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Exemplars in Maternal and Newborn Health India Study

State Report: Odisha

2024

EXEMPLARS IN GLOBAL HEALTH

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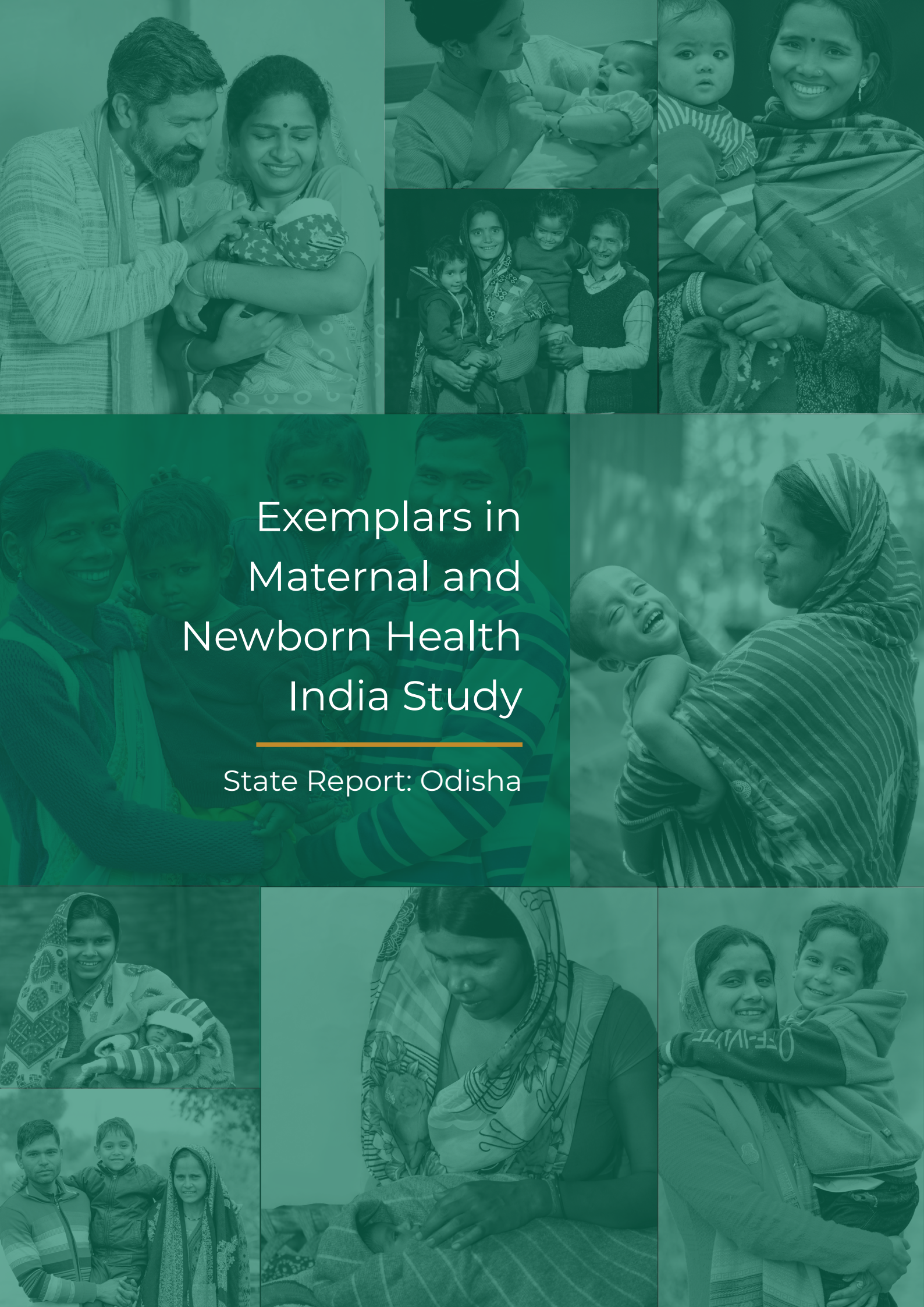

Exemplars in Maternal and Newborn Health India Study

State Report: Odisha

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ACRONYMS

AARC	Average annual rate of change
ANC	Antenatal care
ANM	Auxiliary Nurse Midwife
ASHA	Accredited Social Health Activist
AYUSH	Ayurvedic, Unani, Siddha and Homeopathic
BEmOC	Basic emergency obstetric care
BMI	Body mass index
BSY	Biju Swasthya Kalyan Yojana
CEmOC	Comprehensive emergency obstetric care
CHC	Community health center
CM	Chief Minister
CSSM	Child Survival and Safe Motherhood
DLHS	District Level Household Survey
DM	District Manager
EAG	Empowered Action Group
EmOC	Emergency Obstetric Care
FOGSI	Federation of Obstetric and Gynecological Societies of India
FRU	First referral unit
GBDS	Global Burden of Disease Study
G6PD	Glucose-6-phosphate dehydrogenase
HBNC	Home-based Newborn Care
HMS	Higher mortality states
IGNOU	Indira Gandhi National Open University
IHAT	India Health Action Trust
IIPS	International Institute for Population Sciences
INR	Indian Rupee
JSSK	Janani Shishu Suraksha Karyakaram
JSY	Janani Suraksha Yojana
KII	Key Informant Interview
KMC	Kangaroo mother care
LSAS	Life-saving Anaesthetic Skill
LMS	Lower mortality states
LHV	Lady Health Visitor
MBBS	Bachelor of Medicine, Bachelor of Surgery
MCEE	Maternal and Child Epidemiology Estimation
MCTS	Mother and Child Tracking System
MD	Mission Director

MDS	Million Death Study
MMR	Maternal Mortality Ratio
MNH	Maternal and Newborn Health
NBSU	Newborn Stabilization Unit
NCC	Newborn Care Corner
NFHS	National Family Health Survey
NHM	National Health Mission
NHSRC	National Health Systems Resource Centre
NICU	Newborn Intensive Care Unit
NMR	Neonatal Mortality Rate
NRHM	National Rural Health Mission
NSSK	Navjaat Shishu Suraksha Karyakram
NQAS	National Quality Assurance Standards
OSMCL	Odisha State Medical Corporation Limited
OT	Operation Theatre
OOPE	Out-of-pocket expenditure
PCI	Per capita income
PGDMCH	Post Graduate Diploma in Maternal and Child Health
PHC	Primary Health Centre
PIP	Project implementation plan
PMSMAY	Pradhan Mantri Surakshit Matritva Abhiyan Yojana
PPH	Postpartum Hemorrhage
PRI	Panchayati Raj Institution
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
SAANS	Social Awareness and Action to Neutralize Pneumonia Successfully
SAMPurNA	Shishu Abond Matru Mrutyuhara Purna Nirakaran Abhiyan
SBA	Skilled Birth Attendant
SC	Scheduled Caste
SIHFW	State Institute of Health and Family Welfare
SNCU	Special Newborn Care Unit
SRS	Sample Registration System
ST	Scheduled Tribe
TFR	Total Fertility Rate
UoM	University of Manitoba
UNFPA	United Nations Fund for Population Activities
VHND	Village Health and Nutrition Day
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 high- and low-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 Odisha sub-study and provides background information on the broader India study and research methodology. Key findings for the Odisha state are as follows:

- Odisha made major progress in reducing maternal and newborn mortality during 2000-18, greater than most other higher mortality states.
- All major causes of neonatal death have reduced (prematurity, birth asphyxia, infections) in the state.
- The gains in intervention coverage, antenatal care with contents (ANCq), institutional deliveries notably in hospitals and C-sections have been marked and are greatest during the National Rural Health Mission (NRHM) /National Health Mission (NHM) periods (post 2005).
- The public sector has driven this increase, accounting for nearly 90% of deliveries, and institutional neonatal mortality rates are substantially reduced in private hospitals and lower-level health facilities.
- Several health policies and system reforms have contributed to Odisha's success, including:
    - The state invested in rural government infrastructure, particularly in building health sub-centres in under-served areas and upgrading Community Health Centres (CHCs) into First Referral Units (FRUs) by improving the labour rooms, operating theatres, equipment, and instruments and posting required health workers.
    - The state sought to provide every pregnant woman with at least one ANC from a doctor and at least one ultrasound.
    - Odisha introduced maternity waiting homes, travel support, and additional outreach visits for hard-to-reach areas.
    - Investments in Newborn Intensive Care Units (NICUs), Special Newborn Care Units (SNCUs) and Newborn Care Corners (NCCs) have been ongoing in the state.
    - Health worker training has been a big focus in Odisha, with expertise from state medical colleges, experts across India, and international partners: the state developed Skill Labs and has implemented the 21-day national skilled birth attendant (SBA) training program, Life-Saving Anaesthetic Skill (LSAS) and Emergency Obstetric Care (EmOC) training for medical officers, national training for newborn care, and training on pneumonia management.
    - Odisha was the first state to create a separate nursing directorate, which introduced systematic improvement to nursing education.

- Odisha was the first state to extend SBA training to Ayurvedic, Yoga and Naturopathy, Unani, Siddha and Homeopathic (AYUSH) doctors, has implemented the national policy of expanding Auxiliary Nurse Midwife (ANM) responsibilities to include offering first dose of antibiotic injection gentamicin and amoxicillin, and has created ongoing education opportunities for medical officers.
- Intrapartum care now includes new surgical techniques and the use of pneumatic anti-shock garments.
- Newborn care has ramped up access to tertiary care for fragile neonates, increased use of antenatal corticosteroids, encouraging universal screening, vitamin K injection, kangaroo mother care (KMC) and very high rates of home-based newborn care by Accredited Social Health Activists (ASHAs).
- Health workers and facilities are increasingly incentivized to improve patient care and patient satisfaction through reward- rather than punishment-based approaches.
- Procurement was shifted to the Odisha State Medical Corporation Limited (OSMCL), set up after an exposure visit to Tamil Nadu, that brought speed and transparency to supply chain management.
- Strong political will underpinned the state's progress with the Chief Minister paying specific attention to progress on health.
- Leadership of the Odisha health department and NHM was stable, without frequent short-term transfers; the technical and administrative actors within government worked together closely.
- Odisha mobilized substantial state-level financial resources for maternal and newborn health to add to funding from the NHM.

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 within India 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.

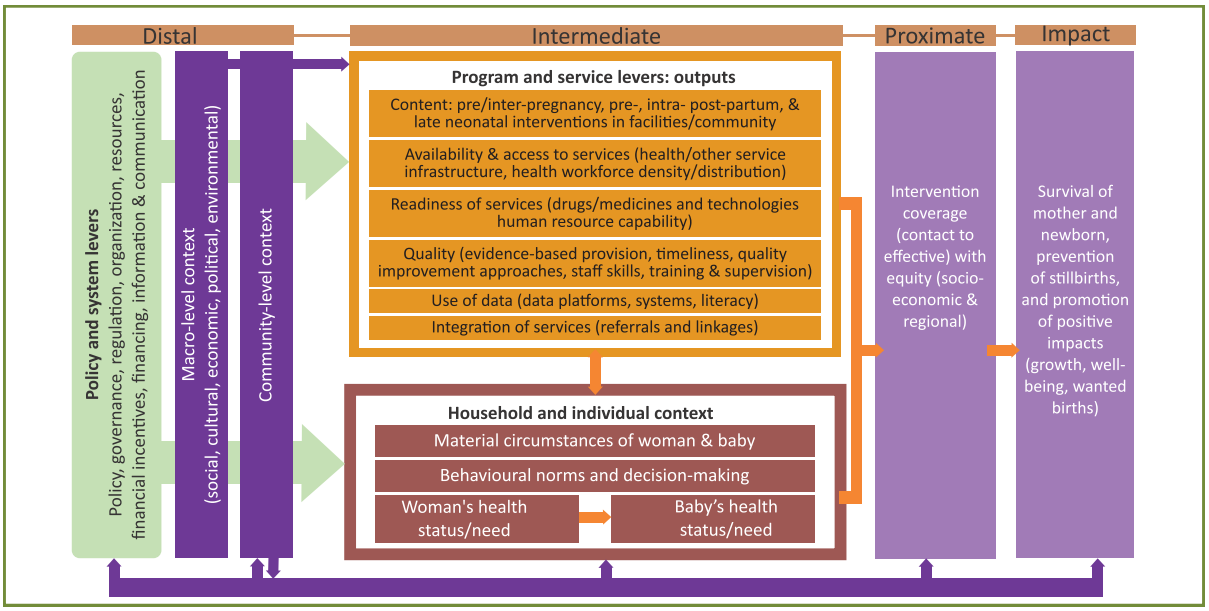
Macro and community-level contextual factors (e.g., social, cultural, economic, political, or geographical) at the distal level may moderate the effects of health policy and system changes on program and service outputs for MNH and their impact on coverage of key MNH interventions and health outcomes. 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.

