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Exemplars in Maternal and Newborn Health India Study

State Report: Tamil Nadu

2023

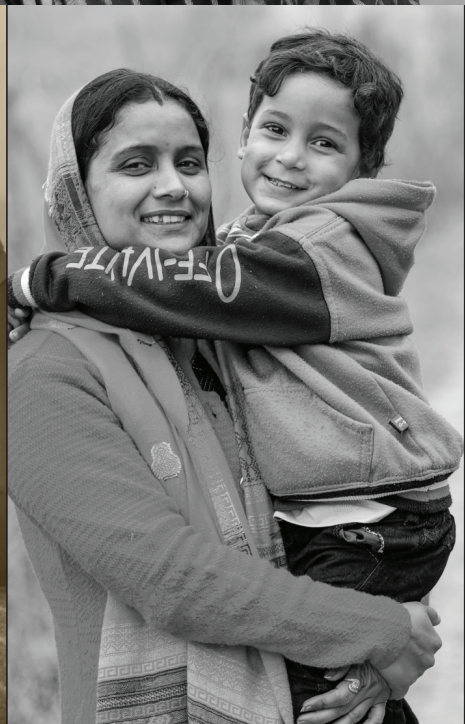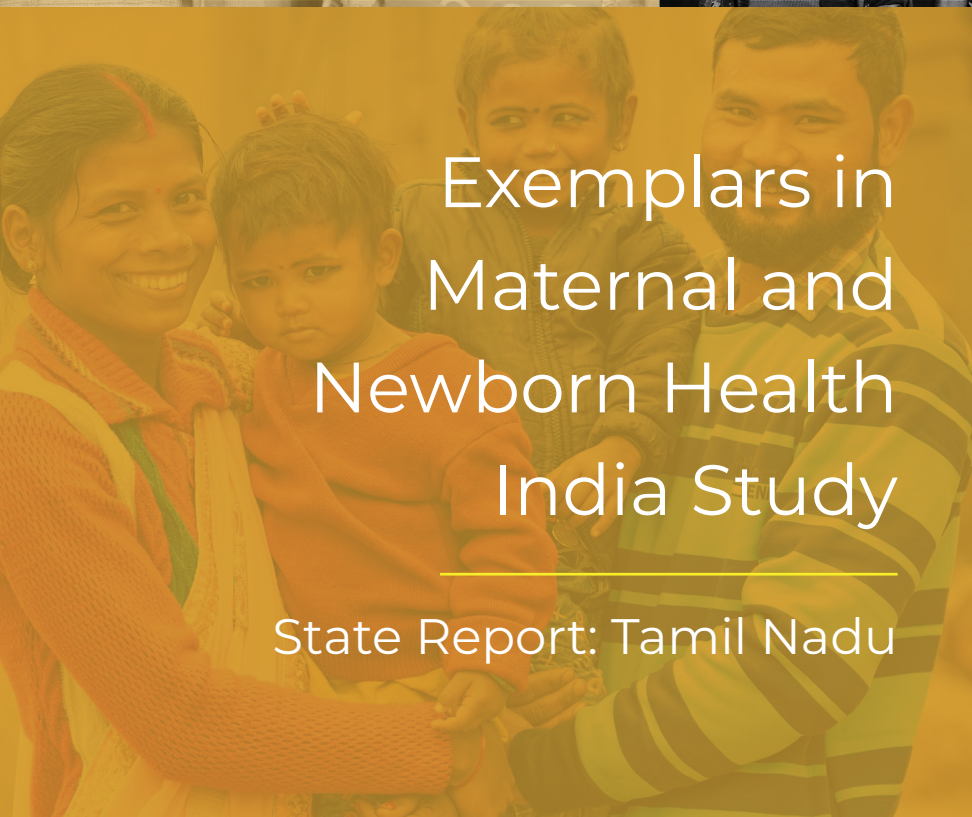# Exemplars in Maternal and Newborn Health India Study

State Report: Tamil Nadu

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ABBREVIATIONS

AARC	Average Annual Rate of Change
ANC	Antenatal Care
ANCq	Antenatal Care with Content
ANM	Auxiliary Nurse Midwife
BEmONC	Basic Emergency Obstetric and Newborn Care
BMI	Body Mass Index
CEmONC	Comprehensive Emergency Obstetric and Newborn Care
CHC	Community Health Center
CSSM	Child Survival and Safe Motherhood
DLHS	District Level Household Survey
DPH	Directorate of Public Health
FOGSI	Federation of Obstetric and Gynecological Societies of India
FRU	First Referral Unit
GBDS	Global Burden of Disease Study
HMIS	Health Management Information System
HMS	Higher Mortality States
HRH	Human Resource for Health
HSC	Health Sub-Centre
IHAT	India Health Action Trust
IIPS	International Institute for Population Sciences
INR	Indian Rupee
JSY	Janani Suraksha Yojana
KII	Key Informant Interview
LMS	Lower Mortality States
LPG	Liquefied Petroleum Gas
MCEE	Maternal and Child Epidemiology Estimation
MDS	Million Death Study
MDSR	Maternal Death Surveillance Response
MMR	Maternal Mortality Ratio
MNH	Maternal and Newborn Health
NFHS	National Family Health Survey
NHM	National Health Mission
NHSRC	National Health Systems Resource Centre
NICU	Neonatal Intensive Care Unit

NMR	Neonatal Mortality Rate
NRHM	National Rural Health Mission
OOPE	Out-of-pocket Expenditure
PCI	Per Capita Income
PHC	Primary Health Centre
PNC	Postnatal Care/Checkup
PPP	Public Private Partnership
RCH I	Reproductive and Child Health I
RCH II	Reproductive and Child Health II
RMNCAH+N	Reproductive, Maternal, Newborn, Child and Adolescent Health plus Nutrition
RMNCH	Reproductive, Maternal, Newborn, and Child Health
RMNCH+A	Reproductive, Maternal, Newborn, and Child Health plus Adolescent Health
SBA	Skilled Birth Attendant
SDG	Sustainable Development Goals
SNCU	Special Newborn Care Unit
SRS	Sample Registration System
TFR	Total Fertility Rate
TNMSC	Tamil Nadu Medical Services Corporation
UoM	University of Manitoba
VHN	Village Health Nurse
WHO	World Health Organization

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EXECUTIVE SUMMARY

The Exemplars in Maternal and Newborn Health Study documents factors associated with rapid reductions in maternal and neonatal mortality over the past two decades. This international effort aims to understand positive outliers and inform policy and practice. India was selected as one of seven "Exemplar" countries and within India the analysis was extended to examine higher- and lower-mortality state clusters separately, and to closely look at six exemplary states: Maharashtra, Tamil Nadu, Rajasthan, Odisha, Uttar Pradesh, and Madhya Pradesh. This report presents the Tamil Nadu sub-study and provides background information on the broader India study and research methodology. Key findings for Tamil Nadu are as follows:

- Tamil Nadu made major progress in reducing maternal and neonatal mortality between 2000 and 2018. The progress was greater than most other lower mortality states and by 2018 the state had the second lowest neonatal mortality rate (NMR) among the major states in India. Tamil Nadu achieved the Sustainable Development Goal (SDG) targets for both maternal mortality ratio (MMR) and NMR.

- Neonatal mortality in the first two days of life (days 0 to 2) declined most rapidly, indicative of improvements to quality of delivery care and the newborn's health status. Deaths attributed to prematurity contributed most to the total decline in NMR, followed by birth asphyxia and infections.

- Tamil Nadu's gains in intervention coverage have been marked: the state experienced rapid increases in four or more antenatal care visits, antenatal care with contents, institutional deliveries (notably in hospitals rather than health centres during the CSSM and RCH-I periods), and C-sections among rural and the poorest.

- Increased neonatal survival has been driven by the rise in hospital deliveries, which accounted for 80% of all deliveries in 2019-21, and concurrent reduction of neonatal mortality in hospitals (more so in private than public hospitals).

- Tamil Nadu has continued to progress into late stage IV of the transition model owing to reaching near universality of key interventions among disadvantaged populations, improving quality of care (increased coverage levels of antenatal care (ANC) with contents and reduced NMR for hospital deliveries) and most women delivering in facilities with comprehensive emergency capacity (C-sections and Special Newborn Care Units).

- Several health policies and system reforms have contributed to Tamil Nadu's success. These are:

  - Tamil Nadu strengthened the Basic Emergency Obstetric and Newborn Care (BEmONC) capabilities in PHCs with SBA-trained staff nurses and medical officers, and increased the density of community health centres, thereby increasing the availability of Comprehensive Emergency Obstetric and Newborn Care (CEmONC)-enabled delivery points.

  - Tamil Nadu invested in public medical colleges and incentivised doctors to work in rural government facilities.

  - Tamil Nadu's unique public health management structure has enabled integrated, primary health care-oriented public health management by experienced and highly trained public health professionals.

- Tamil Nadu has led the country in major clinical and quality improvement processes, including the maternal death review (and addition of referral reviews and near-miss audits), prenatal screening, IV anaemia care for pregnant women, birth companionship, neonatal screening, breastfeeding support, and monitoring and birth planning for high-risk pregnancies.

- The formation of the Tamil Nadu Medical Service Corporation (TNMSC) introduced a robust procurement system that ensures citizen's access to free medicines in the facility.

- Tamil Nadu was the first to introduce a maternity benefit scheme: the Dr. Muthulakshmi Reddy Maternity Benefit Scheme encouraged health care use among the poor and increased women's access to nutrition.

- The government has supported private facilities to improve quality of care by allowing them to access public training and protocols; private facilities that offered free and high-quality services to the poor could participate in the Dr. Muthulakshmi Reddy Maternity Benefit Scheme. This allowed women to receive conditional cash transfers when they delivered in the empanelled private facilities.

- The welfare state model of development has historically received widespread support in the general population and among politicians across major parties in the state.

- Tamil Nadu's leadership drove progress on maternal and newborn survival through targeted interventions (using data to focus on marginalized areas and populations) and an ethos of constant improvement (e.g., building from blood availability to blood availability next to the labour room, from maternal death review to "near-miss" review, from infrastructure to quality, from access to care within an hour to within 30 minutes).

- Tamil Nadu's government has prioritized primary health care and funded it accordingly.

BACKGROUND AND STUDY DESIGN

The Exemplars in maternal and newborn health (MNH) study aims to systematically and comprehensively research and document factors associated with rapid reductions in maternal and neonatal mortality over the past two decades in select countries that have experienced more rapid declines than countries with similar socio-economic progress. This study contributes to a Gates Ventures initiative on Exemplars in Global Health, which includes other subject areas such as child mortality, stunting, community health worker programs, and vaccine delivery. The study is an international effort to learn from success and understand positive outliers to inform policy and practice.

India has made major progress in improving maternal and newborn health outcomes over the past two decades. According to India's Sample Registration System (SRS), between 2000 and 2018, the maternal mortality ratio dropped from 327 to 103 per 100,000 live births and the neonatal mortality rate from 44 to 23 per 1,000 live births. India's decline in mortality outpaced the global and regional decline, with or without adjustment for economic growth. In 2000, India accounted for 23% of maternal deaths and 31% of neonatal deaths globally. By 2017, these proportions had reduced to 12% of maternal deaths and 22% of neonatal deaths globally.[1,2] Therefore, important lessons can be learned from a systematic investigation of the drivers of India's progress, nationally and sub-nationally, for India to build on its success and for other countries seeking to accelerate progress in MNH.

The primary objective was to systematically investigate, document and compare the contribution of health policies and systems, programs, and services, as well as changes in coverage, quality, and equity of reproductive, maternal, newborn, and child health (RMNCH) interventions and contextual factors, to the reduction in maternal and neonatal mortality in India over the past two decades nationally and sub-nationally. The study was implemented by a team led by the National Health Systems Resource Centre (NHSRC) in collaboration with the International Institute for Population Sciences (IIPS), the University of Manitoba (UoM), and the India Health Action Trust (IHAT). The Ministry of Health and Family Welfare, Government of India supported the study under the guidance of a steering committee supported by a technical working group and a core implementation team.

The mixed methods study included the following components:

- *National macro-level analysis*: Develop an understanding of India's levels and trends in maternal and neonatal mortality, and how these coincided with changes in health policies and systems, health programs and services, contextual factors, and MNH intervention coverage and equity, and identify clusters of states with varied contexts contributing most to India's national progress.

- *State-level in-depth analysis:* Gain an in-depth understanding in six exemplar states of the pathways by which key drivers may have led to reductions in the states' neonatal mortality rate (NMR) and maternal mortality ratio (MMR).

- *Synthesis:* Develop an analytical synthesis across the national and state-level research findings on the success factors contributing most to the reduction of maternal and neonatal mortality in India and exemplar states.

Study design

Conceptual framework for the Exemplars MNH study

The Exemplars in MNH study was guided by a conceptual framework that was developed to identify the drivers of change, dividing the interrelated factors hierarchically in distal, intermediate, and proximate drivers of maternal and neonatal mortality decline (Figure 1).[3]

On the far left of the framework, the health policy and system levers are the tools used by governments to improve MNH specifically and, non-MNH issues that may have an enormous impact on MNH. Government actions include changes in policy, services, and financial resources with direct or indirect linkages to MNH. Direct changes include strategies to strengthen the health system, while indirect changes include efforts to enhance gender equity or infrastructure in underserved parts of the country that would affect MNH outcomes.

Macro- and community-level contextual factors (e.g., social, cultural, economic, political, or geographical) at the distal level may moderate the effects of health policy and system changes on program and service outputs for MNH and their impact on coverage of key MNH interventions and health outcomes. They can also directly influence the levels and equity of intervention coverage and/or maternal and newborn survival.

The health policy and system levers at the distal level aim to specifically influence program and service levers at the intermediate level, which are the concrete outputs of government actions in the health sector. These outputs include actual changes in service contents or program strategies, including access, readiness, quality, and integration of health services, necessary to increase intervention coverage and equity, and ultimately impact MNH.

Contextual factors at the intermediate level include the household and individual-level characteristics, including material circumstances (such as household assets and income), behavioural norms and decision-making, and health status/need of the women and babies concerned, which are seen to affect intervention coverage and mortality outcomes directly or indirectly.

These distal and intermediate factors are conceptualized as influencing the proximate factors, namely the coverage of interventions at promotive, preventive, and curative levels. This includes quality-adjusted coverage, and the degree that these are equitable between socio-economic groups and geographical regions. Coverage of interventions is considered most directly associated with a positive impact on maternal and newborn survival.

