




Age-weighted multidimensional women's health deprivation in India: A PCA based state-union territory analysis with rural-urban differentials

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ABSTRACT

Gendered health disparities in India continue to persist due to deep-rooted social, cultural, and economic barriers that limit women's access to adequate healthcare, nutrition, and social support throughout their lives. Conventional health indices often overlook the multidimensional and age-specific nature of women's deprivation, necessitating the construction of an age-weighted Multidimensional Women's Health Deprivation Index (MWHDI) using NFHS-5 data. This study applies Principal Component Analysis alongside the Alkire-Foster framework to measure and compare levels of deprivation across rural and urban areas in all states and Union Territories. The findings indicate moderate overall deprivation, with rural MWHDI (0.2322) marginally higher than urban (0.1896), highlighting persistent spatial disparities. Substantial regional differences emerge; Bihar, Manipur, and West Bengal demonstrate relatively better outcomes, while Goa, Mizoram, and Dadra & Nagar Haveli and Daman & Diu record higher levels of deprivation. Among Union Territories, Andaman & Nicobar Islands and Ladakh perform well, whereas Puducherry and Jammu & Kashmir remain more deprived. The study underscores the importance of region-specific policy interventions to address these variations. Additionally, the age-weighted MWHDI reveals population sensitivity, being primarily influenced by the middle-aged cohort (20-39 years), which may obscure the heightened vulnerabilities and unmet health needs of elderly women.

Contribution/Originality: This study develops an age-sensitive Multidimensional Women's Health Deprivation Index (MWHDI), addressing overlooked age disparities. Combining Principal Component Analysis with the Alkire-Foster method on NFHS-5 data, it provides the first detailed rural-urban and state-union territory comparison of women's multidimensional health deprivation across India.

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1. INTRODUCTION

Gendered health disparities in India persist despite notable progress in overall health indicators, primarily due to deep-rooted social, cultural, and economic structures that continue to disadvantage women across their lives. Women face unequal access to healthcare, nutrition, education, and social protection, while dominant gender norms often prioritize men's health needs, resulting in delayed medical attention and underreporting of women's illnesses. Persistent issues such as malnutrition, maternal health risks, inadequate reproductive healthcare, and exposure to gender-based violence further aggravate women's multidimensional deprivation.

These inequities are compounded by intersecting factors such as caste hierarchies, rural–urban disparities, economic inequality, and restricted mobility, making gendered health gaps a major barrier to equitable and inclusive development. Traditional health indices often fail to reflect the complex and age-specific nature of women's health deprivation. Indicators such as fertility and mortality rates tend to treat the population as homogeneous, overlooking the distinct vulnerabilities women face at different life stages. Younger women often confront early marriage, adolescent pregnancy, and constrained reproductive autonomy, while older women experience higher exposure to chronic illnesses, economic dependency, and limited healthcare access. Moreover, most conventional indices assess only a single dimension of health, neglecting the interconnected factors such as education, nutrition, healthcare access, and exposure to violence that jointly shape women's overall well-being. To address these limitations, this study proposes an age-weighted Multidimensional Women's Health Deprivation Index (MWHDI), offering a more holistic and sensitive measurement framework. By assigning differential weights to women's age groups, the MWHDI captures life-stage-specific risks from adolescent reproductive challenges and maternal health issues to age-related chronic conditions, thereby presenting a more realistic and inclusive picture than age-neutral indices. The inclusion of Union Territories (UTs) further enhances the analytical depth and policy relevance of the MWHDI. Though smaller in size and population, UTs have distinct demographic, economic, and governance characteristics that significantly influence health outcomes. Their direct administrative control by the central government often leads to differences in healthcare delivery and policy implementation compared to states. While some UTs like Delhi and Chandigarh possess advanced health infrastructure, others such as Dadra & Nagar Haveli and Daman & Diu, continue to lag behind on social and health parameters. Excluding them would obscure regional disparities and produce an incomplete national assessment. Incorporating UTs thus strengthens the comprehensiveness, accuracy, and representativeness of the MWHDI, ensuring that the measure captures the full spectrum of women's multidimensional health deprivation across India and contributes meaningfully to targeted, evidence-based policy interventions.

