Disparities in Health Infrastructure and Service Access Among Tribal and Rural Communities in India

1. Project Overview

This project aims to analyse disparities in healthcare access, ICDS (Integrated child development service) service utilization, and infant outcomes among tribal and rural populations in India using publicly available datasets from the **National Data & Analytics Platform (NDAP)** by **NITI Aayog**.

The project covers:

- **Health Infrastructure Indicators** (SourceYear:2013)
- **ICDS Service Utilization** (During pregnancy and breastfeeding) (SourceYear:2005)
- **Infant and Perinatal Mortality Outcomes** (SourceYear:2005)

The analysis emphasizes data-driven insights that could help NGOs, policy researchers, and public health planners identify underserved communities and guide interventions.

2. Introduction

Health outcomes in India vary significantly across social groups. Tribal and Rural communities often face limited access to infrastructure and services. This study investigates:

- Whether health infrastructure is distributed equitably
- How well ICDS services are reaching mothers and children
- What trends are seen in infant mortality and perinatal outcomes

The project highlights both strengths and systemic gaps using quantitative methods and visualization.

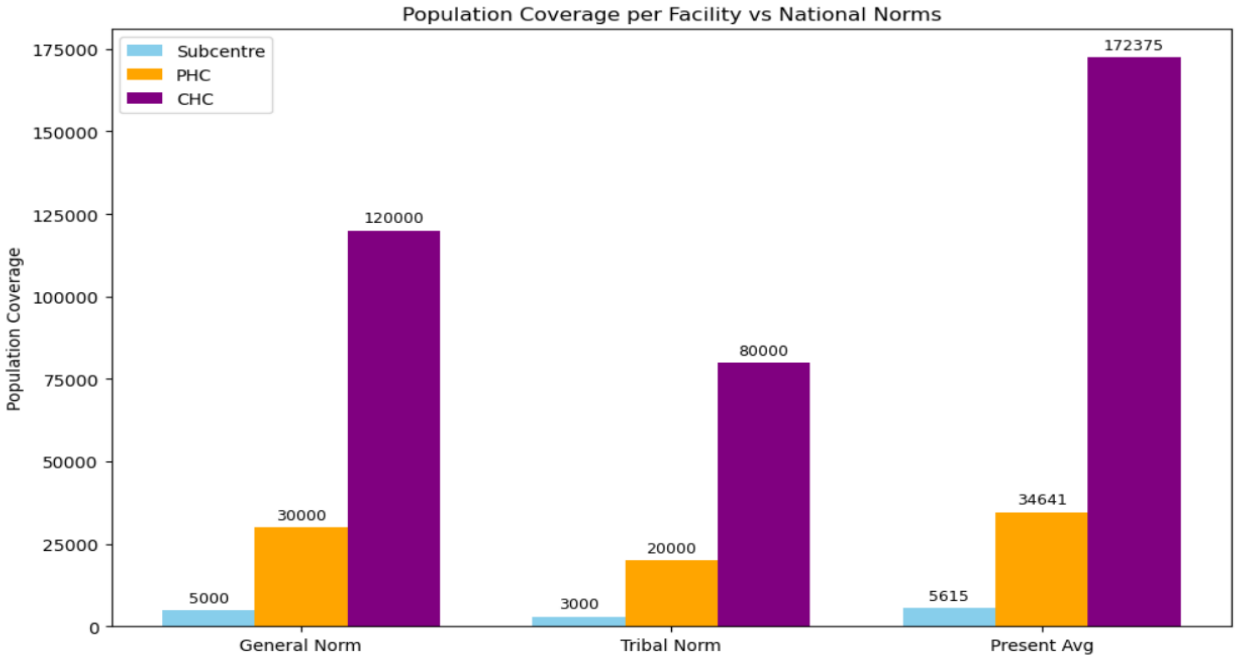
3. Methodology

The analysis was conducted using Python. Datasets from the NDAP platform were imported and cleaned by removing irrelevant columns, renaming long headers, and standardizing labels. Key indicators such as population coverage, health worker ratios, service utilization, and perinatal mortality were extracted and grouped by social categories.

Data was explored using pandas for transformation and summarized through charts using matplotlib, seaborn. Visual comparisons were made across Scheduled Tribes, Castes, OBCs, and other groups to identify disparities in access to health infrastructure, ICDS services, and infant health outcomes.

4. Data Visualizations and Insights

4.1: POPULATION COVERAGE PER HEALTH FACILITY VS NATIONAL NORMS



This chart compares the average population coverage of Subcentres, Primary Health Centres (PHCs), and Community Health Centres (CHCs) against the recommended national norms for both general and tribal areas.

- **Subcentres and PHCs** show moderate overburdening:
    - Average population per Subcentre: 5615 (vs. norm of 5000 for general and 3000 for tribal regions).
    - PHCs cover 34641 people on average (vs. 30,000 norm).
- **CHCs are significantly overstretched**:
    - Average coverage is 172,375, far exceeding the recommended norms of 120,000 (general) and 80,000 (tribal).
    - This indicates critical gaps in secondary care capacity, potentially resulting in delays, overcrowding, and reduced service quality.

Recommendations

- **Urgent review of CHCs**: Assess resource adequacy, staffing, and infrastructure at existing CHCs. Expansion may be necessary in overburdened zones.
- **Evaluate PHCs and Subcentres**: Although only moderately overburdened, regular audits should determine if current capacities are sufficient to maintain quality care.
- **Contextual infrastructure planning**: Future expansion should consider tribal-specific needs, population growth, and geographic barriers to ensure equitable healthcare access.

