in Villupuram district. Those with moderate and high dependence were referred to the Tobacco Cessation Centre (TCC).

Table 1: Contents and brief about the training curriculum

Contents of the implementation package	**Brief about the training workshops**
Curriculum Tobacco dependence treatment guidelines, delivery of patient-centric and culturally sensitive advice	**Participants** NCD staff of PHC Psychologist of TCC Psychiatrist of TCC
Resource material Tobacco cessation clinic-Intake form Motivation assessment form-readiness to quit Fagerstrom score for nicotine dependence Referral slip	**Trainers** District training team medical officer Psychiatrist- NMHP
	Layout 1-day workshop in the district with District Tobacco control cell, organised by District training team medical officer in 4 different batches
	Feedback following the training

These individuals were followed up on for a period of three months until April 2024. We included tobacco users residing in Villupuram who were willing to participate and provided informed consent. We excluded tobacco users who were in follow-up prior to the initiation of this study.

Study Procedure: A primary health centre staff nurse specialising in non-communicable disease screening, referral, and treatment of non-communicable diseases would inquire of the patients visiting the NCD clinic about tobacco use and assess their readiness to quit using the contemplation ladder. Based on the contemplation level of the tobacco user, dependence on tobacco was measured using the Fagerstrom test for nicotine dependence[9], which includes various questions with scores ranging from 1 to 10 and is categorised

as low (1-3), moderate (4-6), and high (7–10) dependence. Low dependence scores received treatment at PHC and moderate and high dependence scores are referred to TCC with the referral slip to TCC. Tobacco users referred to TCC at Government Villupuram Medical College with the referral slip were communicated to the psychologist in TCC by the NCD staff nurse to ensure appropriate treatment and follow-up. At the TCC, referred tobacco users were guided by a psychologist and a social worker to ensure appropriate treatment from the psychiatrist at the TCC and follow-up.A comprehensive list of enrolled tobacco users and their follow-up dates were maintained and communicated to the respective PHC staff nurses about their follow-up dates and assessments. The NCD staff of the PHC reminded the patient about their scheduled visit one day prior through a phone call.

Sampling procedure: A consecutive sampling method was employed, wherein all eligible individuals screened for tobacco use and willing to quit, attending NCD clinics of all 65 PHCs in Villupuram district during January 2024, were enrolled into the cohort and followed up.

Operational definitions:

Follow-up: Tobacco users followed up every 2 weeks until 6 weeks and after 3 months from date of registration

Missed Visits: Tobacco users initiated treatment and not attending one scheduled visit.

No Change: Tobacco users who had no change in the Fagerstrom score in the follow up compared to baseline.

Reduced Use: reduction in Fagerstrom score compared to baseline among the tobacco users

Lost to Follow-up: Beneficiaries missing two or more consecutive visits

Relapse: increase in Fagerstrom score from baseline or after reduced use.

Retention Rate: Beneficiaries followed up in April 2024 without missing any visits to beneficiaries enrolled in January 2024.

Data Collection: NCD staff of all the 65 PHC in the district, oriented towards a one-day training workshop, have been involved in collecting the details of the tobacco user in the process of screening, referral, and follow-up. Primary data collection for the quantitative phase was done in a paper-based form through a semi-structured questionnaire on sociodemographic profile, alcohol drinking, type of tobacco, age at initiation of tobacco, Fagerstrom test for nicotine dependence, and type of treatment (Annexure-1) given to them. Referral cards were provided to the patients referred to the TCC. Once the patient visits the TCC, primary data is obtained from the patient in the TCC, assessed for Fagestrom test for Nicotine Dependence score, and appropriate treatment is initiated by the psychiatrist of the TCC. The compiled patient roster was communicated to PHC staff for follow-up reminders. The data collected from the tobacco users in Tobacco Cessation form was entered in Epi Info V7.2.5.0, and the data was imported into an Excel file and cleaned up for analysis.

Data Analysis: Data Analysis was done using Epi Info V.7.2.5.0 software to report the proportion of the characteristics, mean, and standard deviation, Deviation of age at initiation, age at registration in cessation, and distance of the TCC from the place of residence and STATA version 17 for calculating the incidence rate ratio (IRR)of retention among enrolled in subsequent follow-up, median time to reduced use and relapse of tobacco, and incidence of reduced use and relapse in person weeks. We used STROBE checklist for reporting the study findings.

Human Participant protection: No vulnerable population was included in the study. Tobacco users who initiated treatment and had withdrawal symptoms were managed. A unique identity number was given to the participants to protect their anonymity from being disclosed. Written informed consent was obtained from all the participants. Ethical approval was sought from the Institutional Human Ethics Committee (Academics), Indian Council of Medical Research, National Institute of Epidemiology.

RESULTS

We assessed the eligible 438 participants using Fagerstrom test for nicotine dependence and categorised them as low dependence (n=210), moderate dependence (n=162) and high dependence (n=66). All the 210 low dependence users were given behavioral counselling at PHC and moderate and high dependence in total (n=228) were referred to TCC for behavioural counselling with nicotine replacement therapy and medications.

Of the 210 low dependence users identified, all were provided behavioral counselling. During follow up, 180 attended the first visit in two weeks, 160 attended the second visit at four weeks, 147 attended the third visit at six weeks, 173 attended the fourth visit at three months. Of the 162 moderate dependence tobacco users, 101 attended the first visit, 52 attended the 2nd visit, 50 attended the 3rd visit, 33 attended the 4th visit. Of the 66 high dependence tobacco users, 50 attended the first visit, 17 attended the 2nd visit, 22 attended the 3rd visit, and 47 attended the 4th visit (Figure 2).

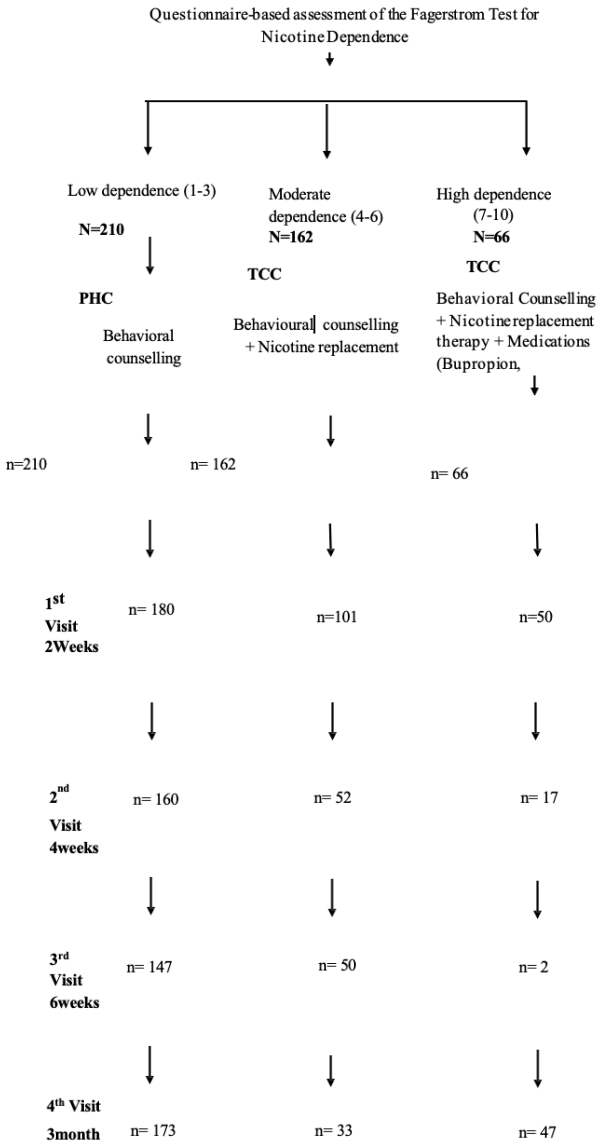

Figure 1: Tobacco users enrolled in study (N= 438)

Of the 438 participants enrolled, 423(97 percent) were rural residents, 198(45 percent) were in 46-60 age group of the 438 participants age ranging from age 21-90, 345 (79 percent) were male, 423 (97 percent) were married, 254 (58 percent) were smokers, 240(53 percent) were alcoholic, 424(97 per cent) were using bus as the mode of transport to reach the treatment centre (Table 2).

Low dependence beneficiaries who are receiving treatment in PHC showed 52 percent retention by three months follow up, whereas moderate dependence beneficiaries showed a significant drop of retention rate to 18 percent in three months follow up from 62 percent in the 1st visit(2weeks) follow up and high dependence beneficiaries showed 19 percent retention during the 4th visit (3months) follow 75 percent in 1st visit (2 weeks) (Table 3).

Table 2: Characteristic profile of the tobacco users initiated treatment cascade during January 2024

Sociodemographic profile		Number	Proportion (%)
Residence	Rural	423	97
	Urban	15	3
Age	21-30	14	3
	31-45	121	28
	46-60	198	45
	>60	105	24
Sex	Male	345	79
	Female	93	21
Education status	Secondary	148	34
	Illiterate	138	32
	Primary	110	25
	Higher Secondary	40	9
	Undergraduate	1	0
	Postgraduate	1	0
Marital status	Married	423	97
	Unmarried	12	3
	Widowed	2	0
Type of tobacco	Smoking	254	58
	Smokeless	154	35
	Both	30	7
Medical conditions	Ischaemic heart disease	4	1
	Stroke	4	1
	Asthma	15	3
	oral cavity	3	1
	others	6	1
Alcohol drinking	Yes	230	53
	No	208	47
Means of transport	Bus	424	97
	Own transport	13	3
	Auto	1	0

Of the 438 tobacco users enrolled males have a higher chance of reduced use compared to females with IRR 1.6(95 percent CI 1.2-2.2) and urban residents had higher relapse rate than rural residents with IRR of 2.1((95 percent CI 1.2-3.8). Beneficiaries receiving combined behavioral counselling and nicotine replacement therapy had 80 percent lesser chance of relapse compared to those who received only behavioral counselling.