2. LITERATURE REVIEW

Research on women's health deprivation in India has consistently underscored the deep-seated socio-economic disparities that persist across regions. Alkire and Seth (2009) introduced the Alkire-Foster methodology, which advanced the measurement of poverty beyond income by incorporating multiple dimensions such as education, health, and living standards, thus facilitating a more comprehensive understanding of deprivation. Building on this framework (Mohanty, 2012) highlighted how intersecting disadvantages in wealth, education, and health significantly reduce Indian women's access to antenatal, postnatal, and skilled delivery care, revealing persistent inequalities despite policy progress. Similarly, Dehury and Mohanty (2015), using the Indian Human Development Survey and the Alkire-Foster approach, found that 43% of India's population was multidimensionally poor, with health and living conditions being the dominant contributors, particularly in Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, and West Bengal. (Singh & Chaddha, 2018) emphasized the importance of enhancing women's access to education and healthcare, noting that health encompasses complete physical, mental, and social well-being as defined by the World Health Organization. explore poverty as a multidimensional issue beyond income-based measures. Drawing on National Family Health Survey (NFHS-4) data, the authors applied fuzzy logic and the Multidimensional Poverty Index (MPI) framework to assess deprivation levels in Uttar Pradesh. The analysis used weighted indicators to reflect varying degrees of poverty, offering a detailed, micro-level perspective on deprivation.

Further, Basu and Das (2021) constructed an Index of Multidimensional Deprivation using PCA and GWPCA techniques, identifying southern Chhattisgarh and Odisha as regions with the highest deprivation.

The Women's Health Index (WHI) was developed to measure health inequalities among Indian women across socio-economic and regional contexts. Incorporating 17 life-stage indicators and validated through Principal Component Analysis, the index highlights significant district and state-level disparities, offering a comprehensive tool for monitoring women's health deprivation (Seth & Alkire, 2021).

Rachel (2021) reported that nearly one-fifth of Indian women experience multidimensional poverty, with higher vulnerability among widowed, divorced, older, and early married women. Seth and Alkire (2021) developed the Women's Health Index (WHI), incorporating 17 life-stage indicators, which revealed stark regional and socio-economic inequalities in women's health outcomes. In a related analysis, they evaluated the 2002 Below Poverty Line (BPL) census and found significant misclassification of poor households, leading to the proposal of a Deprivation Index as a more accurate alternative. Pradhan, Kandapan, and Pradhan (2022) further demonstrated through NFHS-4 data that Scheduled Castes and Scheduled Tribes endure the highest levels of multidimensional poverty, with central and eastern India emerging as the most deprived regions. Das and De (2023) highlight gender disparities in access to education, employment, and digital resources in India. It shows how structural inequalities limit women's mobility and decision-making. The authors argue that equitable access to opportunities is crucial for women's empowerment and socio-economic independence.

Warren, Garrett, and Frame (2025) identified structural gender gaps in medical research and healthcare, emphasizing that the underrepresentation of women in clinical studies perpetuates biased health outcomes.

Banerjee and Kayal (2024) revealed rising inter-state disparities in women's health between 2015 and 2021, attributing them to unequal access to public health and social development. Kushwaha and Viswanathan (2024) found a marginal decline in overall inequality between NFHS-4 and NFHS-5 but persistent disparities across socio-economic and demographic groups. Chen et al. (2024), using data from Ningxia, China, confirmed similar patterns of deprivation among rural women driven by chronic illness, inadequate healthcare access, and financial hardship. Kanji, Carmichael, Darko, Egyei, and Vasilakos (2024) linked early marriage to long-term negative outcomes on women's education, health perception, and life satisfaction. In India, despite policy initiatives like the National Rural Health Mission, Ali and Chauhan (2020) identified continued disparities in maternal care due to differences in education, media exposure, and tribal affiliation. Sehgal, Jatrana, and Johnson (2025) proposed a new Women's Health Index for India incorporating reproductive health, nutrition, and service access, offering an evidence-based policy tool for assessing disparities.

