EDU Journal of International Affairs and Research (EJIAR), ISSN: 2583-9993
Volume 5, Issue 1, January-March, 2026, Available at: https://edupublications.com/index.php/ejiar

Maternal Healthcare Accessibility and Infrastructure in Haryana: A Geographic Perspective

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ABSTRACT

Maternal healthcare accessibility is a crucial determinant of safe childbirth and improved neonatal outcomes. This review-based study examines the spatial distribution of public health infrastructure in Haryana and analyzes its implications for maternal healthcare utilization and birth outcomes. Drawing upon secondary data from government reports of 2025, the study evaluates the availability of Community Health Centres (CHCs), Primary Health Centres (PHCs), Sub-Centres, civil hospitals, and bed strength across districts. The findings reveal that Haryana possesses a relatively extensive public health network; however, significant geographic disparities persist in the distribution of facilities and institutional capacity.

Health infrastructure indicates substantial progress in promoting safe delivery practices. Nevertheless, population pressure in rapidly growing districts and uneven rural coverage continue to impede equitable access to healthcare. The study underscores the importance of geographically balanced health planning, infrastructure strengthening, and targeted policy interventions to reduce regional inequalities. Enhancing accessibility to maternal health services is essential for sustaining high institutional delivery rates and improving maternal and neonatal health outcomes across the state.

Keywords: Maternal Healthcare, Health Infrastructure, Spatial Disparities, Primary Health Centres, Community Health Centres.

1. INTRODUCTION

Maternal health is widely recognised as a critical indicator of a nation's overall health status and socio-economic development. It encompasses the health of women during pregnancy, childbirth, and the postnatal period, stages that are particularly vulnerable to complications if adequate healthcare services are not accessible. Despite significant global progress in reducing maternal mortality, disparities in access to maternal healthcare continue to affect birth outcomes, especially in developing regions.

According to the World Health Organization, approximately 287,000 women died globally from preventable causes related to pregnancy and childbirth in 2020, with the majority occurring in low- and middle-income countries where healthcare accessibility remains uneven (World Health Organization [WHO], 2023). These patterns highlight the importance of examining geographic accessibility as a determinant of maternal and neonatal health.

Accessibility to maternal healthcare refers not only to the physical availability of health facilities but also to the ease with which women can utilize these services. The concept integrates spatial distance, transportation networks, affordability, cultural acceptance, and service quality.

Scholars in health geography argue that spatial barriers often lead to delayed care-seeking behaviour, increasing the risk of adverse birth outcomes such as low birth weight, premature delivery, and neonatal mortality (Joseph & Phillips, 1984; McLafferty, 2003).

The "distance decay" principle suggests that the likelihood of utilizing healthcare services decreases as travel distance increases, particularly in rural settings where transportation infrastructure may be limited (Guagliardo, 2004). Consequently, geographic location becomes a crucial determinant of maternal healthcare utilization.

Globally, improved access to antenatal care (ANC) and skilled birth attendance has been associated with significant reductions in maternal and neonatal mortality. Antenatal care enables early detection of pregnancy-related complications, nutritional deficiencies, and high-risk conditions, thereby improving birth outcomes (Carroli et al., 2001).

Similarly, institutional deliveries under trained healthcare professionals substantially lower the probability of maternal deaths and birth complications (Campbell & Graham, 2006). However, inequitable distribution of health infrastructure continues to create regional disparities in service utilization.

1.1 India's Progress in Maternal Healthcare:

India has made notable progress in expanding maternal healthcare through targeted interventions and national health programs. Institutional deliveries have increased considerably due to schemes such as the Janani Suraksha Yojana, which incentivizes facility-based childbirth, and the Pradhan Mantri Matru Vandana Yojana, which provides financial assistance for maternal care.

Data from the International Institute for Population Sciences indicate that maternal healthcare indicators have improved over the past decade; however, disparities persist across states and districts (IIPS & ICF, 2021). Researchers emphasize that socio-economic inequalities, educational attainment, and spatial accessibility collectively shape maternal health outcomes in India (Goli et al., 2015; Singh et al., 2019).