4.2: SUBCENTRES AND PHCS PER PHC AND CHC

indicator	subcentres_per_phc	phcs_per_chc
National Norms	6.0	4.0
National Norms_General	NaN	NaN
National Norms_Tribal/Hilly/Desert	NaN	NaN
Present Average Coverage	6.0	5.0

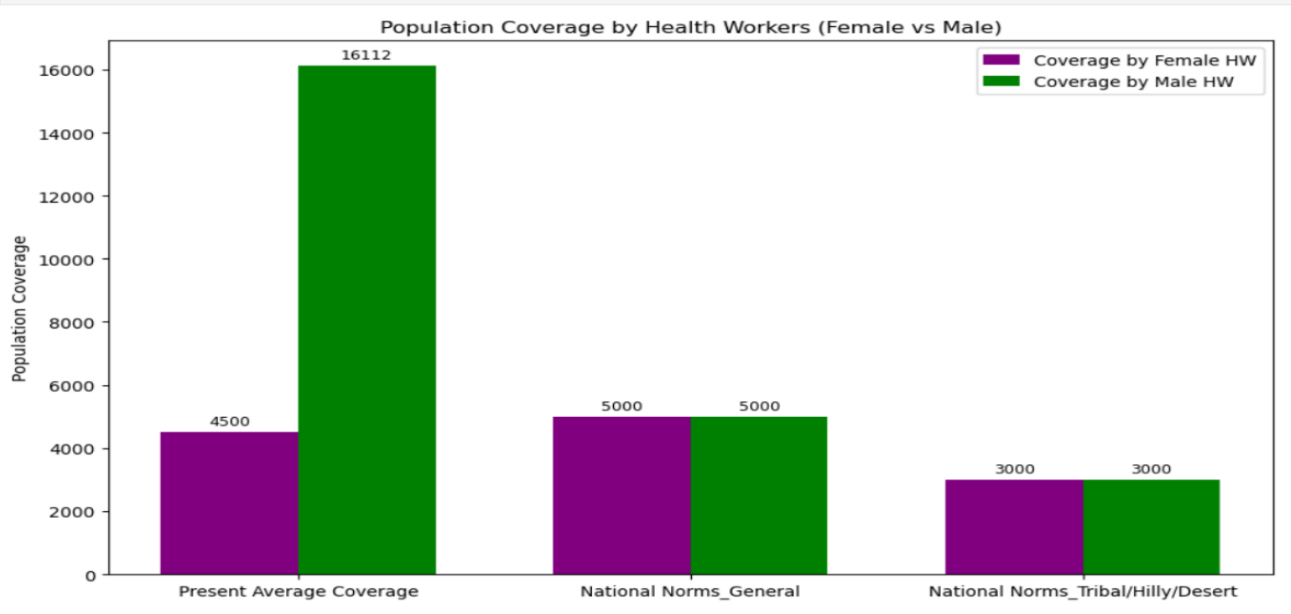
The chart compares the average number of subcentres per PHC and PHCs per CHC with national benchmarks.

- The current average of 6 subcentres per PHC matches national norms.
- PHCs per CHC slightly exceed the standard, averaging 5 vs. 4, suggesting a broader PHC network.

Recommendations

- **No restructuring needed** at subcentre and PHC levels — current ratios meet or exceed guidelines.
- **Focus on CHC strengthening**: Overburdened CHCs point to capacity and staffing issues, not upstream imbalance.
- **Priority**: Invest in expanding and upgrading CHCs to meet growing population demands

4.3: POPULATION COVERAGE BY FEMALE VS MALE HEALTH WORKERS



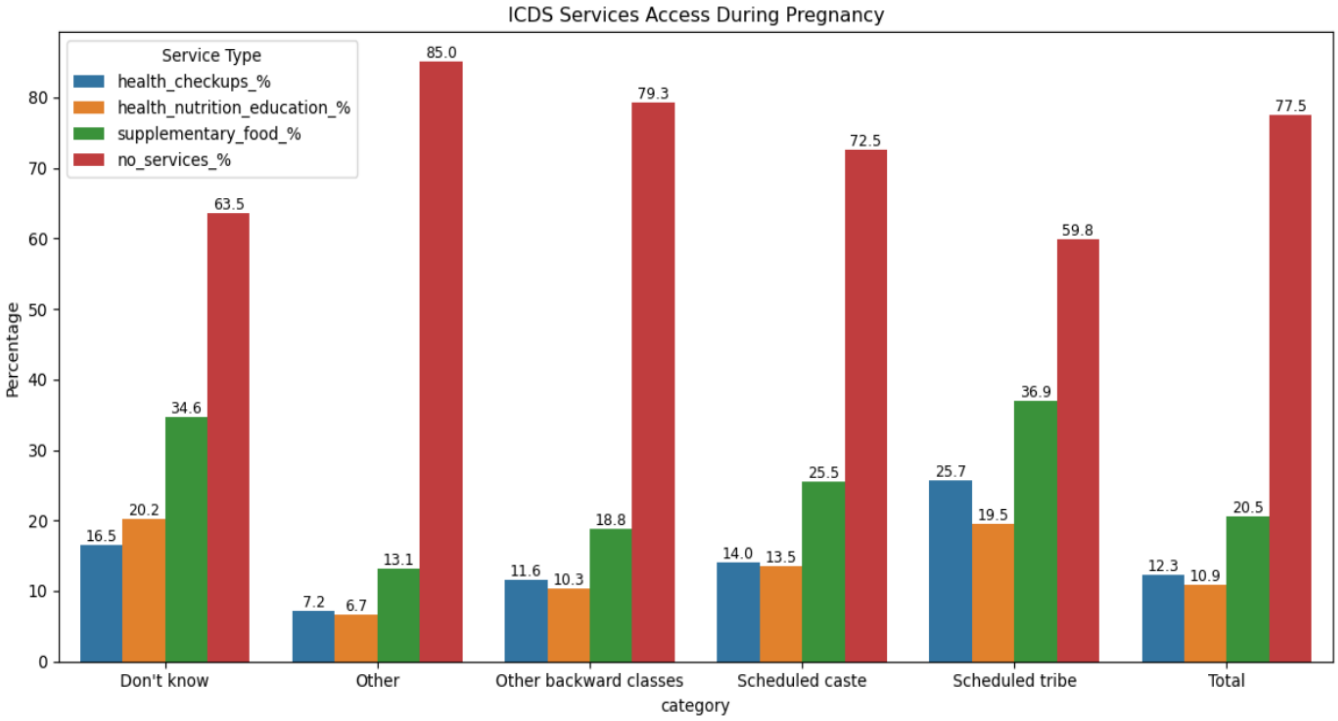
This chart compares average population coverage by female and male health workers against national norms.