Figure 1: Conceptual framework for the study of drivers of the maternal and neonatal mortality decline, MNH Exemplars study
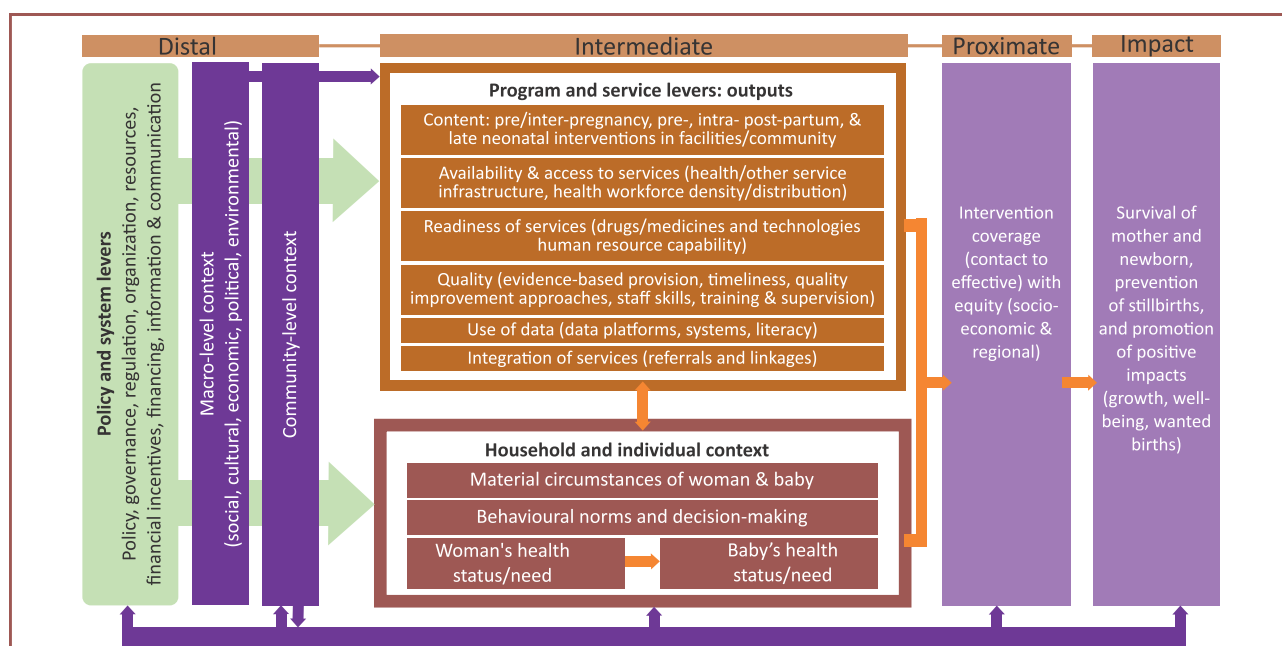
Identifying critical periods of policy change to guide analysis

The period of primary interest is 2000 to 2020, or the year the latest data was available. Levels and trends prior to 2000 are also relevant to understanding whether there were changes in pace of decline post-2000. To assess the possible impact of major policy and program changes implemented through the National Health Mission (NHM) to deliver services across the RMNCAH+N continuum of care across India, we divided the time period into four intervals to guide our mixed-methods analyses: the Child Survival and Safe Motherhood (CSSM) program from 1992 to 1997, the Reproductive and Child Health I (RCH I) program from 1997 to 2005, the Reproductive and Child Health II (RCH II) program and the National Rural Health Mission (NRHM) from 2005 to 2012; and the Reproductive, Maternal, Neonatal, Child and Adolescent Health (RMNCH+A) program and NHM from 2012 to 2020 (Figure 2). In addition, we assessed all annual or five-year time trends (depending on the indicator): periods of acceleration or deceleration of the decline in the relevant indicator (using the average annual rate of change).

Figure 2: India's health policy periods
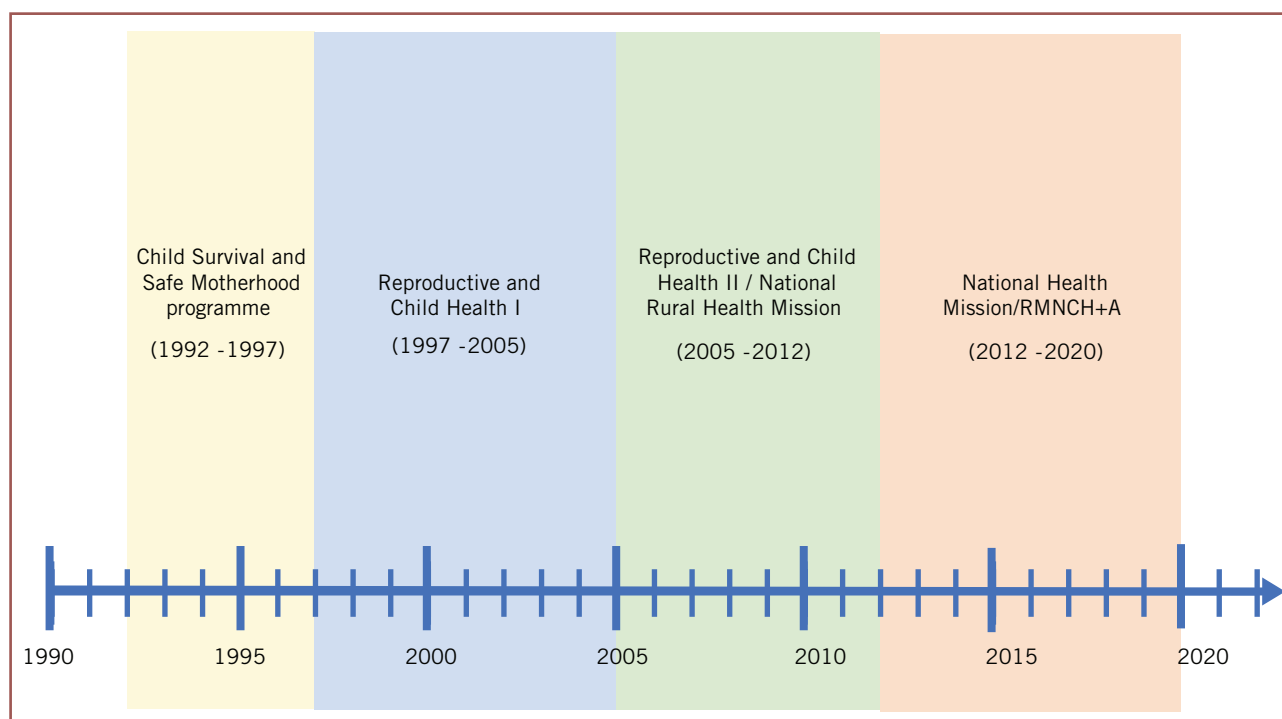
State clusters

We observed two distinct clusters of states based on the situation in 2000 and 2018: one of higher mortality states (HMS) with lower per capita income (PCI), and one of lower mortality states (LMS) with higher PCI (Figure 3). The two state clusters resulting from this approach were:

- Lower mortality with higher PCI (47% of India's population): Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Punjab, **Tamil Nadu**, Telangana, and West Bengal

- Higher mortality with lower PCI (49% of India's population): Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh, Uttarakhand (all of which were part of the Empowered Action Group), and Assam

Figure 3: Comparison of state-specific MMR and NMR levels in 2000 and 2018 by state per capita income
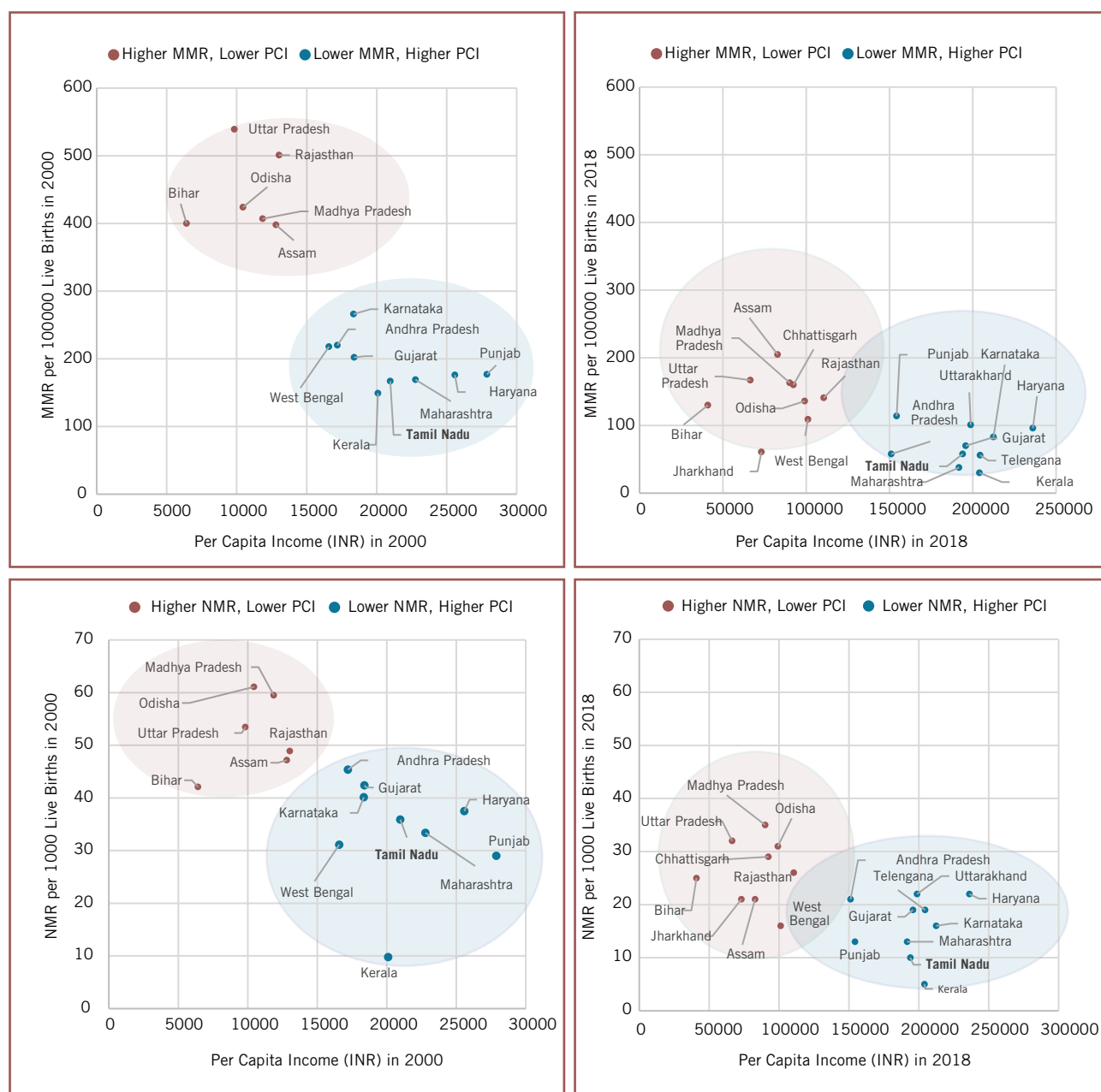
Note: West Bengal, with a similar MMR and NMR to the lower mortality states but lower per capita income in 2018 is included in the lower mortality/higher PCI cluster. Uttarakhand with a similar MMR and NMR to the higher mortality states, but higher PCI in 2018 is included in the higher mortality/lower PCI cluster.

Selection of six states for in-depth analyses

Many states in India experienced impressive declines in both maternal and neonatal mortality during 2000-17, and so it is valuable to comprehensively study how different states achieved success. At the time of state selection, we used available data and computed average annual pace of the decline in both maternal and neonatal mortality during 2000-17 and selected the six best performing states, to reflect the two main outcomes of the study. We also considered population size, and different dimensions of equity (available for the neonatal mortality outcome). However, the results provide variable conclusions on the six states with most progress, and there is more uncertainty because of larger sampling errors for disaggregated data. Hence, considering the key objective of selecting states that have achieved fastest declines in MMR and NMR since 2000, the strongest indicator is the sum of a state's NMR and MMR average annual rates of change (AARCs).

All major (large population) states were considered in the selection process. The AARCs in maternal and neonatal mortality during 2000-17 were used as the main statistics for selection. The selection was based on SRS data, with its high consistency over time and availability for both indicators. The National Family Health Survey (NFHS) also provides trend data on neonatal mortality. The NFHS mortality data are more limited as they are only available for neonatal mortality, and there are more data quality-related and sample size-related issues that affect state-level trends.

The contribution of the cluster of higher mortality states to the India's progress was over 70% for maternal mortality and over 60% for neonatal mortality. Therefore, four of the six states selected for in-depth analysis were from the higher mortality cluster of states, and two from the lower mortality cluster of states. Conducting in-depth analysis in diverse states also provides scope for analyzing the drivers of success within different health systems, socio-economic and demographic contexts over time.

The AARCs for maternal and neonatal mortality are measures of common unit and scale. Therefore, we added the two rates to obtain an overall score for ranking the states within the cluster. The sum of the maternal mortality and neonatal mortality AARCs is shown in Table 1 below. Based on the sum of the two AARCs, the top-ranking four states overall among the high mortality state cluster are Rajasthan (-10.1%), Odisha (-9.9%), Uttar Pradesh (-9.3%) and Madhya Pradesh (-8.5%), followed by Bihar and Assam. In the lower mortality state cluster, the top states overall are Maharashtra (-13.2%) and Tamil Nadu (13.0%), with Kerala and Andhra Pradesh slightly below (both around -11%).

Table 1: Average annual rate of change (AARC) for maternal and neonatal mortality by state (SRS, 2000-17) (states ranked within state cluster by total AARC)

State	MMR			NMR			Sum of AARCs	Rank
	1999-2001	2016-18	AARC	2000	2017	AARC		
Higher mortality states								
Rajasthan	501	164	-6.6	48.9	27.0	-3.5	-10.1	1 (selected)
Odisha	424	150	-6.1	61.1	32.0	-3.8	-9.9	2 (selected)
Uttar Pradesh	539	197	-5.9	53.5	30.0	-3.4	-9.3	3 (selected)
Madhya Pradesh	407	173	-5.0	59.5	33.0	-3.5	-8.5	4 (selected)
Bihar	400	149	-5.8	42.1	28.0	-2.4	-8.2	5
Assam	398	215	-3.6	47.2	22.0	-4.5	-8.1	6
Lower mortality states								
Maharashtra	169	46	-7.7	33.4	13.0	-5.5	-13.2	1 (selected)
Tamil Nadu	167	60	-6.0	35.9	11.0	-7.0	-13.0	2 (selected)
Kerala	149	43	-7.3	9.8	5.0	-3.9	-11.2	3
Andhra Pradesh	220	65	-7.2	45.4	23.0	-4.0	-11.2	4
Karnataka	266	92	-6.2	40.2	18.0	-4.7	-10.9	5
Gujarat	202	75	-5.8	42.4	21.0	-4.1	-9.9	6
West Bengal	218	98	-4.7	31.1	17.0	-3.6	-8.3	7
Haryana	176	91	-3.9	37.5	21.0	-3.4	-7.3	8
Punjab	177	129	-1.9	29.0	13.0	-4.7	-6.6	9

Data sources

We used SRS for maternal and neonatal mortality and fertility trends. The national household surveys including the National Family Health Survey[4] (NFHS, 5 rounds: NFHS-1 1992-93; NFHS-2 1998-99; NFHS-3 2005-06; NFHS-4 2015-16; and NFHS-5 2019-21), and the District Level Household Survey[5] (DLHS, 3 rounds: DLHS-1 1998-99; DLHS-2 2002-04; and DLHS-3 2007-08) were pooled for the trends in intervention coverage and equity analyses. For causes of death trends, we used the Million Death Study (MDS) for 2005-06,[6,7] and reviewed estimates from WHO/ Maternal and Child Epidemiology Estimation (MCEE),[8] and the Global Burden of Disease Study (GBDS).[9]

For the qualitative component, we organized a national stakeholder meeting (length: 2 hours and 10 minutes) with 14 experts in June 2021 to identify key drivers of mortality declines. Key informant interviews (KIIs, averaging 1.5 hours) were conducted during July-November 2021. We invited 21 experts active since 2000 in MNH policy and implementation from the government, donor organizations, private, civil society, and academic spheres, of which 13 consented. We held one round table discussion with state-level experts in the six selected exemplar states separately (n=11 each on average) in March-April 2022, to identify key policy and health system drivers of mortality declines (averaging 3.15 hours). All were conducted on Zoom in English, audio-recorded, and transcribed. Ethical approvals were obtained from the International Institute for Population Sciences [#33/2021] and University of Manitoba [#HS24416] review boards.

Analytical methods

We analysed quantitative trends by computing average annual rates of change (AARC) using exponential growth rate[10] for the different national policy periods. To measure ANC with contents and intensity-related components, we computed a composite index called ANCq[11], which has a 13-point scale. After adaptation to India, our ANCq index consisted of the number of ANC visits, timing of ANC, at least one ANC by skilled provider, blood pressure checked, weight measured, abdomen examined, blood sample collected, urine sample collected, and the number of tetanus toxoid vaccinations during pregnancy.

We coded the qualitative transcripts in Dedoose software using a codebook developed based on *a priori* topics, with additional emergent sub-codes. We shared synthesized results with key informants anonymously to finalize the results.