1.2 Maternal Health Scenario in Haryana:

Within this national context, Haryana presents an interesting case for geographic analysis. As one of India's relatively prosperous states with rapid urbanization and expanding healthcare infrastructure, Haryana has witnessed improvements in maternal health indicators. Nevertheless, the benefits of development have not been evenly distributed. Rural areas and peripheral districts often face shortages of healthcare facilities, trained personnel, and emergency obstetric services. Studies suggest that women residing closer to functional health centres are more likely to complete recommended ANC visits and to opt for institutional delivery than those in geographically isolated regions (Kumar et al., 2014). Such disparities underscore the continued relevance of spatial analysis in understanding maternal healthcare utilization.

Birth outcomes, particularly birth weight, serve as sensitive indicators of maternal health and access to healthcare. Low birth weight remains a major public health concern because it is closely associated with infant morbidity, impaired cognitive development, and increased risk of chronic diseases later in life (United Nations Children's Fund [UNICEF], 2019). Evidence indicates that inadequate antenatal care and delayed medical intervention are major contributors to poor neonatal outcomes, reinforcing the importance of timely and accessible maternal health services.

2. SIGNIFICANCE OF THE STUDY

The present study is of substantial academic and policy relevance, as it examines the relationship among public health infrastructure, maternal health care accessibility, and birth outcomes in Haryana from a geographic perspective. Maternal health is a major indicator of social development and healthcare efficiency; therefore, understanding the spatial distribution of health facilities is essential for ensuring equitable service delivery. By analyzing district-wise variations in Community Health Centres (CHCs), Primary Health Centres (PHCs), Sub-Centres, hospital capacity, and birth patterns, the study provides valuable insights into regional disparities that may influence maternal healthcare utilization.

The study is significant for highlighting how the uneven distribution of infrastructure can create disparities in access to institutional delivery services, skilled birth attendance, and emergency obstetric care. Identifying such gaps is crucial for planners and policymakers aiming to strengthen rural healthcare networks and optimize resource allocation. The findings can assist government agencies in developing geographically targeted interventions to improve maternal and neonatal health outcomes.

3. CONCEPTUAL FRAMEWORK

The conceptual framework provides a theoretical foundation for understanding how accessibility to maternal healthcare influences birth outcomes. In health geography and public health research, accessibility is considered a multidimensional construct shaped by spatial, socio-economic, and institutional factors. This framework integrates perspectives from geographic theory, healthcare utilization models, and social determinants of health to explain variations in maternal healthcare use and neonatal outcomes.

3.1 Concept of Healthcare Accessibility:

Healthcare accessibility refers to the extent to which individuals can access necessary medical services in a timely and efficient manner. It is not limited to the mere presence of healthcare facilities; it also encompasses the interplay among location, service availability, affordability, and acceptability. Roy Penchansky and J. William Thomas conceptualised accessibility through five dimensions: availability, accessibility, accommodation, affordability, and acceptability, commonly known as the "Five A's" framework (Penchansky & Thomas, 1981). This model remains widely used in evaluating healthcare systems, particularly in maternal health research.

3.2 Dimensions of Maternal Healthcare Accessibility:

Maternal healthcare accessibility can be broadly categorized into four interrelated dimensions:

i. **Physical Accessibility:** This includes distance to healthcare facilities, travel time, transportation availability, and geographic terrain. Studies indicate that women living within shorter travel distances are more likely to attend the recommended number of ANC visits and opt for skilled birth attendance (Gabrysch & Campbell, 2009).
ii. **Economic Accessibility:** Cost remains a significant barrier in many developing regions. Expenses related to transportation, consultation, medication, and informal payments may deter women from seeking care. Financial incentive programs have been shown to improve institutional delivery rates by reducing economic burdens (Lim et al., 2010).
iii. **Social and Cultural Accessibility:** Social norms, gender roles, educational status, and decision-making autonomy influence maternal healthcare utilization. Women with higher educational attainment are generally more aware of pregnancy risks and preventive care, resulting in better health-seeking behavior (Bloom et al., 2001).
iv. **Quality and Acceptability of Services:** Perceived quality of care, including provider competence, respectful treatment, and facility readiness, strongly affects utilization. Poor service quality can discourage repeated visits even when facilities are geographically accessible (Kruk et al., 2009).