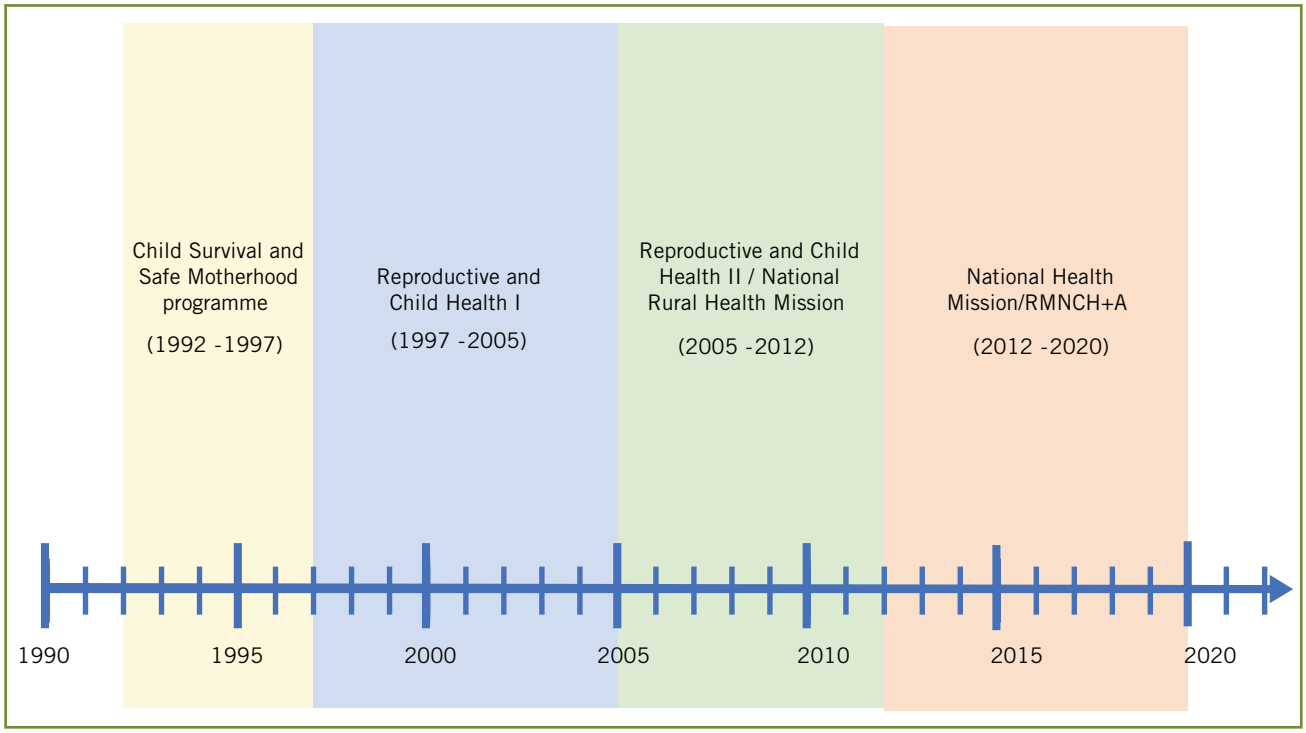
Figure 1: Conceptual framework for the study of drivers of the maternal and neonatal mortality decline, MNH Exemplars study



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 National Health Mission (NHM) from 2012 to 2020 (Figure 2). In addition, we assessed all annual or five-year time trends (depending on the indicator) for 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, EAG), 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 to select 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 for 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 mortality and neonatal mortality by state (SRS, 2000-17) (states ranked within state cluster by total AARC)

	MMR			NMR			Sum of AARCs	Rank
State	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	13.0	-4.7	-6.6	9

Data sources

We used the 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 decline. 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 participated. We held one round table discussion with state-level experts in each of the six selected exemplar states separately (n=11 participants 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.

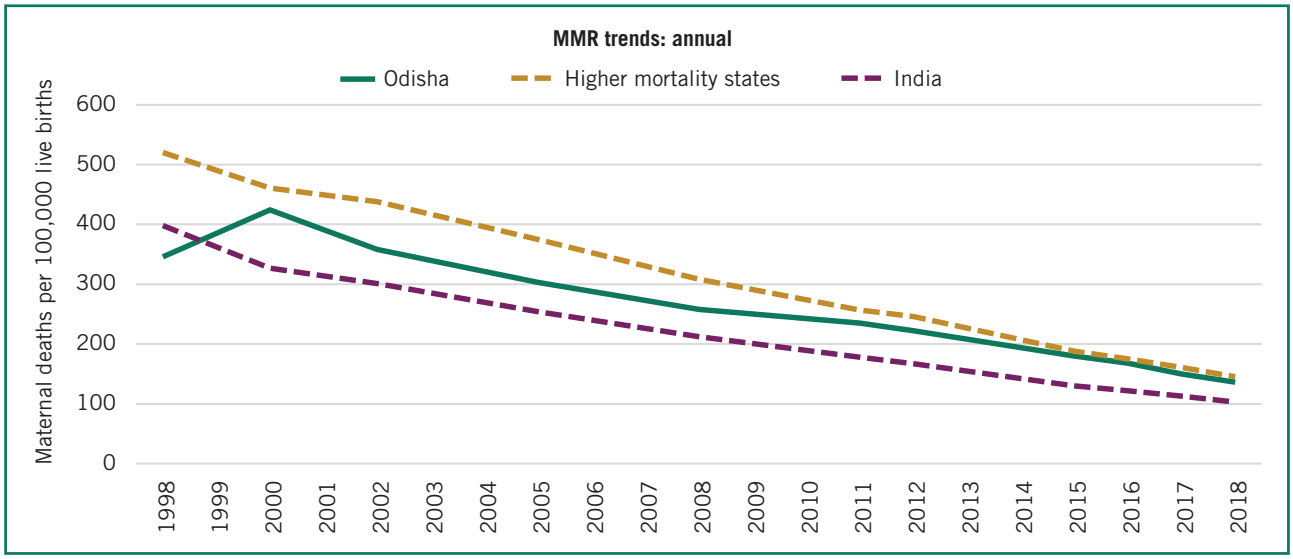
We coded the qualitative transcripts in Dedoose software using a codebook developed based on *a priori* topics, with additional emergent sub-codes. We shared synthesized results with key informants anonymously to finalize the results.

This report presents the results of these analyses for Odisha according to the framework 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 Odisha over the last two decades. Then the study analyzed the linkages between drivers and outcomes to explain how major drivers combined to influence Odisha's maternal and neonatal mortality declines.

MATERNAL AND NEONATAL MORTALITY TRENDS

During 2000-18, Odisha recorded much faster reductions in the maternal mortality ratio (MMR) than in the neonatal mortality rate (NMR) (AARC of -6.3% versus -3.8%) (Figure 4 and Table 2). In 2018, the MMR for the state was 136 maternal deaths per 100,000 live births (almost twice the 2030 SDG goal of 70) and the NMR was 31 per 1000 live births (more than twice the 2030 SDG goal of 12). The fastest decline in MMR was during the NHM/RMNCH+A period (2012-18), with an AARC of -8.2%, while the fastest decline in NMR was during RCH II/NRHM period (2005-12) with an AARC of -4.3% (Table 2). Odisha's MMR was consistently lower than its state cluster, while its NMR was consistently higher than its state cluster since 1984 (Figure 4).

Figure 4: Odisha's MMR (1998-2018) and NMR (1971-2019) levels and trends compared to higher mortality state cluster and all India (SRS)



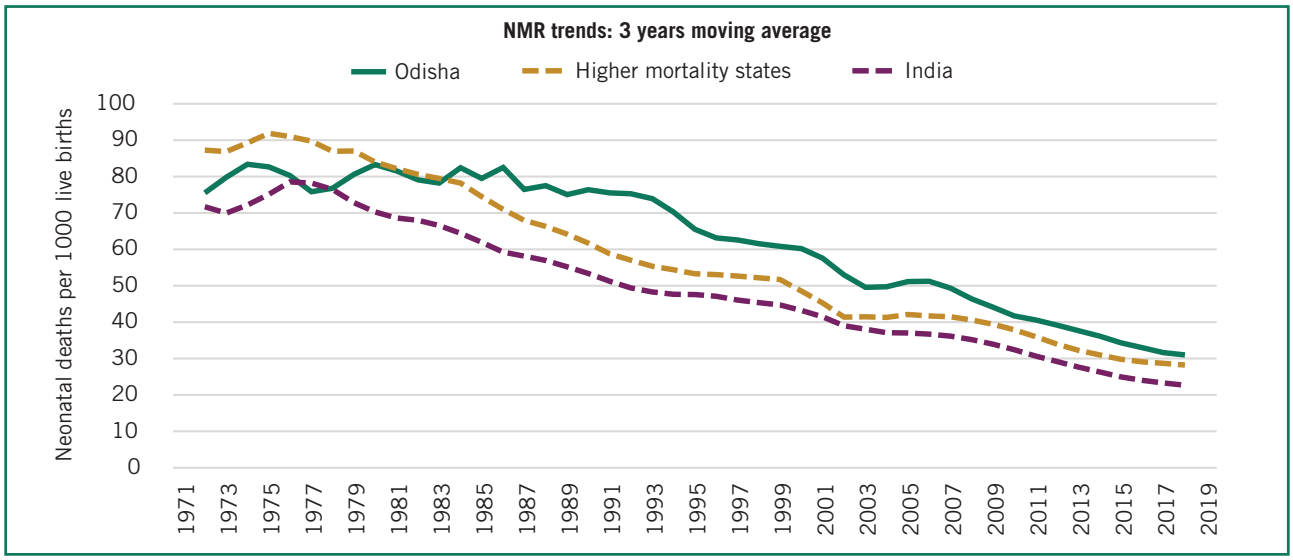


Table 2: Average annual rates of change (AARC) in MMR (1997-2018) and NMR (1971-2019), Odisha, higher mortality state cluster and all India (SRS)

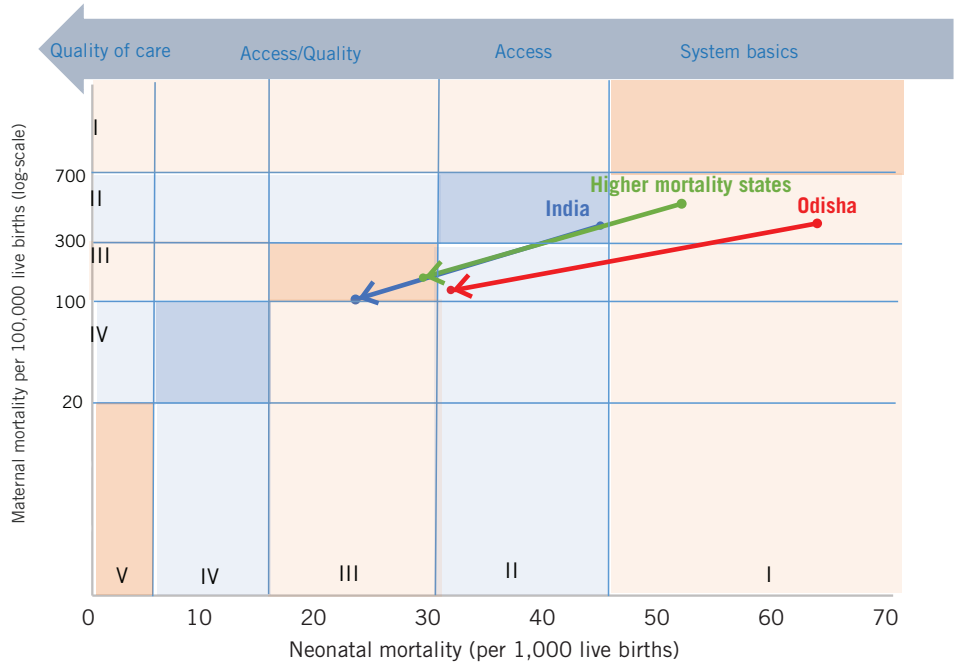
Policy period	Odisha	Higher mortality states	India
AARC in MMR (%)			
1997-2005 (RCH I)	-1.9	-4.7	-6.4
2005-12 (RCH-II/NRHM)	-4.4	-6.0	-6.0
2012-18 (NHM/RMNCH+A)	-8.2	-8.8	-8.1
2000-18	-6.3	-6.4	-6.4
1997-2018 (Overall)	-4.7	-6.4	-6.8
AARC in NMR (%)			
1992-97 (CSSM)	-2.9	-1.2	-1.6
1997-2005 (RCH I)	-2.2	-3.1	-2.8
2005-12 (RCH-II/NRHM)	-4.3	-2.9	-3.4
2012-19 (NHM/RMNCH+A)	-3.9	-3.1	-3.9
2000-18	-3.8	-3.2	-3.7
1971-2019 (Overall)	-3.3	-2.7	-3.0

Maternal and neonatal mortality transition

Odisha'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 Stages 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 declines. 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, Odisha has transitioned from Stage I to Stage III, achieving a three-fold reduction in maternal mortality and reducing the peri-neonatal mortality by half (Figure 5).

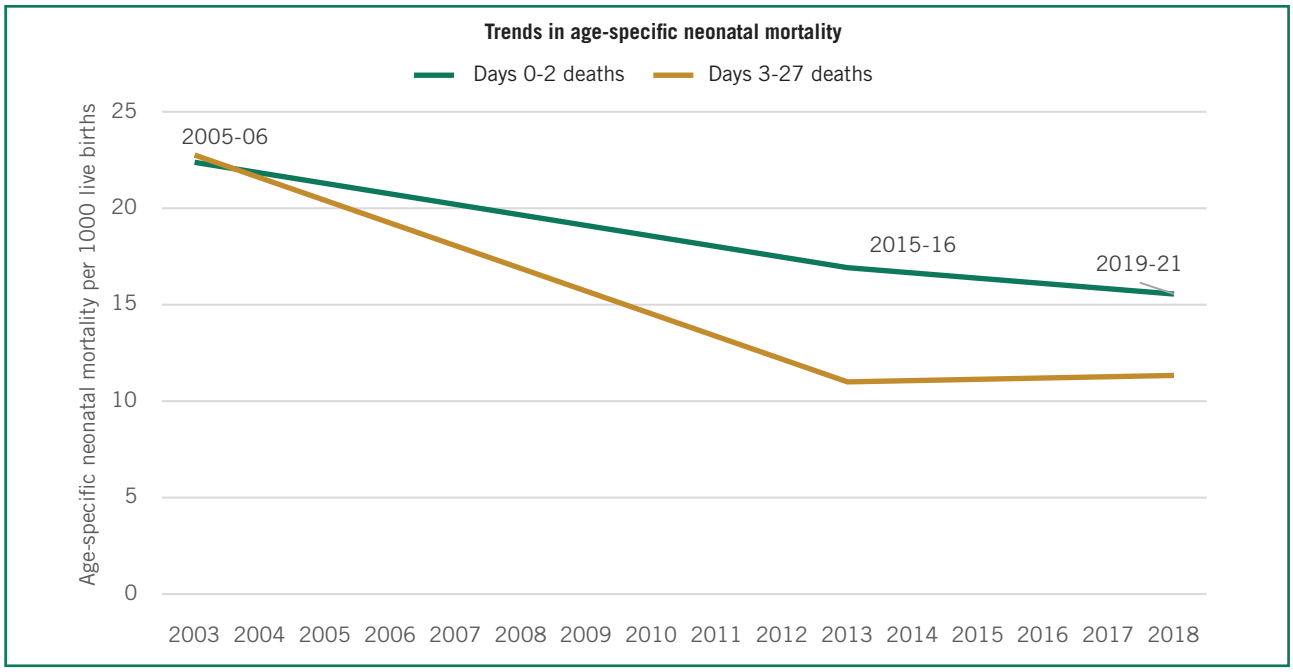
Figure 5: Mortality transition in Odisha, higher mortality state cluster and all India (SRS 2000-18)