- Female health workers cover ~4500 people, aligning with general (5000) and tribal (3000) norms indicating balanced deployment.
- Male health workers, however, are significantly overburdened, covering 16,112 individuals on average, exceeding norms by over 3 times.

Recommendations

- Increase male health workforce in underserved areas to reduce the coverage gap and improve service equity.
- Maintain adequate female staffing through regular reviews, especially in high-growth regions.
- Implement balanced workforce planning to support gender-sensitive care and improve overall service reach.

4.4: ICDS ACCESS DURING PREGNANCY (BY SOCIAL GROUP)



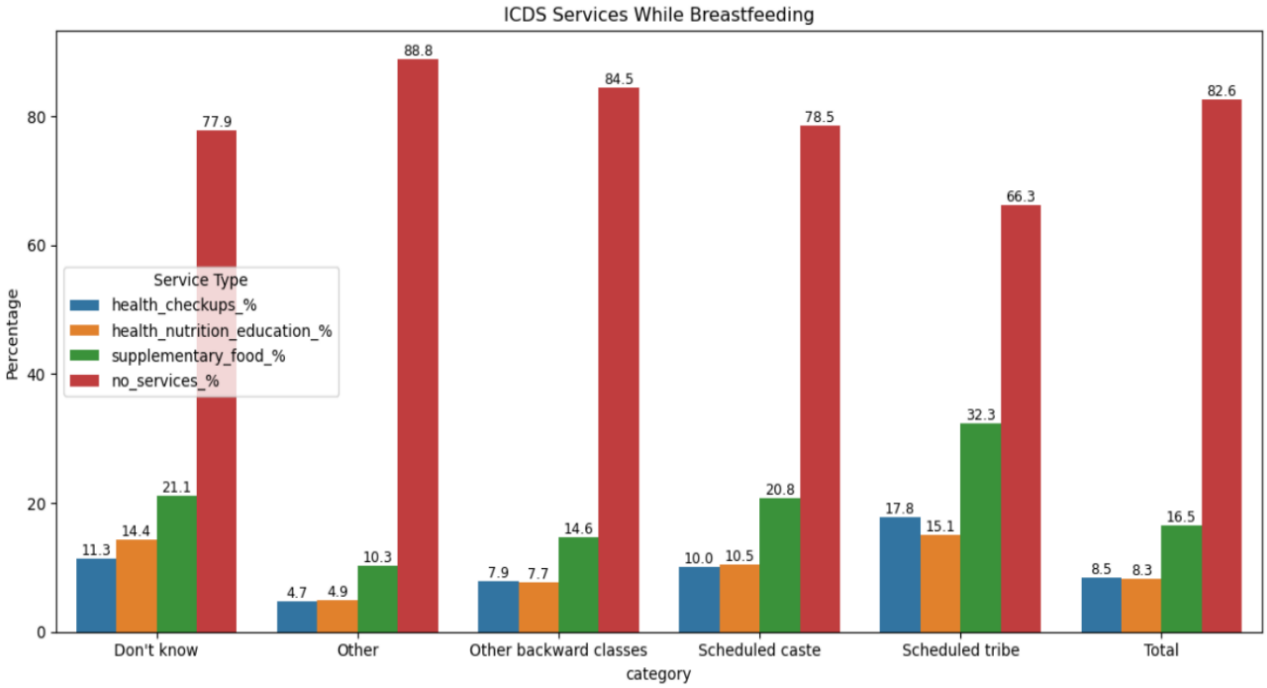
The analysis reveals significant disparities in ICDS service access among social groups during pregnancy.

- High exclusion rates are seen in most groups — 'Other' (85%), OBC (79%), and Scheduled Castes (72%) receive no services.
- Scheduled Tribes show the highest access: 25.7% received health checkups, 19.5% received nutrition education, and 36.9% received supplementary food, with the lowest exclusion (59.8%).
- Nutrition education is the most under-delivered service, with no group exceeding 20% coverage.

Recommendations

- Strengthen outreach efforts for OBC, SC, and ‘Other’ communities.
- Improve delivery of nutrition education, especially in underserved regions.
- Conduct local service audits to identify infrastructural or awareness-related gaps affecting access.

4.5: ICDS SERVICES FOR BREASTFEEDING MOTHERS (BY SOCIAL GROUP)



The analysis highlights **severe underutilization** of ICDS services among breastfeeding mothers across social groups.