Among retained beneficiaries mean age at initiation of tobacco use was found to be (mean=19, SD=9) in high dependence compared to moderate (mean =27, SD=8) and low dependence (Mean=28, SD=12) (Table 4).

Table 3 Proportion of retained among treatment-initiated tobacco users(N=438) with type of dependence in subsequent visit

Follow- up Visits	Low		Moderate		High		Total	
	n1 (210)	%	n2 (162)	%	n3 (66)	%	N (438)	%
1st visit	187	89	101	62	50	75	338	77
2nd visit	141	67	43	26	17	25	201	46
3rd Visit	118	56	37	23	13	19	165	38
4th visit	110	52	29	18	13	19	152	35

Mean distance of TCC from the place of residence in retained patients (attended all 4 visits) receiving care in TCC (mean= 28, SD=10), is lesser than those during the initiation of treatment (mean= 36, SD=12) (Table 5).

Table 4: Mean and standard deviation of age at registration,

Follow- up Visits	Low		Moderate		High		Total	
	n1 (210)	%	n2 (162)	%	n3 (66)	%	N (438)	%
1st visit	187	89	101	62	50	75	338	77
2nd visit	141	67	43	26	17	25	201	46
3rd Visit	118	56	37	23	13	19	165	38
4th visit	110	52	29	18	13	19	152	35

Table 5: Mean and standard deviation of age at registration, age at initiation of tobacco, distance to Tobacco Cessation Centre from residence at baseline(N=438)

Initiated treatment N=438	Age at registration		Age at initiation		Distance of TCC from the residence	
	Mean	SD	Mean	SD	Mean	SD
Low	51	13	28	10	36	17
Moderate	54	10	28	10	38	16
High	52	11	26	11	33	8

The incidence rate of reduced use and relapsed use of tobacco, were reported in person weeks, with 24.48 per 100 person-weeks (95 percent CI: 21.96-27.30) for reduced use, indicating that approximately 24 participants per 100 reduced their tobacco use within a week of treatment initiation. Conversely, the incidence rate of relapse was 6.9 per 100 person-weeks (95 percent CI: 5.91-7.96), indicating that about 7 participants per 100 relapsed within a week who are followed up, persons attending the visit with missing visits are also taken up for study to calculate the time taken by them for relapse or reduced use (Table 8)

Table 6: Probability of reduced use in follow up visits

Time interval (weeks)	No. at risk	Reduced use	Censored	Probability of Reduced use	95 percent CI	
0	438	0	59	1	-	-
2	379	299	10	0.20	0.16	0.24
4	70	11	2	0.17	0.13	0.21
6	57	4	7	0.16	0.12	0.20
12	46	11	35	0.10	0.06	0.14

Kaplan Meyer graph which is plotted with attaining reduced use as event and person with no change or lost to follow up or increased score are censored with the median time to reduced use as 2 weeks, (Figure 3).

The probability of reduced use over 2 weeks follow up period is 80 percent, with probability increasing to 90 percent in 3 months retention of the tobacco user to the programme (Table 6)

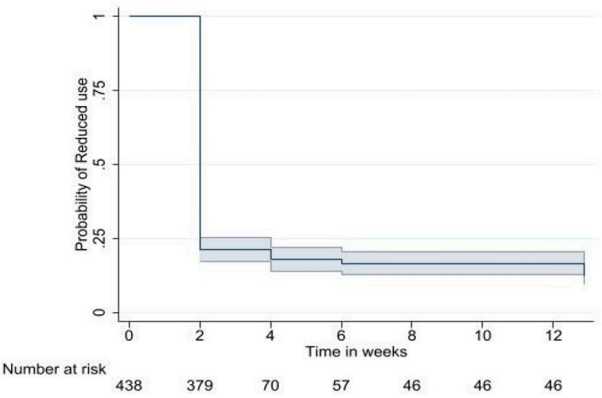

Figure 3: Overall distribution of the cohort for Reduced use

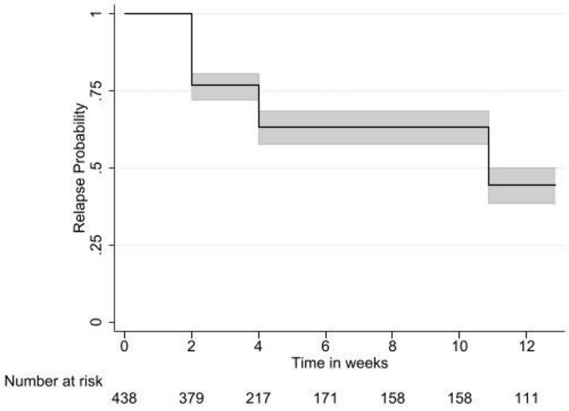

Figure 4 : Overall distribution of the cohort for Relapse

Table 7: Probability of relapse in follow up visits

Time interval (weeks)	No. at risk	Relapse	Censored	Probability of Relapse	95 percent CI	
0	438	0	59	1	-	-
2	379	88	74	0.74	0.69	0.79
4	217	38	8	0.61	0.55	0.66
6	171	0	13	0.61	0.55	0.66
10	158	47	0	0.43	0.37	0.49
12	111	0	111	0.43	0.37	0.49

Kaplan Meyer graph which is constructed with persons attaining relapse as event and no change in score from baseline, reduced score and lost to follow-up as censored, median time taken to relapse in follow up tobacco users as 10 weeks (Figure 4), with probability of getting relapse as 25 percent over 2 weeks follow up period and 57 percent over a follow up of 3 months' duration (Table 7).

Table 8: Incidence of reduced use and relapse per 100 person weeks

Cohort	Person-time	Reduced use	Incidence rate (per 100 person weeks)	95 percent CI	
Total	1327.43	325	24.48	21.96	27.30

Cohort	Person-time	Relapse	Incidence rate (per 100 person weeks)	95 percent CI	
Total	2523.43	173	6.86	5.91	7.96

A total of 74.2% (325/438) participants reported a reduction in Fagerström score. After adjustment, male gender was significantly associated with reduced tobacco use (aIRR 1.7; 95% CI: 1.1–2.8), while age, education, marital status, residence, type of tobacco use, comorbidities, alcohol use, and mode of transport showed no significant association.

Table 10: Multivariable Analysis of Factors Associated with Relapse among Study Participants (n=438)

Baseline characteristics	No relapse (%)	n Relapse (%)	n Total N	IRR (95% CI)	aIRR (95% CI)
Age group					
20–29	5 (55.6)	4 (44.4)	9	Ref	Ref
30–44	49 (51.6)	46 (48.4)	95	1.1 (0.4–3.0)	1.2 (0.3–4.6)
45–60	152 (66.4)	77 (33.6)	229	0.8 (0.3–2.1)	1.3 (0.3–5.2)
>60	59 (56.2)	46 (43.8)	105	1.0 (0.4–2.7)	1.4 (0.4–5.9)
Gender					
Female	65 (69.9)	28 (30.1)	93	Ref	Ref
Male	200 (58.0)	145 (42.0)	345	1.4 (0.9–2.1)	**2.3 (1.2–4.4)**
Education					
Illiterate	82 (59.4)	56 (40.6)	138	Ref	Ref
Primary	75 (68.2)	35 (31.8)	110	0.8 (0.5–1.2)	1.0 (0.6–1.7)
Middle secondary	87 (58.8)	61 (41.2)	148	1.0 (0.7–1.5)	1.2 (0.7–1.8)
Higher secondary	19 (47.5)	21 (52.5)	40	1.3 (0.8–2.1)	1.6 (0.8–3.2)
Graduate	2 (100)	0 (0)	2	–	–
Marital status					
Married	257 (60.8)	166 (39.2)	423	Ref	Ref
Unmarried	7 (58.3)	5 (41.7)	12	1.1 (0.4–2.6)	1.2 (0.4–3.7)
Widowed	1 (33.3)	2 (66.7)	3	1.7 (0.4–6.8)	1.7 (0.2–13.8)
Residence					
Rural	262 (62.1)	160 (37.9)	422	Ref	Ref
Urban	3 (18.8)	13 (81.3)	16	2.1 (1.2–3.8)	1.8 (0.9–3.7)
Type of tobacco use					
Smokeless	95 (61.7)	59 (38.3)	154	Ref	Ref
Smoking	152 (59.8)	102 (40.2)	254	1.0 (0.8–1.4)	0.8 (0.5–1.2)
Both	18 (60.0)	12 (40.0)	30	1.0 (0.6–1.9)	0.9 (0.4–1.9)
Comorbidities					
Hypertension	95 (57.6)	70 (42.4)	165	Ref	Ref
Diabetes	37 (57.8)	27 (42.2)	64	1.0 (0.6–1.6)	0.9 (0.6–1.4)
Others	40 (57.1)	30 (42.9)	70	1.0 (0.7–1.5)	1.0 (0.6–1.5)
Alcohol use					
No	116 (55.8)	92 (44.2)	208	Ref	Ref
Yes	149 (64.8)	81 (35.2)	230	0.8 (0.6–1.1)	0.8 (0.5–1.2)
Mode of transport					
Bus/Auto	252 (59.3)	173 (40.7)	425	Ref	Ref
Own vehicle	13 (100)	0 (0)	13	–	–
Treatment					
Counselling alone	74 (35.2)	136 (64.8)	210	Ref	Ref
Counselling + NRT	146 (90.1)	16 (9.9)	162	**0.2 (0.1–0.3)**	**0.2 (0.1–0.3)**
Counselling + medication	45 (68.2)	21 (31.8)	66	**0.5 (0.3–0.8)**	**0.5 (0.3–0.9)**

Participants receiving counselling plus nicotine replacement therapy demonstrated significantly better reduction compared to counselling alone (aIRR 0.6; 95% CI: 0.4–0.8). Counselling combined with other medications did not show a statistically significant advantage over counselling alone.