Together, these dimensions illustrate that accessibility is not a single measurable factor but a complex interaction of geographic and socio-economic realities.

3.3 Components of Maternal Healthcare:

Maternal healthcare typically consists of three essential stages that collectively influence birth outcomes:

i. **Antenatal Care (ANC):** ANC provides an opportunity for early detection of complications such as anemia, hypertension, and gestational diabetes. The World Health Organization recommends a minimum of eight antenatal contacts to ensure positive pregnancy outcomes (WHO, 2016). Adequate ANC is associated with reduced risk of low birth weight and neonatal mortality (Carroli et al., 2001).
ii. **Skilled Birth Attendance and Institutional Delivery:** Deliveries supervised by trained professionals significantly reduce maternal and neonatal deaths. Access to emergency obstetric care is particularly important in preventing complications such as hemorrhage and obstructed labor (Campbell & Graham, 2006).
iii. **Postnatal Care (PNC):** The postnatal period is critical for monitoring both mother and newborn. Timely PNC can prevent infections, detect feeding problems, and reduce the risk of neonatal mortality (Lawn et al., 2005).

These components form a continuum of care, and disruptions at any stage may negatively affect birth outcomes.

3.4 Indicators of Birth Outcomes:

Birth outcomes are widely used to evaluate the effectiveness of maternal healthcare systems. main indicators include:

i. **Birth Weight:** Low birth weight (less than 2,500 grams) is a major predictor of infant morbidity and mortality. It often reflects inadequate maternal nutrition, insufficient ANC, or delayed medical intervention (UNICEF, 2019).
ii. **Preterm Birth:** Preterm infants face higher risks of developmental delays and chronic health conditions. Improved prenatal monitoring can help identify high-risk pregnancies early (Blencowe et al., 2012).
iii. **Neonatal Mortality:** Many neonatal deaths occur within the first week of life and are closely linked to maternal health and delivery conditions. Access to skilled care substantially lowers these risks (Bhutta et al., 2014).

These indicators help establish the connection between healthcare accessibility and maternal-child health outcomes.

3.5 Theoretical Perspectives Supporting the Framework:

Several theoretical models support the relationship between healthcare accessibility and birth outcomes:

i. **Health Behavior Model:** Developed by Ronald M. Andersen, this model explains healthcare utilization through predisposing factors (age, education), enabling factors (income, distance), and need-based factors (perceived illness). Geographic accessibility functions as a critical enabling factor influencing service use (Andersen, 1995).
ii. **Distance Decay Theory:** This geographic principle posits that interaction with services declines with increasing distance. In maternal health, longer travel distances are often associated with fewer ANC visits, delays in ANC attendance, and lower institutional delivery rates (Guagliardo, 2004).
iii. **Social Determinants of Health Framework:** Proposed by the World Health Organization Commission on Social Determinants of Health, this framework emphasizes that health outcomes are shaped by broader socio-economic and environmental conditions (Marmot et al., 2008). Geographic inequalities, therefore, translate directly into health disparities.
iv. **Three Delays Model:** Introduced by Deborah Maine and Safaï H. Thaddeus, the model identifies delays in (1) deciding to seek care, (2) reaching a facility, and (3) receiving adequate treatment as major contributors to maternal mortality (Thaddeus & Maine, 1994). Spatial barriers primarily affect the second delay, making geographic accessibility a life-saving factor.

4. METHODOLOGY

The present study provides a depth analysis of maternal healthcare accessibility and birth outcomes in Haryana from a geographic perspective. The paper is based entirely on secondary data collected from reliable national and international sources. Major data sources include reports from the International Institute for Population Sciences (NFHS-4 and

NFHS-5), the Ministry of Health and Family Welfare, the World Health Organization, and the United Nations Children's Fund, along with peer-reviewed journal articles, government publications, and census records. In this study, the secondary data is being used that is collected from the various departments of the government of Haryana as well as the government of India.