This report presents the results of these analyses for Tamil Nadu according to the framework (Figure 1) from right to left. This presentation order reflects the iterative approach to the analyses, working from observed trends in mortality outcomes and intervention coverage to describing hypothesized changes in health policy, systems, and service levers, as well as relevant contextual factors in Tamil Nadu over the last two decades. Then the study analyzed the linkages between drivers and outcomes to explain how major drivers combined to influence India's maternal and neonatal mortality declines.

MATERNAL AND NEONATAL MORTALITY TRENDS

During 2000-18, Tamil Nadu's neonatal mortality rate (NMR) declined more rapidly than its maternal mortality ratio (MMR) (AARC of -5.9% versus -7.1%) (Figure 4 and Table 2). The state achieved the SDG target for MMR (70 deaths per 100,000 live births) in 2015 and for NMR (12 deaths per 1000 live births) in 2016, many years ahead of the SDG target year of 2030. The state recorded the fastest decline in MMR during 2000-05, a part of the RCH-I period, with an AARC of -8.2% (Table 2). For the NMR, the fastest decline was during the RCH-II/NRHM period (2005-12) with an AARC of -7.7%. Tamil Nadu's MMR was consistently lower than its state cluster and all India. Tamil Nadu's NMR, however, was consistently lower than all India throughout the period and the state cluster post 2000.

Figure 4: Tamil Nadu's MMR (1998-2018) and NMR (1971-2019) levels and trends compared to lower mortality state cluster and all India (SRS)
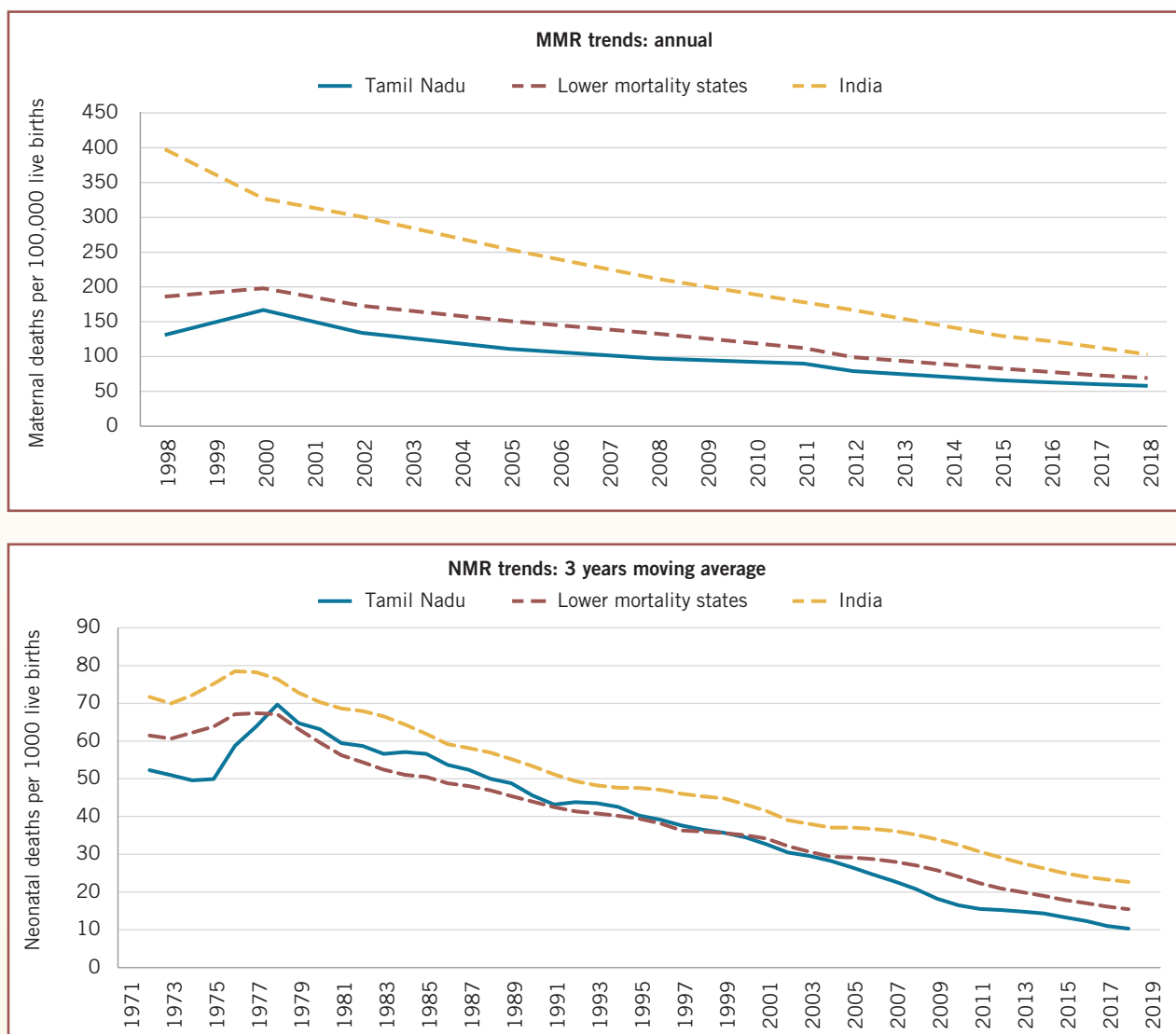
Table 2: Average annual rates of change (AARC) in MMR (1997-2018) and NMR (1971-2019), Tamil Nadu, lower mortality state cluster and all India (SRS)

Policy period	Tamil Nadu	Lower mortality states	India
AARC in MMR (%)			
1997-2005 (RCH I)	-2.4	-3.0	-6.4
2005-12 (RCH-II/NRHM)	-4.9	-6.0	-6.0
2012-18 (NHM/RMNCH+A)	-5.2	-6.0	-8.1
2000-18	-5.9	-5.9	-6.4
1997-2018 (Overall)	-4.1	-5.0	-6.8
AARC in NMR (%)			
1992-97 (CSSM)	-2.3	-3.0	-1.6
1997-2005 (RCH I)	-4.8	-3.0	-2.8
2005-12 (RCH-II/NRHM)	-7.7	-4.7	-3.4
2012-19 (NHM/RMNCH+A)	-6.1	-5.3	-3.9
2000-18	-7.1	-4.7	-3.7
1971-2019 (Overall)	-5.4	-4.0	-3.0

Maternal and neonatal mortality transition

Tamil Nadu's success in reducing maternal and neonatal mortality is presented (Figure 5) against a five-stage mortality transition model for maternal and neonatal mortality developed over the course of the Exemplars in MNH study. Stage I in this model indicates the highest levels of mortality, where access to services is extremely limited, inequalities are large, infectious diseases are a common cause of death, and fertility is high. Populations move across stage II, III and IV as access to health services increases, quality improves, inequality patterns change from top to bottom inequality, infectious diseases and peri-partum conditions decrease in importance as causes of death, and fertility decline. Stage V is the lowest possible maternal and neonatal mortality, wherein mothers and newborns have universal access to high quality care and (almost) all preventable deaths are eliminated.

During 2000-18, Tamil Nadu has transitioned from stage II to stage IV, achieving a three-fold reduction in maternal mortality and a four-fold reduction in neonatal mortality (Figure 5).

Figure 5: Mortality transition in Tamil Nadu, lower mortality state cluster and all India (SRS 2000-18)
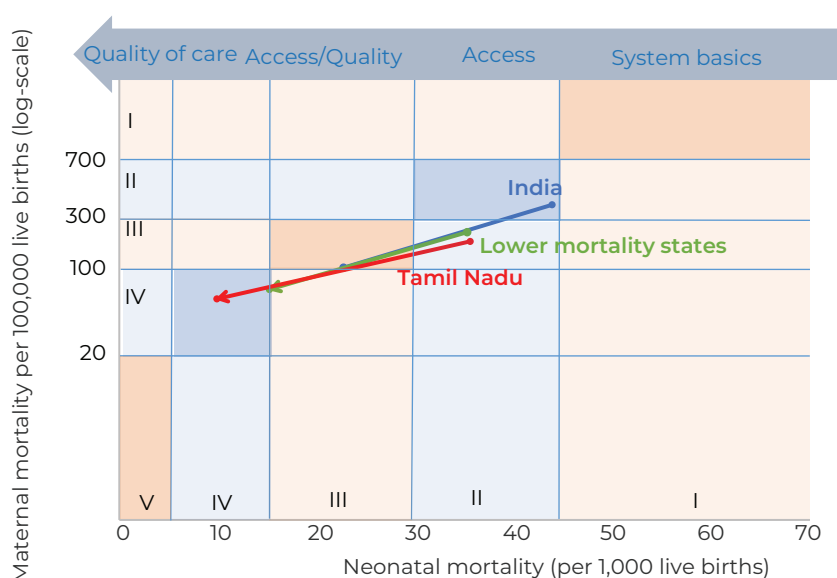
Age and cause-specific neonatal mortality

During 2003-18, Tamil Nadu was especially successful in bringing down mortality in the first two days of life (days 0 to 2), indicative of improvements to quality of delivery care and the newborn's health status (Figure 6). The mortality on days 3 to 27 also declined between 2003 and 2018. The estimates from GBDS indicate that the state has achieved major declines in all leading causes with preterm births contributing 35% to the total decline, birth asphyxia 26% and newborn infections including lower respiratory infections another 17%. Preterm births contributed most to the decline as per MDS and WHO/MCEE data as well.

Figure 6: Trends in age-specific neonatal mortality during 2003-18 (NFHS 2005-06, 2015-16 and 2019-21*) and cause-specific neonatal mortality during 2000-19 (global data 2000, 2015 and 2019), Tamil Nadu
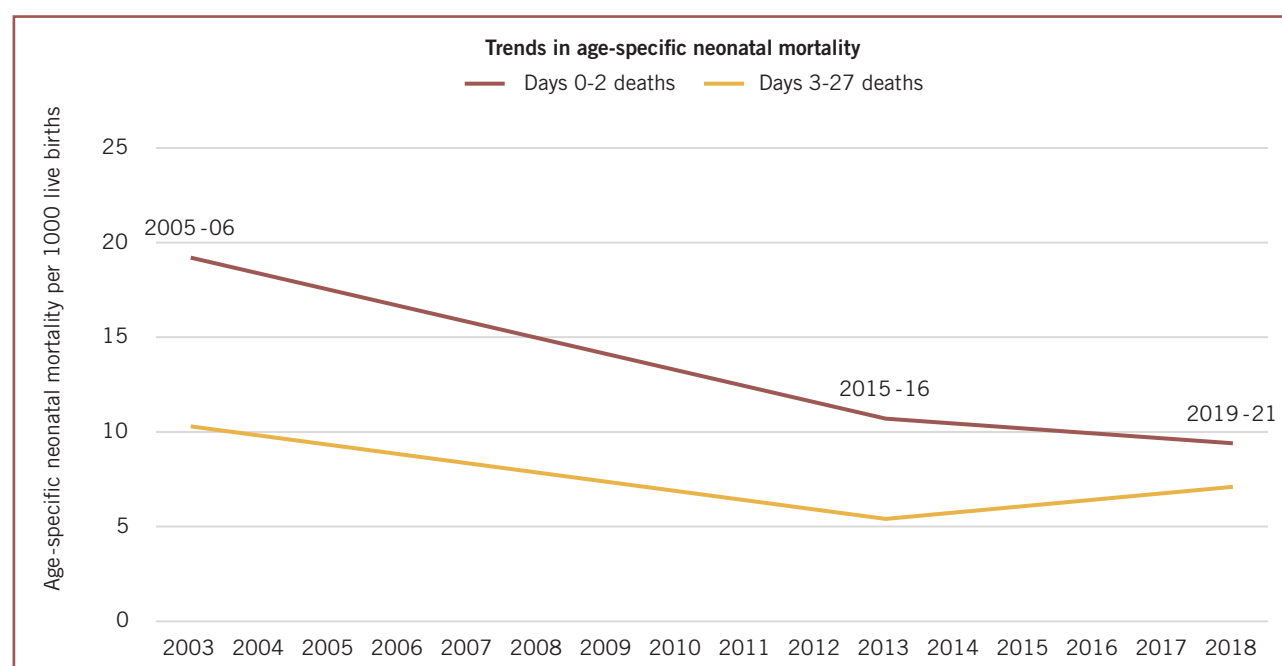
* We included mortality from births in the five years preceding each NFHS round and have taken 2003, 2013 and 2018 as the midpoints for the estimates from NFHS 2005-06, 2015-16 and 2019-21, respectively.
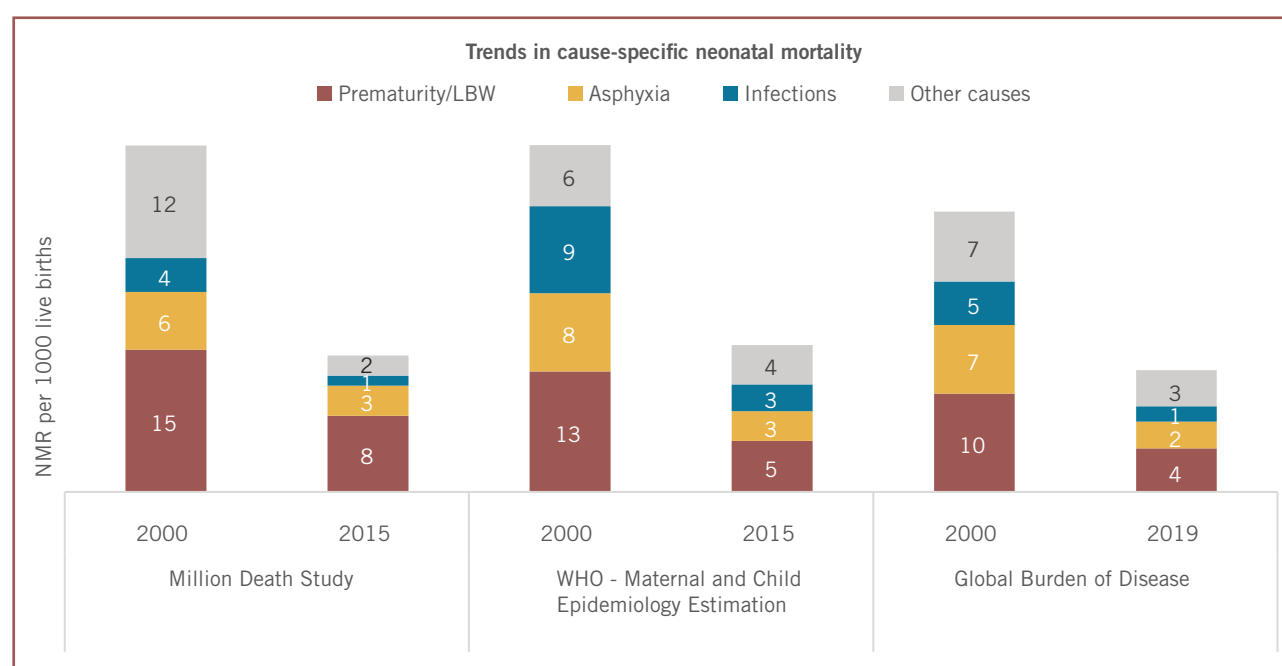
Equity in neonatal mortality

The state has succeeded in reducing the differences in NMR according to urban-rural residence and household wealth tertile (Figure 7). The recent estimates, however, show widening of these inequalities, mainly due to small sample size.