Table 9: Multivariable Analysis of Factors Associated with Reduction in Fagerström Nicotine Dependence Score among Study Participants (n=438)

Baseline characteristics	No reduction N = 113 n (%)	Reduced use N = 325 n (%)	Total N = 438	IRR 95 % CI	aIRR 95 % CI
Age group					
20-29	1 (11.1)	8 (88.9)	9	Ref	Ref
30-44	16 (16.8)	79 (83.2)	95	0.9 (0.5, 1.9)	0.8 (0.3, 2.4)
45-60	64 (28.0)	165 (72.1)	229	0.8 (0.4, 1.6)	0.9 (0.3, 2.5)
Above 60	32 (30.5)	73 (69.5)	105	0.8 (0.4, 1.6)	0.8 (0.3, 2.5)
Gender					
Female	47 (50.5)	46 (49.5)	93	**Ref**	**Ref**
Male	66 (19.1)	279 (80.9)	345	**1.6 (1.2, 2.2)**	**1.7 (1.1, 2.8)**
Education					
Illiterate	43 (31.2)	95 (68.8)	138	Ref	Ref
Primary	34 (30.9)	76 (69.1)	110	1.0 (0.7, 1.4)	1.0 (0.7, 1.5)
Middle Secondary	30 (20.3)	118 (79.7)	148	1.2 (0.9, 1.5)	1.1 (0.8, 1.5)
Higher Secondary	6 (15.0)	34 (85.0)	40	1.2 (0.8, 1.8)	1.2 (0.7, 2.1)
Graduate	0 (0)	2 (100)	2	1.5 (0.4, 5.9)	1.9 (0.4, 8.1)
Marital status					
Married	109 (25.8)	314 (74.2)	423	Ref	Ref
Unmarried	3 (25.0)	9 (75.0)	12	1.0 (0.5, 2.0)	0.8 (0.3, 2)
Widowed	1 (33.3)	2 (66.7)	3	0.9 (0.2, 3.6)	1 (0.1, 7.2)
Residence					
Rural	112 (26.5)	310 (73.5)	422	Ref	Ref
Urban	1 (6.3)	15 (93.8)	16	1.3 (0.8, 2.1)	1.4 (0.7, 2.6)
Tobacco use					
Smokeless	51 (33.1)	103 (66.9)	154	Ref	Ref
Smoke	51 (20.1)	203 (79.9)	254	1.2 (0.9, 1.5)	0.9 (0.7, 1.3)
Both	11 (36.7)	19 (63.3)	30	0.9 (0.6, 1.5)	0.8 (0.4, 1.4)
Comorbidities					
Hypertension	44 (26.7)	121 (73.3)	165	Ref	Ref
Diabetes	14 (21.9)	50 (78.1)	64	1.1 (0.8, 1.5)	1 (0.7, 1.4)
Others	16 (22.9)	54 (77.1)	70	1.1 (0.8, 1.4)	1 (0.7, 1.5)
Alcohol use					
No	61 (29.3)	147 (70.7)	208	Ref	Ref
Yes	52 (22.6)	178 (77.4)	230	1.1 (0.9, 1.4)	0.9 (0.7, 1.3)
Mode of transport					
Bus/Auto	109 (25.7)	316 (74.4)	425	Ref	Ref
Own vehicle	4 (30.8)	9 (69.2)	13	0.9 (0.5, 1.8)	0.9 (0.5, 1.9)
Treatment					
Counselling	27 (12.9)	183 (87.1)	210	**Ref**	**Ref**
Counselling +NRT	70 (43.2)	92 (56.8)	162	**0.7 (0.5, 0.8)**	**0.6 (0.4, 0.8)**
Counselling +Medication	16 (24.2)	50 (75.8)	66	0.9 (0.6, 1.2)	0.8 (0.5, 1.2)

Overall, 39.5% (173/438) of participants experienced relapse during follow-up. After adjustment, male gender was independently associated with a significantly higher risk of relapse (aIRR 2.3; 95% CI: 1.2–4.4), while age, education, marital status, residence, tobacco use pattern, comorbidities, alcohol use, and mode of transport were not significantly associated. Participants receiving counselling combined with nicotine replacement therapy had a substantially lower risk of relapse compared to counselling alone (aIRR 0.2; 95% CI: 0.1–0.3). Counselling combined with pharmacotherapy also demonstrated a significant protective effect against relapse (aIRR 0.5; 95% CI: 0.3–0.9).

DISCUSSION

Our study findings provide valuable insights into the demographic and behavioural factors with gender, place of residence, type of treatment, distance to the tobacco cessation centre, mode of transport used to reach the TCC influencing treatment retention with reduced use, relapse, as well as the effectiveness of different treatment modalities over time. Tobacco users who were male are said to be retained and reduced use, residing in urban are said to relapse. Tobacco users receiving behavioural counselling are said to reduce use within 2 weeks and said to relapse within next 6-8 weeks of recovery. Those who receive combined therapy have less chances of relapse. The comparative analysis over the two time points reveals important insights into patient retention in tobacco cessation programs. Telephonic calls for the patient as a reminder for the follow-up dates are said to improve the retention rate.[10] Younger age at the initiation of tobacco use is associated with high dependence on tobacco.[11] Additionally, closer proximity to the TCC appears to enhance retention. These findings suggest that targeting younger tobacco users and improving accessibility to cessation services could improve programme retention and overall success rates. The high incidence rate of reduced use indicates that the intervention is effective at reducing tobacco use with regular follow-up.[8] Previous studies done for patients with 3 month follow up had only 21 percent improvement from the baseline status[12], the high rate of reduced use is promising, reflecting the immediate impact of the treatment program.

The lower incidence rate of relapse suggests that while some participants relapse, it is less frequent compared to the reduction in use. But participants who are not receiving combined pharmacotherapy and behavioural counselling are said to relapse. The overall retention rate among the cohort was 35 percent at the fourth visit (three- month follow-up), follow up demonstrating a significant decline from 77 percent at the first visit, Previous studies have reported that women, younger age, and low dependence have decreased lost to follow-up.[6]

The type of treatment significantly influenced retention rates, reduced use and relapse use of tobacco. Participants receiving only behavioural counselling had a higher retention rate (52 percent) compared to those receiving a combination of behavioural counselling and nicotine replacement therapy (NRT) (18 percent) and those receiving behavioural counselling, NRT, and medications (20 percent). Previous findings suggest that while combined treatments might be more intensive in smoking cessation[13], this study showed that behavioural counselling is associated with reduced use and relapsed use compared to combined therapy, they may also be more challenging for participants to adhere to, potentially due to increased complexity or side effects.

Conversely, the Kaplan-Meier analysis revealed that the median time to relapse was 10 weeks, with a 25 percent probability of relapse at two weeks and 57 percent at three months. This highlights the critical need for sustained support and interventions beyond the initial treatment phase to maintain long-term tobacco abstinence.

The mean distance from the residence to the Tobacco Cessation Centre (TCC) for retained tobacco users was lower compared to those at the initiation of treatment, suggesting that closer proximity to treatment centres enhances retention rates, possibly by reducing travel barriers. Furthermore, the mean age at initiation of tobacco use was lower among high dependence participants (mean = 19; SD = 9) compared to moderate (mean = 27; SD = 8) and low dependence (mean = 28; SD = 12) participants. This indicates that earlier initiation of tobacco use is associated with higher dependence, necessitating more tailored and intensive interventions for this subgroup.

CONCLUSION

The study highlights the importance of addressing demographic, behavioural, and health-system factors to improve retention in tobacco cessation programmes. Urban residence was associated with relapse, while males were more likely to show reduced tobacco use. Behavioural counselling alone demonstrated better retention and reduced use compared to combined treatment modalities. Proximity to treatment centres and early initiation of tobacco use also emerged as key determinants influencing treatment outcomes.

Sustained programme effectiveness requires strengthening service delivery and system support. Distance to facilities, social stigma, and heavy PHC staff workload

negatively affect follow-up and continuity of care. Improving availability of essential medications, resolving technical challenges with the MTM portal, simplifying documentation, and integrating tobacco cessation services through CHCs and mobile medical units can enhance accessibility and efficiency. Localised interventions, capacity building, and effective use of technology, supported by coordinated resource allocation, are critical to improving retention and long-term tobacco cessation outcomes.

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ORIGINAL ARTICLE

EARLY DETECTION OF BREAST CANCER THROUGH NURSE-LED CLINICAL BREAST EXAMINATION IN PRIMARY HEALTH CARE: A CASE STUDY FROM POONAMALLEE, TAMIL NADU, 2025.