Das (2023), focusing on Nagaland, this study examined the persistence of multidimensional poverty in Northeast India using fuzzy logic. It analyzed district-level data to capture variations in deprivation and identified cultural and regional isolation as key contributors to inequality. Mlambo (2025) highlighted menstrual health as a neglected yet vital public issue, urging stronger legislation to combat period poverty and promote gender equality. (Faizi & Ahmad, 2025) compared the Simple Poverty Scorecard (SPS) with the Multidimensional Poverty Index (MPI) and found weak agreement between them, suggesting the superiority of multidimensional indicators in poverty measurement. Sharma and Shukla (2026), using National Sample Survey Office (NSSO) data, observed persistent gender bias in household health expenditure, with women receiving less financial investment in healthcare than men. Finally, Raghupathi and Wu (2026) analyzed global data from 116 countries and found that gender inequality in education, employment, and safety substantially affects women's mortality and life expectancy, emphasizing the need for policies that move beyond access equality to address deeper social and structural barriers.

Collectively, these studies underscore that multidimensional poverty frameworks are indispensable for understanding women's health deprivation. Despite methodological advances such as fuzzy logic, principal component analysis, and composite health indices, significant regional and structural disparities remain. The reviewed literature reveals a persistent gap in integrating contemporary national survey data particularly NFHS-5 (2019-21), to comprehensively examine intra-state variations in women's health deprivation, a gap the present study seeks to address.

2.1. Objective

- Develop an age-weighted multidimensional index to measure women's health deprivation across India.
- Quantify the extent of deprivation using Head Count Ratio (HCR), Average Variable Intensity (AVI), and a composite Multidimensional Women's Health Deprivation Index (MWHDI).
- Identify regional disparities by comparing states and union territories.

3. METHODOLOGY

The study formulates a comprehensive analytical framework to measure women's multidimensional health deprivation in India by utilizing data from the National Family Health Survey (NFHS-5). It integrates both statistical and conceptual approaches to ensure methodological rigor and contextual relevance. Principal Component Analysis (PCA) is employed to derive objective statistical weights for the selected indicators, thereby minimizing subjectivity in indicator selection and simplifying the dataset by reducing dimensionality. The analytical process is guided by the Alkire Foster (AF) methodology, which serves as the conceptual foundation for constructing the Multidimensional Women's Health Deprivation Index (MWHDI).

This index is designed to capture the diverse and interrelated dimensions of women's health deprivation, extending beyond conventional unidimensional indicators such as mortality or fertility rates. The methodology is uniformly implemented across all States and Union Territories (UTs), with separate computations for rural and urban areas to account for contextual variations in access to healthcare, resources, and social infrastructure. Comparative analysis between rural and urban MWHDI values allows the study to highlight regional disparities and identify specific areas requiring policy attention. The empirical process begins by defining deprivation cut-offs for a set of key indicators representing multiple dimensions of women's well-being. These include age at first childbirth, prevalence of early marriage, literacy status, employment participation, place of delivery, health insurance coverage, and the adequacy of basic amenities such as access to safe drinking water, electricity, and sanitation facilities. Additionally, indicators reflecting exposure to emotional or sexual violence are incorporated to capture the broader social determinants that critically shape women's physical and mental health outcomes. Each indicator is assigned a weight according to its relative contribution to women's overall health status. Unlike traditional indices, this framework introduces an age-weighting mechanism, acknowledging that health vulnerabilities differ significantly across life stages. For instance, adolescent and young women often face reproductive and nutritional risks, while older women experience heightened exposure to chronic diseases, economic dependency, and limited healthcare accessibility. Incorporating age as a moderating factor enables the MWHDI to reflect life-course-specific health deprivation more accurately.