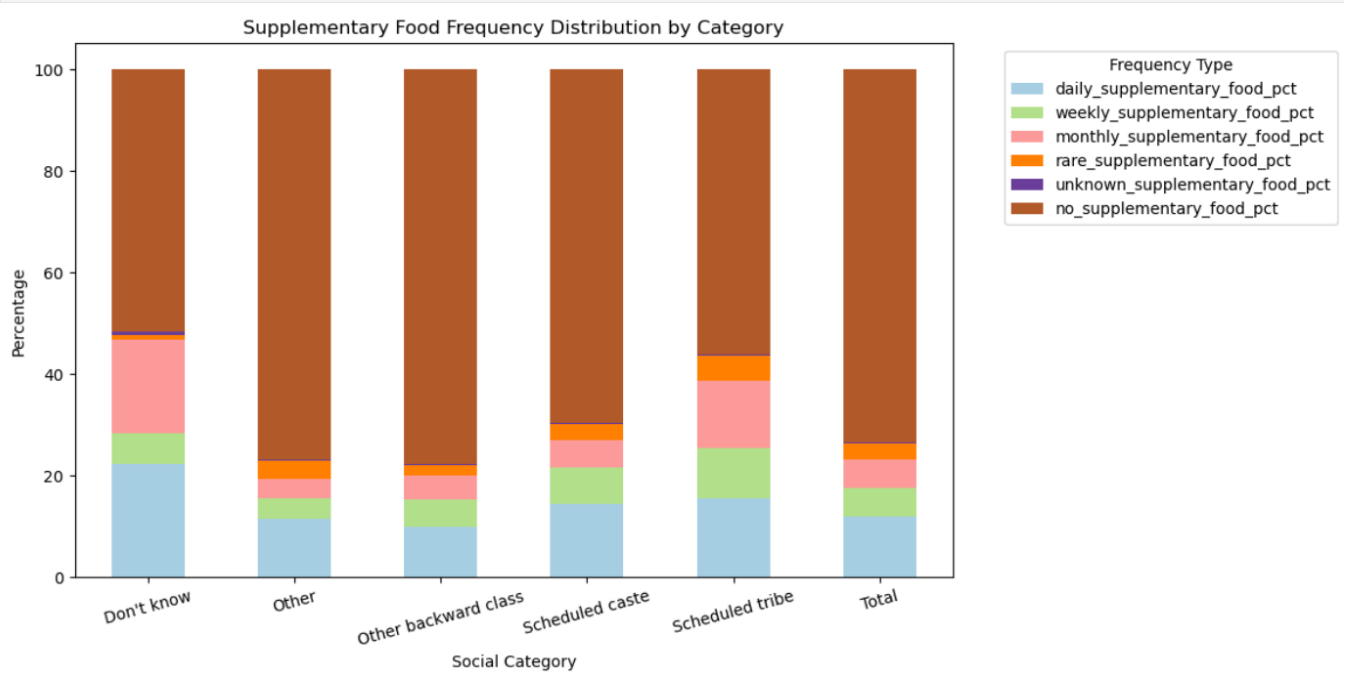
- High exclusion rates: Majority of mothers received no services — ‘Other’ (88.8%), OBC (84.5%), and the overall population (82.6%).
- Scheduled Tribes show relatively better access: 17.8% received checkups, 32.3% received supplementary food, and exclusion is lowest at 66.3%.
- Nutrition education access is critically low across all groups, especially for the ‘Other’ category (4.9%).

Recommendations

- Enhance ICDS outreach during the postpartum period, a critical phase for maternal and child health.
- Focus on underserved groups like OBC, SC, and ‘Other’ categories with targeted programs.

- Strengthen nutrition education delivery through collaboration with NGOs and community health workers.
- Review and improve Anganwadi Centre (AWC) infrastructure and service reach in low-performing areas.

4.6: SUPPLEMENTARY FOOD FREQUENCY (BY SOCIAL GROUP)



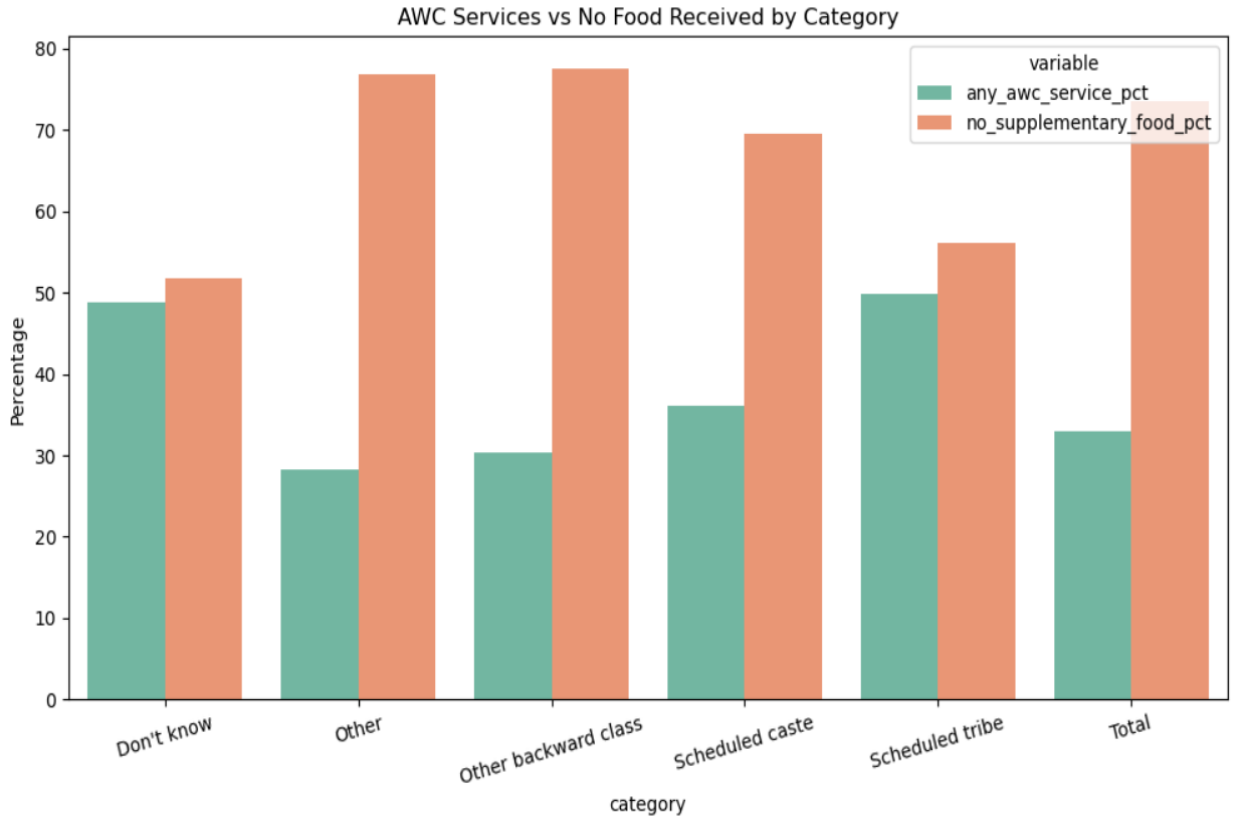
The data highlights significant disparities in the frequency of supplementary food received by women across social categories.