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ABSTRACT

INTRODUCTION : Breast cancer is the most common cancer among women in India and a leading cause of cancer-related mortality, largely due to late-stage diagnosis. Strengthening early detection at the primary care level is critical for improving outcomes and reducing inequities. This case study describes the early detection of breast cancer through nurse-led Clinical Breast Examination (CBE) at a Primary Health Centre (PHC) in Poonamallee, Tamil Nadu, in 2025. A 55-year-old woman attending the PHC for routine follow-up of hypertension and diabetes underwent opportunistic CBE by a staff nurse, which revealed a suspicious axillary lymph node. Prompt referral and further diagnostic evaluation confirmed invasive breast carcinoma, despite initial benign imaging findings. The patient underwent definitive treatment and has completed therapy successfully. This case highlights the strength of the primary health care system in delivering comprehensive, people-centred care, the importance of integrating cancer screening into routine services, empowering nurses, and ensuring effective referral linkages. Strengthening such primary care–based interventions can significantly contribute to early cancer detection and improved survival in resource-constrained settings.

INTRODUCTION

Breast cancer is the most common cancer among women in India and a leading cause of cancer-related mortality, largely due to late-stage diagnosis. Strengthening early detection at the primary care level is critical for improving outcomes and reducing inequities. This case study describes the early detection of breast cancer through nurse-led Clinical Breast Examination (CBE) at a Primary Health Centre (PHC) in Poonamallee, Tamil Nadu, in 2025.

A 55-year-old woman attending the PHC for routine follow-up of hypertension and diabetes underwent opportunistic CBE by a staff nurse, which revealed a suspicious axillary lymph node. Prompt referral and further diagnostic evaluation confirmed invasive breast carcinoma, despite initial benign imaging findings.

The patient underwent definitive treatment and has completed therapy successfully. This case highlights the strength of the primary health care system in delivering comprehensive, people-centred care, the importance of integrating cancer screening into routine services, empowering nurses, and ensuring effective referral linkages. Strengthening such primary care–based interventions can significantly contribute to early cancer detection and improved survival in resource-constrained settings.

BACKGROUND

Breast cancer is the most common malignancy among women worldwide, with an estimated 2.3 million new cases and 670,000 deaths reported in 2022.[1] While it can occur at any age after puberty, its incidence increases with advancing age. Global patterns reveal marked inequities: in very high Human Development Index (HDI) countries, approximately 1 in 12 women will develop breast cancer and 1 in 71 will die from the disease, whereas in low-HDI countries, only 1 in 27 women are diagnosed but 1 in 48 die, reflecting limited access to early detection and timely treatment.[1,2] In India, breast cancer is the leading cancer among women, accounting for approximately 27% of all female cancers.[3] Although advances in diagnostics and treatment have improved survival in high-income settings, late presentation remains a major challenge in low- and middle-income countries. In the Indian context, sociocultural barriers, limited awareness, and inadequate access to screening services frequently result in diagnosis at advanced stages.[3,4]

Clinical Breast Examination (CBE) is a cost-

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effective and feasible screening tool recommended for early detection in resource-limited settings.[5] The Government of Tamil Nadu has strengthened primary care services through comprehensive care delivery at Primary Health Centres (PHCs), with an emphasis on preventive and promotive health services.[6] PHCs serve as the first point of contact for the community and provide an ideal platform for opportunistic screening, continuity of care, and early identification of non-communicable diseases, including cancers.[6,7]

Tamil Nadu's Organized Cancer Screening program(OCS), focuses on early detection of breast, cervical, and oral cancers for individuals over 30, expanding existing NPCDCS efforts, integrating with Makkalai Thedi Maruthuvam using personal invitations and community outreach for greater coverage and awareness.

This case study, conducted at the Primary Health Centre (PHC), Poonamallee, Tamil Nadu, illustrates how routine Clinical Breast Examination at the primary care level enabled early clinical suspicion, timely referral, and life-saving treatment in a woman from a socio-economically disadvantaged background, reinforcing the critical role of strong primary health care systems in cancer control.[5-7]

CASE DESCRIPTION

A 55-year-old woman from a lower socio-economic background presented to the PHC, Poonamallee, for routine follow-up of hypertension and type 2 diabetes mellitus on October 21, 2025. She had no breast-related complaints. As part of integrated primary care services, staff nurse performed a Clinical Breast Examination. Examination revealed a firm, immovable axillary lymph node. Recognizing the abnormal finding, the nurse promptly informed the Medical Officer, and the patient was referred to a tertiary care facility for further evaluation on the same day. Patient reached the tertiary care centre 2 days later. At the tertiary care centre, mammography suggested a BIRADS-2 category (likely benign) on November 2nd 2025. However, given the strong clinical suspicion, further evaluation was pursued. Fine Needle Aspiration Cytology (FNAC) and histopathological biopsy confirmed Invasive Breast Carcinoma on November 17th 2025. The patient subsequently underwent mastectomy, followed by 12 cycles of chemotherapy and adjuvant radiotherapy. She has completed treatment successfully and is currently in good health under regular follow-up.

The patient underwent mastectomy followed by chemotherapy and adjuvant radiotherapy. She completed treatment successfully and remains under regular follow-up with good clinical outcomes.

DISCUSSION

This case demonstrates the effectiveness of cancer screening using Clinical Breast Examination (CBE) integrated within routine primary care services. The nurse-led Clinical Breast Examination (CBE) enabled early clinical suspicion in an otherwise asymptomatic woman who may have presented at an advanced stage in the absence of such screening. The Primary Health Centre (PHC) functioned as a critical entry point into the health system, facilitating early detection, timely referral, and continuity of care. This highlights the importance of strong primary care in ensuring equitable access to cancer services for women from socio-economically disadvantaged backgrounds.

The findings of this case are consistent with evidence from previous studies demonstrating the effectiveness of CBE conducted at the primary care level in facilitating early detection of breast cancer, particularly in low- and middle-income countries. Multiple Indian and international studies have shown that CBE performed by trained nurses or community health workers contribute to earlier-stage diagnosis and reduced delays in care, especially among populations with limited access to diagnostic imaging.[3-6]

Randomized controlled trials and programmatic evaluations from India have reported that CBE-based screening leads to a shift towards earlier stages at diagnosis and improved survival outcomes when compared with usual care.[3-5] Studies from Mumbai and Trivandrum have further demonstrated that trained non-physician health workers can reliably identify clinically significant breast abnormalities, supporting the feasibility and effectiveness of task-sharing within primary health systems.[3-5] The present case aligns with these findings, wherein a trained staff nurse identified a suspicious axillary lymph node during a routine visit in an asymptomatic individual.

Previous literatures have highlighted that sole dependence on imaging for breast cancer detection can lead to missed or delayed diagnoses, particularly in early or atypical presentations.[8,9] In line with findings from diagnostic accuracy studies and clinical audits, this case illustrates that low-risk or benign imaging findings do not exclude malignancy when clinical suspicion remains high.

Proceeding with tissue diagnosis despite a BIRADS-2 mammography result reflects best practices that emphasize the importance of correlating radiological findings with clinical examination.8

Health systems research further supports the role of efficient referral mechanisms between primary and tertiary care in improving cancer outcomes. Evaluations of integrated care

models within public health systems in India have shown that timely referrals from PHCs reduce diagnostic delays and facilitate earlier initiation of treatment, particularly among socio-economically disadvantaged women.[7,10] The seamless referral pathway and continuity of care observed in this case are consistent with these findings and highlight the functional strength of the primary care network.

In Comparison with settings where delayed referrals or fragmented service delivery contribute to advanced-stage presentation, this case demonstrates the advantage of comprehensive primary care models that integrate non-communicable disease management with preventive services such as cancer screening.[6,7] Overall, this case reinforces existing evidence that primary care based, nurse-led CBE is a practical, effective, and equitable strategy for early breast cancer detection in resource-constrained settings.[3-6] It highlights programmatic insight from Tamil Nadu and supports the growing body of literature advocating for the strengthening of primary health care as a central pillar of cancer control strategies in low- and middle-income countries.[1,7]

CONCLUSION

Routine Clinical Breast Examination conducted by trained Staff nurses at the primary care level can play a decisive role in early detection of breast cancer. This case from PHC Poonamallee demonstrates that a strong, responsive primary health care system can serve as the foundation for effective cancer control, enabling early diagnosis, timely referral, and successful treatment. Scaling up such primary care driven models across health facilities can substantially reduce diagnostic delays, address health inequities, and improve breast cancer outcomes in similar settings.

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ORIGINAL ARTICLE

PREVALENCE OF HIGH-RISK PREGNANCIES IN POONAMALLEE HUD, TAMIL NADU, 2024-2025

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ABSTRACT

INTRODUCTION : Maternal mortality remains a major public health challenge globally and in India. Although India's maternal mortality ratio (MMR) has declined, high-risk pregnancies (HRP) continue to contribute significantly to adverse maternal and perinatal outcomes. Tamil Nadu has achieved a low MMR through robust maternal death audits; however, systematic assessment of HRP patterns is needed. This study aimed to estimate the prevalence, patterns, and outcomes of HRP in Poonamallee Health Unit District (HUD), Tamil Nadu.