5. REVIEW OF LITERATURE

Relevant literature was selected using thematic criteria focusing on healthcare accessibility, maternal health infrastructure, antenatal care utilization, and birth outcomes. The collected studies were systematically reviewed, classified, and synthesized to identify patterns, disparities, and research gaps. A geographic approach was employed to interpret spatial inequalities in service distribution and utilization. The analysis is descriptive and analytical, aiming to provide a comprehensive understanding of maternal healthcare accessibility and its implications for neonatal health in Haryana.

The relationship between access to maternal health care and birth outcomes has been extensively examined in global and national scholarship. Existing literature highlights that equitable access to antenatal care (ANC), skilled birth attendance, and institutional delivery play a decisive role in reducing maternal and neonatal mortality. However, spatial disparities in healthcare infrastructure continue to influence service utilization, particularly in developing regions. This section synthesizes major studies under thematic categories to establish the scholarly foundation for the present review.
Healthcare access is shaped by socioeconomic inequalities, transportation barriers, and uneven distribution of infrastructure in developing nations. Peters et al. (2008) noted that poverty interacts with geographic isolation to create compounded disadvantages, limiting maternal healthcare utilization among vulnerable populations.

Economic barriers are equally significant. Conditional cash transfer programs have shown measurable success in improving institutional delivery rates by reducing financial constraints. For instance, Lim et al. (2010) observed that financial incentives substantially increased facility-based childbirth in resource-poor settings.

Education also plays a critical role. Bloom et al. (2001) found that women with greater autonomy and higher educational attainment were more likely to access maternal health care services. This relationship suggests that accessibility is not purely spatial but also socio-cultural.

India has made considerable progress in maternal health over the past two decades through targeted policy interventions and health programs. According to the International Institute for Population Sciences (IIPS) and the ICF, institutional deliveries and antenatal care coverage have increased significantly, yet regional disparities remain pronounced (IIPS & ICF, 2021).

Despite these advancements, inequalities persist across states and districts. Singh et al. (2019) identified education, household wealth, and urban residence as strong predictors of maternal healthcare utilization. Similarly, Goli et al. (2015) linked early marriage and poor maternal nutrition with unfavorable birth outcomes, reinforcing the need for comprehensive maternal care.

Haryana presents a distinctive case due to its rapid economic growth alongside persistent socio-spatial inequalities. While the state has achieved improvements in maternal health indicators, intra-state disparities continue to influence healthcare utilization.

Data from the National Family Health Survey indicate substantial growth in institutional deliveries and ANC coverage; however, rural districts still lag behind urban centres in terms of healthcare infrastructure (IIPS & ICF, 2021).

Kumar et al. (2014) highlighted pronounced rural–urban differences in maternal healthcare utilization, noting that women in rural areas often face transportation challenges and limited facility availability. These barriers contribute to delayed care-seeking behaviour and increase the likelihood of complications during childbirth.

Geographic barriers remain among the most persistent obstacles to access to maternal healthcare. The concept of distance decay, discussed by Guagliardo (2004), explains that healthcare utilization declines as travel distance increases.

Transportation limitations further intensify this challenge. Women in remote areas often rely on unreliable or costly transportation, resulting in delays in reaching healthcare facilities during emergencies.

Workforce distribution is another spatial concern. Shortages of trained healthcare professionals in rural regions reduce service availability even when facilities exist. Such imbalances contribute to regional inequalities in birth outcomes.

Settlement patterns also influence accessibility. Dispersed rural populations typically require greater investment in infrastructure to ensure equitable access to healthcare.