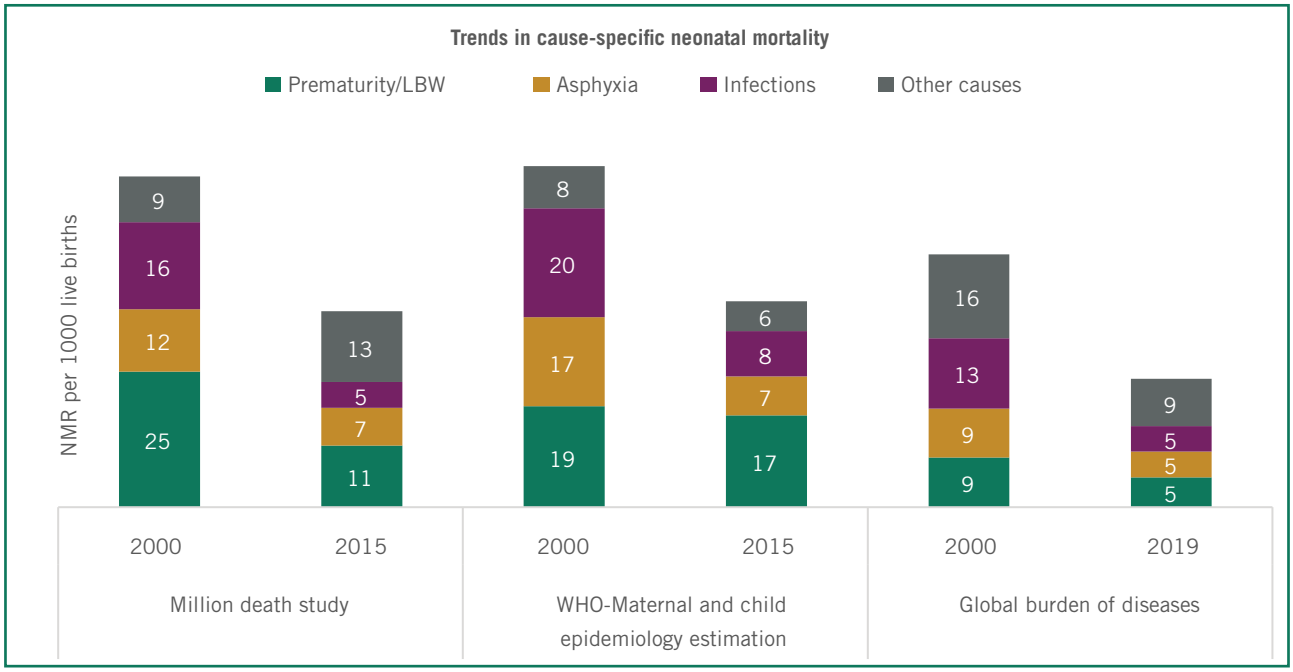
Age and cause-specific neonatal mortality

During 2003-18, Odisha was successful in bringing down mortality both on days 0 to 2 and on days 3 to 27, with a greater decline in the latter (Figure 6). However, during 2013-18, the state recorded faster decline in mortality on days 0-2 AARC of -2.1% against -0.7% in 3–27-day mortality (data not shown), indicating improvements to quality of delivery care and newborn's health status in the recent times. The estimates from GBDS indicate that the state has recorded major declines in all leading causes, with newborn infections including lower respiratory infections contributing 36%, asphyxia 19% and preterm birth another 16% (Figure 6). A reduction in newborn infections contributed most to the decline as per WHO/MCEE data as well. However, reduced preterm-related causes of death contributed most to the decline as per MDS data.

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), Odisha



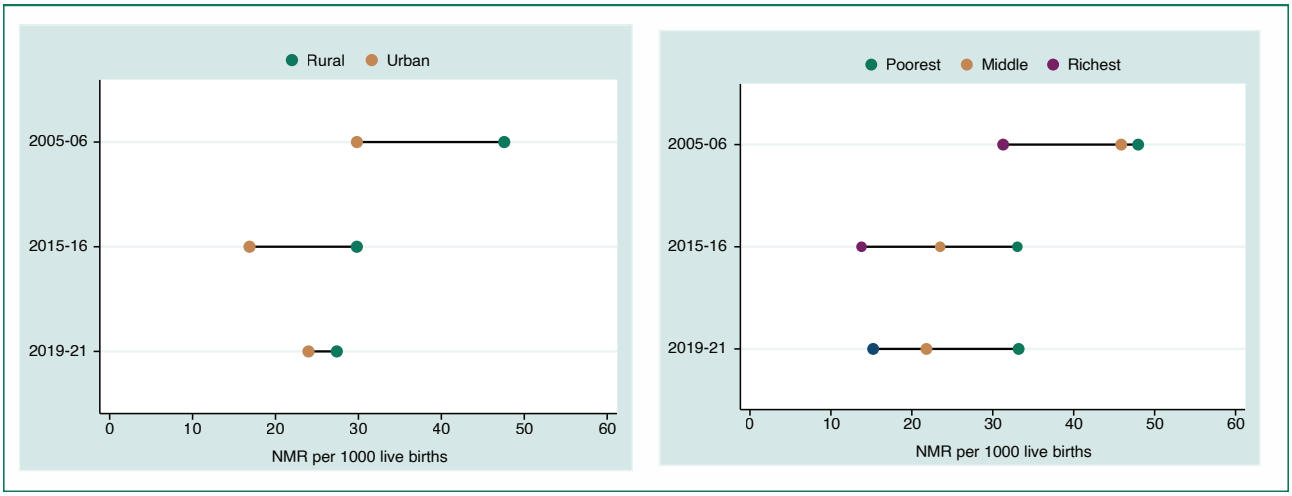
* We included mortality from births in the five years preceding each NFHS round and have taken 2003, 2013 and 2018 as the midpoints for the estimates from NFHS 2005-06, 2015-16 and 2019-21, respectively.



Equity in neonatal mortality

The NMR has reduced significantly in both rural and urban areas, as well as in each wealth tertile between 2005-06 and 2015-16, thus reducing inequity. However, the NMR recorded in these groups in 2019-21 are not significantly different from the earlier survey estimates (Figure 7).

Figure 7: Trends in NMR by urban-rural residence and household wealth tertile, Odisha (NFHS 2005-06, 2015-16 and 2019-21)



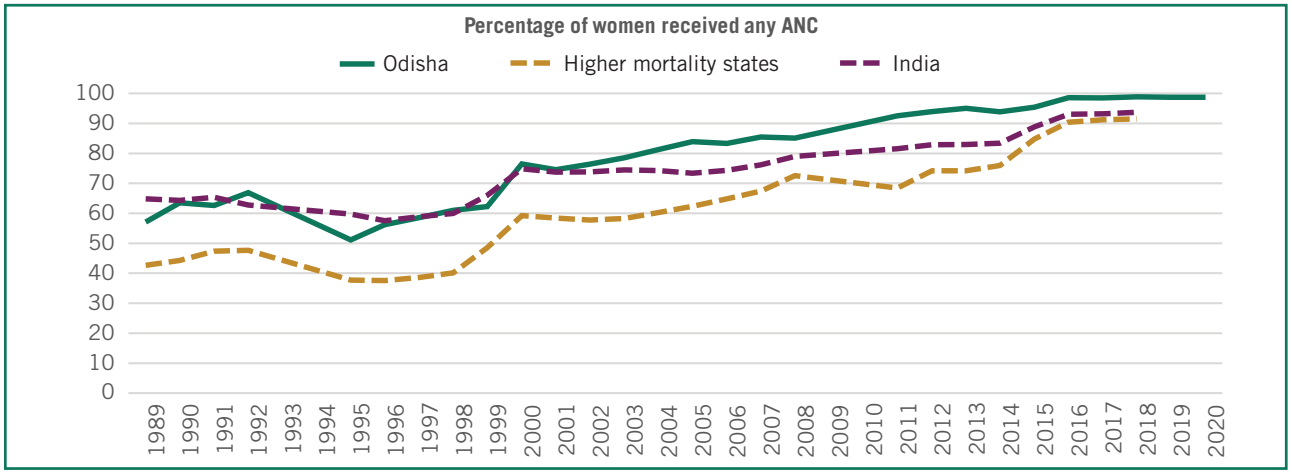
INTERVENTION COVERAGE AND EQUITY

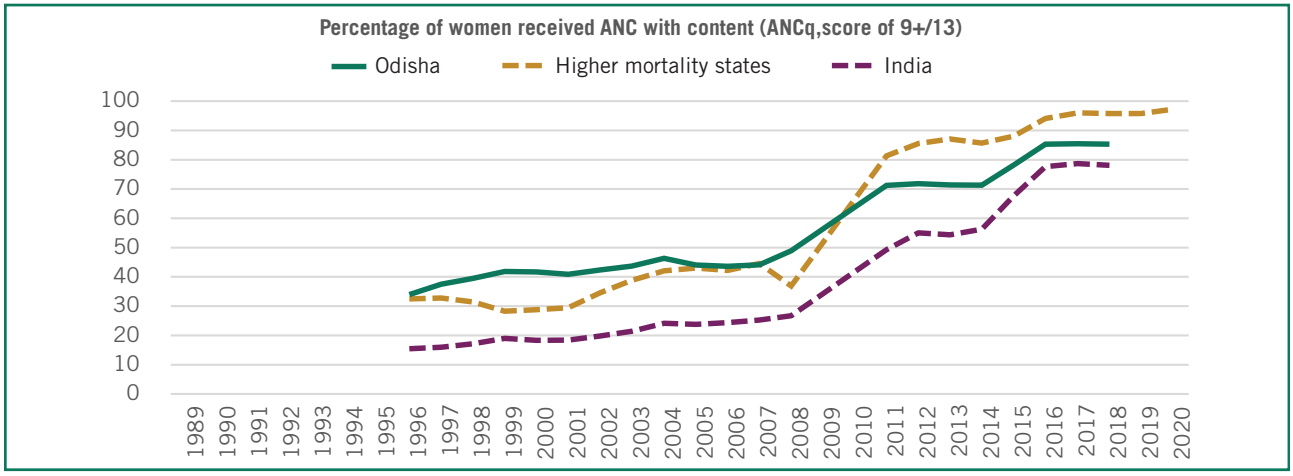
How did Odisha achieve these major mortality reductions since 2000? In this section, we analyse the trends and equity in the coverage of key interventions in the state against the backdrop of the various national health policy periods.

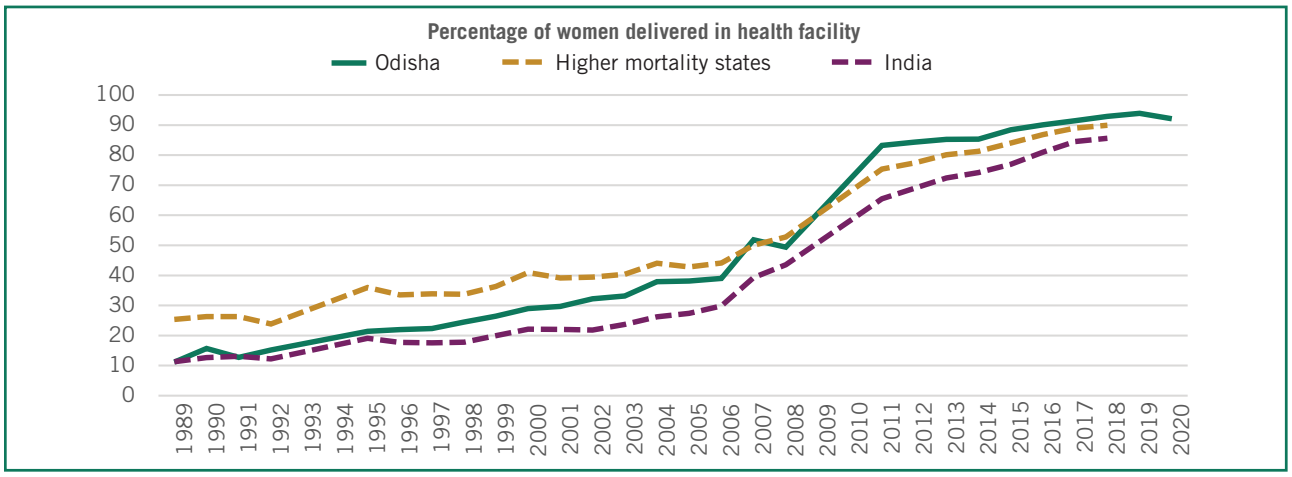
Antenatal and delivery care

The coverage of key interventions has improved in Odisha according to the pooled NFHS and DLHS data (Figure 8). The fastest increase in any ANC coverage was during the RCH-I period (1997-2005), whereas the coverage for ANC with content and institutional delivery increased fastest during the RCH-II/NRHM period (2005-12), all reaching over 92% by 2020.

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

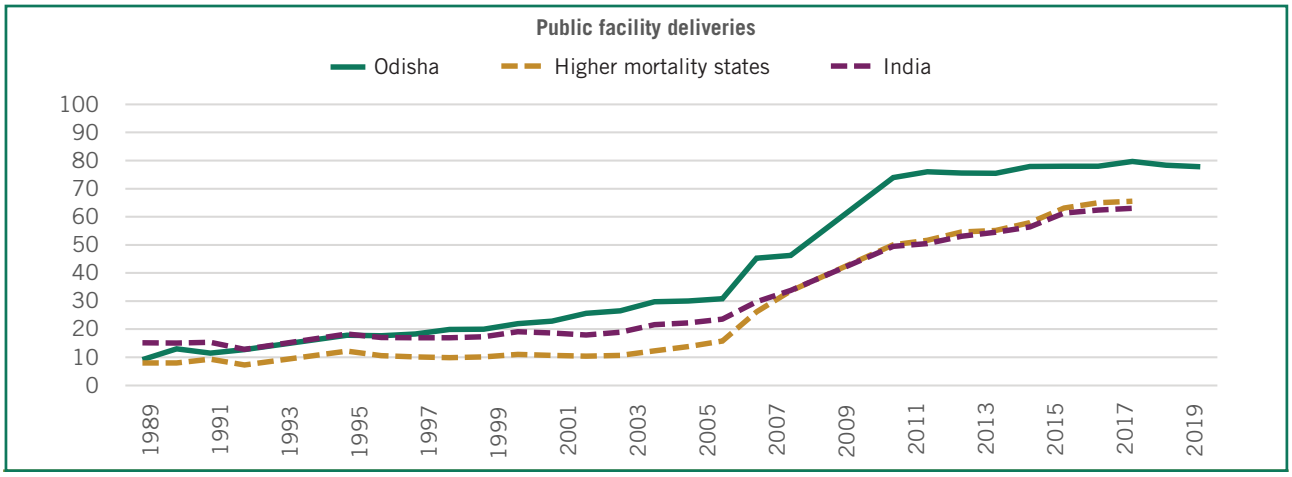


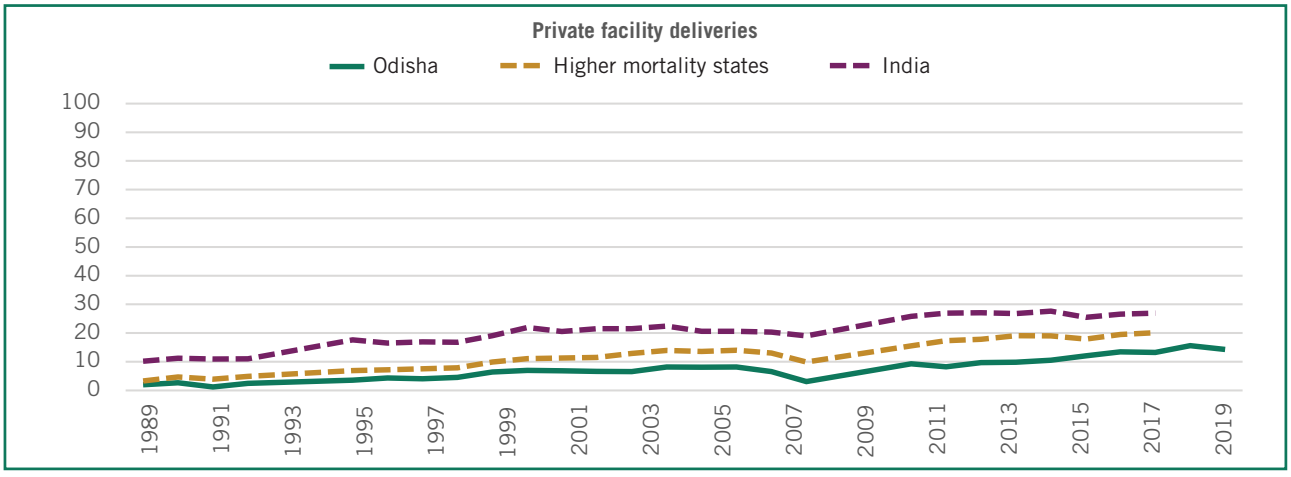




Increases in institutional deliveries was mainly driven by public facilities (Figure 9). The public facility deliveries consistently constituted more than three-fourths of all deliveries in Odisha for the past two decades. The greatest increase in public facility deliveries was during the RCH-II/NRHM period (2005-12) with an AARC of 13.3% (data not shown).