METHODS : A descriptive cross-sectional study was conducted using secondary data from the Pregnancy and Infant Cohort Monitoring and Evaluation (PICME) system. All registered HRPs in Poonamallee HUD from April 2024 to March 2025 were included (n = 3,593). Maternal sociodemographic details, antenatal risk factors, and pregnancy outcomes were analyzed using descriptive statistics

RESULTS: Among 9,426 registered pregnancies, 3,593 (38.1%) were high-risk, with higher prevalence in Avadi (urban) (53.0%). Most women were aged 25–29 years (42.6%) and gravida 2 (43.3%). Caesarean section was the predominant mode of delivery (64.5%). Live births accounted for 99.7%, while stillbirths were 0.3%. Low birth weight was observed in 15.6% of neonates. Common risk factors included hypothyroidism (26.1%), previous LSCS (18.4%), gestational diabetes mellitus (10.2%), and pregnancy-induced hypertension (6.7%). Nearly one-third (32.2%) had multiple coexisting risk factors.

CONCLUSION: Over one-third of pregnancies were high-risk, with hypothyroidism, previous LSCS, and gestational diabetes as major contributors. The high caesarean rate and burden of low birth weight underscore the need for strengthened antenatal risk stratification, timely referral, and comprehensive perinatal care to further reduce maternal and neonatal morbidity and mortality.

INTRODUCTION

Maternal mortality remains a significant public health challenge globally and in India despite improvements in maternal health indicators. Globally, maternal deaths due to complications from pregnancy or childbirth were estimated at 211 deaths per 100 000 live births in 2017.[1] About 1.3 million maternal deaths were estimated among Indian women in the last two decades, accounting for 12% of global maternal deaths. The majority of maternal deaths were due to direct medical causes. According to the Sample Registration System, the maternal mortality ratio (MMR) has declined from 113 deaths per 100 000 live births between 2016 - 2018 to 103 deaths per 100 000 live births between 2017- 2019, and the majority of maternal deaths occurred in the age range of 20-29 years.[2] Poor maternal health indicators are directly associated with pregnancy-related morbidities and mortality. High-risk pregnancies (HRP) contribute substantially to adverse maternal and perinatal outcomes. Tamil Nadu, with a robust maternal death audit system since 2004, has achieved a marked decline in maternal mortality ratio (MMR) to 35 per 100,000 live births in 2021–20233. However, the burden and patterns of HRP require systematic assessment to guide targeted interventions. Hence we aim to estimate the prevalence of high-risk pregnancies and describe their patterns and outcomes in Poonamallee HUD of Tamil Nadu.

METHODS

Poonamallee Health Unit District (HUD) is one of the Health Unit Districts in Tiruvallur District, Tamil Nadu. The Poonamallee HUD covers both Poonamallee and Avadi Corporation, catering to a large urban and peri-urban population. The HUD comprises a total of 13 Primary Health Centres (PHCs), which serve as the primary point of contact for maternal, child health, and other public health services. During the period from April 2024 to March 2025, a total of 9,426 pregnancies were registered in Poonamallee HUD. A descriptive cross-sectional study was conducted in

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Poonamallee HUD using secondary data from the Pregnancy and Infant Cohort Monitoring and Evaluation (PICME) system, which captures maternal and child health indicators across Tamil Nadu. All registered high risk pregnancies between April 2024 and March 2025 in Poonamallee HUD were included (n = 3,593 high-risk pregnancies). Variables analyzed included maternal sociodemographic characteristics (age, parity, gravida), antenatal high-risk conditions (e.g., hypothyroidism, gestational diabetes, pregnancy-induced hypertension, previous LSCS), and pregnancy outcomes (type of delivery, birth outcome, neonatal characteristics such as sex and birth weight). Descriptive analysis was done using standard statistical software and results were presented as frequencies and percentages.

RESULTS

A total of 9,426 pregnancies were registered between April 2024 to March 2025. Of which 3,593 (38.1%) were classified as high-risk. The prevalence was higher in Avadi (Urban) (53.0%) compared to Poonamallee (47.0%).

Table 1: High risk Pregnancies , Poonamallee HUD, 2024-2025

	n	Percentage (%)
Avadi (Urban)	1,906	53.0
Poonamallee (Semi urban/Rural)	1,687	47.0

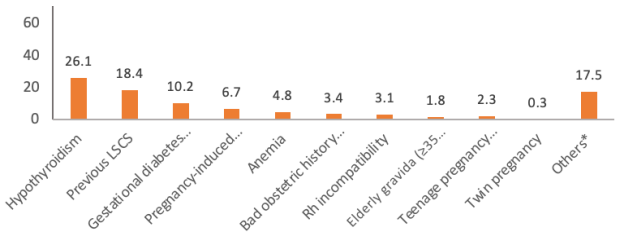

Figure1: High risk conditions, Poonamallee HUD, 2024-2025

The leading high-risk conditions were hypothyroidism (26.1%), previous LSCS (18.4%), gestational diabetes mellitus (10.2%), and pregnancy-induced hypertension (6.7%). Other risk factors included anemia (4.8%), bad obstetric history (3.4%), Rh incompatibility (3.1%), twin pregnancy (1.3%), elderly gravida (1.8%), and teenage pregnancy (2.3%), while the remaining (29.2%) were attributed to medical and surgical diseases complicating pregnancy. Notably, nearly (32.2%) of the high-risk mothers had two or more coexisting risk factors. The majority of high-risk mothers belonged to the 25–29years age group (42.6%), followed by the 20–24 years group (27.4%), ≥35 years (5.4%) and <20 years (4.1%). Almost 43.3% of the high risk mothers were gravida 2 women and (39.8%) primi gravida while higher-order pregnancies (gravida ≥4) accounted for 4.2%.

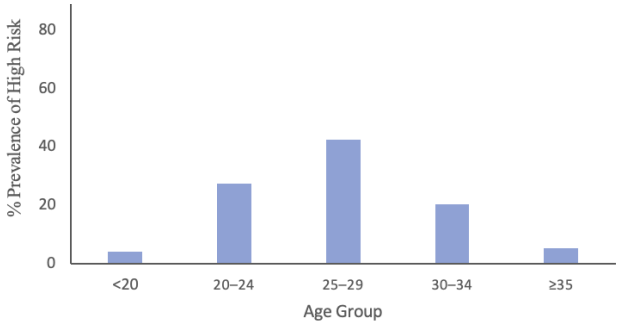

Figure 2: Age distribution of high risk pregnancies in Poonamallee HUD(N=3593), 2024–2025

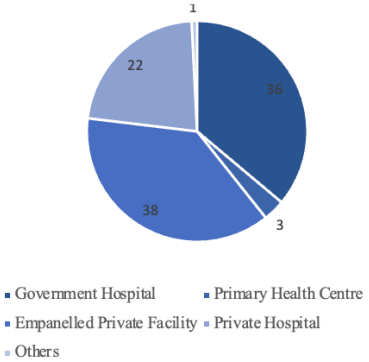

Figure3: Facilities deliveries occurred for High risk pregnancies in Poonamallee HUD, 2024-2025.

Among the high-risk pregnancies, the largest proportion of deliveries occurred in empanelled facilities (38%), followed by government hospitals (36%). Deliveries in private hospitals accounted for 22%, while only a small proportion took place in primary health centres (3%).

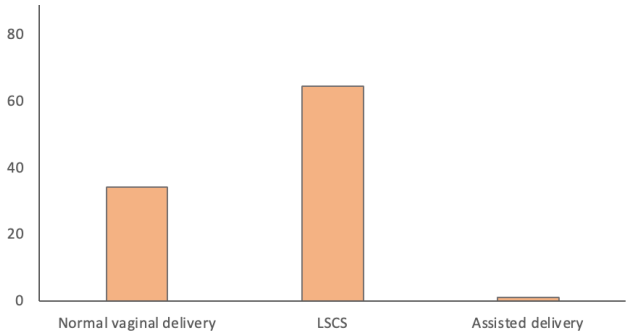

Figure4: Mode of delivery for High risk Pregnancies, Poonamallee HUD, 2024-2025.

Among deliveries, caesarean section was the most common mode (64.5%), followed by normal vaginal delivery (34.3%). Live births constituted 99.7% of outcomes, while stillbirths accounted for 0.3%. Neonatal low birth weight was observed in 15.6% of cases.

DISCUSSION

This study highlights a prevalence of 1/3rd of high-risk pregnancies (38.1%) in Poonamallee HUD during 2024–

2025. The observed prevalence is higher than the expected prevalence from population-level surveys, reflecting the improved screening and reportingin Poonamallee HUD. The findings for Tamil Nadu, NFHS-5 reports that nearly 49% of women aged 15–49 years are anaemic, 26.4% have a BMI ≥25, and 9% have elevated blood sugar or are on medication for diabetes. The relatively lower proportion of anaemia (4.8%) observed in the present study likely reflects improved antenatal detection, treatment, and reporting practices in Tamil Nadu's public health system. In contrast, the increased prevalence of hypothyroidism (26.1%) and gestational diabetes mellitus (10.2%) aligns with NFHS-5 evidence of a rising burden of non-communicable diseases among women of reproductive age in Tamil Nadu, particularly in urban and peri-urban settings.[5]

Also a longitudinal community-based study near Bangalore reported a 61.6% prevalence of HRP, with previous LSCS (16.1%), hypothyroidism (11.6%), and bad obstetric history (5.5%) among common risk factors. Women with HRP had significantly higher odds of adverse maternal outcomes.[6] The age distribution of high-risk pregnancies in this study shows that the majority occurred among women aged 25–29 years, which mirrors NFHS-5 findings that most births in Tamil Nadu occur in the 20–29 year age group. Similar findings have been reported in studies from Kerala and Karnataka, where gestational diabetes and thyroid disorders were common contributors to high-risk status among women aged 20–30 years.