Individual deprivation scores are calculated by summing the weighted indicators in which a woman is deprived. A cut-off threshold of typically 33% or 50% is then applied to classify individuals as multidimensionally deprived, depending on whether their cumulative deprivation surpasses the established limit. This dual-threshold approach enhances robustness and allows for sensitivity testing of results. At the aggregate level, the AF method produces two primary measures: the Headcount Ratio (H) and the Intensity of Deprivation (A). The Headcount Ratio represents the

proportion of women experiencing multidimensional health deprivation, while the Intensity of Deprivation captures the average extent of deprivation among those identified as deprived. These two components are combined to generate the overall Multidimensional Women's Health Deprivation Index (MWHDI), expressed as $MWHDI = HCR \times AVI$. A higher MWHDI value signifies a greater degree of both prevalence and depth of deprivation within the population. By integrating the incidence and intensity dimensions, the index offers a nuanced understanding of women's health inequality across India. This methodological framework not only quantifies deprivation but also provides a comparative lens across geographic and socio-economic contexts. The inclusion of both states and Union Territories ensures national representativeness, while the age-weighted and multidimensional design captures the complex realities of women's health deprivation with greater precision. The resulting MWHDI thus serves as a robust policy tool to identify priority regions, understand structural inequalities, and guide evidence-based interventions for promoting gender-equitable health outcomes in India. Table 1 shows Headcount Ratio (HCR), Average Intensity (AVI) & Multidimensional Women's Health Deprivation Index(MWHDI) of Rural States of India 2019-21.

Table 1. HCR, AVI & MWHDI of Rural States of India.

| State | HCR | AVI | MWHDI |
|---|--------|--------|--------|
| Andhra Pradesh | 0.9076 | 0.2494 | 0.2263 |
| Arunachal Pradesh | 0.9507 | 0.2268 | 0.2156 |
| Assam | 0.9028 | 0.2320 | 0.2094 |
| Bihar | 0.9877 | 0.2897 | 0.2862 |
| Chhattisgarh | 0.8567 | 0.2308 | 0.1977 |
| Goa | 0.5358 | 0.1503 | 0.0805 |
| Gujarat | 0.9132 | 0.2346 | 0.2143 |
| Haryana | 0.9701 | 0.2404 | 0.2332 |
| Himachal Pradesh | 0.9157 | 0.2024 | 0.1854 |
| Jharkhand | 0.9557 | 0.2825 | 0.2699 |
| Karnataka | 0.9562 | 0.2515 | 0.2405 |
| Kerala | 0.9008 | 0.2024 | 0.1823 |
| Madhya Pradesh | 0.9620 | 0.2849 | 0.2741 |
| Maharashtra | 0.9659 | 0.257 | 0.2483 |
| Manipur | 0.9920 | 0.2575 | 0.2555 |
| Meghalaya | 0.8989 | 0.2301 | 0.2068 |
| Mizoram | 0.8365 | 0.2002 | 0.1675 |
| Nagaland | 0.9651 | 0.2095 | 0.2022 |
| Odisha | 0.9279 | 0.2388 | 0.2215 |
| Punjab | 0.9651 | 0.2017 | 0.1947 |
| Rajasthan | 0.8682 | 0.2411 | 0.2094 |
| Sikkim | 0.9588 | 0.2185 | 0.2095 |
| Tamil Nadu | 0.9072 | 0.2127 | 0.1930 |
| Telangana | 0.9139 | 0.2634 | 0.2407 |
| Tripura | 0.9589 | 0.2666 | 0.2556 |
| Uttar Pradesh | 0.9861 | 0.256 | 0.2525 |
| Uttarakhand | 0.8979 | 0.224 | 0.2011 |
| West Bengal | 0.9645 | 0.2874 | 0.2772 |
| Andaman & Nicobar Islands (UT) | 0.9941 | 0.2164 | 0.2151 |
| Chandigarh (UT) | 0.9535 | 0.2352 | 0.2243 |
| Dadra & Nagar Haveli and Daman & Diu (UT) | 0.7970 | 0.2102 | 0.1676 |
| Jammu & Kashmir (UT) | 0.9937 | 0.2012 | 0.1999 |
| Ladakh (UT) | 0.9740 | 0.1904 | 0.1854 |
| Lakshadweep (UT) | 0.8800 | 0.2025 | 0.1782 |
| Nct of Delhi (UT) | 0.9340 | 0.2180 | 0.2036 |
| Puducherry (UT) | 0.9087 | 0.1748 | 0.1589 |
| India | 0.9405 | 0.2469 | 0.2322 |

Source: NFHS (2019-21) individual record.