6. MATERNAL HEALTHCARE INFRASTRUCTURE

Table 1 presents a comprehensive overview of public health infrastructure across the districts of Haryana, highlighting the availability of primary and secondary healthcare facilities alongside birth registration data for 2024. The state comprises 122 Community Health Centres (CHCs), 408 Primary Health Centres (PHCs), and 2,736 Sub-Centres, supported by 72 civil hospitals, with a total bed strength of 7,798, indicating a relatively well-developed public health care network.

Table 1: Public Health Infrastructure in Haryana, 2025

Sr. No.	District	No. of (CHCs)	No. of (PHCs)	Sub Centres	No. of Civil Hospitals	Total Bed Strength
1	Ambala	5	17	107	4	650
2	Bhiwani	5	24	148	7	558
3	Charkhi Dadri	3	12	79	2	230
4	Faridabad	4	8	55	2	250
5	Fatehabad	5	20	135	3	250
6	Gurugram	3	12	86	5	525
7	Hisar	8	29	202	6	525
8	Jhajjar	6	20	134	5	250
9	Jind	8	24	187	4	450
10	Kaithal	4	22	147	3	300
11	Karnal	8	24	153	4	350
12	Kurukshetra	5	16	120	3	400
13	Nuh	6	17	110	1	300
14	Mahendragarh	6	20	148	3	350
15	Palwal	6	17	95	2	350
16	Panchkula	2	6	47	2	300
17	Panipat	7	14	91	2	400
18	Rewari	5	18	116	2	350
19	Rohtak	6	17	119	3	410
20	Sirsa	6	26	162	4	250
21	Sonipat	7	30	177	4	250
22	Yamuna Nagar	7	15	118	3	100
Total		**122**	**408**	**2736**	**72**	**7798**

Source: Health Department, Haryana

Sub-Centres serve as the first point of contact for maternal health services, providing basic antenatal checkups, immunization, and referrals. PHCs function as intermediate units that offer skilled birth attendance and limited emergency care, whereas CHCs are expected to provide comprehensive emergency obstetric services.

The distribution of facilities reveals notable spatial disparities. Districts such as Hisar, Karnal, and Jind exhibit a stronger rural healthcare base, with more PHCs and Sub-Centres, suggesting greater outreach capacity in dispersed settlements. In contrast, rapidly urbanizing districts like Faridabad and Gurugram have comparatively fewer primary facilities but higher institutional capacity, reflecting an urban-centric healthcare model.

Birth registration data further highlights demographic variations. Nuh and Faridabad report significantly higher numbers of registered births, indicating greater population pressure on existing healthcare services. Conversely, districts such as Charkhi Dadri and Jhajjar show lower birth counts, corresponding with smaller population bases.

The table underscores that, although Haryana has achieved substantial expansion in public health infrastructure, the uneven geographic distribution of facilities and bed capacity may affect healthcare accessibility. These disparities are particularly relevant in the context of maternal healthcare utilization and birth outcomes, emphasizing the need for regionally balanced health planning.