The high proportion of gravida 2 and primi gravida women among cases is consistent with earlier studies from Tamil Nadu and Andhra Pradesh, which report that primigravida and second gravida women often have better service utilization and hence higher detection of risk conditions. The relatively small proportion of higher-order pregnancies (≥4) reflects Tamil Nadu's sustained success in fertility reduction, as also documented in NFHS-5, where the total fertility rate is reported as 1.6, well below replacement level.[5] A community-based study conducted in rural Andhra Pradesh reported that primigravida and second-gravida women constituted more than 65% of identified high-risk pregnancies, attributed to early registration, regular antenatal visits, and better compliance with screening protocols under the public health system.[6]

This study also highlights the high caesarean section rate (64.5%) among high-risk pregnancies. NFHS-5 reports an overall caesarean section rate of 36.3% in Tamil Nadu, one of the highest in the country. The much higher rate observed in the present study is expected given the exclusive focus on high-risk pregnancies, particularly those with previous LSCS (18.4%), gestational diabetes, and hypertensive disorders. A study in rural western India reported an HRP prevalence of 34.3%. Hypothyroidism (43.7% among HRP women) and previous LSCS (19.1%) were primary contributors, closely aligning with the study results.[7]

The low birth weight (LBW) prevalence of 15.6% among HRP cases is comparable to NFHS-5, which reports 15.4% LBW in Tamil Nadu overall. This similarity suggests that despite a high proportion of medically complicated pregnancies, effective antenatal care, timely referral, and institutional deliveries may have mitigated adverse neonatal outcomes. Studies from other districts in Tamil Nadu have also demonstrated that robust antenatal follow-up and early identification of HRP can substantially reduce stillbirths and neonatal mortality, findings supported by the very low stillbirth proportion (0.3%) observed in this study.

A community-based study from southern Tamil Nadu reported an LBW prevalence of 14–16%, similar to state and NFHS estimates. The study highlighted that early risk identification, minimum four ANC visits, and nutrition supplementation were associated with reduced LBW and stillbirths.[8]

Notably, nearly one-third of high-risk mothers had two or more coexisting risk factors, emphasizing the growing complexity of maternal risk profiles. This clustering of risks has been reported in multiple Indian studies and is increasingly linked to urbanization, delayed childbearing, lifestyle changes, and the rising prevalence of non-communicable diseases among women. NFHS-5 similarly points to a convergence of anaemia, overweight/obesity, and diabetes risk in Tamil Nadu, particularly in urban areas, which may explain the higher HRP prevalence observed in Avadi compared to Poonamallee.

Overall, the findings reaffirm Tamil Nadu's epidemiological transition in maternal health from predominantly obstetric causes to a combination of obstetric and medical conditions complicating pregnancy. While the state's strong maternal death surveillance and institutional delivery have contributed to a low MMR, the high prevalence of HRP calls for strengthened antenatal risk stratification, integration of NCD screening into routine ANC, focused counselling for women with previous LSCS, and continuity of care through referral linkages. Aligning programmatic strategies with insights from systems like PICME and population-level evidence from NFHS-5 will be crucial to sustain and further improve maternal and neonatal outcomes in Tamil Nadu.

CONCLUSION

More than one-third of pregnancies were categorized as high-risk, with hypothyroidism, previous LSCS, and gestational diabetes as major contributors. The high caesarean rate and notable burden of low birth weight highlight the need for strengthened antenatal risk stratification, timely referral, and comprehensive perinatal care to further reduce maternal and neonatal morbidity and mortality.

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ORIGINAL ARTICLE

KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING MEDICAL CERTIFICATION OF CAUSE OF DEATH AMONG PUBLIC HEALTH MEDICAL OFFICERS IN TAMIL NADU: A CROSS-SECTIONAL STUDY

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ABSTRACT

INTRODUCTION : Accurate cause-of-death data is vital for public health surveillance, policy-making, and monitoring health trends. In India, the Civil Registration System (CRS) mandates the documentation of deaths through the Medical Certification of Cause of Death (MCCD), yet the completeness and quality of data remain suboptimal.

OBJECTIVES : To assess the knowledge, attitudes, and practices (KAP) of Medical Officers in Public Health in Tamil Nadu regarding MCCD and CRS processes.

METHODS : A cross-sectional study was conducted among 1,421 Government Medical Officers working in Primary Health Centres (PHCs), Urban PHCs, and Community Health Centres (CHCs)across Tamil Nadu. A structured questionnaire assessed demographic details, knowledge of CRS/MCCD, attitudes toward their role, and current practices.

RESULTS: Among 1,421 practitioners, 84.3% identified the CRS objective correctly, 96.5% recognized mandatory reporting of vital events, and 94.4% knew the legal framework. Knowledge gaps remained for the death registration time limit (80.6% correct) and death report forms (57.3% correct). Attitudes were favourable, with >90% agreeing on the value of CRS/MCCD and supporting formal training. Most knew correct use of Forms 4 and 4A, but 52.5% deprioritized certification under workload.

CONCLUSION: Practitioners showed strong knowledge and attitudes, but gaps in specific practices and workload-related barriers persist. Curriculum integration, refresher training, and systemic support are needed to improve data quality for public health policy.

KEYWORDS : Medical certification, Civil Registration System, KAP.

INTRODUCTION

Reliable mortality data are foundational for public health surveillance, health policy formulation, and resource allocation. The Medical Certification of Cause of Death (MCCD) is a critical component of the Civil Registration System (CRS) in India, designed to record the medical cause of death using the internationally recognized International Classification of Diseases, 10th Revision (ICD-10) developed by the World Health Organization (WHO).[1]

Despite the mandatory nature of MCCD under the Registration of Births and Deaths Act, 1969, the system suffers from underutilization and poor quality of data, especially in low- and middle-income settings.[2] In India, only a fraction of deaths is medically certified, and even among those, many certificates lack accuracy or completeness, compromising the validity of cause-of-death statistics.[3]

Tamil Nadu, known for its progressive public health infrastructure, has shown relatively better coverage of civil registration and MCCD compared to other states.[4] However, anecdotal reports and prior audits suggest persisting gaps in knowledge, documentation practices, and adherence to ICD-10 guidelines among certifying physicians, particularly at the primary care level. Understanding the **knowledge, attitudes, and practices (KAP)** of medical practitioners who are directly responsible for certifying deaths is essential for strengthening the MCCD process. This study aims to assess the KAP of government Medical Officers working in Primary Health Centres (PHCs) across Tamil Nadu and to identify key barriers and enablers that influence compliance with MCCD standards.

METHODS

Study Design and Population: A cross-sectional survey was conducted involving 1,421 government-employed Medical Officers from Primary Health Centres including Urban Primary Health Centres(UPHCs) and Community

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Health Centres(CHCs) across all districts of Tamil Nadu. The inclusion criteria required participants to be actively working in any PHC/UPHC/CHC with a minimum of 2 years experience and involved in certifying deaths. All the primary health centres including UPHC and CHC from all the districts of Tamil Nadu were included for the study. Participation was voluntary and anonymous. The doctors not working in primary health centres and the doctors working under other schemes such as RBSK, MMU were excluded from the study.

Sampling method and Sample Size: Total population sampling or census sampling was used, wherein all Medical Officers working in Primary Health Centres (PHCs), Urban Primary Health Centres (UPHCs), and Community Health Centres (CHCs) across all districts of Tamil Nadu who fulfilled the inclusion criteria were invited to participate in the study. The final sample consisted of 1,421 Medical Officers who consented to participate during the study period.

Assuming a prevalence of 50% for adequate knowledge regarding Civil Registration System and Medical Certification of Cause of Death, with a 95% confidence level and 3% absolute precision, the minimum sample size required was calculated to be 1,067. The achieved sample size of 1,421 exceeded this requirement.

Given the large sample size (n = 1,421), the study was adequately powered (>80%) to detect moderate differences in practice behaviors across qualification levels at a 5% level of significance.

A self-developed structured questionnaire was used, as no standardized tool specific to CRS and MCCD was available. The questionnaire was developed based on the Registration of Births and Deaths Act, 1969, Registrar General of India guidelines, WHO manuals, and relevant literature. The questionnaire consisted of 42 items: 18 Knowledge, 14 Attitude, and 10 Practice questions. It was administered in English.

The tool was pilot tested among Medical Officers not included in the final analysis, and minor modifications were made based on feedback. Content validity was ensured through expert review. Attitude and practice items used a 5-point Likert scale (strongly disagree to strongly agree). For analysis, "agree" and "strongly agree" responses were considered positive. Knowledge items were analyzed as correct or incorrect.

Results were analyzed domain-wise rather than as composite KAP scores. The survey questionnaire included Demographic Information such as age, gender, qualifications, work location. Knowledge Section consisted of questions on CRS objectives, time limits, legal framework, ICD-10 coding, purpose and responsibilities related to Form 4/4A. The Attitude Section consisted of questions related to perceived importance of MCCD, willingness to learn, training needs, and ethical views on accurate death certification and the Practice section consisted of questions related to training history, frequency of form completion, availability of materials, feedback mechanisms, and use of the CRS online portal.

Responses included multiple choice, Likert scales, and yes/no options. Data was captured via google forms to each participant, informing the participant the objectives of the study ensuring confidentiality. The operational definitions we used in this study are listed below,

Civil Registration System (CRS): A statutory system for the registration of births and deaths as mandated under the Registration of Births and Deaths Act, 1969.

Form 2: The official death report submitted to the Registrar under the Civil Registration System for the purpose of death registration.