Figure 1 illustrates: Age Weighted Headcount Ratio (HCR), Average Intensity (AVI) & Multidimensional Women's Health Deprivation Index(MWHDI) across States-Union Territories of Rural India.

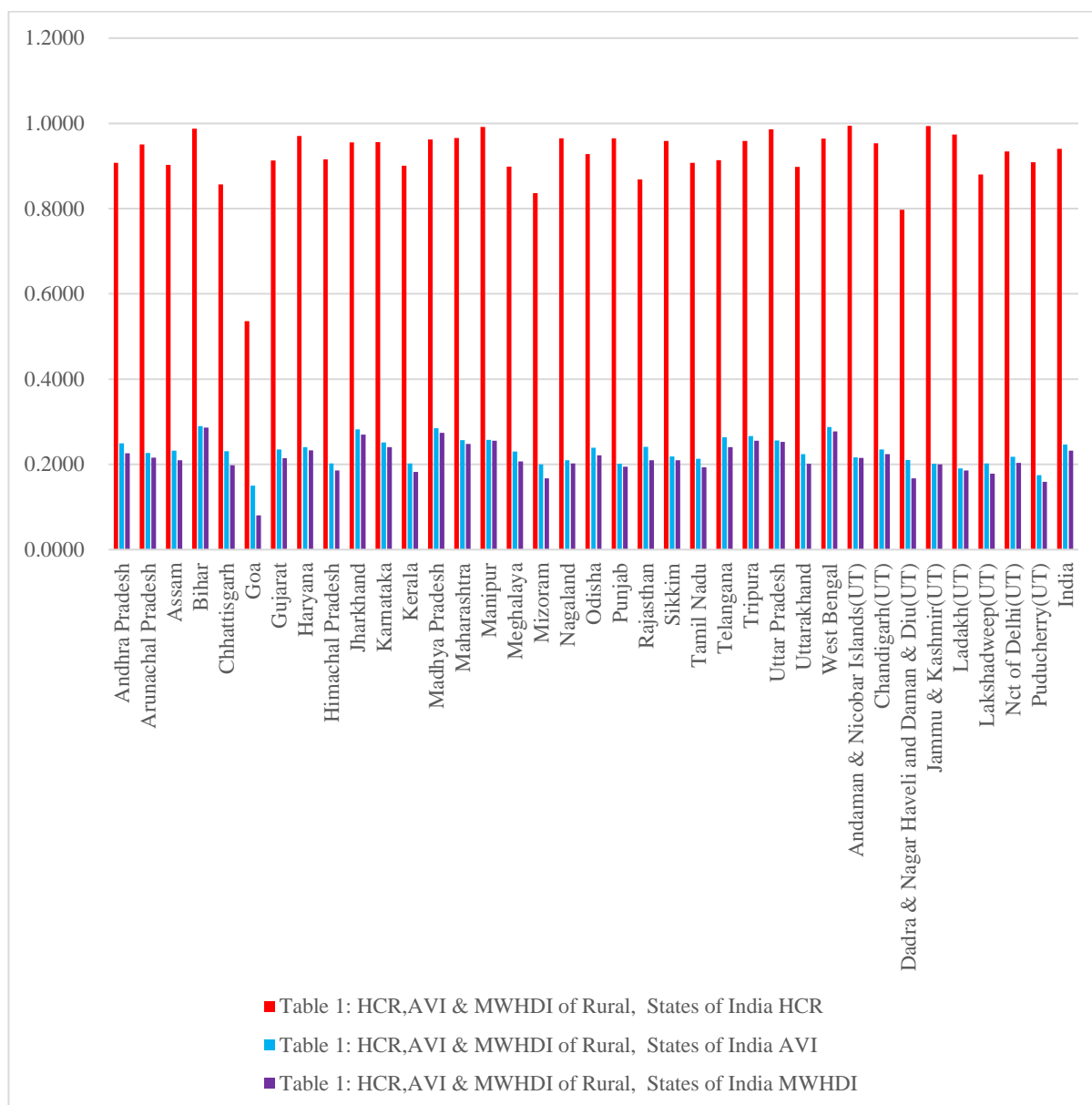


Figure 1. Age weighted headcount ratio (HCR), Average intensity (AVI) & multidimensional women's health deprivation index(MWHDI) across states-Union territories of rural India.

3.1. Data Analysis

The analysis of multidimensional women's health deprivation across India's States and Union Territories highlights pronounced spatial and socio-economic disparities. Significant regional variation is evident, reflecting the uneven distribution of health opportunities and resources across the country. States such as Bihar, West Bengal, Uttar Pradesh, Jharkhand, Tripura, and Manipur emerge as the most deprived, with Multidimensional Women's Health Deprivation Index (MWHDI) scores exceeding 0.25. These high values indicate both a substantial Headcount Ratio (HCR) signifying that a larger proportion of women experience multiple deprivations and a high Average Intensity of Deprivation (A), implying that those who are deprived face multiple, overlapping disadvantages. In these regions, women often lack access to adequate healthcare facilities, nutritional resources, and reproductive services, conditions further exacerbated by poverty, limited mobility, and entrenched gender norms.

In contrast, a cluster of southern and western states, including Goa, Kerala, Himachal Pradesh, Tamil Nadu, Punjab, and Mizoram perform notably better, each registering MWHDI values below 0.20. Among these, Goa consistently outperforms other states across most indicators, benefiting from higher literacy rates, stronger public health systems, and better access to sanitation and health insurance coverage. Kerala's long-standing investment in social infrastructure and public health has also contributed to its low deprivation levels, reinforcing the importance of inclusive health and education policies. A group of states such as Andhra Pradesh, Gujarat, Odisha, Assam, Rajasthan, Sikkim, and Uttarakhand fall within the moderate deprivation range, with MWHDI values close to the national average of 0.2322.