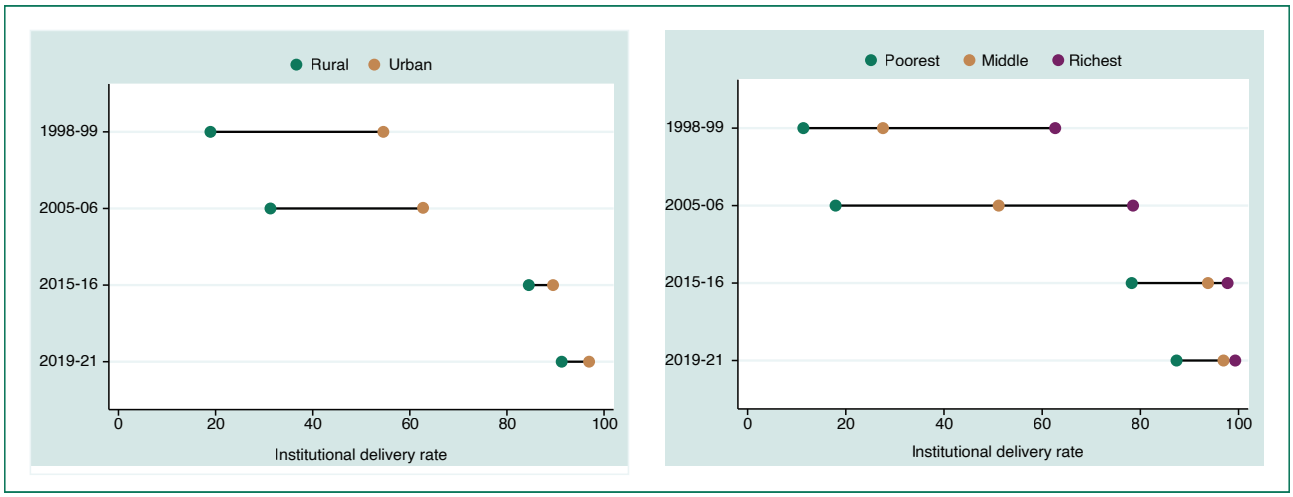
Figure 9: Trends in public and private health facility deliveries, Odisha, higher mortality state cluster and all India (NFHS and DLHS pooled data, 1989-2020)





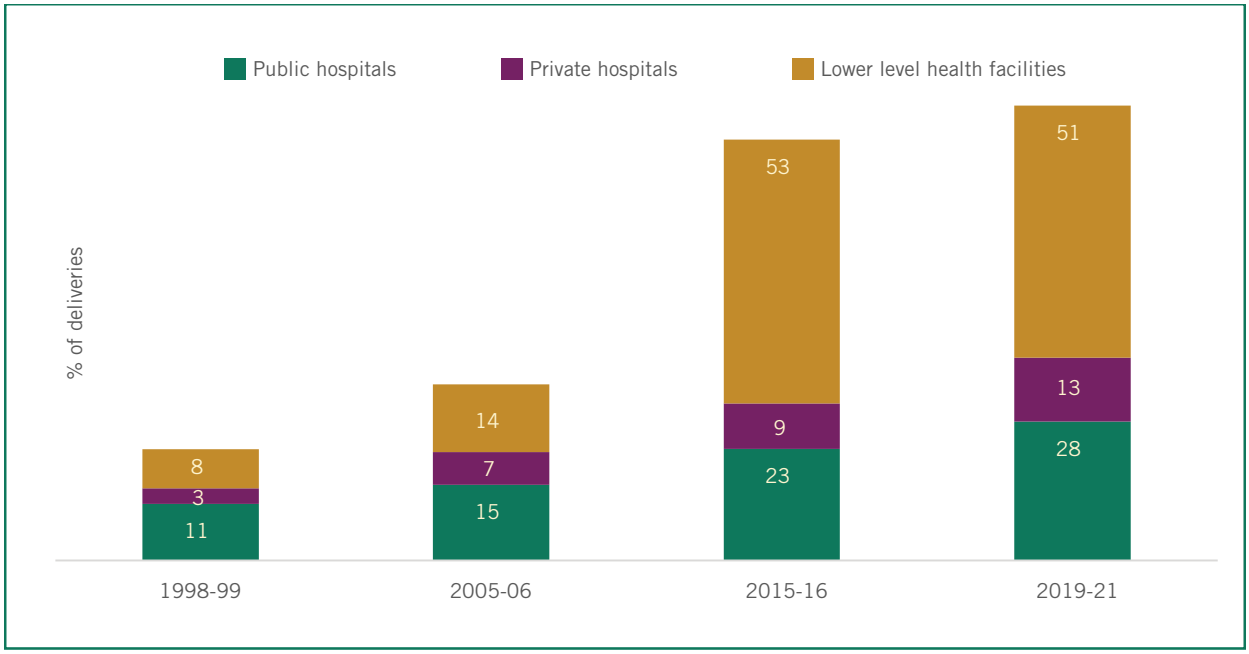
Odisha's major increases in institutional delivery was possible because the rural and the poorest women were reached, and disparities were reduced substantially (Figure 10).

Figure 10: Trends in institutional delivery by urban-rural residence and household wealth tertile, Odisha (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)



Since 2015-16, little more than half of all deliveries in Odisha were conducted in lower-level health facilities (Figure 11). However, there has been an increase in hospital deliveries over time, constituting 41% of all deliveries in 2019-21. The national analysis indicated that NMR decline is strongly associated with increases in hospital deliveries (MNH Exemplar Study, National Report).

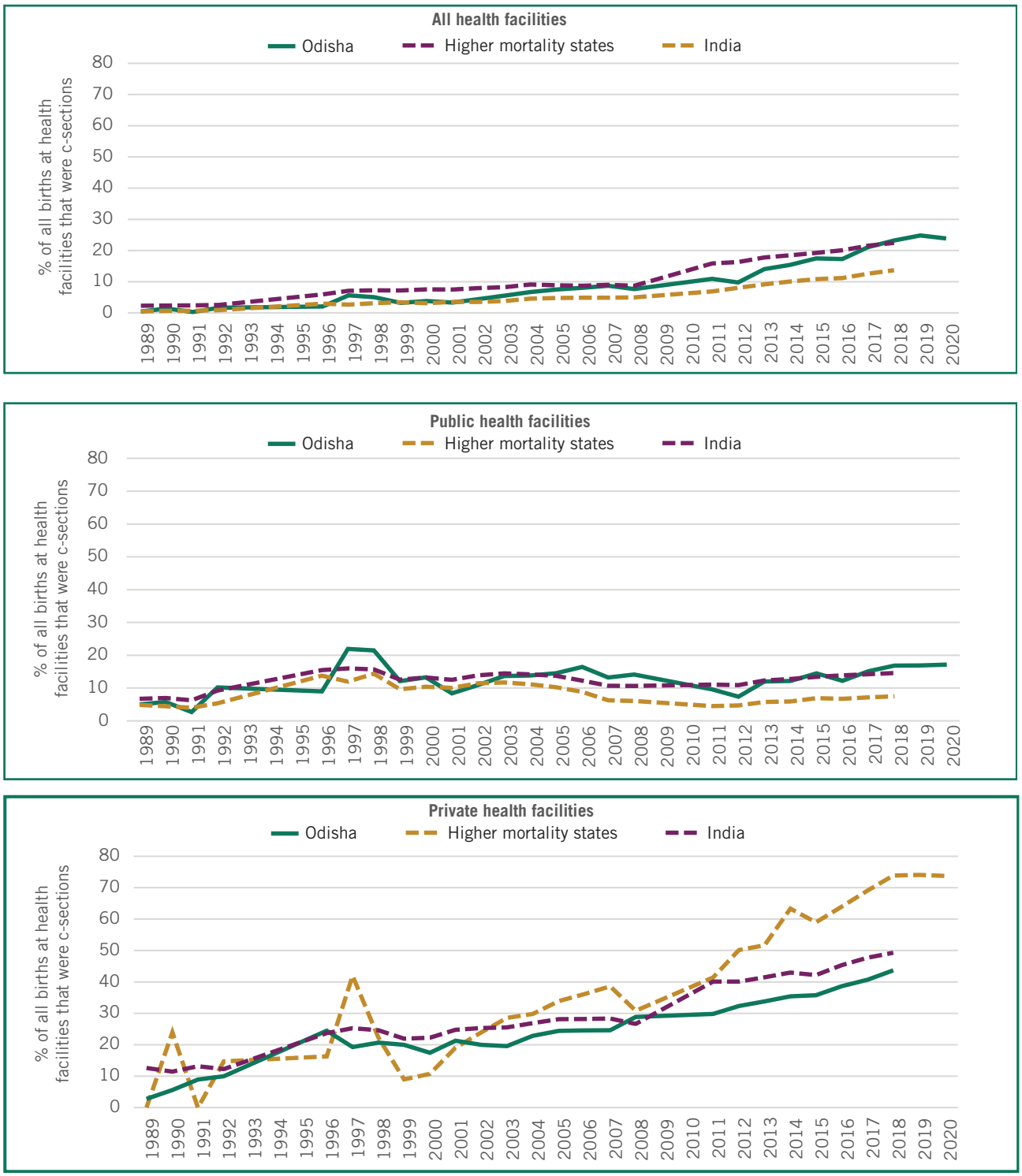
Figure 11: Trends in institutional delivery by health facility level, Odisha (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)



C-sections

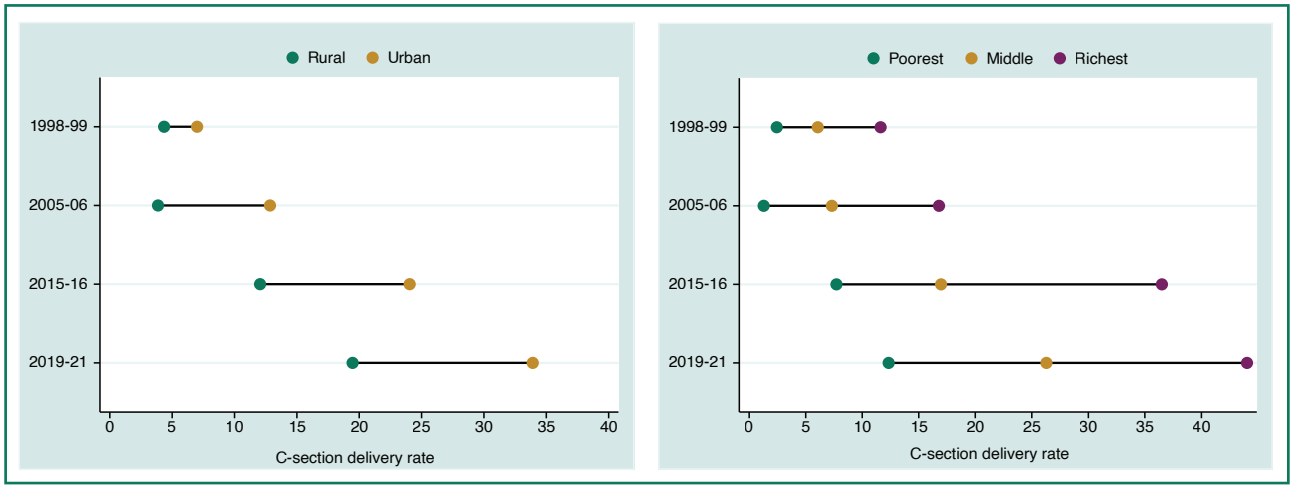
C-section rates have increased six-fold in Odisha from 4% in 2000 to 24% in 2020 (Figure 12). Post 2000, the greatest increase was in the NHM/RMNCH+A period (2012-20; AARC of 11.2%, data not shown), primarily driven by an increase in public facility c-sections. The share of private facility c-sections has also increased substantially reaching 47% during the NHM/RMNCH+A period. During this period, the institutional c-section rate was 4-5 times as high among private facility deliveries as among public sector deliveries. The state has shown considerable rise in the c-section deliveries in public health facilities during 2012-20, faster than all India and its state cluster.

Figure 12: Trends in c-section delivery rates by health facility type, Odisha, higher 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, Odisha recorded a five-fold increase in c-section rates among the rural (reaching 20%) and six-fold increase in c-section rates among the poorest (reaching 12%) suggesting that the need for this intervention is now largely being met (Figure 13). C-section rates have increased to more than 33% in the urban and 44% among the richest, going beyond recommended levels, indicating over-use.