Figure 7: Trends in NMR by urban-rural residence and household wealth tertile, Tamil Nadu (NFHS 2005-06, 2015-16 and 2019-21)
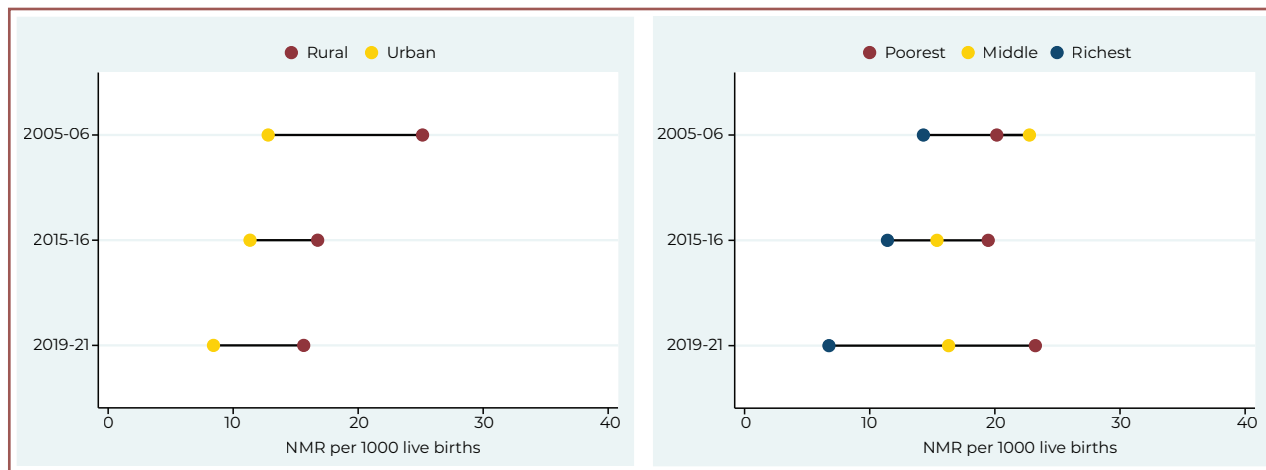
INTERVENTION COVERAGE AND EQUITY

How did Tamil Nadu achieve these major mortality reductions since 2000? In this section, we analyse the trends and equity in the coverage of key interventions in the state against the backdrop of the various national health policy periods.

Antenatal and delivery care

The coverage of key interventions has improved in Tamil Nadu according to the pooled NFHS and DLHS data (Figure 8). In 1989 itself, Tamil Nadu's coverage for 4 or more ANC (67%) and institutional delivery (60%) was more than twice as high as the national coverage and about one and a half times higher than the coverage in lower mortality states.

Figure 8: Trends in antenatal and delivery care coverage, Tamil Nadu, lower mortality state cluster and all India (NFHS and DLHS pooled data, 1989-2020)

Percentage of women delivered in health facility
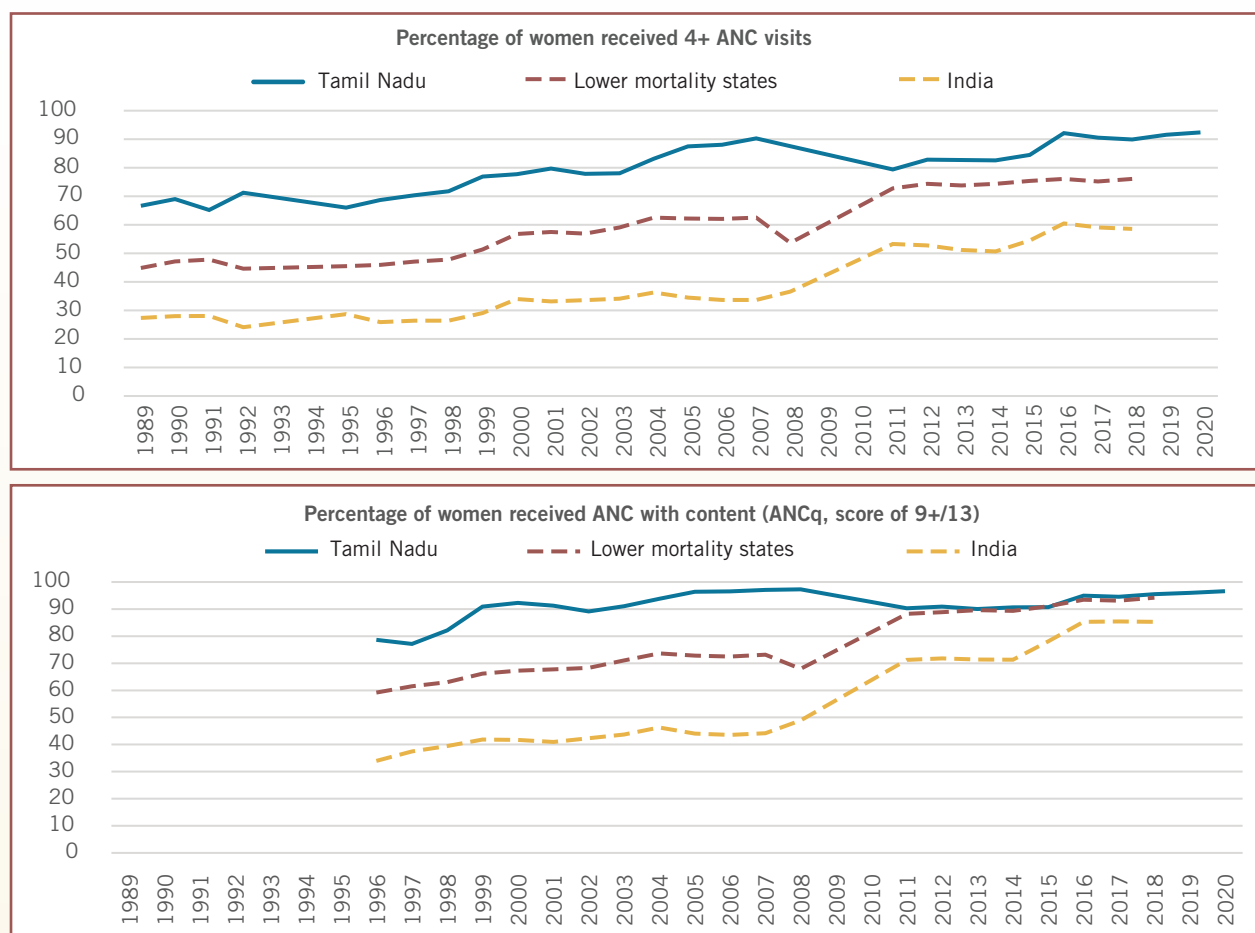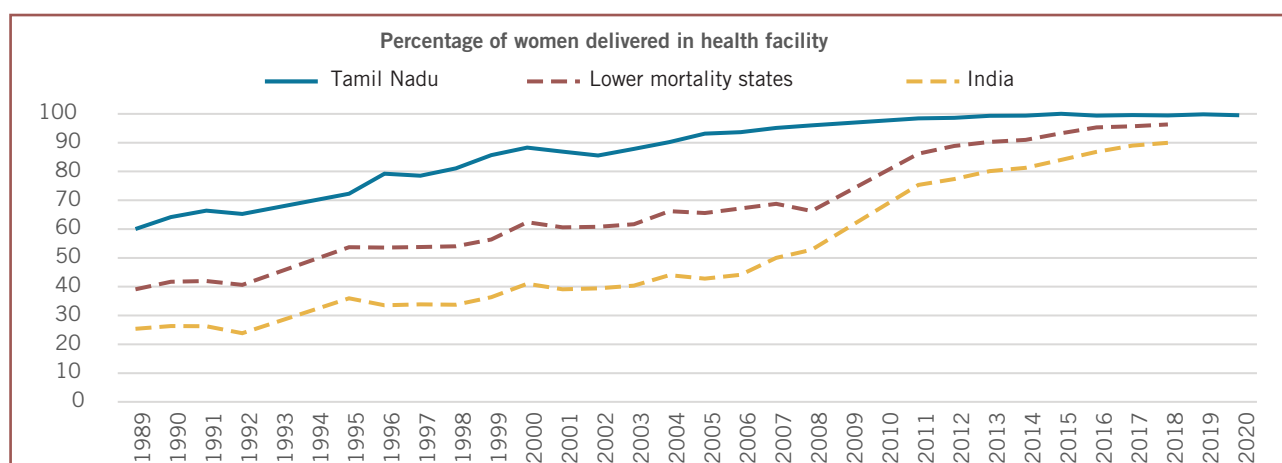
Subsequently, there was a rapid increase in 4 or more ANC coverage during the RCH-I period (1997-2005), and in institutional deliveries during the CSSM period (1992-97) and RCH-I period (1997-2005). The coverage of institutional deliveries rose above 95% in 2007 and became almost universal since 2014.

Increases in institutional deliveries was mainly driven by public facilities (Figure 9).

Figure 9: Trends in public and private health facility deliveries, Tamil Nadu, lower mortality state cluster and all India (NFHS and DLHS pooled data, 1989-2020)

Public facility deliveries

Private facility deliveries
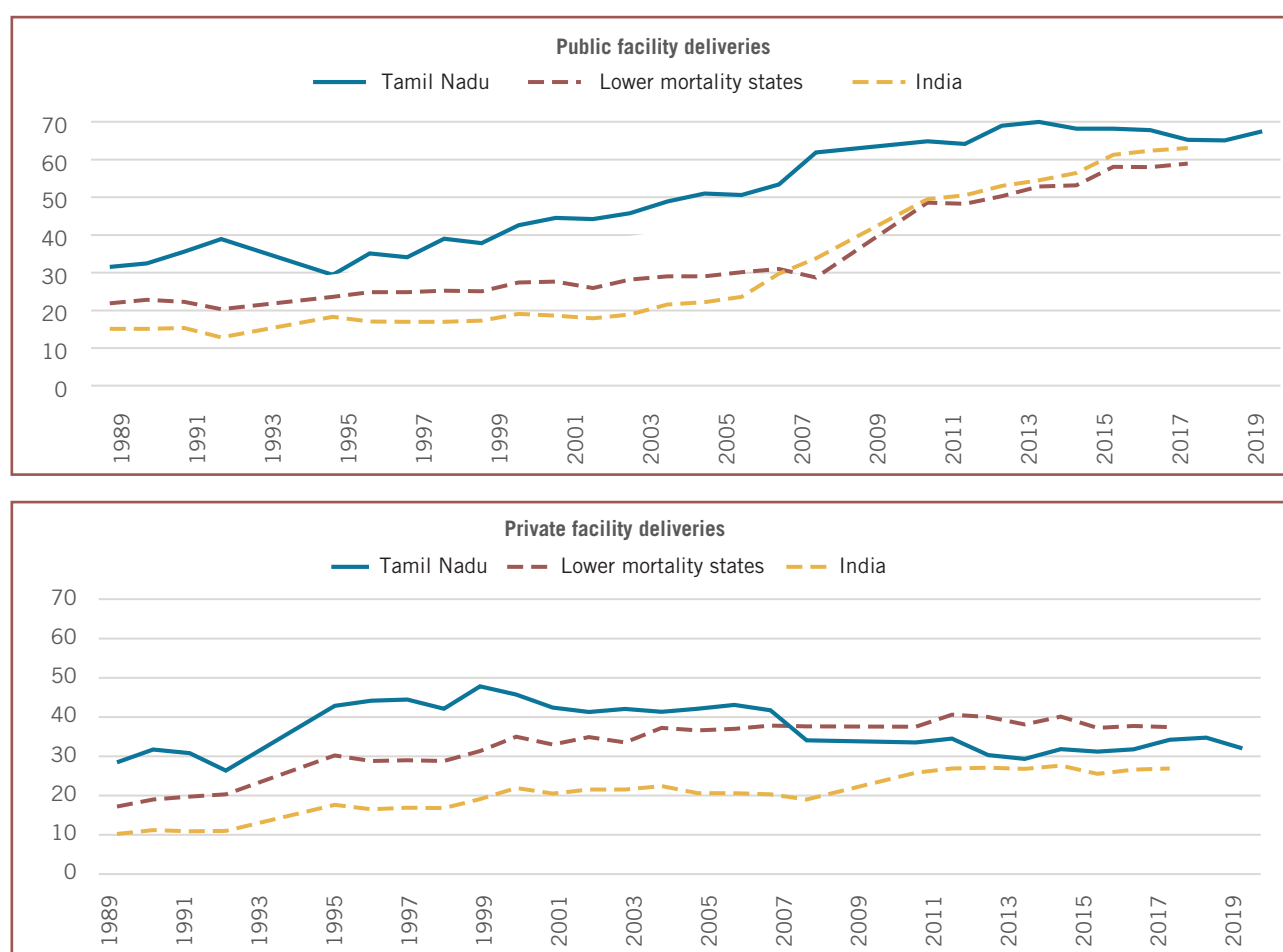
Public facility deliveries constituted more than half of all institutional deliveries in Tamil Nadu (except for the years 1995-2000 when private sector deliveries were higher), reaching 68% of all institutional deliveries in 2020. The greatest increase in public facility deliveries was achieved during the RCH-I period (1997-2005) with an AARC of 5% (data not shown).

Tamil Nadu's major increases in institutional delivery was possible because the rural and the poorest women were reached, and disparities were reduced substantially (Figure 10).

Most institutional deliveries in Tamil Nadu were hospital deliveries (Figure 11). Hospital deliveries accounted for 80% of all deliveries in the state during 2019-21. The national analysis indicated that NMR decline is strongly associated with increases in hospital deliveries (MNH Exemplar Study, National Report). Within the hospital deliveries, the contribution of public hospital deliveries has increased in Tamil Nadu.

Figure 11: Trends in institutional delivery by health facility level, Tamil Nadu (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)
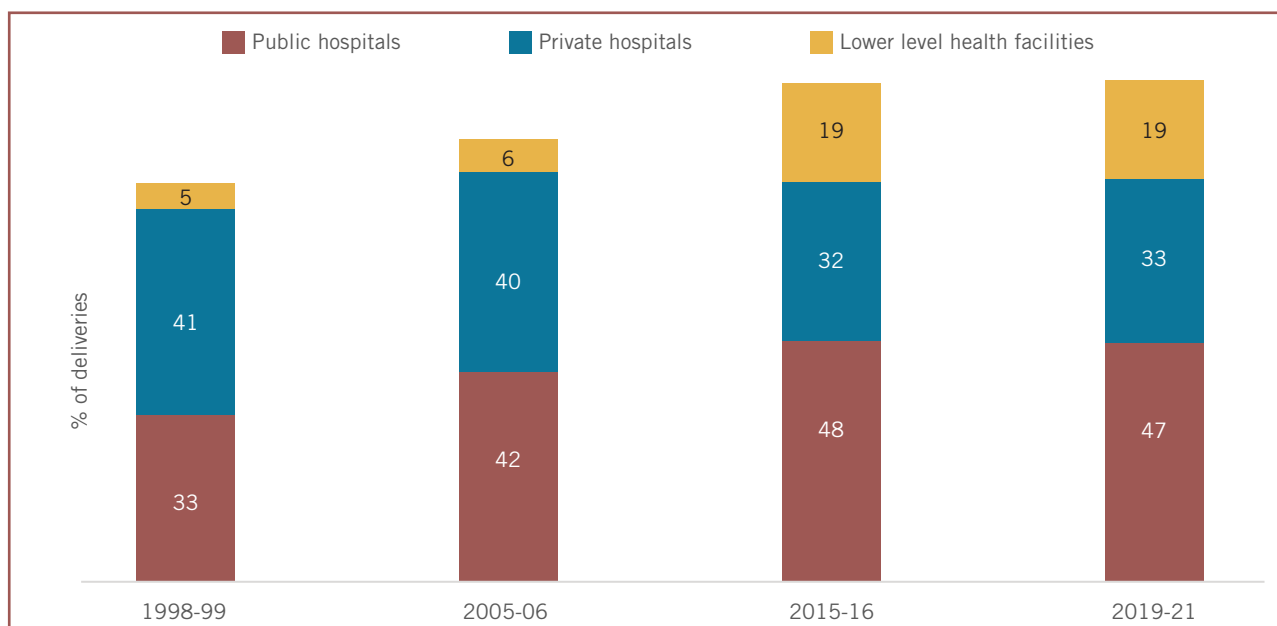
C-sections

C-section rates have increased by more than three-fold in Tamil Nadu, from 14% in 2000 to 48% in 2020 (Figure 12). The greatest increase was in the RCH-II/NRHM period (2005-12; AARC of 5.3%, data not shown). The share of private facilities in c-section deliveries has been greater than the public facilities in Tamil Nadu. During the RCH-II/NRHM period, the institutional c-section rate was twice as high among private facility deliveries as among public facility deliveries. However, there has been a considerable increase in c-section deliveries in the public health facilities since 2011, faster than all India.