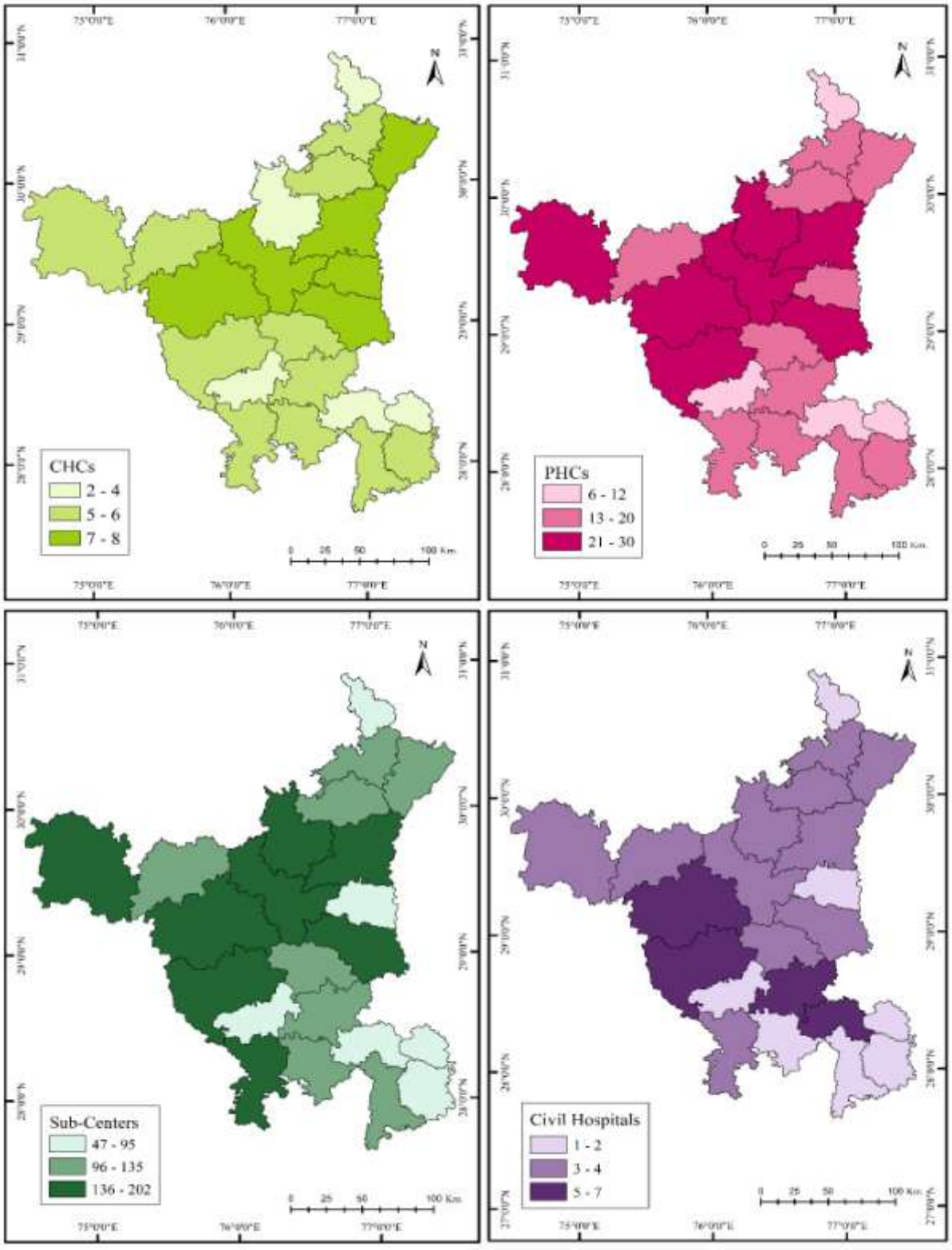
Studies note that population growth and rapid urbanization have placed additional pressure on existing infrastructure. Facilities in densely populated districts often experience overcrowding, whereas sparsely populated rural areas may suffer from inadequate service availability.

Geographic disparities are particularly evident in peripheral districts where travel distances to higher-level facilities are longer. Such spatial barriers can discourage routine ANC visits and delay institutional delivery, increasing the risk of adverse birth outcomes.

Multiple policy interventions have contributed to the expansion of maternal healthcare services in Haryana. Programs such as the Janani Suraksha Yojana have incentivized institutional deliveries, while the Pradhan Mantri Matru Vandana Yojana provides financial assistance to support maternal nutrition and healthcare utilization.