These states exhibit mixed performance: while some have improved access to healthcare and education, persistent gaps remain in women's employment, nutrition, and reproductive autonomy. Such variations suggest that progress in women's health is uneven even within states of similar economic status, often reflecting governance quality and regional

development priorities. Among Union Territories (UTs), disparities are equally striking. Puducherry, Dadra & Nagar Haveli and Daman & Diu, and Lakshadweep record relatively higher MWHDI values, pointing to significant challenges in women's health and social conditions. In contrast, Chandigarh, Delhi, Andaman & Nicobar Islands, and Ladakh perform better, lying within the moderate to low deprivation range. These differences can be attributed to contrasting administrative capacities, levels of urbanization, and public health infrastructure across UTs. At the national level, India's overall MWHDI score of 0.2322 places it in the moderate deprivation category, suggesting that while substantial progress has been made, a large section of women continues to face multidimensional disadvantages. The data reveal a clear east-central versus southwest divide, with states in eastern and central India showing persistently higher deprivation levels compared to their southern and western counterparts. This pattern underscores how socio-economic inequalities, governance quality, and historical investment in social sectors shape women's health outcomes. The findings emphasize the need for region-specific, age-sensitive, and multidimensional policy interventions that address the structural roots of gendered deprivation and ensure equitable progress across India's diverse regions. Table 2 presents. Headcount Ratio (HCR), Average Intensity (AVI) & Multidimensional Women's Health Deprivation Index (MWHDI) of Rural, Union Territory of India.