Figure 12: Trends in c-section delivery rates by health facility type, Tamil Nadu, lower mortality state cluster and all India (NFHS and DLHS pooled data, 1989-2020)
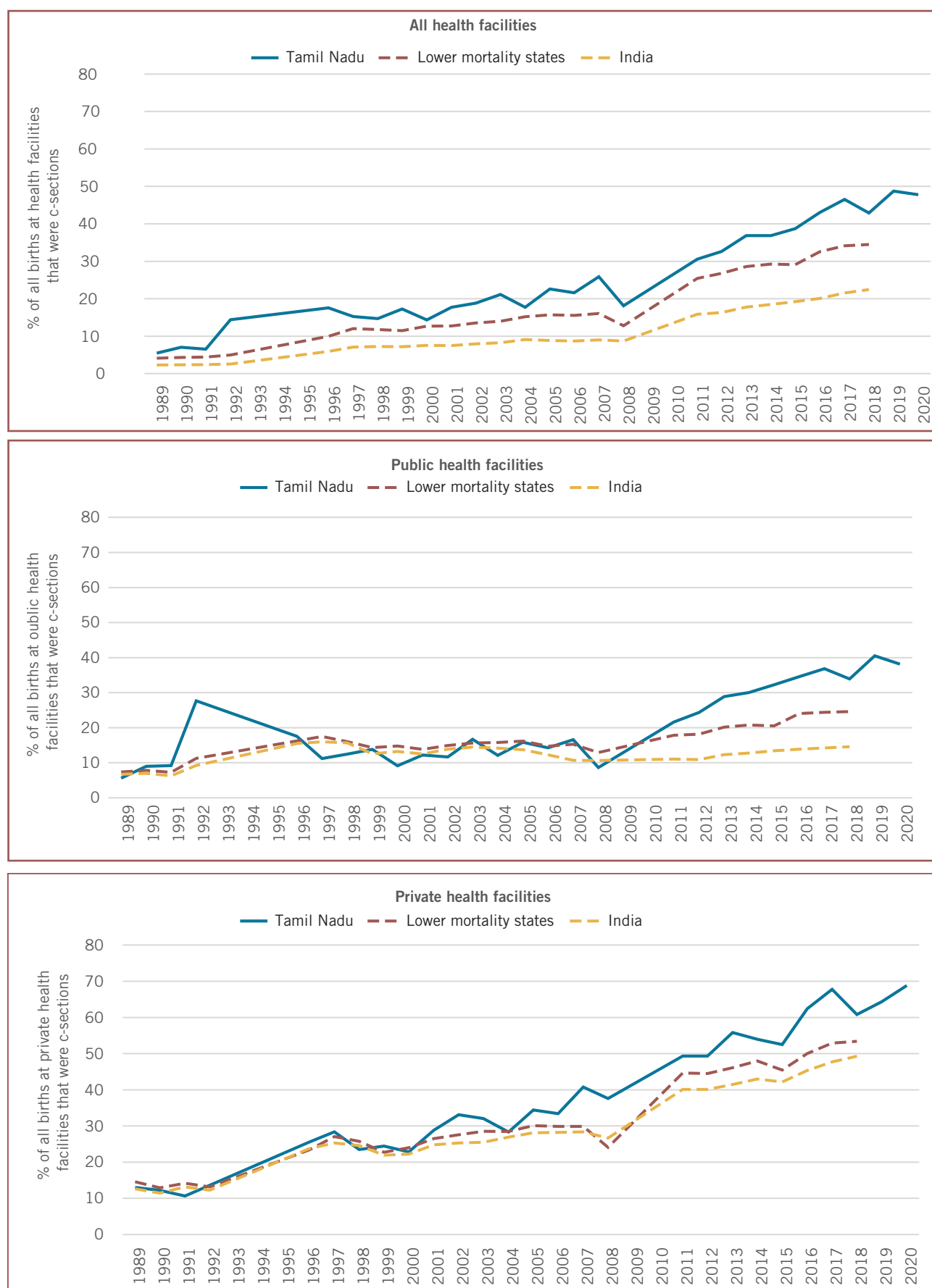
About 10-15% of deliveries is considered an acceptable range for medically indicated c-sections. [12,13] By 2019-21, c-section rates among people living in rural areas reached 43% and among the poorest tertile reached 32%. These 2019-21 rates were four times higher than the 1998-99 rates for rural areas and five times higher than the 1998-99 rates for the poorest tertile (Figure 13). C-section rates among the urban and the wealthy have doubled to nearly 50%. These c-section levels indicate overuse, even among the rural and the poorest.

Figure 13: Trends in C-sections delivery rates by urban-rural residence and household wealth tertile, Tamil Nadu (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)
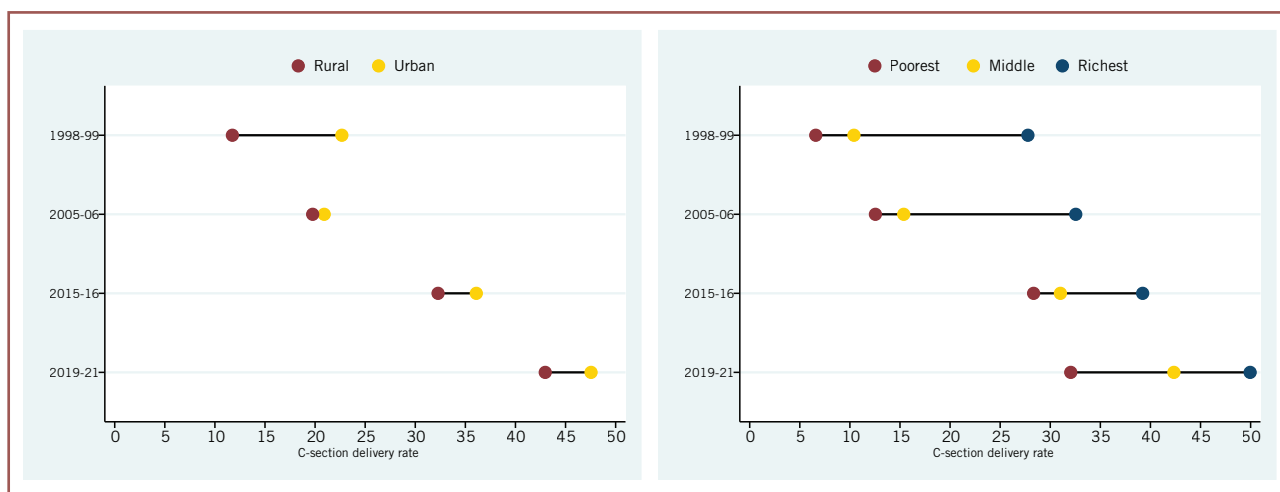
Postnatal care and essential newborn care including early initiation of breastfeeding

Figure 14 presents the percentage of mothers and/or newborns in Tamil Nadu who had a postnatal check-up (PNC) within 48 hours after delivery, either in the health facility or at home by either a trained professional such as a staff nurse, Village Health Nurse (VHN -- equivalent to auxiliary nurse midwife (ANM) elsewhere in India), doctor or a community health worker. Coverage of any postnatal check-up (PNC) increased from 59% for births during 1998-99 to 94% for births during 2019-21, a 59% increase in two decades. The PNC coverage in recent times has converged for deliveries that occurred in public and private health facilities.

Figure 14: Postnatal care coverage for either the mother or the newborn within 0-2 days after delivery by place of delivery, Tamil Nadu (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)
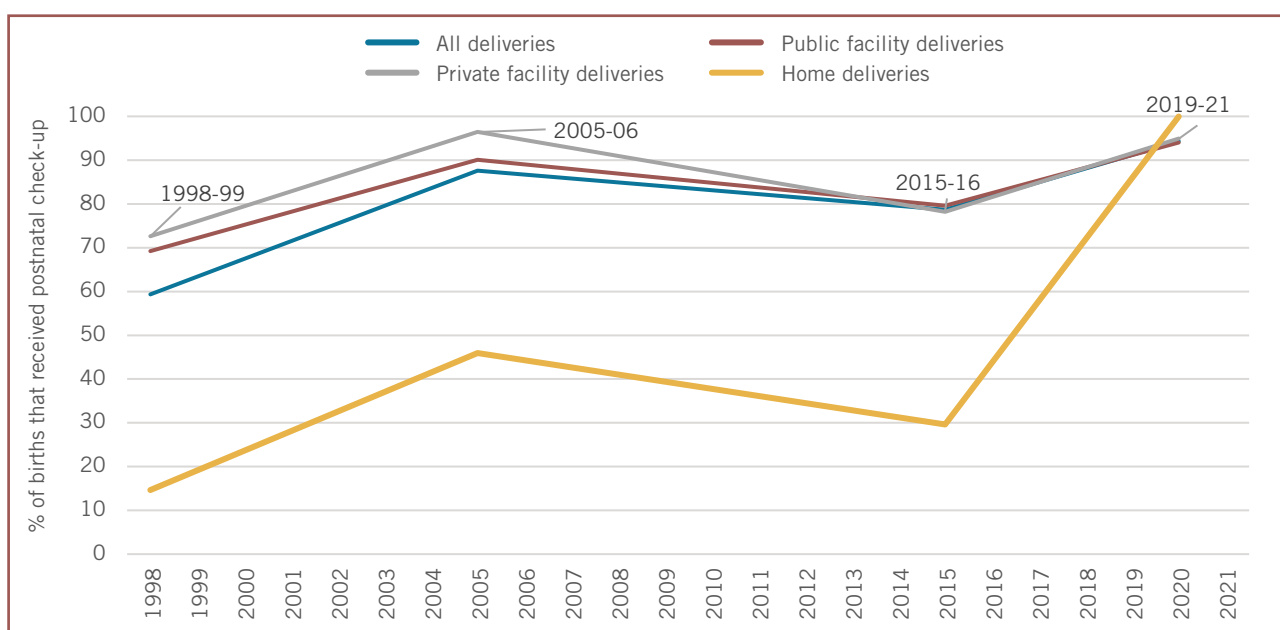
NMR by place of delivery

NMR in institutional deliveries declined substantially in private hospitals (from 20 per 1000 live births in 2005-06 to 7 in 2019-21), but the decline was relatively slow in public hospitals (from 20 per 1000 live births in 2005-06 to 15 in 2019-21) (Figure 15). NMR in lower-level health facilities declined from 15 per 1000 live births in 2015-16 to 12 in 2019-21. The other health facilities include CHCs, PHCs, SHCs, and private non-hospitals.

Figure 15: Trends in NMR among institutional deliveries by health facility level, Tamil Nadu (NFHS 2005-06, 2015-16 and 2019-21)
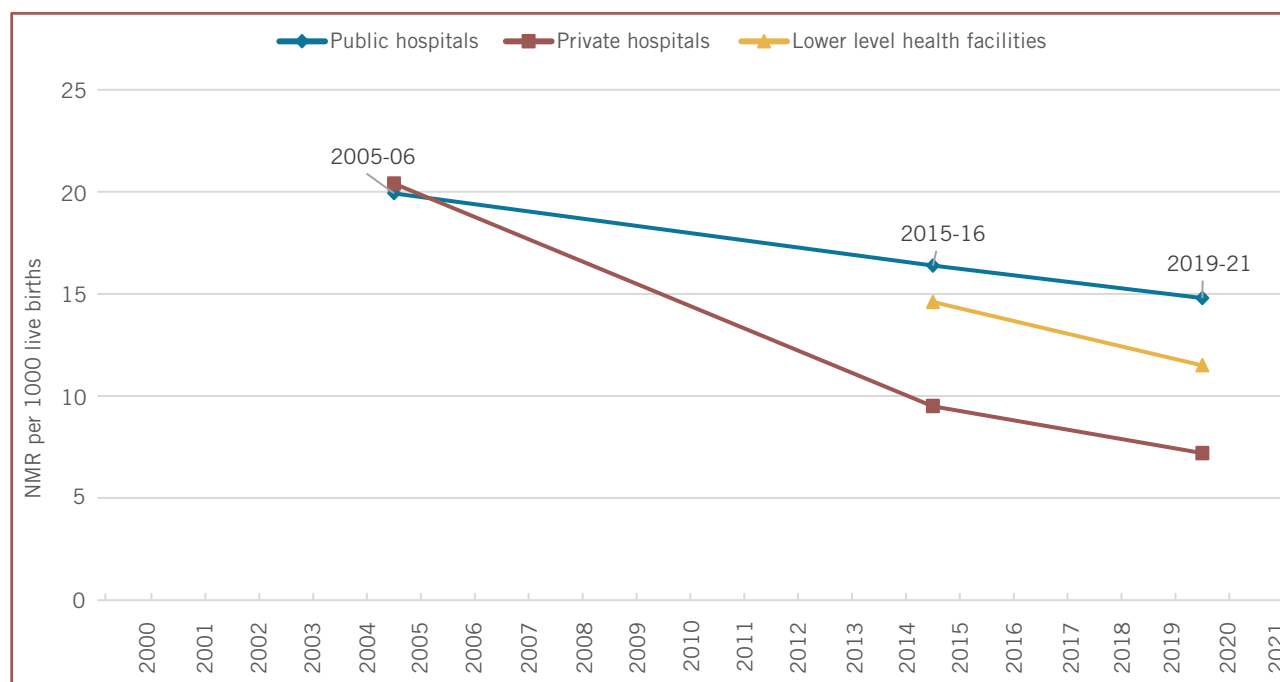
Note: In the 2005-06 survey, there were no neonatal deaths reported among children born in lower-level health facilities.

DEMOGRAPHIC AND SOCIO-ECONOMIC CONTEXTUAL SHIFTS

Tamil Nadu is a mix of dense urban, peri-urban and very remote and tribal rural areas; underserved areas with high rates of poverty and poor maternal and newborn health indicators exist alongside major economic and industrial centres with better socio-economic health status. Experts reflected that it is difficult to tease out the role of contextual factors in driving success, but recognized the value of investments in women's education, rising per capita income, promoting "small family norm," which reduced high-risk pregnancies, and urbanization, which improved access to health facilities alongside improved access to health facilities in rural areas.

Household-level context

Fertility declines

The total fertility rate (TFR) in Tamil Nadu declined from 2.8 children per woman in the mid 1980s, 2.0 in the mid-1990s and further to 1.5 in 2019 (Figure 16). Since 1970, the state has consistently recorded lower TFR levels than the lower mortality state cluster. However, the number of live births declined moderately from 1.4 to 1.1 million annual births (data not shown). Fertility rates were generally higher in rural areas. However, the gap narrowed as the fertility rates declined faster in the rural than urban areas (data not shown). In the recent times, the rural and urban fertility rates in Tamil Nadu have converged at the same level.

Our analysis using decomposition method showed that Tamil Nadu's fertility declines during 2000-18 contributed 31% of each of the maternal and newborn lives saved and 24% of the reductions in MMR and NMR (data not shown).