- 70–80% of women across all groups received no food support, with 'Other' and OBCs being the most underserved.
- Scheduled Tribes show the highest daily and monthly distribution, indicating relatively better program outreach.
- Weekly food support remains minimal, and daily access rarely exceeds 20%, even among well-covered groups.

Recommendations

- Prioritize OBC and 'Other' groups to enhance nutritional outreach services.
- Increase distribution frequency, ensuring at least weekly delivery where daily provision isn't feasible.
- Conduct awareness campaigns to inform beneficiaries of their food entitlements during pregnancy and postpartum.

4.7: AWC SERVICES VS. LACK OF SUPPLEMENTARY FOOD



While many women reported access to Anganwadi Centres (AWCs), a significant portion did not receive supplementary food:

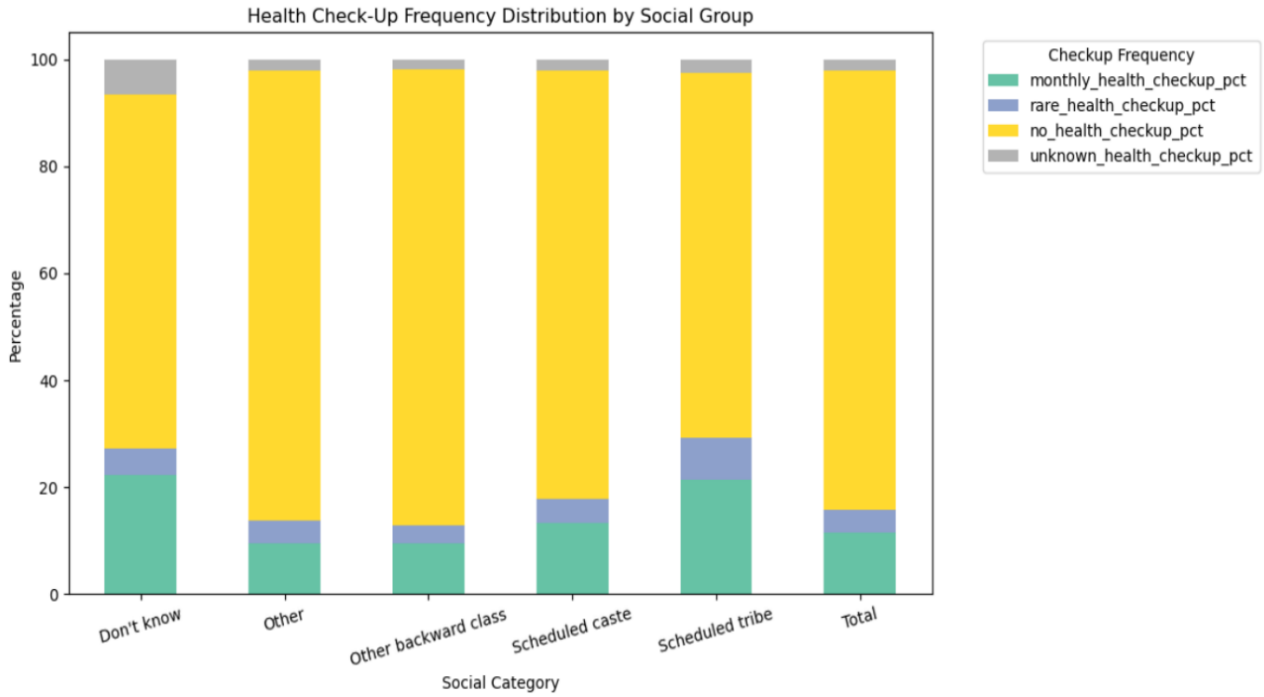
- OBCs and 'Other' groups show the widest gap, with over 75% not receiving food despite AWC engagement.
- Even among Scheduled Tribes, who had the highest AWC access (~50%), 56% still received no food.

This indicates a service delivery disconnect — AWCs are being accessed, but nutritional support is not consistently reaching beneficiaries.

Recommendation

- Strengthen monitoring and accountability at AWCs to ensure service access results in actual food provision.
- Focus efforts on vulnerable groups with high access but low delivery to close the implementation gap.

4.8: FREQUENCY OF HEALTH CHECK-UPS BY SOCIAL GROUP



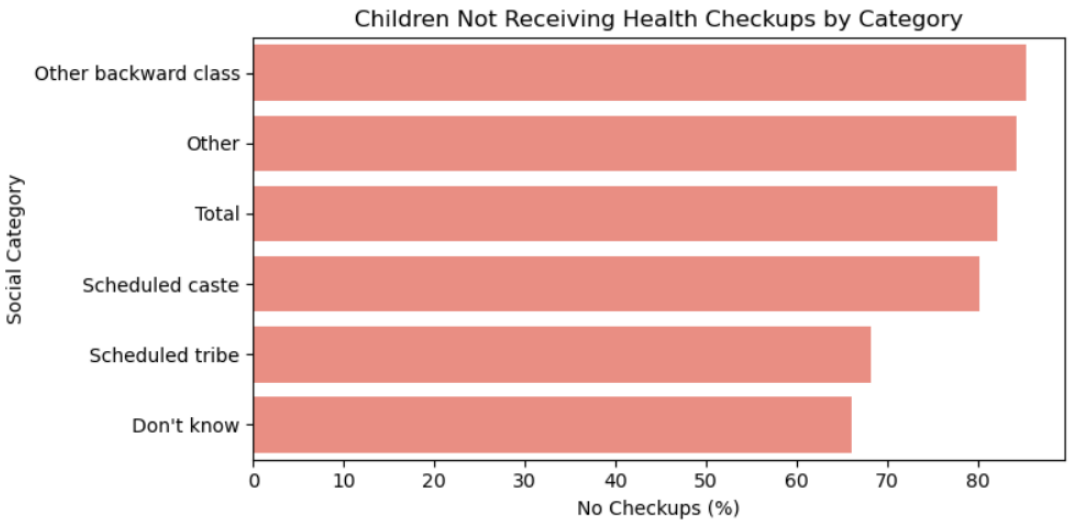
The data reveals substantial gaps in routine maternal health check-ups across all social categories:

- "No Health Check-up" dominates, exceeding 70–80% across all groups — indicating limited access or outreach.
- Scheduled Tribes and Unspecified categories report the highest monthly check-ups (~21–22%), suggesting relatively better service delivery.
- OBC and 'Other' groups show the lowest monthly check-ups (~10–12%), pointing to underserved populations.
- Rare and unknown responses are minimal but highlight gaps in consistency and service awareness.