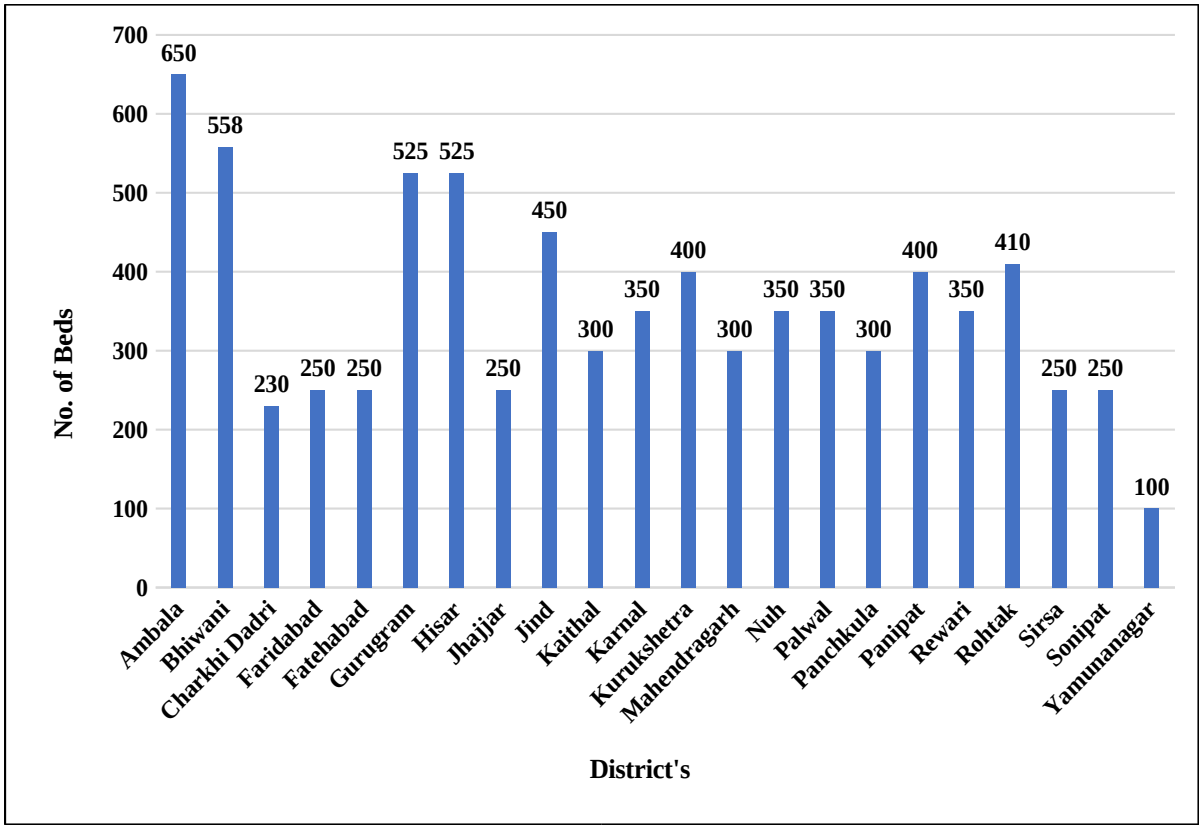
The Ayushman Bharat initiative aims to enhance healthcare accessibility through upgraded Health and Wellness Centres and financial protection for hospitalization. These efforts have collectively improved service uptake, particularly among economically vulnerable populations.

Map 1: *Public Health Infrastructure in Haryana, 2025*



Source: Based on table 1

Fig. 1: ***Total Beds Strength in Government Hospitals of Haryana, 2025***



Source: Based on table 1

Evidence suggests that states investing in healthcare infrastructure experience greater reductions in maternal mortality (Bhutta et al., 2014). Haryana's progress reflects the positive impact of such policy measures, although targeted interventions remain necessary to address intra-state disparities.

Rural populations often depend on public facilities that may lack advanced equipment or specialists. Travel time becomes a critical determinant of service utilization, aligning with the distance decay principle discussed in health geography (Guagliardo, 2004).

Socio-economic differences further compound spatial inequality. Women in rural areas may face transportation costs, limited awareness, and cultural barriers that discourage healthcare use. Consequently, infrastructure disparities translate into differences in maternal service uptake and birth outcomes.

7. ACCESSIBILITY AND UTILIZATION OF MATERNAL HEALTH SERVICES

Haryana has experienced substantial progress in maternal healthcare utilization due to policy interventions, infrastructure expansion, and increased awareness. However, geographic disparities continue to affect service uptake across districts, particularly between urban and rural areas.