Figure 16: Trends in total fertility rate, Tamil Nadu, lower mortality state cluster and all India (SRS 1970-2019)
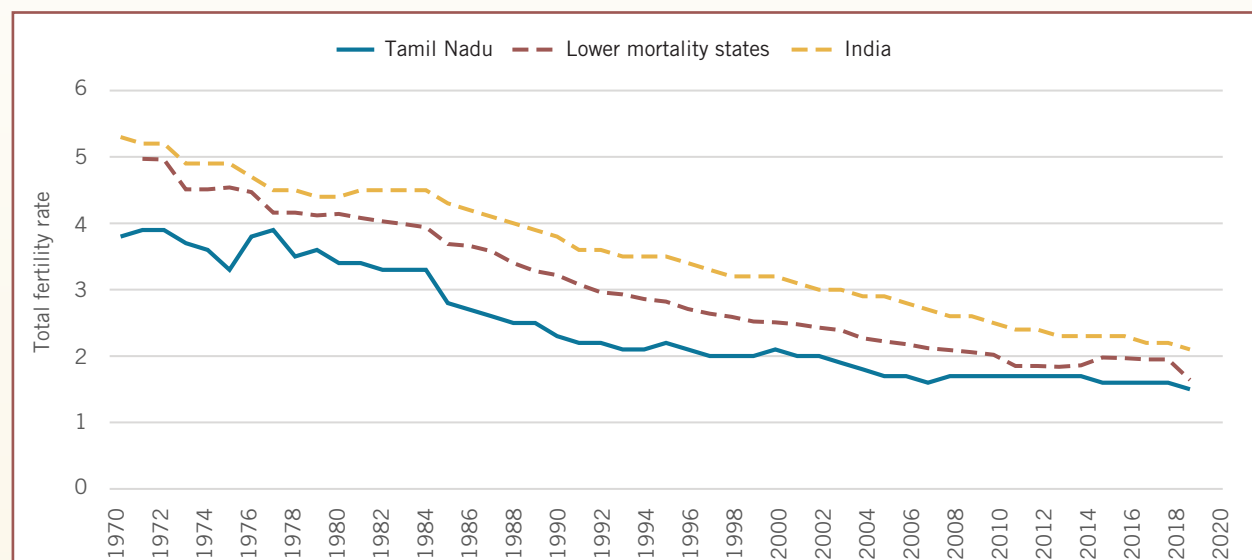
Nutritional status

NFHS data showed that the proportion of births to women with a BMI lower than 18.5 (considered underweight) declined from 29% to 11% between 2005-06 and 2019-21 (Figure 17). Child size at birth showed improvement; the proportion of newborns considered by their mothers to be small for gestational age declined from 28% to 10% during the same period. The proportion of maternal anemia and low birth weight babies showed a decline of three percentage points each, from 56% to 53% and from 32% to 29%, respectively.

Figure 17: Trends in maternal nutrition, maternal anemia and reported child's size at birth and low birth weight babies, Tamil Nadu (NFHS 2005-06 and 2019-21)
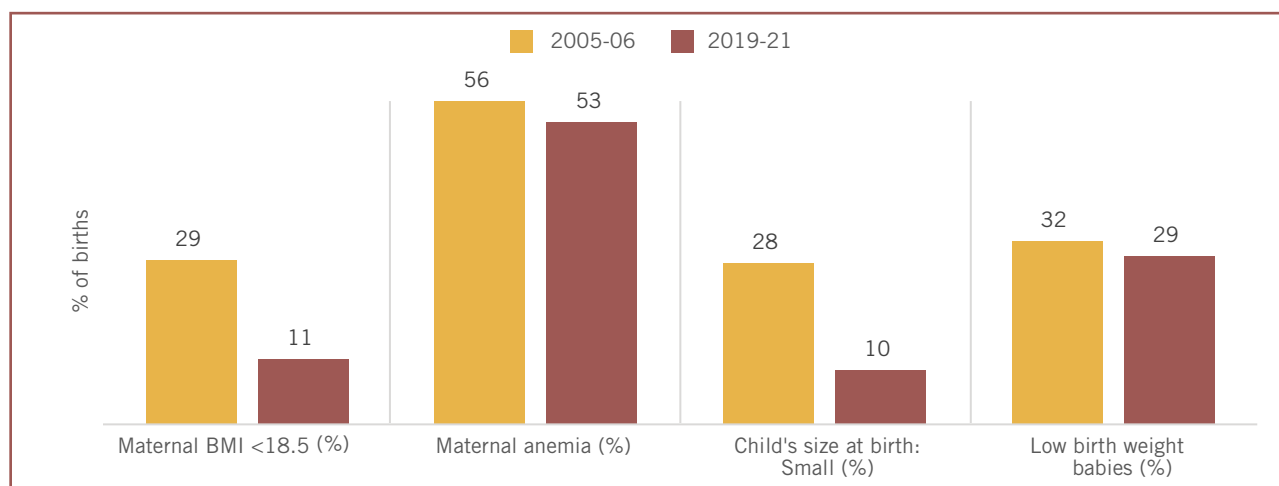
Women's empowerment and educational status

Age at first cohabitation (after marriage) in Tamil Nadu has increased from a median of 19 years to 21 years between 2005-06 and 2019-21 (Table 3). The increase was slower in rural than in urban areas, where it was higher in both the survey periods. The proportion of women with some education has also improved in this period, from 69% to 84% who were literate, and 58% to 79% who had secondary or higher education. The gaps also closed between rural and urban areas in female literacy rates and the proportion with secondary education, more so in case of the latter (the absolute difference in secondary education halved from 23 to 11 percentage points). The results from the most recent round of the NFHS suggest that compared to the births to women with some education, the NMR was 2.5 times higher among births to women with no education during 2019-21 (data not shown).

In terms of decision-making roles, the proportion of women reporting that their husbands solely decided on their health care reduced from 25% to 17%, while those who made decisions about their health care jointly with their husbands increased markedly from 44% to 64% between 2005-06 and 2019-21 (which was somewhat similar in rural and urban areas).

Table 3: Trends in selected indicators of women's empowerment, Tamil Nadu overall and by place of residence (NFHS 2005-06 and 2019-21)

	Tamil Nadu		Rural		Urban	
	2005-06	2019-21	2005-06	2019-21	2005-06	2019-21
Median age at first cohabitation, women aged 25-49 (in years)	19.1	20.5	18.4	19.7	19.9	21.4
Women aged 15-49 who are literate (%)	69.4	84.0	59.4	79.6	80.2	88.9
Women aged 15-49 with secondary or higher education (%)	57.9	78.6	47.0	73.5	69.8	84.1
Mainly husband decides on woman's health care (%)	25.4	17.3	28.4	16.5	22.0	18.4
Husband and wife jointly decide on woman's health care (%)	44.1	64.3	38.4	64.5	50.7	64.0

Community-level context

Household's access to basic amenities such as electricity, safe drinking water, improved sanitation, clean fuel for cooking, telephone/mobile and bank account has improved substantially in the state between 2005-06 and 2019-21 (Figure 18). Ninety-nine percent of the households presently have electricity and 84% have access to safe drinking water. Percentage of households having access to improved sanitation more than tripled from 22% in 2005-06 to 71% in 2019-21. Concurrently, households reporting open defecation reduced markedly from 57% to 23%. Use of clean fuel for cooking nearly tripled from 31% in 2005-06 to 83% in 2019-21. Eighty-eight percent of the households now live in pucca houses and 93% have a telephone. Percentage of households that reported any member having a bank or post office account more than tripled from 31% to 97% during the same period. The corresponding rise was even sharper for women aged 15-49 years (from 16% to 92%).

Figure 18: Trends in selected indicators of community development, Tamil Nadu (NFHS 2005-06 and 2019-21)

* Percentage of women aged 15-49 years having back/post office account is obtained among all women included in the state module.
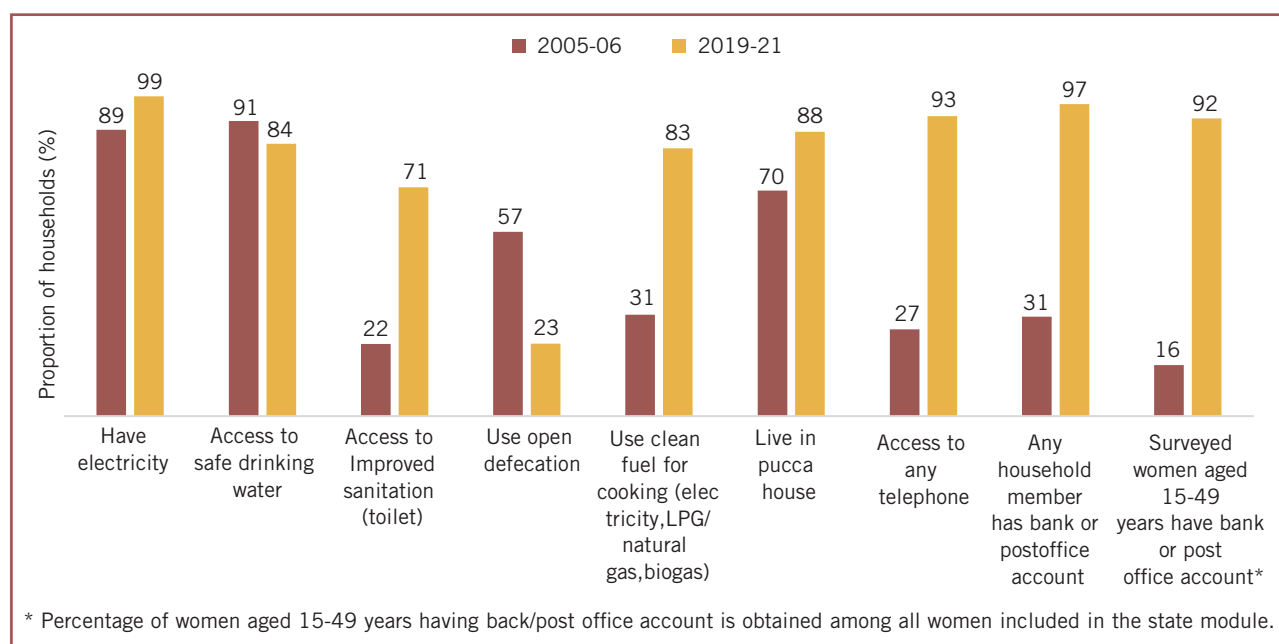
Societal-level context

Economic growth and inequality reduction

Tamil Nadu has experienced substantial economic growth in the past two decades. The per capita net state domestic product in Tamil Nadu has risen rapidly, from INR 19,432 in 2000[14] (INR 68,114 in 2020 INR[1]) to INR 142,028 (INR 1,82,044 in 2020 INR) in 2015 and INR 2,25,106 in 2020-21.[15] However the state's Gini coefficient for consumption, a common measure of income inequality where '0' is perfect equality and '1' is total inequality, has increased slightly from 0.31 in 1994 to 0.33 in 2012.[16] The percentage of the population below the poverty line has reduced from 29% in 2004-05 to 11% in 2011-12.[17] Between 1998-99 and 2019-21, the state has also experienced increased urbanization, with the proportion of the population that lives in urban areas increasing from 34% to 48%.

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1   We considered an average annual inflation rate of 6.47% from 2000-2020 and 5.09% from 2015-2020 (http://www. inflationtool.com/indian-rupee)

MAJOR HEALTH POLICY AND SYSTEMS DRIVERS

This section draws from consultations with policy experts, as well as policy document and literature review, to present major health policies and health system drivers of improved maternal and newborn survival. We first present the state's efforts to increase MNH service availability and quality including (1) health care infrastructure and services, (2) human resource for health; (3) clinical and technical innovations and quality assurance; and (4) the role and regulation of the private sector. We then present the broader policy implementation and administrative reforms underpinning these changes to service availability and quality, including: (1) political will and leadership for MNH; (2) decentralized governance and financial flexibility; (3) accountability, progress review and data systems; (4) community participation and demand generation; and (5) partnerships.

Transitions in MNH service availability and access to quality

Expanding service availability, access and integration

- Tamil Nadu leads India and the lower mortality state cluster in density of government health facilities
- While the density of health sub-centres (HSCs) and PHCs has not increased, the state has invested in improving the quality of care available there, particularly through staffing PHCs with SBA-trained staff nurses and medical officers to offer high quality ANC and 24/7 BEmOC services
- The state has greatly increased the density of CHCs, thereby increasing the availability of CEmONC-enabled delivery points

Tamil Nadu is far above the all-India and lower mortality state cluster averages for density of health infrastructure (Figure 19). The state focused less on increasing the density of health sub-centres (HSCs) and PHCs (which was already above average) and more on improving their functioning; new infrastructure development focused on building community health centres, bringing the density from 2 CHCs to 10 CHCs per 1 million population from 1997-2002 to 2007-12. These two trends (investing in existing BEmOC infrastructure and increasing CEmONC infrastructure) enabled the state to gradually shift deliveries towards higher level facilities, while also ensuring better quality care for ANC and uncomplicated deliveries at PHCs.

Tamil Nadu improved access to BEmONC and timely referral with their early introduction of a 24/7 PHC policy. The state sanctioned three positions for SBA-trained staff nurses for each PHCs. With this staffing, each nurse could cover an eight-hour shift thereby ensuring continuous availability of a nurse who could handle uncomplicated deliveries and make appropriate referrals. At the same time, the availability of ambulances increased in the state. The state also introduced a policy to upgrade selected PHCs to have five medical doctors.

Tamil Nadu implemented numerous policies to improve quality and access to CEmONC. The state was the first to establish standards of practice and clinical care guidelines for all hospitals. The state expanded access

to blood transfusion, with 36 medical colleges offering a comprehensive care unit with blood transfusion, 25% of district hospitals offering blood transfusions and blood banking, and all PHCs expected to store two units of type 'O' blood to start transfusions before transfers.

Figure 19: Trends in the density of health sub-centres, primary health centres and community health centres, per million population, Tamil Nadu (Rural Health Statistics 1981-85 to 2019-20)
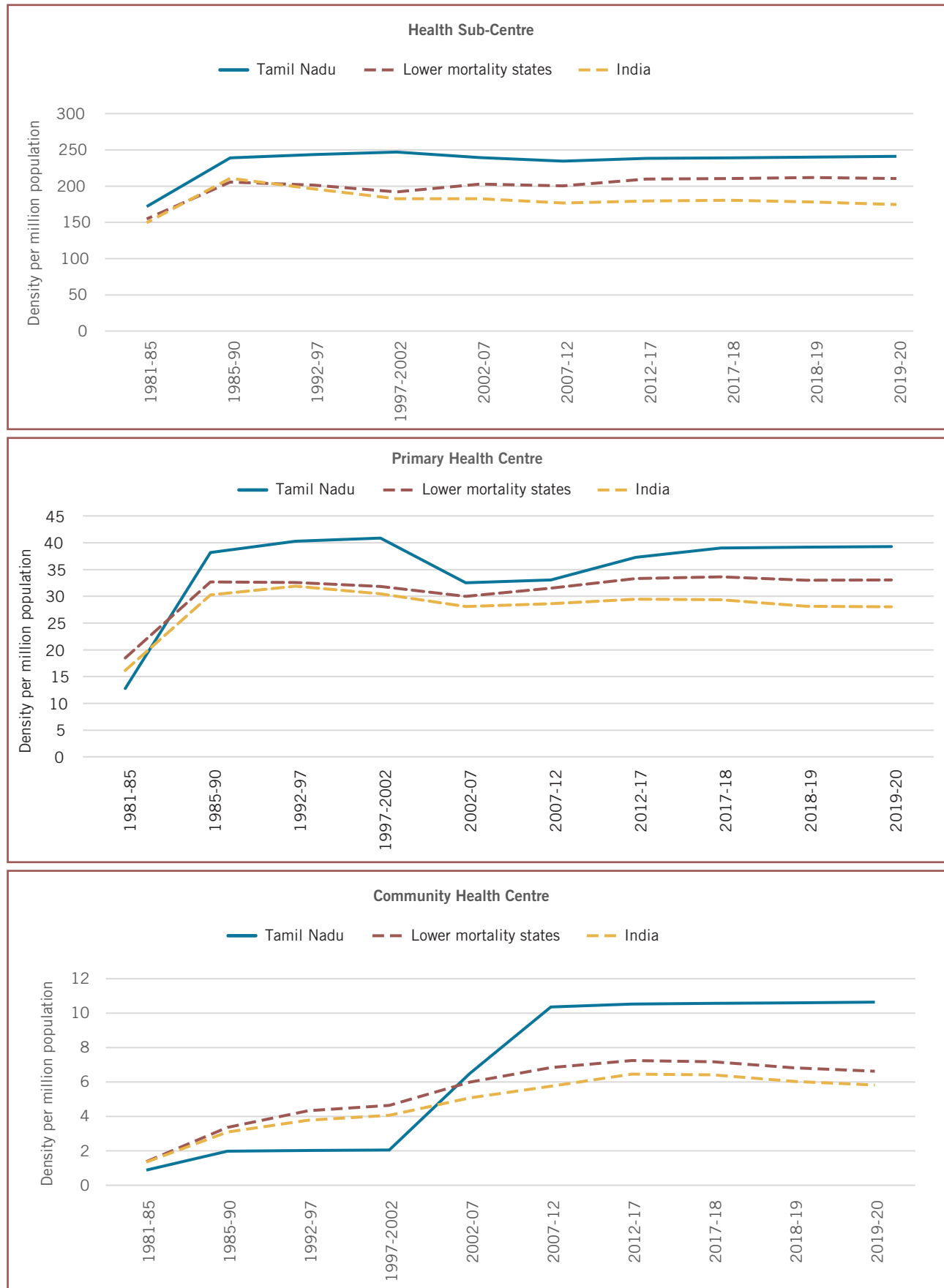
Specific to neonatal survival, Tamil Nadu increased availability of tertiary neonatal care. The state developed an RCH Centre for Excellence, with a neonatal intensive care unit, in almost every district hospital and two special newborn care units (SNCUs) in every district. Paediatric emergency units were initially developed in districts without medical colleges; once each district had a medical college, all emergency units were upgraded to neonatal intensive care units (NICUs). SNCUs were staffed by nurses with neonatal resuscitation training, an SNCU nodal officer (who was both a clinician and administrator responsible for operations) and paediatricians. The development of SNCUs and NICUs at the district level was matched by investment in neonatal emergency transfer within the state's 108 ambulance service, ensuring that NICU and SNCU facilities could quickly and safely receive vulnerable newborns who had been born at PHCs and CHCs/FRUs.