Key Takeaway

The widespread lack of regular health check-ups calls for tailored outreach strategies, improved community health engagement, and enhanced maternal care delivery, particularly for marginalized and less-documented groups.

4.9: CHILDREN NOT RECEIVING HEALTH CHECKUPS (BY SOCIAL GROUP)



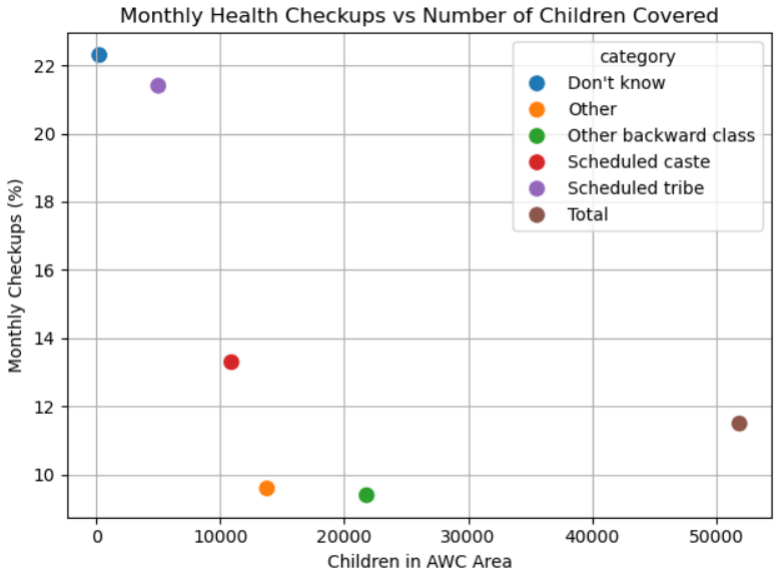
The data highlights widespread gaps in child health monitoring:

- OBC, 'Other', and Total categories have the highest non-checkup rates, each exceeding 80%.
- Scheduled Castes follow closely with 78% of children missing health checkups.
- Scheduled Tribes and Unspecified groups show slightly better coverage (66–68%), but rates remain concerning.

Key Takeaway

There is a systemic shortfall in child health services across all groups. Urgent attention is needed for OBC and general rural populations, alongside sustained support for tribal health programs to ensure equitable child health outcomes.

4.10: MONTHLY HEALTH CHECKUPS VS. CHILD POPULATION IN AWC AREAS



This scatter plot reveals an inverse relationship between the number of children and health checkup coverage:

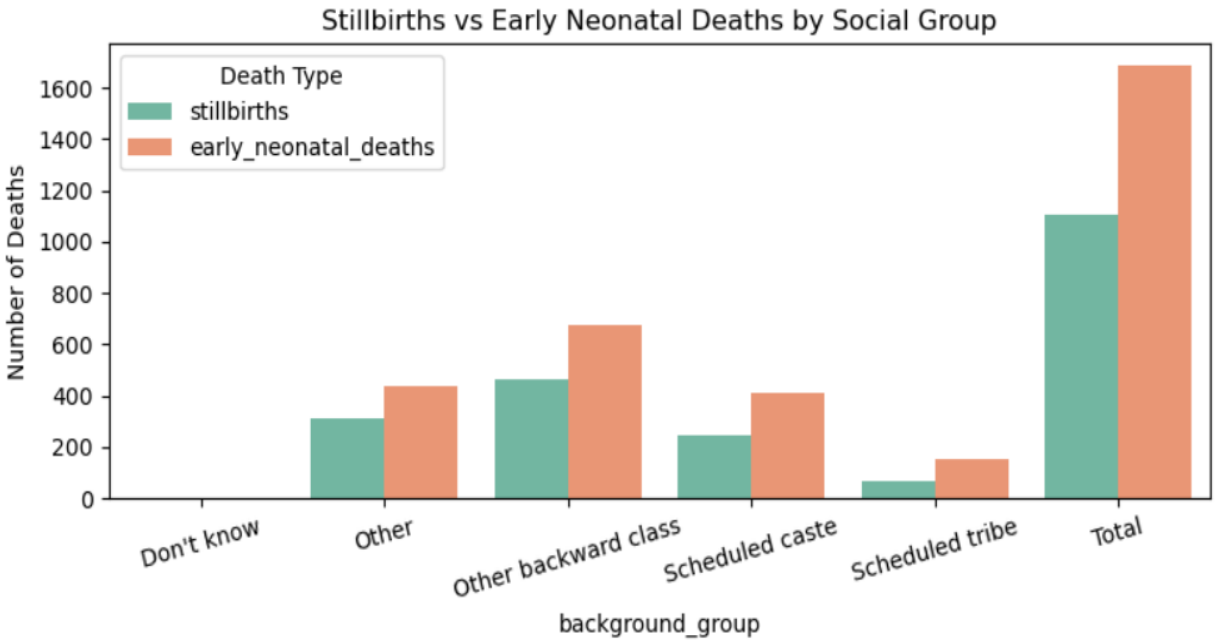
- Scheduled Tribes and Unspecified groups show the highest monthly checkup rates (~21–22%), but serve a relatively small child population.
- In contrast, OBC and Total categories cover larger populations (20,000–50,000 children) but have lower checkup rates (9–12%).