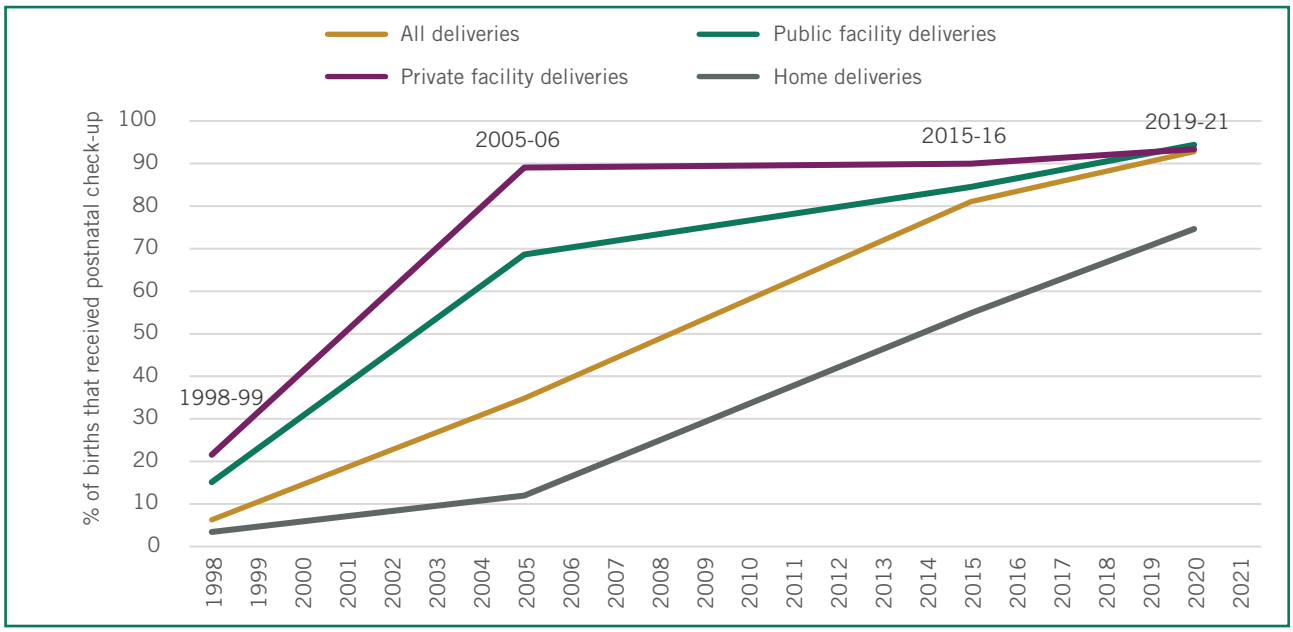
Figure 13: Trends in C-sections delivery rates by urban-rural residence and household wealth tertile, Odisha (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)



Postnatal care and essential newborn care including early initiation of breastfeeding

Figure 14 presents the percentage of mothers/newborns in Odisha who had a postnatal check-up within 48 hours after delivery, either in the health facility or at home by either a trained professional such as a nurse, ANM or a doctor or a community health worker. Coverage of any postnatal check-up (PNC) increased substantially from 6% for births during 1998-99 to 93% for births during 2019-21. The PNC coverage in the recent times has almost converged in both public and private health facilities reaching almost 94%. However, the coverage was lower at 75% for home deliveries.

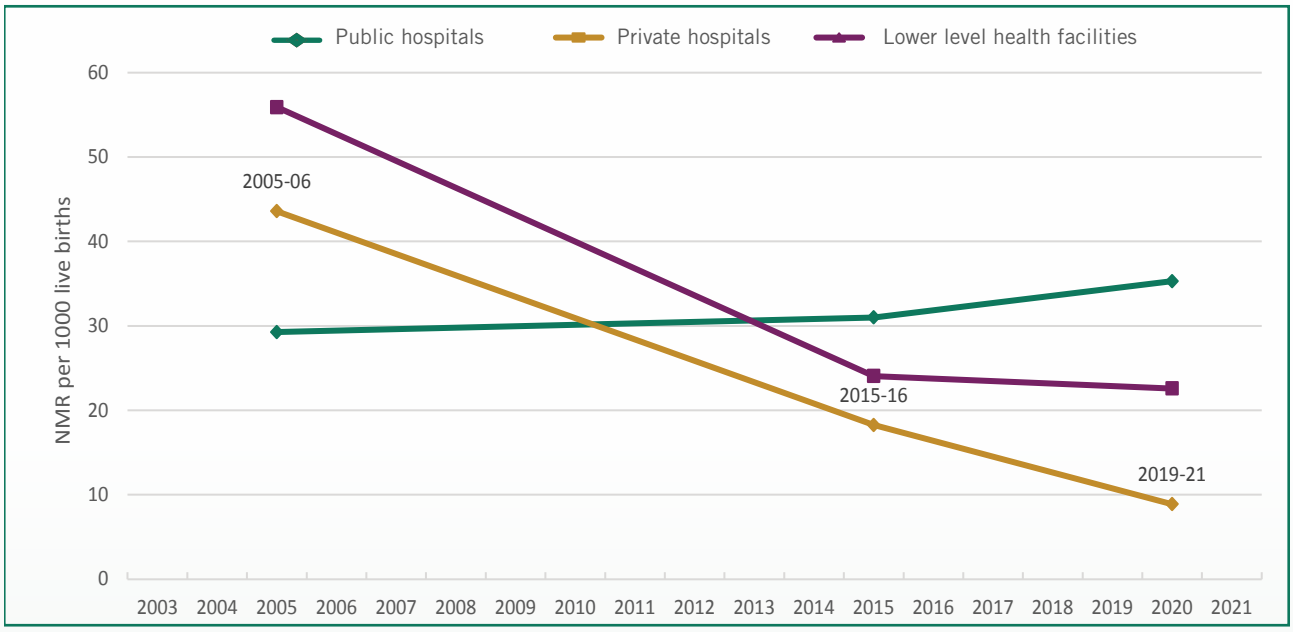
Figure 14: Postnatal care coverage for either the mother or the newborn within 0-2 days after delivery by place of delivery, Odisha (NFHS 1998-99, 2005-06, 2015-16 and 2019-21)



NMR by place of delivery

NMR in institutional deliveries declined substantially in private hospitals (from 44 per 1000 live births in 2005-06 to 9 in2019-21) and lower facilities (from 56 per 1000 live births in 2005-06 to 23 in2019-21) (Figure 15). However, the apparent increase in NMR in public hospitals is not statistically significant. The rate of decline in NMR was higher in private hospitals (AARC of -11.4%) than lower-level facilities (AARC of -6.5%). The lower facilities include CHCs, PHCs, HSCs, and private non-hospitals.

Figure 15: Trends in NMR among institutional deliveries by health facility level, Odisha (NFHS 2005-06, 2015-16 and 2019-21)



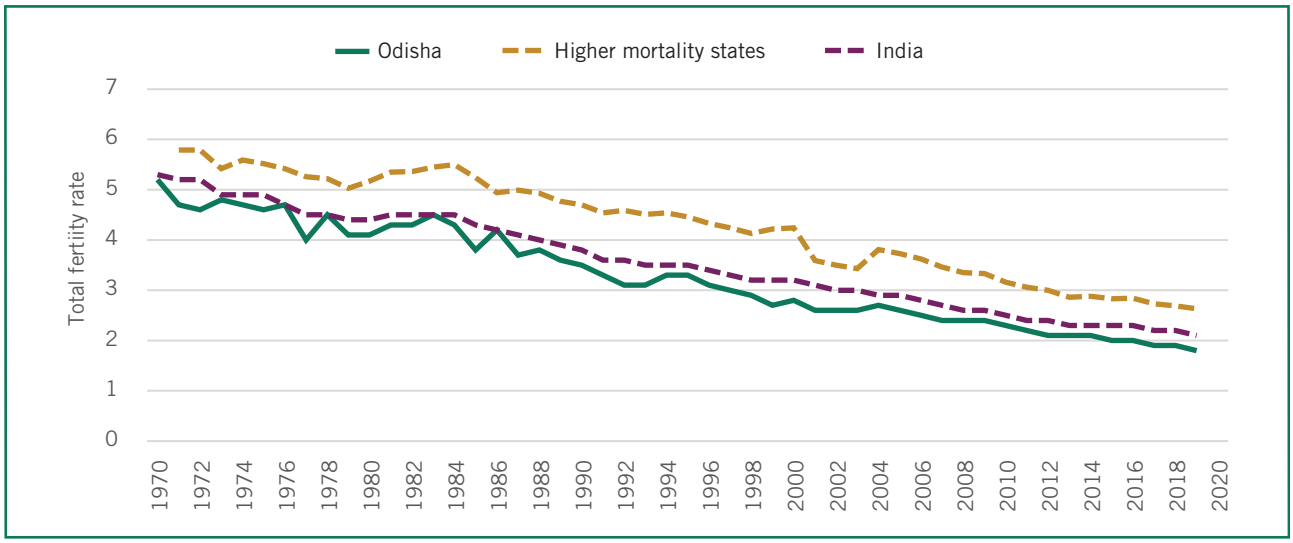
DEMOGRAPHIC AND SOCIO-ECONOMIC CONTEXTUAL SHIFTS

Household-level context

Fertility declines

Fertility in Odisha has been declining from a total fertility rate (TFR) of 3-5 children per woman during 1976-91 to less than 2 since 2017 (Figure 16). However, the decline in the number of live births was marginal from 0.9 million to 0.8 million, due to the population momentum. Since 1970, the state has consistently recorded lower TFR levels than the higher mortality state cluster average.

Figure 16: Trends in total fertility rate, Odisha, higher mortality state cluster and all India (SRS 1970-2019)



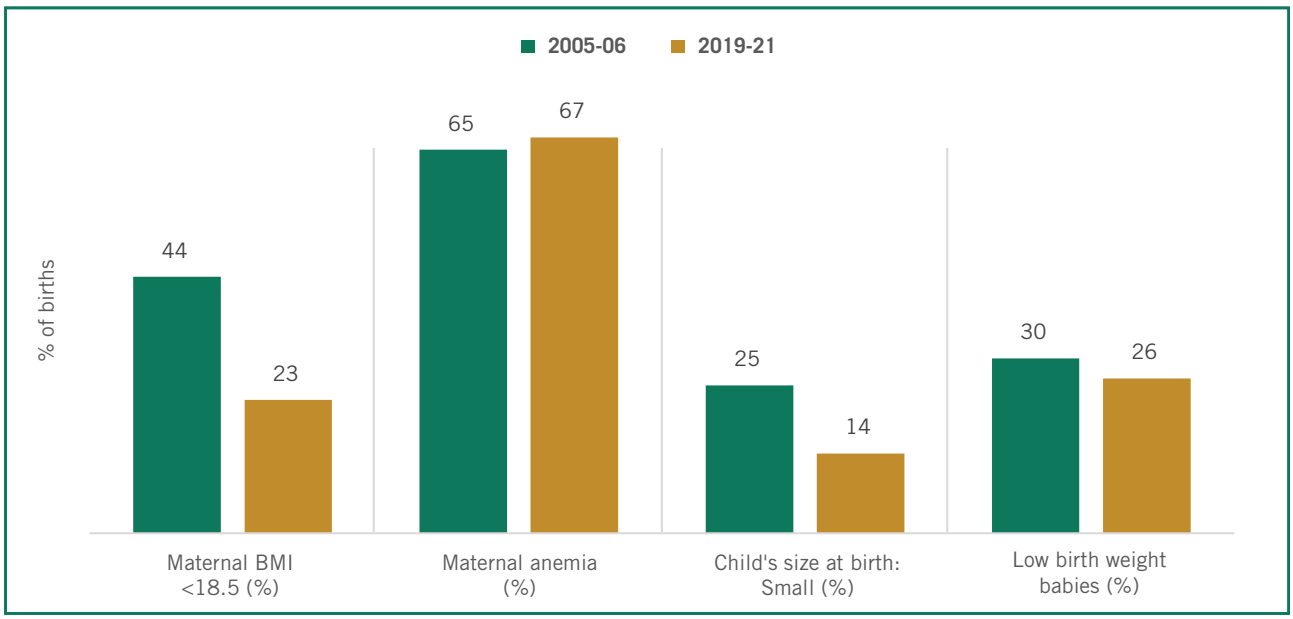
Fertility rates were overall higher in rural areas compared to urban areas. The gap between the rural and the urban areas with respect to TFR remained the same (data not shown).

Our analyses using Jain's decomposition method[14] showed that Odisha's fertility declines during 2000-18 contributed 39% and 46% of the maternal and newborn lives saved respectively, and 30% of the reductions in both MMR and NMR (data not shown).

Nutritional status

NFHS data showed that the proportion of births to women with a BMI lower than 18.5 (considered underweight) declined from 44% to 23% between 2005-06 and 2019-21 (Figure 17). The state observed a slight increase in the proportion of women with anemia during the same period. Child size at birth showed improvement; the proportion of newborns considered by their mothers to be small for gestational age declined from 25% to 14% during the same period. The proportion of low-birth-weight babies also showed a decline of four percentage point, from 30% to 26%.

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



Women's empowerment and educational status

Age at first cohabitation (after marriage) in Odisha has increased by two years, from a median of 18 years to 20 years between 2005-06 and 2019-21 (Table 3). The increase was almost similar in rural and urban areas, higher in urban areas in both the survey periods. The proportion of women with some education has also improved in this period, from 52% to 69% who were literate, and from 41% to 64% who had secondary or higher education. The gaps also closed between rural and urban areas in female literacy rates as well as the proportion with secondary education. Compared to the births to women with some education, the NMR was higher among births to women with no education in 2020, it was similar in both groups in 2005; declined faster among the women with no education (data not shown).

In terms of decision-making roles, the proportion of women reporting that their husbands solely decided on their healthcare reduced from 31% to 18%, while those reporting that they made decisions jointly with their husbands about their healthcare increased markedly from 27% to 75% between 2005-06 and 2019-21 (which was somewhat similar in rural and urban areas).