Tamil Nadu not only showed leadership in introducing emergency transportation services, but also in framing emergency transportation as a patients' rights issue. Whereas in other states transportation problems were often framed as the patient's and their family's problem, the Tamil Nadu government sought to frame them as the facility's responsibility.

> *And we even keep telling them: in case there is going to be a delay in getting the ambulance, don't wait. Make arrangement with the local vehicle or local ambulance and pay them from the government funds. Don't ever ask the public to pay for that. (Government health system expert, Tamil Nadu)*

When the emergency medical transportation 108 ambulance service was introduced, it was originally for acute injuries, primarily road traffic accidents. The state expanded this service to cover first access to maternity care (between homes and health facilities) and then inter-facility transfers.

Tamil Nadu introduced a hearse service to reduce "discharge against medical advice." Families would often take relatives home when the patient appeared close to death because transporting a dead body was difficult and costly. The Red Cross Society introduced a hearse service, which the state scaled up, to reassure families that in the event of death all transportation would be handled for them. The hearse service encouraged families to keep near-death patients in facilities, which enabled medical providers to provide additional potentially life-saving care.

Analysis of NFHS data suggests that the average out-of-pocket expenditure (OOPE) for delivery (including the OOPE for transport, hospital stay, drugs, diagnostics, and other) in Tamil Nadu in constant 2020 rupees (i.e., 2015-16 cost adjusted for inflation to the 2020 value[2]) increased from INR 13,465 to INR 15,410 in 2019-21 (Figure 20). The average OOPE paid for C-section deliveries was nearly two and a half times higher than that for a vaginal delivery, and the average expenditure for both vaginal and C-section deliveries in the state decreased by 6% and 1% during 2015-16 and 2019-21, respectively. The OOPE for public facility deliveries for both C-sectional and vaginal deliveries decreased. The OOPEs were 7-8 times higher in private than public facilities, and the increase from 2015-16 was 19% in private facilities.

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2   We considered a average annual inflation rate of 5.09% from 2015 to 2020 (https://www.inflationtool.com/indian-rupee?amount=7124&year1=2015&year2=2020&frequency=yearly)
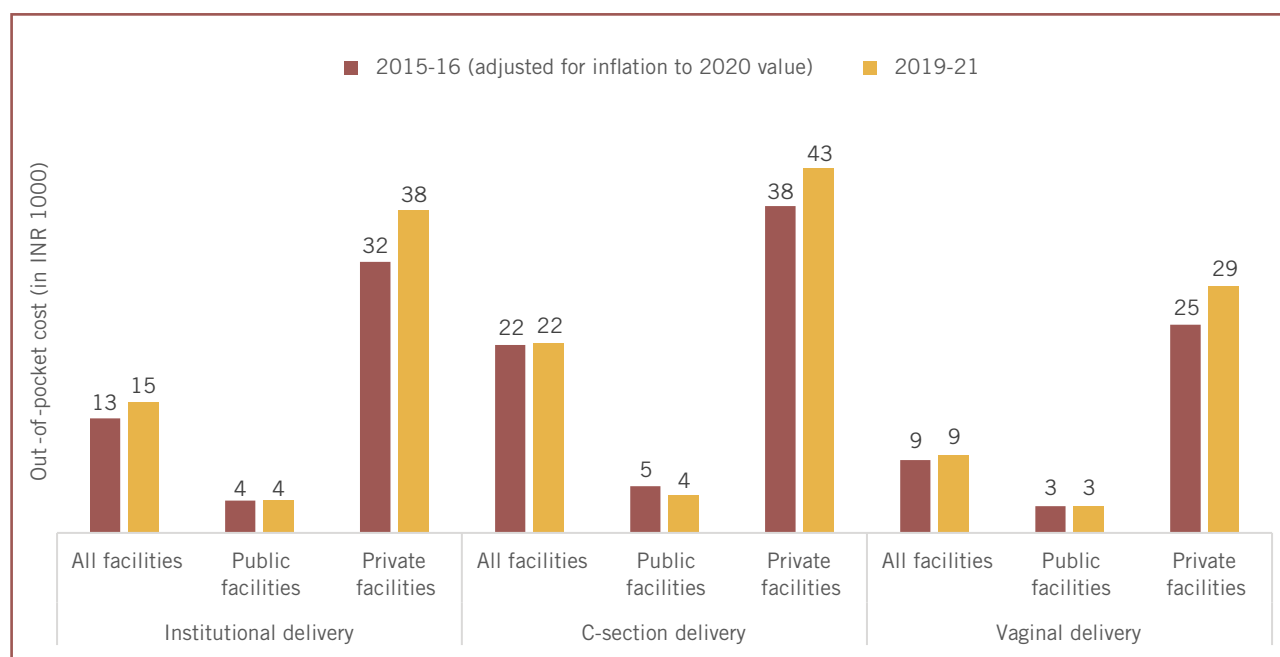
Human resources for health

- Tamil Nadu has a unique public health management structure – the Directorate of Public Health – that has enabled integrated, primary health care oriented public health management by experienced and highly trained public health professionals and technical experts

- Tamil Nadu has invested in public medical colleges where students are accepted based on merit, thus increasing the supply of middle class, service-oriented doctors

- The state was also the first to incentivize doctors to work in rural government facilities by posting medical students to PHCs and reserving post graduate training seats for "in-service" government candidates

A fundamental driver of Tamil Nadu's success in MNH is the longstanding Directorate of Public Health (DPH) cadre in government. In other states, clinicians or staff from the general administrative services oversee planning and management for public health services. In Tamil Nadu, the Directorate of Public Health, staffed with public health management professionals, statisticians and epidemiologists, manages all public health issues allowing for a more integrated and primary health care approach (rather than a primarily disease focused and medical/clinical oriented approach). This cadre extends all the way down through the administration to the level of health inspector. Staff in the Directorate of Public Health begin their careers in planning and oversight of public health services at the PHC level and shift to the district and state management and leadership levels only after gaining hands-on experience in various contexts. The existence of this cadre and its merit- and experience-driven promotions structure has provided strong career pathways in government for public health specialists.

Under the NRHM and then NHM, many states hired NHM consultants and clinicians (doctors and nurses) on contractual bases. Yet Tamil Nadu sought integration of all HRH. The government ensured that every technical NHM specialist was hired not as a consultant but as a regular employee of the Directorate of Public Health. Contractual doctors were absorbed into regular employment and contract nurses were regularized shortly after they were hired.

Tamil Nadu is a "high production" state for nurses, doctors and pharmacists, has established one medical college per district, and has made strong state investments in medical and nurse training. Because of government investment in public medical colleges, the state has never had a shortage of doctors. Moreover, these public medical colleges – unlike private ones that dominate in other states – do not require students to pay capitation for seats. Instead, students are accepted based on merit, resulting in more medical students who are middle

class. The state takes pride in supplying human resources for health across the country and globe. Tamil Nadu is also unique in requiring staff nurses to have Bachelor of Science in Nursing degrees (whereas in other states, staff nurses can have a General Nursing and Midwifery diploma). The state engaged in several upskilling initiatives for in-service health workers. Anaesthesia training was extended from 16 to 24 weeks. NICU nurses received training in neonatal resuscitation. Obstetrics and gynecology specialists were appointed as block mentors for medical doctors and nurses to support management of high-risk pregnancies.

While staff retention is an ongoing challenge in many other states, Tamil Nadu has been relatively successful in retaining health workers in government facilities through incentives. The state has tried compulsory posting and bonds requiring work in rural and hilly areas. However, these attempts were unpopular and relatively unsuccessful. Instead, the state inculcated a public service ethic in students through frequent training placements in PHCs. It also incentivized rural government employment by reserving 50% of post graduate medical seats for these "service candidates," with additional points for those working in PHCs. After training, staff nurses and medical doctors were required to work at PHC for several years before being eligible to move to higher level facilities.

Clinical/technical innovations, quality assurance, and procurement

- Tamil Nadu has led the country in major clinical and quality improvement processes, including the maternal death review (and addition of referral reviews and near miss audits), prenatal screening, IV anaemia care for pregnant women, birth companionship, neonatal screening, breast feeding support, and monitoring and birth planning for high-risk women

- The formation of the Tamil Nadu Medical Service Corporation (TNMSC) introduced a robust health system procurement system that ensures citizens access free medicines in the facility

Tamil Nadu led the country in several clinical, quality assurance and procurement innovations. Clinically, the state was first to introduce prenatal screening and IV anaemia care for pregnant women. The state also introduced a birth companionship policy, delivery point screening for congenital malformation, and human milk banks along with comprehensive lactation management centres. Neonatal transportation was introduced, which shifts newborns between any facilities (even private to private) while providing emergency stabilization care.

Tamil Nadu also developed a robust maternal monitoring and birth planning system: when a Village Health Nurse or PHC medical officer identified a high-risk factor in a pregnant woman, the health worker contacted a block mentor (a specialist in a district hospital or other tertiary facility). This mentor then helped the woman, and her health care providers, develop a detailed monitoring and birth plan to account for higher risk status.

Tamil Nadu designed a referral system to avoid re-referral. When a referral from a PHC is required to a CEmONC facility, the Village Health Nurse calls the labour ward in the CEmONC facility to tell them a PHC case is being referred. The CEmONC centre checks that they have the woman's blood available and confirms that they are ready and waiting for the referral.

Quality assurance in Tamil Nadu has been closely linked to maternal death reviews, which identified strategies to address quality of care issues that were found to have contributed to maternal deaths. The addition of referral reviews and near miss audits showcases the state's expansion of processes to enhance accountability and continuous improvement. One strategy arising from these reviews was the creation of birth waiting homes at upgraded PHCs (those with a medical officer and trained staff nurse). All women were able to come and stay at the PHC a week before their estimated date of delivery, and high-risk women came earlier.

In forming the Tamil Nadu Medical Service Corporation, the state introduced a robust health system procurement system. The state also improved the availability of medicines in government facilities by granting and enforcing the right to access drugs in the facility. Facilities were able to fill procurement gaps and ensure a continuous supply of medicines by buying drugs from local drug vendors. Vendors were willing to provide commodities to government facilities because of the "passbook system," which detailed each facility's funding entitlement and gave suppliers confidence that they would be paid on time. Improved medicine and supply

procurement was linked to the state's revised medical equipment maintenance system. This maintenance registered each item of equipment in a health facility to a biomedical engineer, who was responsible for maintaining and fixing it.

Role and regulation of private sector

- Tamil Nadu's strong investment in public sector MNH has limited private sector expansion into maternal and newborn health services

- The government has supported private facilities to improve quality of care by allowing them to access public training and protocols; private facilities offering free and high-quality services to the poor can also enrol in the Dr. Muthulakshmi Reddy Maternity Benefit Scheme, so that women who deliver in these private facilities can still receive their conditional cash transfer for an institutional delivery

Experts explained that Tamil Nadu's strong investment in public maternal and newborn health services has limited private sector expansion into these health care areas. The private sector is widely used for health care related to cancer and other diseases but compared to other states in India, the private sector is not a major provider of antenatal, intrapartum, and newborn health care services. Exemplifying the strong role of public services was the fact that infants delivered in private facilities who require specialized newborn care are frequently transferred to government SNCUs. An exception to this predominance of public-sector maternity care is in tribal areas, where some not-for-profit missionary hospitals are important health care providers.

Despite the relatively small role of private sector in providing maternity care in Tamil Nadu, the government has engaged private maternity providers to reduce out of pocket expenditure and improve quality of care for those who choose private care. Any private facility giving low cost or free services to the poor can access Government of India training, funding, and protocols. While the Dr. Muthulakshmi Reddy Maternity Benefit Scheme primarily provides cash transfers to women delivering in public facilities, private facilities providing free and high-quality maternity care can also be enrolled in the scheme. Public ambulances (including the state's neonatal transportation system) and hearses will provide transportation to and between private facilities, depending on the patient's or family's request. Private sector health care providers are expected to participate in the state's maternal death review process and are encouraged to join the district level high risk tracking WhatsApp to follow up on patients.

Beyond patient care provision, private sector actors in Tamil Nadu have played a role in shaping the state's standards for maternity care. Tamil Nadu was the first state to form a Federation of Obstetricians and Gynaecologists, and Tamil Nadu's branch of the Federation of Obstetric and Gynecological Societies of India (FOGSI) produced maternity care guidelines that were used (instead of government of India guidelines) to set standards of care in public and private facilities. Furthermore, the state's medical officer training was developed and implemented through a public-private partnership. Public sector health facilities also began partnering with private laboratories to improve access to lab tests.

For those who do seek private sector maternity care, the available services vary in quality, are largely unregulated, and lack fixed pricing.

Policy implementation and administrative reforms

Political will and leadership for MNH

- The welfare state model of development has historically received widespread support across the general population and among politicians across major parties

- Political success during elections is thus linked to how well governing parties achieve social welfare goals, including a well-functioning public health care sector

- This ongoing political commitment in the health sector has resulted in enormous innovation; many policies and programs developed in Tamil Nadu were eventually adopted at the national level as best practice

⊙ The state's leadership drove progress on maternal and newborn survival through targeted interventions (using data to focus on marginalized areas and populations) and an ethos of constant improvement (e.g., building from blood availability to blood availability next to the labour room, from maternal death review to "near miss" review, from infrastructure to quality, from access to care within an hour to within 30 minutes)

Tamil Nadu's development is grounded in commitment to the welfare state model. There is widespread popular belief, "championed" by leaders across all major political parties, that the public sector should provide social services, including health care, to all citizens, without financial barrier. Citizens have always demanded more from the state, forming a major source of political pressure.

> *[The] welfare state model has been the corner stone of whatever be the political dispensation in Tamil Nadu. [...] I come from a state of Kerala, and I work in Tamil Nadu. I see that is the difference -- that provisioning in public is something which the state, irrespective of the political dispensation, sees that it's a fundamental for a welfare state. It's the definition of welfare state in Tamil Nadu. Public provisioning. (Government health expert, Tamil Nadu)*

The state's public administrators "wanted to prove" to the rest of India, and other countries, that a public health system can bring down MMR and NMR to single digits. State elections were fought partially over which party was best able to deliver on promises of strong social development, including in education, nutrition, and health care services. To push progress on development in the health sector, the state's ministers met frequently with health secretaries. This political will to deliver positive health outcomes through government-provided services, alongside a more educated and gender-equitable population, meant that the state government implemented centrally funded initiatives and pursued additional innovation.