This trend suggests that as child population increases, monthly health service coverage decreases, likely due to workforce or resource constraints.

Key Takeaway

To maintain service quality across all social groups, scaling up frontline health capacity or implementing targeted interventions is essential in high-density child populations.

4.11: STILLBIRTHS VS EARLY NEONATAL DEATHS ACROSS SOCIAL GROUPS



This chart compares the number of stillbirths and early neonatal deaths (0–6 days) across social groups:

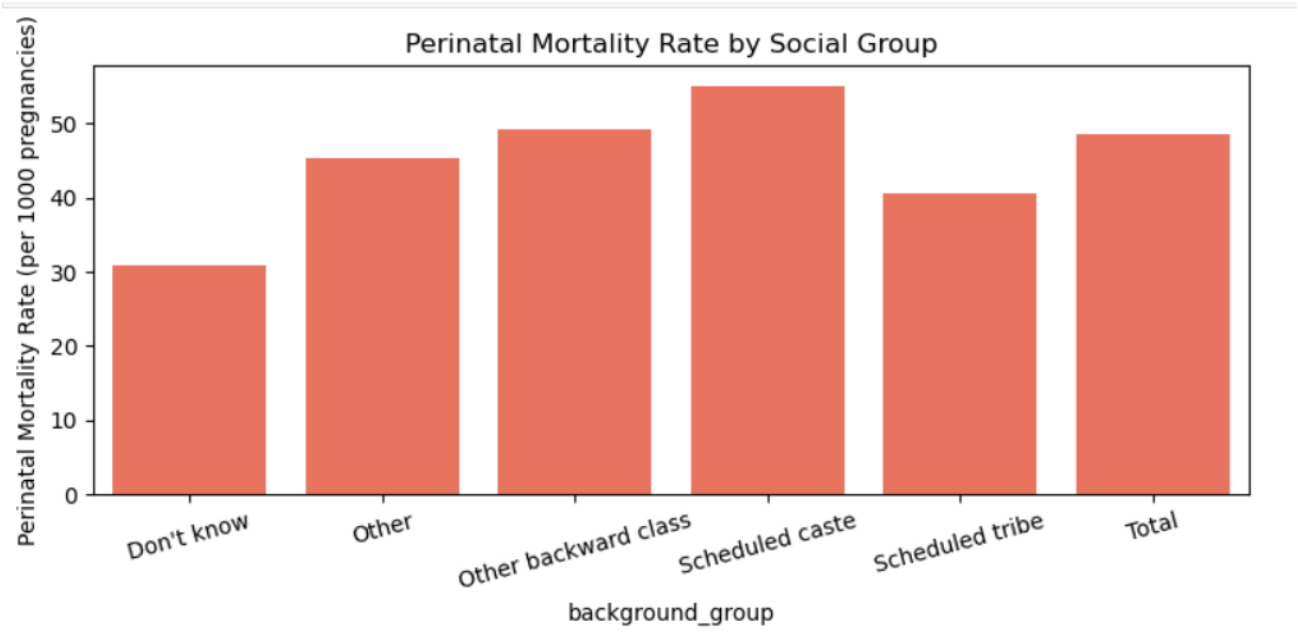
- Early neonatal deaths consistently surpass stillbirths, signalling critical gaps in postnatal care.
- OBC and Scheduled Caste groups experience the highest mortality, indicating the need for targeted health interventions.
- Scheduled Tribes report the lowest deaths, though this may be influenced by smaller population size rather than better outcomes.
- Overall, the combined figures reveal systemic challenges in prenatal and neonatal healthcare delivery.

Key Takeaway

Reducing early neonatal mortality requires:

- Enhanced institutional delivery coverage
- Robust postnatal follow-up systems
- Strengthened maternal and newborn care, especially in marginalized communities

4.12: PERINATAL MORTALITY RATE (PMR) BY SOCIAL GROUP



This chart shows the perinatal mortality rate (PMR)—the number of stillbirths and early neonatal deaths per 1,000 pregnancies of 7+ months—across various social groups:

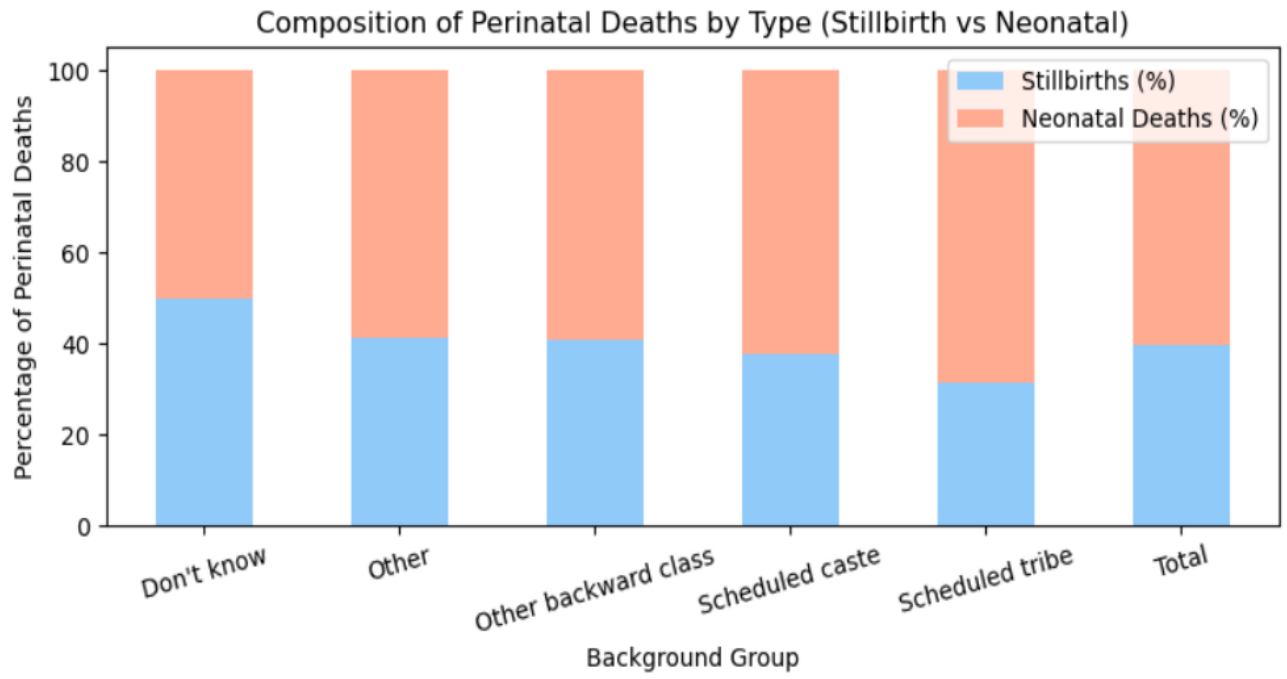
- Scheduled Castes have the highest PMR, indicating greater risk during late pregnancy and childbirth.
- OBC and 'Other' groups also show above-average PMR, reflecting systemic disparities in maternal and newborn care.
- Scheduled Tribes report a moderate PMR, still concerning given their overall vulnerability.
- Unspecified category shows the lowest PMR, though this may result from data gaps rather than better outcomes.