Medical Certification of Cause of Death (MCCD): Certification of the cause of death by a registered medical practitioner using prescribed formats - **Form 4** for institutional deaths and **Form 4A** for non-institutional deaths.

Medical Officer: A registered medical practitioner employed in Government Primary Health Centres (PHCs), Urban Primary Health Centres (UPHCs), or Community Health Centres (CHCs) in Tamil Nadu.

Knowledge: Correct responses to questions related to CRS and MCCD, scored as 1 for correct and 0 for incorrect responses.

Attitude: Perceptions towards CRS and MCCD measured using a Likert scale; responses of "agree" or "strongly agree" were considered indicative of a positive attitude.

Practice: Self-reported behaviours related to CRS and MCCD; responses reflecting adherence to recommended practices were considered appropriate.

Workplace: Classified as rural or urban based on the geographical location of the health facility.

DATA ANALYSIS

Knowledge items were scored 1 for correct and 0 for incorrect (range: 0–18). Attitude and practice items used a 5-point Likert scale and were dichotomized for analysis: agree/strongly agree = 1, others = 0 (ranges: attitude 0–14; practice 0–10). Scores were analyzed domain-wise without creating composite KAP categories. Descriptive statistics (frequencies, percentages) were used to summarize

demographic and KAP variables. Inferential analysis including cross-tabulations explored associations between qualification level and practice behaviours. Data analysis was done using SPSS-26.

RESULTS

Participant Characteristics

A total of 1,421 government Medical Officers participated in the study. Of these, 54.3% were female (n=771) and 45.7% male (n=650). The majority were from rural postings (86.1%), while 13.9% worked in urban areas. Only 11.0% held a postgraduate qualification, while the rest were graduates.

Table 1: Knowledge, Attitudes, and Practices (KAP) of Government Medical Officers (N=1421)

Domain	Key Findings	% Correct/Positive
Knowledge	Knew CRS objective = vital statistics	84.3%
	Reported all events under CRS	96.5%
	Knew legal framework (RBD Act, 1969)	94.4%
	Knew correct time limit for death registration (21 days)	80.6%
	Correctly identified ICD-10 role	94.9%
Attitudes	CRS data useful for decision-making	91.6%
	MCCD as legal/public health duty	92.9%
	Motivated to improve skills	93.2%
	Training should be in UG & PG	89.7%
	Death certification affects healthcare perception	86.3%
	Accurate certification valuable for national policy	96.0%
Practices	Form 4 issued by treating RMP	93.8%
	Form 4A for community deaths	91.0%
	Find MCCD form easy to use	94.2%
	Likely to deprioritize under workload	52.5%

Knowledge of CRS and MCCD

Most Medical Officers (84.3%) correctly identified the primary objective of the Civil Registration System (CRS) as generating vital statistics, while 14.8% incorrectly reported hospital records as the main purpose. Nearly all respondents (96.5%) recognized that births and deaths must be mandatorily reported, and 94.4% identified the Registration of Births and Deaths Act, 1969 as the governing law.

Regarding death registration, 80.6% correctly reported the 21-day time limit, though some cited 7, 14, or 30 days. When asked about the death report form (Form 2), 57.3% selected Form 4(Cause of death form), 38.8% selected Form 2, and smaller proportions selected other options. Awareness of the purpose of MCCD was high, with 76.8% reporting "all of the above" (legal confirmation, insurance, and statistical analysis). Similarly, 94.9% recognized that ICD-10 is used to classify causes of death.

Attitudes toward CRS and MCCD

Overall, attitudes were favourable (Table 1). More than nine in ten Medical Officers considered CRS data useful for local public health decision-making (91.6%) and agreed that MCCD is an important legal and public health duty of doctors (92.9%). Motivation was high, with 93.2% willing to improve their certification skills, and 89.7% supporting inclusion of MCCD training in both undergraduate and postgraduate curricula.

Further, 86.3% agreed that certification influences community perceptions of healthcare quality, and 96.0% valued accurate certification for shaping national health policies. Regarding accountability, 68.2% favoured penalties for deliberate misreporting, while 26.2% preferred awareness-based approaches.

Practices in Death Certification

Most participants (93.8%) correctly reported that Form 4 (institutional deaths) is issued by the treating registered medical practitioner, while 91.0% identified that Form 4A is used for deaths outside institutions. A large majority (94.2%) found the current MCCD form easy to use. However, workload affected compliance: 52.5% admitted that they deprioritize MCCD documentation during high patient loads.

Table 2: Significant Associations between Demographics and Knowledge/Practices (Chi-square Tests)

Variable	Rural (%)	Urban (%)	χ^2	p-value
Correct time limit for death registration (21 days)	79.3	88.8	17.01	**0.001**
Correct death report form	56.1	63.8	4.03	**0.045**
Purpose of MCCD(Form 4, 4A)	76.5	78.9	0.87	0.832
Role of ICD-10 in certification	94.7	96.1	1.1	0.776

Associations with Demographics

Chi-square analysis revealed significant associations (Table 2). Knowledge of the time limit for death registration differed significantly between rural and urban practitioners, with urban doctors more frequently answering correctly (p=0.001). Similarly, rural practitioners were less likely to identify the correct death report form (p=0.045). Other knowledge domains (CRS objectives, legal framework, purpose of MCCD, role of ICD-10) showed no significant differences.

DISCUSSION

This study assessed the knowledge, attitudes, and practices (KAP) of government Medical Officers in Tamil Nadu regarding the Civil Registration System (CRS) and Medical Certification of Cause of Death (MCCD). The findings reveal generally high awareness of CRS objectives, legal frameworks, and death certification processes, accompanied by favourable attitudes toward the utility of these systems. However, gaps remain in certain domains of knowledge and practice, particularly in identifying the correct death reporting forms and ensuring compliance under heavy workloads.

Knowledge levels were encouraging, with most Medical Officers recognizing the importance of CRS in generating vital statistics and identifying the Registration of Births and Deaths Act, 1969, as the governing law. Similar high awareness of ICD-10 classification indicates that international coding standards are well understood.
Nonetheless, nearly one in five respondents were unaware of the correct 21-day time limit for death registration, and over 40% misidentified the correct death report form, highlighting areas where targeted training is still required. These gaps are consistent with previous studies in India and other low- and middle-income countries, which have documented variability in physician knowledge of MCCD procedures and reporting timelines[5-7]

Attitudes toward CRS and MCCD were overwhelmingly positive. The majority perceived certification as a professional responsibility and a valuable tool for health planning, in line with global evidence that accurate mortality data strengthens surveillance and policy development. [8,9] The strong motivation to improve skills and demand for inclusion of MCCD training in both undergraduate and postgraduate curricula further reinforces the need to institutionalize capacity-building in medical education, as recommended by the Registrar General of India and the World Health Organization.[10,11]

Practices reflected both strengths and weaknesses. Most doctors correctly reported the responsibility of the treating practitioner in issuing Form 4 and the use of Form 4A for community deaths. Nearly all found the MCCD form easy to use, which is reassuring. However, more than half admitted deprioritizing certification under high workload conditions. Similar barriers, including competing clinical priorities and lack of administrative support, have been reported in studies from India, Nepal, and sub-Saharan Africa.[12,13]

These findings emphasize the need for systematic training and supportive supervision to address residual gaps in MCCD implementation. Integrating MCCD modules into undergraduate and postgraduate curricula, as strongly supported by respondents, may ensure consistent competency across cadres. Refresher training and continuous medical education programs, especially targeted at rural practitioners, could bridge the observed knowledge disparities.

The tendency to deprioritize certification under workload pressure highlights structural challenges within government facilities. Simplification of procedures, digitalization of death certification, and dedicated data entry support could reduce the burden on doctors and improve compliance.[10-14] Strengthening accountability mechanisms, including clear guidelines on penalties for deliberate misreporting, may further enhance accuracy, though this should be balanced with educational approaches to avoid punitive resistance.

LIMITATIONS

This study was limited to government medical practitioners in Tamil Nadu and may not capture practices in private or tertiary institutions. Self-reported practices may also be influenced by social desirability bias. Moreover, while the study identified associations between demographics and knowledge, causal inferences cannot be drawn due to the cross-sectional design.

RECOMMENDATIONS

Based on the findings, the recommendations proposed are , Integration of MCCD training into curricula at both undergraduate and postgraduate levels, in line with global best practices, Targeted refresher training for rural practitioners, supported by district health authorities, Supportive supervision and accountability frameworks that balance education and enforcement, ensuring compliance without punitive backlash, Continuous monitoring and evaluation of CRS/MCCD data quality to inform iterative policy improvements.

CONCLUSION

Government Medical Officers in Tamil Nadu demonstrate high knowledge and favourable attitudes toward CRS and MCCD, but gaps persist in specific knowledge areas and in consistent practice under high workloads.

Addressing these challenges through curriculum reform, refresher training, and systemic support will be essential to improve the completeness and quality of mortality data, thereby strengthening public health surveillance and policy-making.

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CONFLICT OF INTEREST

None

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ORIGINAL ARTICLE

OPPORTUNITIES FOR PROCESS IMPROVEMENT: IMPLEMENTING GOOD PRACTICES TO ENHANCE EFFICIENCY IN REPORTING MEDICAL CAUSES OF DEATH IN KELAMANGALAM BLOCK, KRISHNAGIRI DISTRICT

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ABSTRACT

INTRODUCTION : Accurate reporting of Medical Certification of Cause of Death (MCCD) is essential for reliable mortality statistics and informed public health planning. In Krishnagiri district, Tamil Nadu, a review of internal processes was undertaken to identify gaps in documentation and electronic reporting within the Civil Registration and Vital Statistics system.