Antenatal care represents one of the most important components of maternal healthcare because it enables early identification of pregnancy-related complications and promotes preventive health practices. The World Health Organization recommends a minimum of eight antenatal contacts to ensure a positive pregnancy experience and reduce perinatal risks (WHO, 2016).

According to the International Institute for Population Sciences (IIPS), antenatal care (ANC) coverage in Haryana has improved markedly, with a growing proportion of women receiving at least four ANC visits (IIPS & ICF, 2021). This progress reflects enhanced outreach services, improved road connectivity, and community health initiatives.

India has witnessed a dramatic rise in institutional deliveries following the introduction of the Janani Suraksha Yojana, a conditional cash transfer program designed to encourage facility-based childbirth. Evaluating the initiative, Lim et al. (2010) reported substantial increases in institutional births, particularly among economically disadvantaged populations.

Haryana mirrors this national trend, with a large majority of births now occurring in healthcare facilities (IIPS & ICF, 2021). Improved accessibility, financial incentives, and expanded healthcare infrastructure have collectively contributed to this shift.

8. MATERNAL HEALTHCARE SPATIAL INEQUALITIES

Haryana presents a paradox of economic advancement alongside persistent intra-state disparities. While districts within the National Capital Region (NCR) benefit from advanced healthcare infrastructure, several peripheral districts continue to face shortages of facilities and specialists.

Evidence from the International Institute for Population Sciences indicates that maternal healthcare indicators vary across districts, reflecting differences in infrastructure availability, literacy levels, and urbanization (IIPS & ICF, 2021). Districts with higher facility density tend to report better antenatal care coverage and institutional delivery rates.

Rural populations often face longer travel distances and limited facility choices. Gabrysch and Campbell (2009) found that distance to health facilities is a major determinant of whether women opt for institutional delivery. Women residing in rural settings are, therefore, more vulnerable to delays in receiving obstetric care.

Noor et al. (2006) highlight the usefulness of geographic information systems (GIS) in identifying underserved areas and guiding infrastructure expansion. Spatial tools enable policymakers to allocate resources more efficiently and improve service coverage.

The “second delay” identified by Safaï H. Thaddeus and Deborah Maine refers specifically to the time taken to reach a healthcare facility (Thaddeus & Maine, 1994). This delay is particularly dangerous during obstetric emergencies, where timely intervention can determine survival.

Peters et al. (2008) argue that financial constraints limit access to healthcare even when services are physically available. Similarly, Bloom et al. (2001) found that education enhances women’s autonomy and healthcare utilization, suggesting that social development can mitigate spatial barriers.

Thus, addressing geographic inequality requires integrated strategies that combine infrastructure development with socio-economic empowerment.

The growing presence of private healthcare providers has reshaped India’s maternal health landscape. Private hospitals are predominantly concentrated in urban centers, improving service availability but also raising concerns about affordability.

While private sector participation reduces pressure on public facilities, it may inadvertently widen spatial inequality if rural populations cannot afford such services. Balanced public investment is therefore essential to ensuring equitable maternal health care coverage.

9. CONCLUSION

Accessibility to maternal healthcare is a critical determinant of maternal and neonatal well-being, influencing the utilization of antenatal care, institutional delivery, and postnatal services. This review highlights that although Haryana has made considerable progress in expanding healthcare infrastructure and improving maternal health indicators, significant spatial disparities persist across districts and between rural and urban areas. Geographic barriers such as travel distance, uneven facility distribution, and workforce shortages continue to affect service uptake and birth outcomes. Evidence suggests that improved accessibility leads to higher healthcare utilization, reduced pregnancy complications, and lower risks of low birth weight and neonatal mortality. However, achieving equitable maternal healthcare requires geographically informed planning, strengthened rural health systems, and targeted policy interventions. Integrating spatial analysis into healthcare decision-making can help identify underserved regions and optimize resource allocation. Ultimately, reducing geographic inequalities is essential for promoting maternal health equity and ensuring healthier beginnings for future generations in Haryana.

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