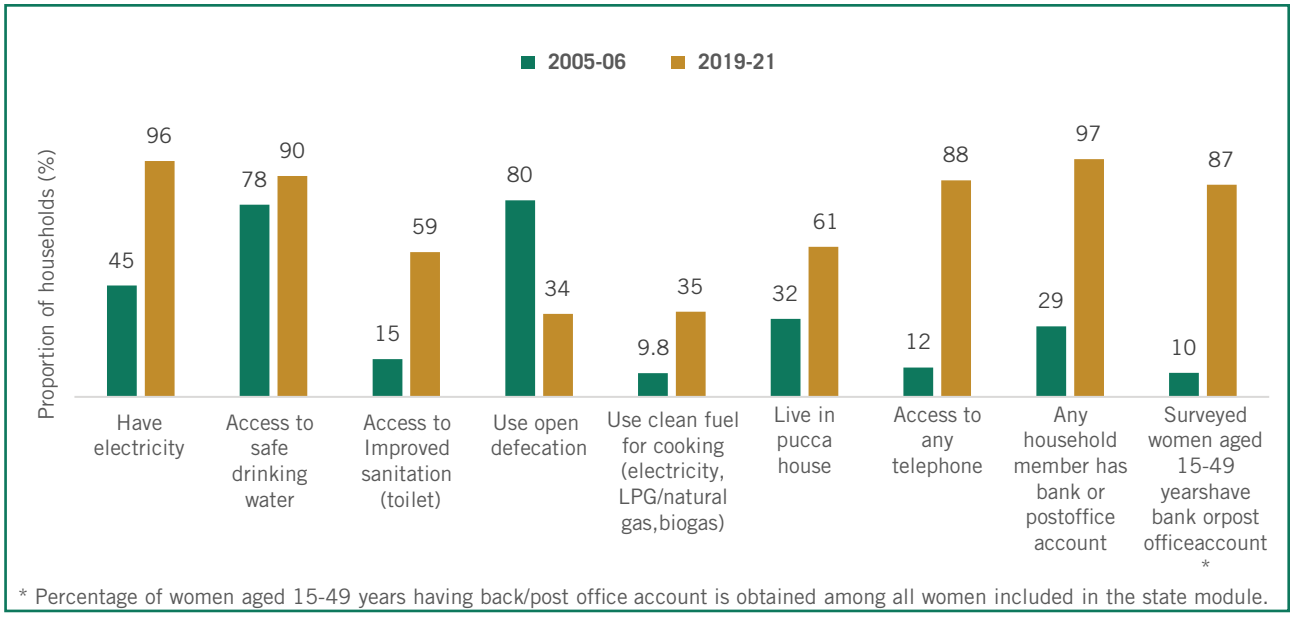
Table 3: Trends in selected indicators of women's empowerment, Odisha overall and place of residence (NFHS 2005-06 and 2019-21)

	Odisha		Rural		Urban	
	2005-06	2019-21	2005-06	2019-21	2005-06	2019-21
Median age at first cohabitation among women aged 25-49 (in years)	17.8	19.8	17.6	19.6	18.8	20.6
Women aged 15-49 who are literate (%)	52.2	69.5	47.4	66.7	74.3	81.9
Women aged 15-49 with secondary or higher education (%)	40.9	64.2	36.0	61.1	64.2	77.8
Mainly husband decides on woman's health care (%)	31.3	18.4	32.1	18.5	27.4	18.1
Husband and wife jointly decides on woman's health care (%)	26.6	75.0	25.4	74.8	32.7	75.8

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). Nearly 96% of the households now have electricity and 90% have access to safe drinking water. Percentage of households having access to improved sanitation increased four-fold from 15% in 2005-06 to 59% in 2019-21. Concurrently, households reporting open defecation reduced markedly from 80% to 34%. Use of clean fuel for cooking increased from 10% in 2005-06 to 35% in 2019-21. Three-fifths of the households now live in pucca houses and 88% have a telephone. Percentage of households reporting any member having a bank or post office account increased from 29% to 97% during the same period. The corresponding rise was even sharper for women aged 15-49 years (from 10% to 87%).

Figure 18: Trends in selected indicators of community development, Odisha (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

Odisha has experienced substantial economic growth in the past two decades. The net state domestic product in Odisha has risen rapidly from INR 10,567 in 1999-2000[15] (INR 38,425 when adjusted to 2020 rupees value[a]) to INR 65,993 in 2015 (INR 84,586 when adjusted to 2020 rupees value) and 109,730 in 2020-21.[16] 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 0.25 in 1994 to 0.28 in 2012.[17] The percentage of the population below the poverty line has reduced from 57% in 2004-05 to 33% in 2011-12.[18] Between 2000 and 2020, the state has also experienced increased urbanization, the proportion urban population increasing from 11% to 17%.

a We considered an average annual inflation rate of 6.35% from 1999-2020 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 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) healthcare 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.

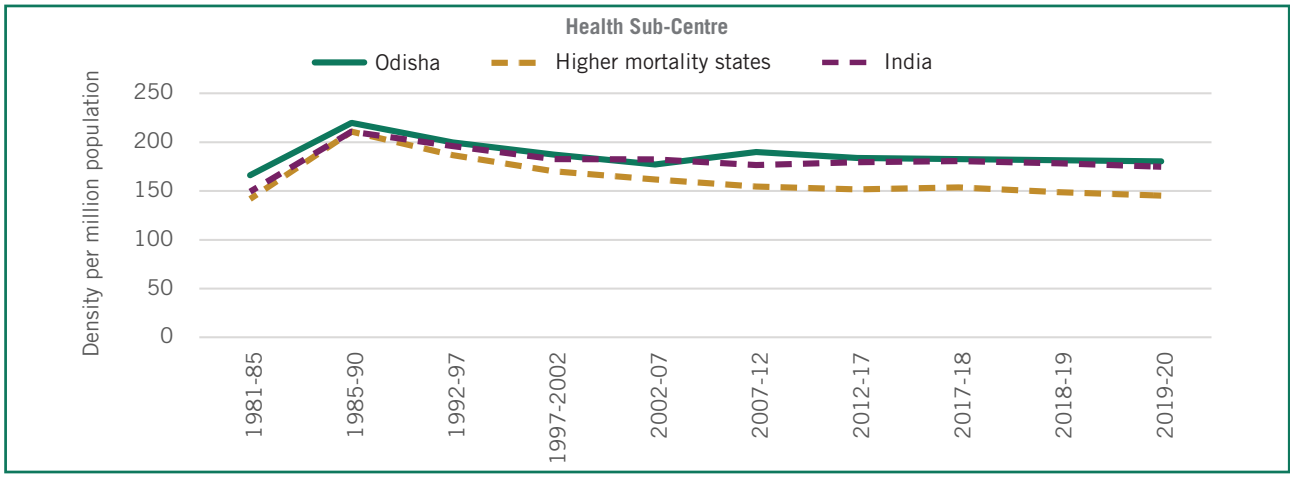
Transitions in MNH service availability and access to quality

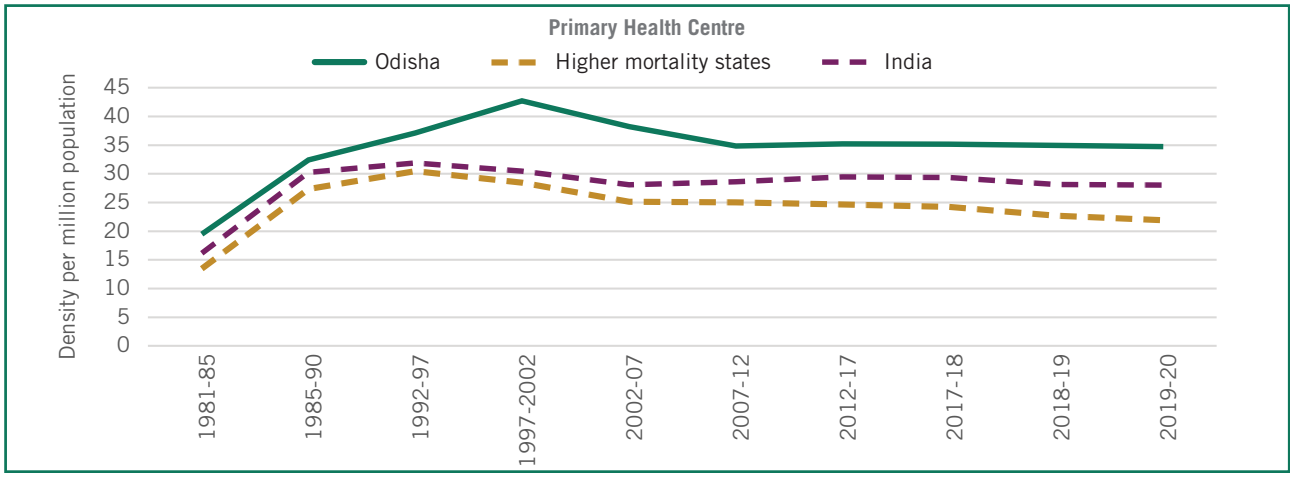
Expanding service availability, access, and integration

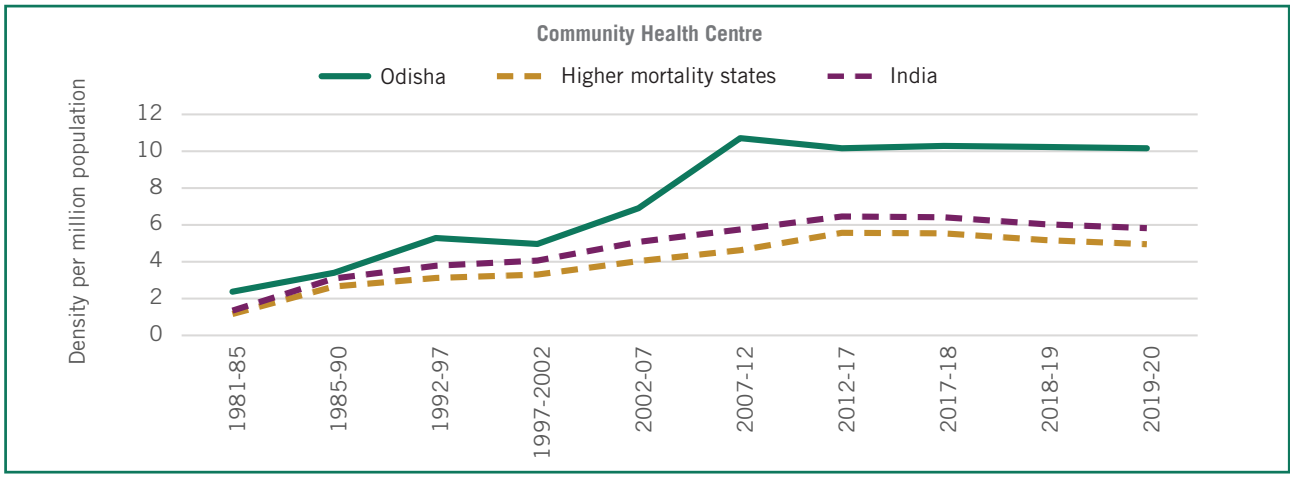
- Odisha invested in rural government health infrastructure, particularly in building health sub-centres (HSCs) in under-served areas, and upgrading CHCs into FRUs by improving the labour rooms, operating theatres, equipment, instruments and posting required health workers
- The state sought to provide every pregnant woman with at least one ANC from a doctor and at least one ultrasound
- The state introduced maternity waiting homes, travel support, and additional outreach visits for hard-to-reach areas
- Investments in NICUs, SNCUs and NCCs have been ongoing

While the density of health sub-centres has not changed from 1992 onward, the density of primary health centres increased between 1985 to 2002. After 2002, the density of community health centres in Odisha substantially increased, then held steady after 2012 (Figure 19).

Figure 19: Trends in the density of health sub-centres, primary health centres and community health centres, per million population, Odisha (Rural Health Statistics 1981-85 to 2019-20)







Odisha has prioritized the health system "basics" of infrastructure, accessibility, and capacity building (Government health expert #2). Infrastructure was noted by many experts as a driver of improved maternal and newborn health care provision.

> *One of the most important political initiatives of Odisha is infrastructure strengthening. Unless there is infrastructure, you'll not be able to deliver your services. (Government health expert #3)*

One expert summarized the state's progress as: "More funds, more resources, more manpower, more skills, more infrastructures" (government expert #7). The state focused on developed operating theatres, labour rooms, equipment, instruments, and human resources in delivery points. Increasing the number of facilities, and specifically the number of delivery points and FRUs has been central. Increasing the number of FRUs has

required ensuring the presence of gynecologists, anesthetists, pediatricians, and either a blood bank or a blood storage unit at a facility. In creating more FRUs, travel time for women in labour has been reduced.

> *So very short distance has to be covered by the beneficiaries to come to the FRUs. So, the valuable time is not lost for the service. (Government health expert #2)*

The Pradhan Mantri Surakshit Matritva Abhiyan Yojana (PMSMAY) set out the expectation that all pregnant women receive at least one ANC check-up from a doctor or obstetrician during the second or third trimester, and at least one ultrasound. The state government began paying private facilities to provide ultrasounds if public facilities were unable to do the same.

In hard-to-reach areas, the Odisha government introduced maternity waiting homes (Maa Gruha), additional Village Health and Nutrition Days (VHNDs), and improved emergency transportation. Women and their attendants were encouraged to come two weeks before the estimated date of delivery, and were provided antenatal care, food, and housing. Management of maternity waiting homes was outsourced to local people, who received operational costs depending on the number of pregnant women in the home. This incentivized operators to provide attractive living arrangements and to proactively find and recruit pregnant women to use the waiting homes. ANMs, Lady Health Visitors (LHVs), male health workers and ASHAs visited hard-to-reach villages outside regular VHND programming to conduct additional antenatal care and check-ups. At these outreach visits the team would assess weight and hemoglobin and offer immunization. Boat, motorcycle, and three-wheeler ambulances have been trialed in remote areas. In addition, in "cut off areas" (government health expert #9) families were given INR 1000 cash without requiring a bill, to compensate families for travel costs, including to pay stretcher bearers who brought women on foot. This program, called Shishu Abond Matru Mrutyuhara Purna Nirakaran Abhiyan (SAMPurNA) Yojana, was launched in 2017. Recently, the government introduced Vayu Seva, which brings specialists by ambulance to care for critical patients in remote areas.