METHODS : A process review and audit were conducted in Kelamangalam and Denkanikottai Town Panchayats. Verbal autopsy practices, availability of Form 4 and Form 4A (MCCD), and entries in the Electronic Mortality (e-MOR) platform were assessed. Discrepancies between available hard-copy MCCD forms and electronic records were identified and escalated through district health authorities. Corrective actions, including retroactive data entry and district-wide audits, were initiated.

RESULTS : In Kelamangalam Town Panchayat, 79 of 85 home deaths had Form 4A available; however, 63 were not entered into e-MOR. In Denkanikottai, 54 of 173 deaths had Form 4A available, with 7 not uploaded to e-MOR. The review highlighted underutilization of available MCCD documentation and gaps in data entry processes. Following escalation, retroactive provisions enabled correction of pending entries, and a district-wide audit was initiated to standardize practices.

CONCLUSION: Strengthening documentation practices, improving data entry training, and instituting regular audits can significantly enhance the completeness and accuracy of cause-of-death reporting. The collaborative model adopted in Kelamangalam demonstrates a scalable good practice for improving CRS efficiency and supporting evidence-based public health decision-making.

KEYWORDS: Medical Certification of Cause of Death (MCCD), Civil Registration and Vital Statistics, Electronic Mortality (e-MOR), Mortality Data Quality, (e-MOR), Mortality Data Quality.

INTRODUCTION

Vital statistics data offer the most comprehensive evaluation of the annual mortality burden and provide essential metrics for assessing both the direct and indirect impacts of mortality on public health.[1] Accurate estimates of injury-related deaths are crucial for setting national health priorities and developing effective prevention strategies. 2,3 District Civil Registration System (CRS) approach was piloted in two districts of Tamil Nadu. As part of the ongoing commitment to optimize the accuracy and efficiency of cause-of-death reporting, a review of internal processes was undertaken. This review aimed to identify areas for improving the quality of data and streamlining operations. During the evaluation, gaps were identified that presented opportunities to enhance the accuracy and timeliness of cause-of-death information. Addressing these gaps would strengthen the reliability of mortality data and contribute positively to public health monitoring and resource allocation. This report outlines the identified process gaps, their impact, and recommendations for improvement.

IDENTIFYING OPPORTUNITIES FOR PROCESS IMPROVEMENT

In Krishnagiri district, verbal autopsies were systematically conducted to ascertain causes of death for all cases reported without a Medical Certificate of Cause of Death (MCCD) using Form 4 or Form 4A. Form 4 is used for institutional deaths, while Form 4A is used for non-institutional deaths. Verbal autopsies are carried out by Public Health Staff, who play a critical role in collecting essential information during the process.

During field assessments, Public Health Staff identified instances where Form 4A was available with respondents, indicating that important documentation existed but had not been adequately utilized in the reporting process.

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Recognizing the significance of this finding, the Public Health Staff informed the Block Health Supervisor, who subsequently escalated the matter to the Block Medical Officer for further action. Under the guidance of the Block Medical Officer, a dedicated team visited the Kelamangalam Town Panchayat Office to conduct a comprehensive audit assessing the availability and utilization of Form 4A in official records. The audit aimed not only to verify documentation but also to understand the underlying processes affecting the accuracy of cause-of-death reporting. The review at the Town Panchayat Office highlighted a commendable practice of collecting comprehensive documentation related to causes of death, including Form 4, Form 4A, and FIR/postmortem reports. Among the 85 home deaths registered, MCCD documentation was available as hard copies for 79 deaths, while FIR copies and postmortem reports were available for the remaining six deaths (Table 1).

Table 1: Reporting of Home Deaths in Krishnagiri District

Registration Unit	Total Home Deaths Registered	Form 4A Available	MCCD Captured in e-MOR
Kelamangalam Town Panchayat	85	79	16
Denkanikottai Town Panchayat	173	54	47

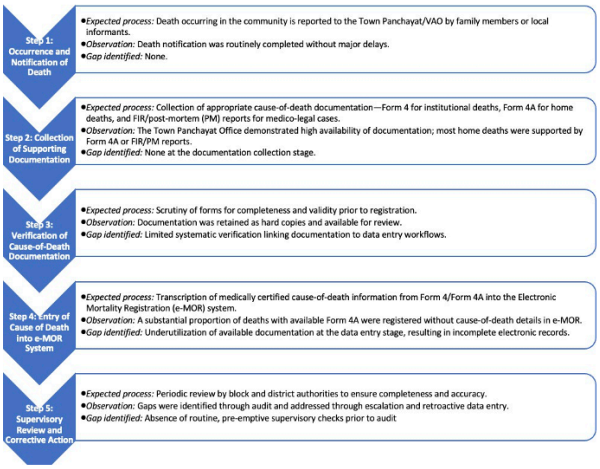

Figure 1: Process Flow and Identified Gaps of Cause-of-Death Documentation in Kelamangalam block, Krishnagiri district, Tamil Nadu

This proactive approach demonstrates a commitment to thoroughness and accuracy in mortality reporting. However, the review also identified an opportunity for improvement in data entry practices, as 63 out of 79 deaths with available Form 4A were not entered into the e-MOR system. As a follow-up measure, the Denkanikottai Town Panchayat Office was also audited to identify similar issues related to cause-of-death documentation. Of the 173 deaths registered, 54 had Form 4A available; however, for seven of these deaths, the cause of death had not been entered into the e-MOR platform despite the availability of supporting documentation. The identified cases were promptly escalated to district officials. Through the District Health Officer (DHO), who oversees birth and death registration activities in the district, the issue was brought to the attention of state authorities. In response, retrospective data entry provisions were enabled in the e-MOR platform to facilitate accurate and timely documentation of these cases.

To further improve the availability and utilization of MCCD during death registration, the DHO directed audits of all town and village panchayat offices in the district. This initiative aimed to ensure that all available documentation is accurately uploaded into the system, thereby improving the overall quality of mortality registration. The collaborative efforts of Public Health Staff, the Block Health Supervisor, and the Block Medical Officer in Kelamangalam exemplify a proactive approach to improving mortality data quality. Their identification of documentation gaps and coordinated response represent a good practice model for strengthening mortality surveillance systems. By ensuring effective utilization of available forms and documentation, the initiative contributes to improved public health monitoring and evidence-based decision-making. This review also highlights the need for enhanced awareness and training among data entry operators regarding the interpretation and entry of information from available documents. Regular training workshops and feedback sessions may help operators discuss challenges, share best practices, and foster a culture of continuous quality improvement. The initiative successfully identified critical gaps in the documentation process within the Electronic Mortality Registration (e-MOR) system.

DISCUSSION

The Tamil Nadu Vital Statistics Report 2020 observed that only a small proportion (25%) of deaths in Krishnagiri district had medically certified causes of death. The present review demonstrates that timely interventions can help rectify gaps in CRS reporting. Ensuring that all deaths are accurately documented in the CRS portal can substantially improve the quality of mortality data and support more effective public health planning and intervention.[4] The initiative undertaken by the team was particularly important because accurate cause-of-death data are essential for public health monitoring. Identification of mortality trends enables better allocation of resources and informs targeted public health actions.[5,6] Despite ongoing efforts to strengthen standardized registration systems,

MCCD documentation continues to face challenges related to completeness, transparency, and accuracy. Previous findings have shown considerable gaps between reported deaths and medically certified causes of death, highlighting the need for improved documentation practices.[7] The present review revealed significant challenges, particularly the underutilization of Form 4A despite its availability, which compromises the accuracy of mortality data and limits the effectiveness of public health interventions. The audit at Kelamangalam Town Panchayat Office demonstrated strong documentation practices, with MCCD available for 79 out of 85 deaths. However, deficiencies in data entry practices were identified as a major concern. One key area requiring improvement is the training of data entry operators.[8] Ensuring that personnel are adequately trained to interpret and correctly enter information from Form 4A could substantially enhance the quality and completeness of mortality data. The collaborative efforts of Public Health Staff, Block Health Supervisors, and Block Medical Officers were instrumental in identifying and addressing documentation gaps. This teamwork model could serve as a best practice for replication in other regions. The district-wide audit initiated by the District Health Officer represents an important step toward strengthening mortality surveillance. Such comprehensive reviews can ensure adherence to standardized documentation practices across all town and village panchayat offices, thereby improving the overall quality and reliability of mortality data.

LIMITATION

A limitation of this review is that it did not assess the underlying reasons for the non-utilization of Form 4A despite its availability, such as gaps in staff training, workload issues, or administrative barriers affecting data entry practices.

CONCLUSION

The review of cause-of-death reporting processes in Krishnagiri district identified important gaps in the utilization of Form 4A (MCCD) during verbal autopsies and mortality registration. Audits conducted in Kelamangalam and Denkanikottai Town Panchayat Offices revealed that several deaths with available MCCD documentation had not been entered into the e-MOR system, resulting in incomplete cause-of-death data. These findings prompted the District Health Officer to initiate district-wide audits to ensure accurate and timely data entry across all registration units. The review underscores the importance of standardized training for personnel, strengthened data entry procedures, and periodic monitoring to improve documentation practices. Implementing these measures can enhance the reliability of mortality reporting systems, support effective public health monitoring, and facilitate evidence-based decision-making at the community and district levels.

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