Key Takeaway

High PMRs in marginalized communities point to the need for:

- Improved prenatal and delivery care access
- Focused maternal health outreach
- Monitoring and addressing health inequalities across social groups

4.13: COMPOSITION OF PERINATAL DEATHS BY SOCIAL GROUP



This chart highlights the breakdown of perinatal deaths into stillbirths and early neonatal deaths across different social categories:

- Early neonatal deaths make up ~60% of perinatal mortality in most groups, indicating postnatal care challenges.
- Scheduled Tribes show the highest neonatal death share (~68%), suggesting gaps in newborn care services.
- Unspecified group displays a nearly equal split between stillbirths and neonatal deaths, possibly due to data inconsistencies.
- Scheduled Caste and OBC groups also have a higher neonatal death share, pointing to the need for immediate post-birth interventions.

Key Takeaway

Efforts to reduce perinatal mortality must prioritize **immediate postnatal care**, including:

- Skilled birth attendance
- Access to neonatal intensive care
- Maternal awareness and follow-up support

4.14: DISPARITIES IN HEALTH SERVICES & INFANT MORTALITY BY SOCIAL GROUP

	Social Group	No Health Checkups (%)	No Supplementary Food (%)	Perinatal Mortality Rate
0	Don't know	66.1	51.8	30.8
1	Other	84.2	76.8	45.3
2	Other backward class	85.3	77.6	49.3
3	Scheduled caste	80.1	69.6	55.0
4	Scheduled tribe	68.2	56.1	40.6
5	Total	82.2	73.5	48.5

This chart shows that OBCs and 'Other' groups face the highest service exclusion—over 84% lack health checkups and ~77% lack food support—alongside high perinatal mortality (49–45 PMR).

Scheduled Castes have the highest PMR (55) despite moderate service access, suggesting deeper health system gaps.

Scheduled Tribes fare better, with lower exclusion and a moderate PMR (40.6), while the Unspecified category shows the best overall outcomes (though data may be incomplete).

5. Limitations

- Datasets are based on older data (2005–2013).
- "Don’t know" and "Other" labels in social categories reduce clarity and hinder targeting.
- The analysis focuses on social group-level trends, not geographic patterns.
- Population size and facility capacity metrics (e.g., AWC reach per capita) were not uniformly available.

6. Conclusion

This project explored disparities in rural health infrastructure, ICDS service utilization, and perinatal outcomes among various social groups in India using publicly available datasets. The findings reveal that Scheduled Tribes generally have better access to health and nutrition services, while Scheduled Castes, OBCs, and ‘Other’ groups face persistent exclusion and higher health risks. Community Health Centres are critically overburdened, and male health worker deployment is significantly lacking. These systemic inequalities in service coverage and health outcomes point to the urgent need for targeted and equitable healthcare strategies.

7. Recommendations

- **Expand CHC Infrastructure** in overburdened zones to reduce patient load and improve service delivery.
- **Balance Health Workforce** by deploying more male health workers and ensuring supervisory parity for female workers.

- **Improve Postnatal Service Delivery**, especially for breastfeeding mothers, through better tracking and outreach.
- **Prioritize Marginalized Groups** such as OBCs, SCs, and 'Other' categories for ICDS and healthcare interventions.
- **Boost Nutrition and Health Education** coverage at Anganwadi Centres through consistent delivery and awareness drives.
- **Address Data Gaps** by improving classification of ambiguous categories like “Don’t Know” and “Other.”
- **Enable NGO Partnerships** to fill last-mile service gaps, support community engagement, and assist with monitoring.

8.1 Appendix A: Data Sources

- Source: National Data & Analytics Platform (NDAP), NITI Aayog
- Dataset Title: Statistical Profile of Scheduled Tribes in India – 2013
- Access Link: Open the link
- Published By: Ministry of Tribal Affairs, Government of India
- Data Scope: Rural health infrastructure, ICDS service utilization, supplementary nutrition, and infant mortality among tribal and other social groups.
- Data Period: Mostly 2005–2013, as per respective source tables.

8.2 Appendix B: Tools, Libraries, and Methodology

Tools Used:

Python (Jupyter Notebook): Data cleaning, transformation, and exploratory analysis

GitHub: Project repository and version control

Excel: Preliminary data inspection and cross-verification

Python Libraries:

pandas – for data manipulation and summarization

matplotlib / seaborn – for data visualization

NumPy – for numeric operations

Methodology:

Cleaned column names and standardized category labels. Aggregated data by social group (Scheduled Tribes, Castes, OBC, etc.)

Created comparative visualizations to analyse disparities & constructed a summary disparity table for high-level policy insight.