> *It was not that we discovered anything, we were just in a better position to implement because those who went before us gave a lot of importance to women and children. (policy expert)*

Tamil Nadu implemented a wide range of health system programs and policies that promoted maternal and newborn health through primary health care. It also introduced key innovations, many of which were subsequently adopted at the national level as best practice. These innovations included: the Maternal Death Surveillance and Review; upgrading PHCs to become 24/7 delivery centres through hiring three staff nurses; instituting the right to birth companionship; prenatal screening and IV anaemia care for pregnant women; the right to be provided medicines at government facilities and the related passbook system of purchasing; and the development of the Medical Service Corporation, which introduced robust health system procurement.

The state's leadership drove progress on maternal and newborn survival through targeted interventions and an ethos of constant improvement. "Specific solutions for specific problems" ensured that the state used data to identify areas of greatest need (e.g., high mortality among tribal areas, high rates of adolescent pregnancy) and then developed strategies to address these issues in a targeted manner. The ethos of "constant improvement" created a work culture wherein officials responded rapidly to issues and continuously sought new ways to build onto success. Several examples were provided by experts: Hospital blood banks and labour wards were often too far apart, resulting in a delay of up to 30 minutes to walk between these areas. The state developed and implemented a policy to store blood right next to labour rooms. Now that the maternal death audit process is strong, the state has added "near miss" audits. BEmONC and CEmONC capable health facilities began with investment at just a few centres but slowly these expanded. Once the infrastructure was in place, the state has shifted to focusing on quality, respectful maternity care, and the reduction of unnecessary c-section. Initially, the health system committed to ensuring no mother travelled more than one hour to reach a facility; when this was achieved, they revised the ambition to no more than 30 minutes.

In addition to political will, Tamil Nadu had a uniquely stable bureaucracy: political leaders, project directors and health secretaries have all stayed in their positions for long periods of time. This stability allowed for program continuity, fostered positive and collaborative relationships (especially between medical and public health cadres), allowed leaders to see the fruits of their labour, and inspired leaders to push forward even more.

Decentralized governance and financial flexibility

❯ Tamil Nadu emphasized district level management and accountability for health; performance review for district collectors included assessment of maternal and child health indicators

District-level leadership and accountability for health is a feature of Tamil Nadu's success. Maternal death reviews were initially at the village and health worker level, but were moved to the district level, wherein the district magistrate became a key actor in these reviews. The Tamil Nadu state government made district collectors responsible for improving health care services and gave them the power to coordinate health-related resources and manage health crises. The district collector's performance monitoring included assessing maternal and child health indicators, and district collectors were awarded and recognized for reductions in infant and maternal mortality under their leadership. Furthermore, Tamil Nadu's unique Directorate of Public Health has long had its own dedicated budget.

Accountability, progress review and data systems

❯ "No other state looks so closely at data"; in Tamil Nadu, data is interrogated closely to first assess its quality and then assess the causes and potential solutions to any problems it highlights

❯ Reviews, progress meetings, and "no penalization" maternal death audits were taken seriously by the health system administration and health care providers

Central to Tamil Nadu's success is their use of data to drive accountability, target resources, and ensure decisions are driven by evidence. An expert reflected that, "No other state looks so closely at data" and further pointed out that data is not just collected – it is interrogated. This interrogation assessed both data quality and reasons for the trends shown by the data.

You've heard all of these experts; I don't think there is any other state which looks at data so closely and uses it so much. The more you look at data, the quality improves, and people start taking, making evidence-based decisions. I think this state is a front runner in the amount of good quality data that it captures. This is the only project in my lifetime where we had over 150 indicators that we collected day after day, week after week, month after month and people looked at it and people questioned. Not just the quality of data but why were things happening the way they were happening and then taking informed decisions accordingly. (Government health expert, Tamil Nadu)

Tamil Nadu routinized data review and audits for accountability across a range of programs and health areas, which increasingly harnessed the power of online databases. These review meetings and audits were discussed by many experts as an important driver of success. Reviews included monthly examinations of financial records (wherein the utilization amount is the key performance indicator), monthly 108 emergency transportation service reviews, and routine reviews of health monitoring information system data, hospital management data, CEmONC data, and SNCU data. HMIS and hospital management data were linked across facilities from PHCs to medical colleges, ensuring that patients could be tracked. Even doctor prescription data was reviewed to ensure rationality of care.

One important feature of these reviews was the government's ability to integrate actors across a variety of administrative and technical roles. For example, the regular joint CEmONC review meetings that discussed maternal and neonatal survival, technical care provision, and issues of late referral, brought together clinical specialists (wherein obstetricians and paediatricians were expected to contribute and work together), actors from Tamil Nadu's public health cadre, and the District Maternal and Child Health Officer.

Tamil Nadu also led the country in instituting maternal death audits, referral audits, and recently "near -miss" audits. The state developed "no penalization" Maternal Death Surveillance and Response (MDSR) reviews, which focused on problem-solving rather than blame-finding and encouraged universal maternal death reporting. These audits were discussed by experts as an important driver of improved maternal health care provision. Experts credited the MDSR process with driving important policy changes including birth companionship, locating blood banks close to labour rooms, hearse services, and dedicated maternity

operating theaters. The state's NHM Director was personally notified within 24 hours of any maternal death. Recently, WhatsApp has been used for immediate (same day) reporting of maternal deaths to the DPH and other officials. Referral audits address delays in timely referrals for emergencies and "near miss" audits now examine how to improve maternal health and avoid severe life-threatening complications.

High risk pregnant and postpartum women and newborns are closely tracked in Tamil Nadu. Infants using the SNCU are tracked through an online database by the state nodal person, the obstetrician, and a public health official; the state health secretary and even minister also sometimes track infants. High risk pregnancies are tracked on WhatsApp, and women who leave health facilities against medical advice, whether due to maternal or neonatal health risk, are reported to local health officials on WhatsApp, so that local health workers can follow up with them at their homes.

At the facility level, nodal officers who provided clinical care were also given administrative oversight to manage SNCUs. SNCUs were properly equipped because the same person who oversaw operational costs and ensuring supplies, also reported to the DDHS on how funds were utilized.

Community participation and demand generation

- Tamil Nadu's government has prioritized primary health care and funded it accordingly
- Citizens are well educated and aware of their right to social services, particularly free public education, and health care, and thus hold the system to account
- The state was the first to introduce a maternity benefit scheme: the Dr. Muthulakshmi Reddy Maternity Benefit Scheme encouraged health care use among the poor and increased women's access to nutrition

Tamil Nadu has a longstanding commitment to population-wide health services and primary health care, and the Directorate of Public Health has the budget to enact this commitment. Compared to other states, Tamil Nadu's budget for primary care, including for village health workers, is far higher than for secondary and tertiary care. Tamil Nadu has always had a village level nurse. While investment in doctors and nurses has also been robust, the state has not neglected the Village Health Nurse or the Urban Health Nurse. Bottom-up demand from the community has been a strong feature of the Tamil Nadu's health system since before the 1970s. People have been clear that free education and free health care are their right, and they will protest if this right is violated.

Tamil Nadu was the first state to introduce a maternity benefit program of cash and in-kind goods transfer for poor women. The Dr. Muthulakshmi Reddy Maternity Benefit Scheme, launched in 1987, created a financial incentive for women to access government health care (including ANC and intrapartum care) and drove the health system to respond to the needs of maternal care. This scheme has been periodically expanded to increase the cash transfer amounts, add additional nutrition support, and add a basket of goods for the mother and baby. By encouraging women to deliver in health facilities long before the NRHM introduced JSY, Tamil Nadu built a "virtuous cycle" of trust between communities and providers, community demand for services, and health system capacity expansion to meet demand. The state has expanded the scheme to migrant mothers with the Dr. Muthulakshmi Reddy Scheme for migrants.

IMPLICATIONS FOR STRATEGIC PLANNING

As part of the Exemplars study, a five-stage integrated framework for maternal and neonatal mortality transition was developed. The framework encapsulates key factors associated with reducing mortality using data from nearly 150 countries over the past two decades, including cause-of-death patterns, fertility, health service coverage and inequalities.[18] We used the transition framework as a tool to understand change in these interrelated factors, benchmark current situations, and inform strategy development, as well as improve data quality in Tamil Nadu and nationally.

Comparing Tamil Nadu's indicators at stage IV (2017) against the median values for countries in stage V of the transition model (Table 4) highlights the following key policy considerations:

- With a 2018 MMR of 58 deaths per 100,000 live births, reaching the average MMR for stage V countries (9 deaths per 100,000 live births) requires that Tamil Nadu reduce its MMR even further.

- Tamil Nadu's NMR of 10 deaths per 1000 live births is closer to the stage V average (3 deaths per 1000 live births).

- Tamil Nadu needs to focus on infection control and treatment during the neonatal period and peri-partum causes; infection-related causes of deaths (18%) and peri-partum causes of death (26%) currently contribute a far higher proportion than the average in stage V countries (7% and 14%, respectively).

- The state's fertility has already fallen to stage V levels, so further contributions to mortality decline are unlikely.

- In terms of intervention coverage, Tamil Nadu has already achieved stage V levels of 4 or more ANC visit coverage and delivery in health facilities but can reduce mortality by ensuring all deliveries take place in hospital-level facilities (In 2017, 77%[3] of deliveries were in hospital level facilities, compared to a stage V average of 91%).

- In Tamil Nadu, women in the poorest tertile have already achieved sufficient access to C-sections; rural women are also very well served by delivery care.

- Thus, Tamil Nadu's progress should be closely tied to ensuring quality of care for the poor and addressing wider determinants of health particularly with a pro-poor focus.

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3   The hospital delivery percentage here and in Table 4 is different from the percentage in Figure 11 due to differences in data sources (Table 4 uses the NFHS and DLHS pooled data whereas Figure 11 used only the NFHS data) as well as differences in the reference period (Table 4 uses the annual rates whereas Figure 11 used estimates for the births in the three years before NFHS-2).

Table 4: Summary of key indicators in 2000 and 2017 for Tamil Nadu, and common characteristics of countries in stage V in 2017

Indicator	Tamil Nadu		Median stage V values
Year	2000	2017	
Stage	II	IV	
Mortality			
Maternal mortality per 100,000 LB (SRS 2000-18)	167	58	9
Neonatal mortality per 1,000 LB (SRS 2000-18)	36	10	3
Neonatal mortality, home births (NFHS 2005-06 and 2019-21)	26	NC	NA
Stillbirth rate per 1,000 births (SRS)	15	3	3
Cause pattern (neonatal) (MCEE 2000 & 2015)			
Infections (Group 1)	25	18	7
Health status[1] (Group 2)	44	55	78
Peri-partum (Group 3)	30	26	14
Fertility (SRS)			
Total fertility rate	2.1	1.6	1.6
Adolescent fertility (per 1000)	33	11	13
Coverage of interventions (NFHS+DLHS)			
ANC four or more visits (%)	78	91	87
Delivery in health facility (%)	88	100	99
Delivery in hospital (%)	80	77	91
C-sections (%)	14	47	25
Inequalities			
Neonatal mortality poor-rich gap (abs) (NFHS 2005-06 and 2019-21)	NC	NC	7
Delivery care, rural (%) (NFHS+DLHS)	78	99	99
Delivery care, poor-rich gap (abs) (NFHS 2005-06 and 2019-21)	-30	-4	-1
C-section, poorest quintile (%) (NFHS 2005-06 and 2019-21)	10	32	23

[1] Includes prematurity, small for gestational age and congenital anomalies.

NC: Not computed due to small numbers.

NA: Not available.

Works cited

1   United Nations Children's Fund. (2019). Maternal mortality Geneva: United Nations Children's Fund. [cited 2021 October 23]. Available from: https://data.unicef.org/topic/maternal-health/maternal-mortality/.

2   United Nations Children's Fund. (2019). Neonatal mortality Geneva: United Nations Children's Fund. [cited 2021 October 23]. Available from: https://data.unicef.org/topic/child-survival/neonatal-mortality/#targetText=Globally%2C%20 the%20average%20annual%20rate,47%20per%20cent%20in%202018.

3   Singh NS, Blanchard AK, Blencowe H, et al. on behalf of the Exemplars MNH research team. (2022). Zooming in and out: a holistic framework for research on maternal, late foetal and newborn survival and health. Health Policy and Planning. 37(5):565-574.Available from: doi:10.1093/heapol/czab148.

4   National Family Health Survey India. International Institute for Population Studies, Mumbai, Maharashtra. [Accessed Sept 5, 2023] https://rchiips.org/nfhs/

5   District Level Household Project, District level household project under Reproductive and Child Health (RCH) project & Facility survey-3, India. International Institute for Population Studies, Mumbai, Maharashtra. [Accessed Sept 5, 2023] https://iipsindia.ac.in/content/district-level-household-project

6   Million Death Study Collaborators. (2017). Changes in cause-specific neonatal and 1-59-month child mortality in India from 2000 to 2015: a nationally representative survey. The Lancet 390 (10106): 1972-1980.

7   Montgomery AL, Ram U, Kumar R, Jha P, Million Death Study Collaboration. Maternal mortality in India: causes and healthcare service use based on a nationally representative survey. PloS One. 2014;9(1):e83331. Available from: doi: https://dx.doi.org/10.1371/journal.pone.0083331.

8   Liu, L., Y. Chu, S. Oza, D. Hogan, J. et al. (2019). National, regional, and state-level all-cause and cause-specific under-5 mortality in India in 2000-15: a systematic analysis with implications for the Sustainable Development Goals. The Lancet Global Health 7 (6): e721-e734.

9   Dandona, R., G. A. Kumar, N. J. Henry, et al. (2020). Subnational mapping of under-5 and neonatal mortality trends in India: the Global Burden of Disease Study 2000-17. Lancet 395 (10237): 1640-1658.

10 United Nations Children's Fund. (2007). Technical note: How to calculate average annual rate of reduction (AARR) of underweight prevalence https://data.unicef.org/resources/technical-note-calculate-average-annual-rate-reduction-aarr-underweight-prevalence/

11 Arroayave L, Saad GE, Victora CG and Barros AJD. (2021). A new content-qualified antenatal care coverage indicator: development and validation of a score using national health surveys in low- and middle-income counties. J Glob Health 11:04008. doi: 10.7189/jogh.11.04008.

12 Boerma T, Ronsmans C, Melesse DY, et al. Global epidemiology of use of and disparities in caesarean sections. Lancet. 2018;392(10155):1341–8.

13 Belizán, J. M., Minckas, N., McClure, E. M., et al. (2018). An approach to identify a minimum and rational proportion of caesarean sections in resource-poor settings: a global network study. The Lancet. Global health, 6(8), e894–e901. https://doi.org/10.1016/S2214-109X(18)30241-9

14 Government of India. (2010). Economic Survey 2009-10 – Ap-1-09 (indiabudget.gov.in)

15 Government of India. (2022). Economic Survey 2021-22. https://www.indiabudget.gov.in/economicsurvey/ebook_ es2022/index.html

16 World Bank. (2016). Tamil Nadu: Poverty, Growth & Inequality https://documents1.worldbank.org curated/ en/380971504177733539/pdf/119267-BRI-P157572-Tamil-Nadu-Poverty.pdf

17 Reserve Bank of India. (2020). Table 154 : Number and Percentage of Population Below Poverty Line https://www.rbi. org.in/scripts/PublicationsView.aspx?id=19887

18 Boerma T, Campbell OMR, Amouzou A, Blumenberg C, Blencowe H, Moran A, Lawn JE, Ikilezi G. Maternal mortality, stillbirths, and neonatal mortality: a transition model based on analyses of 151 countries. The Lancet Global Health. 2023;11(7):e1024-e31. Available from: doi:https://doi.org/10.1016/S2214-109X(23)00195-X.

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