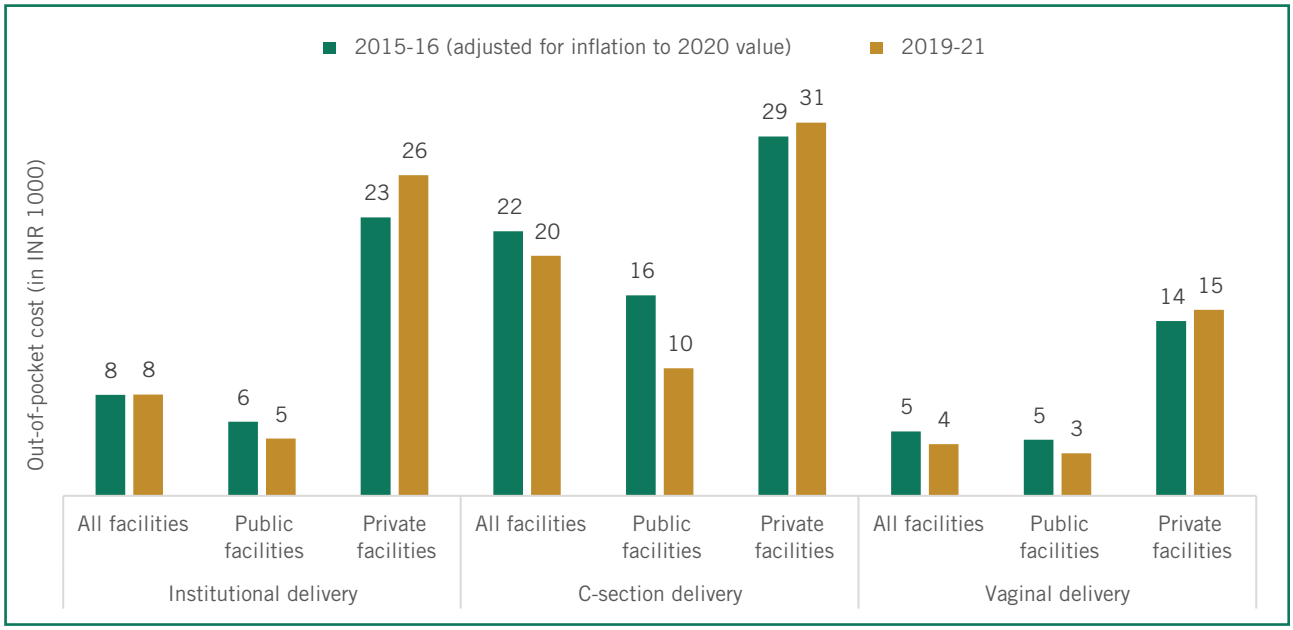
For those accessing 108 referrals, the state has sought to reduce re-referral by ensuring that critical patients immediately go to medical colleges when there is no other appropriate tertiary facility. Furthermore, the state implemented a free referral transportation service for all pregnant women.

In terms of neonatal survival, the state developed NICUs in "apex hospitals and medical colleges" (Government health expert #2), at least one special newborn care unit and newborn stabilization unit in each district and created 500 newborn care corners. The state's 45 newborn stabilization units provide warmers and phototherapy, as well as staff (nurses, AYUSH and some MBBS doctors) with newborn care training. The newborn care corners are specific locations in the facility where staff can handle essential newborn care including birth asphyxia and stabilize neonates who need to be transferred.

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 Odisha in constant 2020 rupees (i.e., 2015-16 cost adjusted for inflation to the 2020 value[b]) changed only marginally from INR 8264 to INR 8291 in 2020-21 (Figure 20). The average out-of-pocket costs paid for c-section deliveries was four times higher than that for a vaginal delivery, and the average costs for both vaginal and c-section deliveries in the state decreased by 19% and 9% during 2015-16 and 2020-21, respectively. The OOPE for public facility deliveries for both c-sectional and vaginal deliveries decreased. The OOPE were 2-4 times higher in private than public facilities, and the increase from 2015-16 was 15% in private facilities.

b 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)

Figure 20: Trends in average out-of-pocket cost (in INR 1000) paid for delivery by type of delivery and health facility type, Odisha (NFHS 2015-16 and 2019-21)



Human resources for health

- Health worker training has been a big focus in Odisha: it has implemented the 21-day national skilled birth attendant training program, LSAS and EmOC training for medical officers, national training for newborn care, training on pneumonia management, and developed skill labs
- Odisha was the first state to create a separate nursing directorate, which introduced systematic improvement to nursing education
- The state has invested in clinical and technical trainings, and has tapped into expertise from state medical colleges, from experts across India, and from international partners including UNICEF and the Liverpool School of Tropical Medicine
- Odisha was the first state to extend SBA training to AYUSH doctors, has implemented the national policy of expanding ANM responsibilities to include offering first dose of antibiotic injection gentamicin and amoxicillin, and has created ongoing education opportunities for medical officers

Odisha has focused on capacity building through in-service training and task shifting. The state has built capacity among ANMs, LHVs, senior ANMs, staff nurses, and AYUSH doctors to provide basic emergency obstetric care through implementing the central government's 21-day skilled birth attendant training program. The training equipped these health workers to handle uncomplicated deliveries, to make referral decisions, and to provide basic newborn care. More recently, the state added Navjaat Shishu Suraksha Karyakram (NSSK) training on newborn care for all health workers and Social Awareness and Action to Neutralize Pneumonia Successfully (SAANS) training to improve pneumonia management among newborns. The state has developed skill labs, which consist of stations for health workers to gain and practice clinical skills through working with mannequins, simulation exercises, demonstration videos and presentations. Odisha was the site of the Indian Council of Medical Research's study into whether AYUSH doctors could take on maternity care. This research concluded that with 30 days of pre-training, AYUSH doctors could then handle the 21-day SBA training and gain the capacity to conduct deliveries and give injections. ANMs have been given legal permission and are increasingly being trained to provide the first dose of antibiotic injection gentamicin and amoxicillin.

Odisha was the first state to create a separate nursing directorate, which systematized nursing education and strengthened the technical capacity of its nurses. More recently the state provided virtual and in-person training to FRU-based health workers on basic obstetric care and managing post-partum hemorrhage, including on the use of the pneumatic anti-shock garment.

The State Institute of Health and Family Welfare (SIHFW) has led many of Odisha's health worker capacity building trainings and has been so effective that it was then asked to provide support to other states on how to improve quality of training. UNICEF supported the National Health Mission's health worker training efforts through a hub and spoke model that matched state medical colleges to peripheral facilities.

> *They want that all the medical colleges should be linked to the peripheral facilities and expertise from the medical colleges, knowledge and skill should be transferred right to the specialists in the FRUs and at delivery points of medical officers. So, this we've tried our level best to do. (Government health expert #6)*

> *And by the way we are having the center of excellence in one of the apex institutes of Cuttack Shishu Bhavan, so […] for maternal health and child health, we are having this hub and spoke model. We are training on critical care, all facility based newborn care, everything we are giving training. (Government health expert #2)*

Odisha introduced an online concurrent mentoring program for frontline health workers through a partnership with the Liverpool School of Tropical Medicine. The state also encouraged medical officers to take the Indira Gandhi National Open University's (IGNOU) courses on Post Graduate Diploma in Maternal and Child Health (PGDMCH), which included training in community healthcare. More recently, the state has partnered with College of Physicians and Surgeons in Mumbai to enable medical officers to take diploma courses in obstetrics and gynecology, and then be placed in government health facilities to provide specialized care (government health expert #3).

Although the state has found it more difficult to retain doctors in lower-level facilities and specialists in the FRUs, they have overall increased the number of program managers and frontline health workers.

> *We had around 4000 program managers indoctrinated from the state to block. Then, we had also added more human resource for service providers. Around 10,000 more service providers like staff nurse, ANM, doctor, health team, pharmacist has been indoctrinated into the systems. So that system will strengthen, so that we will have more adequate manpower […] Because there is inadequate manpower to run the PHC or CHC […] or the particular facility of the labour room or OT or laboratory like that. Wherever there is a gap we have tried to fill up that gap to strengthen our health system. (Government health expert #7)*

The state sought to increase willingness to work in "difficult" areas by introducing financial bonuses for doctors, specialists, and paramedics -- but continued to face major shortages. To cope with these persistent shortages, the state implemented task shifting and as mentioned above, brought AYUSH doctors onboard as skilled birth attendants. To fill specialist gaps (anesthesiology and gynecology/obstetrics) at FRUs, the Odisha government has implemented the national government's 18-month training for MBBS medical officers in life-saving anesthesia skills (LSAS) and emergency obstetric skills (EmOC). These trainings have been provided by resource people at the centres of excellence in state medical colleges and SIHFW. Monitoring and follow up with people who received this training was also provided through site visits.

> *And we went down to their workplace to evaluate them also. And many have performed caesarean sections in local anesthesia in Kalimela Naxal area, where I had been myself there. And there was one Naxal bandh at that time. […] And I went to remotest corners to find out all what EmOC trainees were doing. Many of them are still performing caesarean sections and emergency obstetric services along with the LSAS services (Government health expert #6)*

Clinical/technical innovations, quality assurance, and procurement

- ANC in Odisha has increasingly focused on identifying and marking high risk pregnancies, and ensuring women have one ultrasound and one antenatal care check up from a doctor.
- Intrapartum care now includes new surgical techniques and the use of pneumatic anti-shock garments.
- Newborn care has ramped up access to tertiary care for fragile neonates, increased use of antenatal corticosteroids, encouraging universal screening, vitamin K injection, kangaroo mother care and very high rates of home-based newborn care by ASHAs

- Health workers and facilities are increasingly incentivized to improve patient care and patient satisfaction through reward- rather than punishment-based approaches
- Procurement was shifted to the Odisha State Medical Corporation Limited, set up after an exposure visit to Tamil Nadu, that brought speed and transparency to supply chain management

Several technical and clinical innovations have been scaled up in Odisha: red cards for high-risk pregnancies, pneumatic anti-shock garments, at least one ultrasound and doctor-led antenatal care visit, and the use of devascularization sutures during caesarean sections. The state introduced a system of issuing red cards during ANC for high-risk pregnancies. This card ensures that the ASHA and ANM are aware of the woman's risk category during her pregnancy and that the staff at the delivery point are aware when she arrives in labour.

After finding out that only 30% of ultrasound machines were being used, the state (with financial support from UNICEF) introduced a webinar-based ultrasound training for FRU specialists, led by a national expert in fetal medicine. On-site follow-up mentoring, supported by medical experts and ultrasound engineers, is being implemented to track progress on ultrasound and pneumatic anti-shock garments. Many pneumatic anti-shock garments to manage post-partum hemorrhage were lying unused in facilities. In response, the state Center of Excellence introduced a training program to increase use of the garments, with the support of the Federation of Obstetric and Gynecological Societies of India (FOGSI) and technical experts from Karnataka and Tamil Nadu. The presentations shared by these experts were recorded for future use and wider dissemination with new batches of BEmOC trainees and newly recruited medical officers. The state brought in national experts to provide training for CEmOC providers on devascularization sutures and reduce PPH deaths from there during caesarian sections.

Clinical interventions for neonates have ranged from increasing access to NICUs and phototherapy and warmers at SNCUs and NBSUs to encouraging kangaroo mother care (KMC) across all facilities. They have made efforts to standardize labour rooms, improve infection control measures, and train providers on newborn asphyxia management. Providers are trained on KMC using videos. The state is continuing to try to reduce neonatal infection and asphyxia is has added focus on prematurity to their strategy for improving neonatal survival. They have found that 12-15% of newborns in the state are preterm and are now promoting the use of antenatal corticosteroids for immanent preterm birth. This strategy involved incentivizing ASHAs to detect preterm labour and refer women to ANMs, then giving ANMs the capacity to administer the first dose of steroid. Additional clinical interventions that the state has rolled out include universal vitamin K injection for newborns and universal screening for hyperthyroidism, G6PD deficiency, and congenital defects at birth. These strategies have been implemented through frontline worker training.

After hospital discharge, home based newborn care has been essential for identifying and referring newborns with danger signs. Over 98% of Odisha's newborns are visited by an ASHA.

> *And I'll be explicit in saying that the home-based neonatal care is a main stay for picking out danger signs [and] referring them. And this HBNC strengthening is our, one of the major motoes, a major target to strengthen the HBNC. (Government health expert #3)*

However, the detection, referral and management of sick infants remains problematic, with gaps in HBNC as well as in medical officer, ANM and pediatrician management of these cases, particularly for pneumonia. As mentioned above, the state implemented a training program called SAANS. This program focuses on training health workers specifically on pneumonia and providers them with a pulse oximeter and nebulizer. The program aims to ensure protocol-based management of pneumonia.

Odisha has prioritized quality of care, in part through the extensive investment in health worker training discussed in the section above, Human Resources for Health. The Odisha government began providing financial bonuses for regular staff (health workers and program managers) in high-performing health facilities (i.e., those receiving LaQshya certification, those completing Kayakalp, and National Quality Assurance Standards, NQAS) and deputed contracted staff to foreign countries, such as Thailand, for exposure visits. The state has also started assessing patient satisfaction and rewarding health workers, which is a shift from the previous

punitive-oriented approach. Odisha's focus on training and capacity building has been recognized: the state's Sri Rama Chandra Bhanja Medical College and Hospital was recognized as the training center for northeastern states.

The state has a dedicated corporation that manages drug supply and inventory: "on a click of button you can have the idea regarding uh the availability of the drugs and all" (Government health expert #3). The Odisha State Medical Corporation Limited was developed after an exposure visit to Tamil Nadu.

Role and regulation of private sector

- **The private sector was not discussed in any depth during the expert consultation, except to note that the government introduced payment to private facilities for ANC ultrasound**

The Odisha government agreed to pay private facilities to provide ANC ultrasound to all women, when no public facility was available. The Odisha chapter of FOGSI was very supportive of government efforts to develop and implement quality of care guidelines and trainings. The state bureaucracy and technical experts always included FOGSI leaders in planning meetings related to maternal and newborn health.

Policy implementation and administrative reforms

Political will and leadership for MNH

- Strong political will underpinned the state's progress with the Chief Minister paying specific attention to progress on health
- Leadership of the Odisha health department and NHM was stable, without frequent short-term transfers
- Technical and administrative actors within government worked together closely
- The state government exhibited great openness to innovations and good practices coming from global experiences, the central government, or local practices
- Odisha mobilized substantial state-level financial resources for maternal and newborn health to add to funding from the NHM

Strong political will underpinned the state's progress, particularly when matched with added funding and support from the NHM. Experts reported that Odisha benefitted from political leadership that was supportive of the health systems administration. They observed that political changes and interests did not disturb the structure and tenure of the health department's administration. Other EAG states saw frequent leadership changes in the health department and short tenures for bureaucrats. But in Odisha, the mission directors, principal secretaries, other leaders, and bureaucrats were able to serve their tenures, and at times extend them. Odisha's Secretary of Health was also a medical doctor: placing a technical officer in a secretary level post indicated the state's political commitment to technically sound approaches to health system challenges.

> *And there is a great coordination between the state side and the NHM side. […] We were working as a chain and our MD was here for last 6 years and with all able secretaries. One of our secretaries was a medical personal and all other secretaries were very supportive to technical inputs so that it can be amalgamated into the administrative decision. (Government health expert #3)*

Respondents felt that the state showcased ownership of its programs and was open to innovations and good practices coming from global experiences, the central government, or local practices. For example, as mentioned above, the government partnered with the Liverpool School of Tropical Medicine to provide online concurrent health worker mentoring. Odisha conducted a gap analysis by comparing central government guidelines to the actual services offered in the state. As a result of this analysis, the state identified that high risk pregnancies in hard-to-reach areas require additional supports and introduced maternity waiting homes. The state noticed that anti-shock non-pneumatic garments and ultrasound machines were procured but

sitting unused in many facilities; to increase appropriate use, they introduced innovative trainings including video trainings and bringing in experts from other states.

Experts reported that the Chief Minister and Chief Secretary of the state took great interest in health planning and personally attended key health-related meetings and provided recommendations for action. Leaders in the state health system, such as the Mission Directors and Director Generals of Health in Odisha, have taken a personal interest in monitoring the quality of health worker training. They have shown ongoing interest in planning and monitoring progress, particularly in remote areas.

The state mobilized substantial state-level financial resources for maternal and newborn health. 'This state-level mobilization of funds was possible only because the Chief Minister and Chief Secretary were personally engaged with health planning. Without their involvement, "it is very difficult to get finance from the finance department "(Government health expert #3). Yet because Odisha had strong state leadership interest in health, the finance department approved significant funding.

> *Unless the chief secretary at the CM office is not agreed to that proposal, finance department will not give any penny to any department. Because of our strong political and administrative commitment, we are able to have more than 15, 16 state specific programs out of state budget to supplement the entire health system activities. […] Continuously they are supporting the health department to go forward, to do any activities which can improve, which can ensure quality health care in the people. (Government health expert #7)*

Experts noted several examples of state-funded health initiatives. SAMPurNA Yojana, mentioned above, was funded by the state, and augmented to include a delivery kit along with the INR 1000 for women reaching health facilities in areas that are not serviced by the ambulance service. Eighty percent of the operating costs of the 108 and 102 ambulance services were borne by the state. Odisha's Biju Swasthya Kalyan Yojana (BSY) initiative, which brought health insurance coverage for marginalized families, was state-funded.

The structure of the state's governance facilitated systematic planning and ensured administrative and technical processes worked together, rather than interfered with one another. When issues arose, such as new research showcasing high incidence of anemia, the state formed steering committees. Steering committees included secretaries of all relevant departments (such as the SC/ST Department, Women and Child Development, Panchayat Raj Institutions, and Education), and were chaired by the Chief Secretary. The Committee Chair reviewed progress on a bi-weekly basis. Below the steering committees were the state task forces, chaired by the Additional Chief Secretary, and the technical committee. Twice a week the chair reviewed progress with the districts. Each district had a task force, chaired by the District Collector, who undertook almost-daily reviews. Furthermore, each block had a task force, chaired by the Block Development Officer and involving the Block Medical Officers, who conducted micro-planning.

> *So, by this way it is going on and the administrative person they don't enter into these technical things. They give us full liberty to do the technical things in the most fruitful way and they approve it. So, by this way the system is going on in our state. (Government health expert #2)*

Decentralized governance and financial flexibility

- Odisha introduced need-based planning, which enabled the unique needs of its districts to be analysed and planned for
- Because of needs-based planning, the state developed several special inputs for marginalized areas, including salary top ups for health workers, maternity waiting homes, and investments in the ASHA program and sub-health centres
- The Project Implementation Planning (PIP) process encouraged tailored planning and brought financial flexibility
- District collectors were given responsibility and financing to take on additional strategies to improve local-level health outcomes

Need-based planning, which was a core aspect of the NRHM/NHM, was identified by experts as a major driver of success for Odisha. The Odisha government conducted provisional analysis to classify its districts. It then planned health interventions based on the district's needs and provided additional support for the poor performing districts, including additional compensation for health workers in these districts. In the most inaccessible areas, where Naxalite activity was a major concern, non-governmental organizations and women's self-help groups were invited to manage PHCs. This need-based planning enabled the state to develop locally appropriate interventions (such as maternity waiting homes and building additional health sub-centres) and mobilize additional funding and support for the highest-need districts. As a result, high-needs districts have an ASHA per hamlet (resulting in a higher density of ASHAs) rather than an ASHA per 1000 people and have proper sub-health centre buildings rather than sub-centres renting or sharing space.

The state undertook volume-based mapping of health facilities, to target salary top-ups for doctors and specialists working in key locations. Furthermore, the decision of whether to develop one or more SNCUs and NBSUs in the districts was guided by need-based planning. As part of this approach to planning and monitoring, the state brought in significant expert consultation and research support. For example, the state conducted district-specific studies on causes of child death to understand specific cultural and behavioral practices that could be addressed through community-level behavior change communication in collaboration with folk media, ASHAs, and traditional healers.

Flexible financing and planning under the NHM PIP process was also discussed as an enabler of success. The state developed plans based on their analysis of district level requirements and received NHM funding based on these proposed expenditures. The state could also re-allocate their budget during the year if priorities shifted.

> *The flexible fund system is there. For the state budget it is as per our requirement. The budgeting was prepared as per our requirement. So even for SAMPurNA we have a state plan for that. In that plan also we have revised four times. We have added many activities, we have to add many activities. So, it is always flexible. […] Because of that flexibility it is possible to do the need-based planning. Even the district also they have taken up many kinds of activities from their district fund (government health expert #7)*

Odisha implemented the NRHM's Village Health Committee program, which provides village committees with INR 10,000 in untied funds. In Odisha, this money was often used to ensure pregnant women reach health facilities when they need delivery care. District Collectors were given significant financial resources for discretionary use to try to address health worker shortages. A corpus fund of one crore (~USD $125,000) was provided to each Collector, and the Collector could even use that funding to bring in specialists for shorter periods from other states.

Accountability, progress review and data systems

- The state implemented a robust management and monitoring process to implement high-impact programs
- Administrative and technical government experts were responsive to national and state level survey data, and provided critical and frank reflection on the state's successes and failures
- Ashish portal, which replaced the Maternal and Child Tracking System, enabled digital tracking of all pregnant women
- The state instituted maternal and child death audits to identify system failures and gaps

Experts reported that ongoing monitoring from the top government leaders in the state all the way down to the health facility level drove success. Need-based planning shaped Odisha's approach to selecting and implementing high impact MNH interventions. For example, the state introduced free referral transportation for pregnant women. The Odisha government developed the idea and secured funding for it through the NHM.

Administrative and technical government experts were responsive to national and state level survey data and provided critical and frank reflection on the state's successes and failures: "whenever these reports are published, we used to give the feedback to the field office, where we have failed, where we have success"

(government health expert #7). Field level action plans were prepared to address failures and account for constructive recommendations from leaders.

The state developed a strong data system that enabled each pregnant woman to be tracked through the Ashish portal, which replaced the Maternal and Child Tracking System (MCTS). Under Ashish, the state could track whether every woman received services, whether her pregnancy or newborn were high risk, and their health outcomes. The state also introduced the 104 call centres which makes random outgoing calls to check in with people about the health services they received.

Odisha conducts maternal and child death audits. These audits have struggled to capture all deaths and, among those captured, to pinpoint the cause of many deaths. In response, the state has emphasized to health workers the importance of determining cause of death and introduced protocols and additional training on death audits. Furthermore, these audits have taken a non-punitive approach that focuses more on correcting the system to prevent future deaths. The maternal and child death reviews involve a verbal autopsy at the peripheral level and then a district-level Maternal and Child Death Review Committee examination of all records and reports. The committee brings together the medical officers of the facilities involves, as well as District Manager of Family Welfare, Chief District Medical Officer, and clinical specialists (medicines, surgery, pediatric, gynecologists, pathologists, and anesthetists). Critical cases are also reviewed by the District Magistrate, who involves the ASHA, ANM, health care providers and attendants of the deceased; in these cases, health system actors may be penalized for failures that led to death.

The state has introduced a system of rewards for providers and facilities with high patient satisfaction scores, which is a departure from the previous approach which focused on punishment. Patient satisfaction is measured in terms of receiving appropriate services, respectful behavior from health workers, and zero out of pocket payment. Respondents reported that the Chief Minister's office took an interest in this initiative and required the patient satisfaction scores to be reported to them.

Community participation and demand generation

- The communitization features of the NRHM/NHM, particularly the ASHA program and village health and nutrition days, have been essential to Odisha's progress
- The state works with local folk media and self-help groups to support behaviour change communication
- The state has successfully implemented JSY and JSSK, which have increased community demand for health services

Odisha invested in several community-level supports to increase access to primary health care in the villages: Village Health, Sanitation and Nutrition Committees Self Help Groups, ASHAs and Village Health and Nutrition Days.

> *Hundred percent implementation of Janani Suraksha Yojana and also the Janani Shishu Suraksha Karyakaram: all the free service, diet, drugs, diagnostics, blood, etc. Everything has been supplied freely and also, we are giving a transport cost of INR 500 for going back to their uh home. (Government health expert #2)*

Odisha's ASHAs are "very vibrant" and were seen as the main reason for the state's progress in institutional delivery, high risk pregnancy identification, immunization coverage, and reduced IMR (government health expert #7). The state moved from a 1 ASHA per 1000 population norm to 1 per 500. ASHAs were essential in bringing women to VHNDs for antenatal care.

'Information and education on health has been widely disseminated at the village level, in the local language, and often with support from local folk media. The districts and blocks in Odisha have vibrant and unique cultural associations that have been engaged for behavior change communication on health. Self Help Groups in Odisha have become an important support and coordinating body for health action at the village level. However, overall community awareness and uptake of health promoting behaviors remained an ongoing challenge.

While home based newborn care, provided by ASHAs, was discussed as an important driver of neonatal survival, experts noted that detection and management of neonatal pneumonia remains poor in rural areas. The state has successfully implemented JSY and JSSK, which have increased community demand for health services.

Partnerships

- Odisha state benefitted from supportive partnerships with the central government
- Within the state government, the Department of Health and NHM worked together seamlessly, and the state health system received support from the Scheduled Caste/ Scheduled Tribe Department and Tribal Welfare
- Development partners (particularly UNICEF, UNFPA and Jhpiego), and academic institutions within the state and internationally were identified as supportive technical partners in Odisha
- Private sector actors including FOGSI, the Paediatric Association, the National Neonatology Forum, the Indian Medical Association, and the Indian Academy of Paediatrics provided technical input as well
- The media highlighted gaps in government health service, thereby increasing pressure on the government to improve

The state government of Odisha benefitted from support and a close relationship with technical experts in the central government:

> *And he [technical expert in the central government] was always asking, 'what is your state doing particularly?' He had made contact with me and our state program manager particularly by telephone. He takes our views and gives advise... (government health expert #9)*

The state NHM Mission Director and "state machinery" worked together seamlessly towards common goals: "that there is no difference between NHM and the state machinery; it is one team" (government health expert #8). The state's SC/ST Department and Tribal Welfare Departments worked closely with the Health Department.

Development partners, particularly UNICEF, UNFPA, and Jhpiego, were identified: UNICEF supported health worker trainings, UNFPA provided system supports, and Jhpiego supported the development of delivery points. One non-Indian academic institution, the Liverpool School of Tropical Medicine, was highlighted as an important source of support for the state's health worker mentoring program.

Odisha's medical associations were important government partners. The state chapter of FOGSI played an important role in conducting the EmOC training and supporting LaQshya certification of medical colleges. The Pediatric Association also supported progress on neonatal health, including on NSSK. Top pediatricians convened a National Neonatology Forum online every Saturday, involving representatives from Odisha, Karnataka, and Andhra Pradesh to discuss progress on neonatal survival in the state. The Indian Medical Association and Indian Academy of Pediatrics in Odisha have supported training, certification, and short-term health care provision initiatives. The government also deputed service providers and program managers to foreign countries, such as Thailand, for health system exposure visits.

The media increased the attention given to the quality of health care services in government facilities. Experts felt that their investigations and reporting generated pressure on the government to improve.

IMPLICATIONS FOR STRATEGIC PLANNING

As part of the Exemplars study, a five-stage integrated framework for maternal and neonatal mortality transition was developed. This 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.[19] We used the transition framework as a tool to understand change in these interrelated factors, benchmark current situations, and inform strategy development in Odisha and nationally.

A comparison of Odisha's indicators at stage III (2017) against the median values for India's low mortality states in 2017 (Table 4) highlights the following key policy considerations:

- Moving towards India's lower mortality state (LMS) average requires halving MMR, from 136 to 73 deaths per 100,000 live births, and NMR, from 31 to 16 deaths per 1000 live births.
- The total fertility rate in Odisha was slightly higher than the LMS average (1.9 versus 1.7), suggesting that small gains in survival could be achieved through continued reductions in fertility including family planning.
- In terms of intervention coverage, Odisha had already achieved LMS levels of ANC 4+ (78% versus 75% LMS average) and is near the LMS average for health facility coverage for deliveries (91% versus the LMS average of 96%) but can now focus on shifting deliveries to hospital-level facilities from only 39% in 2017, to pursue the LMS average of 71%.
- Access to C-sections in Odisha is already 21%; although this is lower than the LMS average of 34%, survival gains related to C-section access will be found by increasing access among the poor (currently 9%) rather than increasing overall use of C-sections.
- Inequality in neonatal mortality requires major attention in Odisha, with an absolute poor-rich gap of 16 per 1000 live births, which is lower than the LMS average of 18 per 1000 live births but higher than the median values for countries in Stage IV (7).

Table 4: Summary of key indicators in 2000 and 2017 for Odisha, and common characteristics of lower mortality states and countries in stage IV in 2017

Indicator	Odisha		Lower mortality state cluster stage IV values, 2017	Median values for countries in stage IV, 2017
Year	2000	2017		
Stage	I	III		
Mortality				
Maternal mortality per 100,000 LB (SRS 2000-18)	424	136	73	43
Neonatal mortality per 1,000 LB (SRS 2000-18)	61	31	16	9
Neonatal mortality, home births (NFHS 2005-06 and 2019-21)	45	53	33	NA
Stillbirth rate per 1,000 births (SRS)	15	12	5	9
Cause pattern (neonatal) (MCEE 2000 & 2015)				
Infections (Group 1)	32	22	21	14
Health status[1] (Group 2)	34	53	57	70
Peri-partum (Group 3)	34	25	22	17
Fertility (SRS)				
Total fertility rate	2.8	1.9	1.7	2.2
Adolescent fertility (per 1000)	39	10	15	44
Coverage of interventions (NFHS+DLHS)				
ANC four or more visits (%)	24	78	75	89
Delivery in health facility (%)	29	91	96	95
Delivery in hospital (%)	18	39	71	78
C-sections (%)	4	21	34	26
Inequalities				
Neonatal mortality poor-rich gap (abs) (NFHS 2005-06 and 2019-21)	1	16	18	7
Delivery care, rural (%) (NFHS+DLHS)	23	90	95	91
Delivery care, poor-rich gap (abs) (NFHS 2005-06 and 2019-21)	-71	-15	-12	-12
C-section, poorest quintile (%) (NFHS 2005-06 and 2019-21)	1	9	15	17

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

NA: Not available.

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