Table 2. HCR, AVI & MWHDI of Rural, Union Territory of India.

| State | HCR | AVI | MWHDI |
|--------------------------------------|--------|--------|--------|
| Andaman & Nicobar Islands | 0.9941 | 0.2164 | 0.2151 |
| Chandigarh | 0.9535 | 0.2352 | 0.2243 |
| Dadra & Nagar Haveli and Daman & Diu | 0.7970 | 0.2102 | 0.1676 |
| Jammu & Kashmir | 0.9937 | 0.2012 | 0.1999 |
| Ladakh | 0.9740 | 0.1904 | 0.1854 |
| Lakshadweep | 0.8800 | 0.2025 | 0.1782 |
| Nct of Delhi | 0.9340 | 0.2180 | 0.2036 |
| Puducherry | 0.9087 | 0.1748 | 0.1589 |

Source: NFHS (2019-21) individual record.

Figure 2 illustrates Headcount Ratio(HCR), Average Intensity(AVI) & Multidimensional Women's Health Deprivation Index (MWHDI) of Union Territory of Rural India.

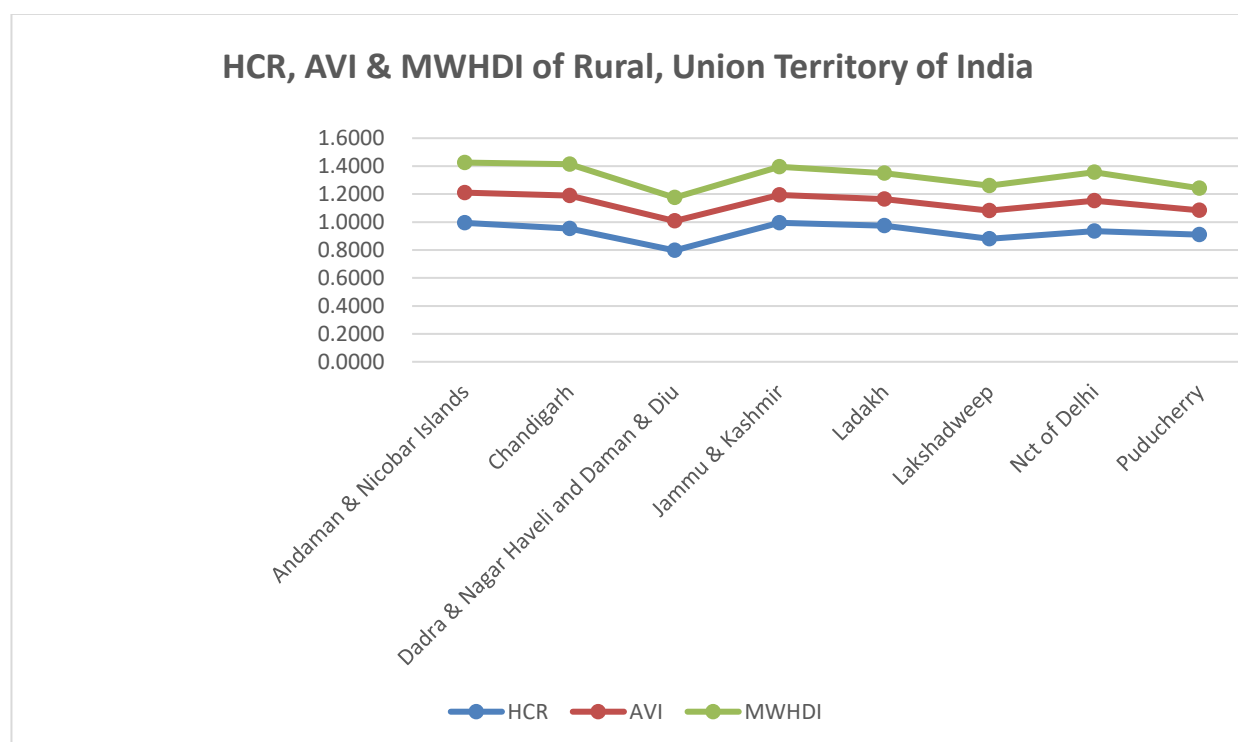


Figure 2. Headcount ratio(HCR), Average intensity (AVI) & multidimensional women's health deprivation index (MWHDI) of union territory of rural India).

The assessment of rural multidimensional poverty across India's Union Territories (UTs) reveals pronounced disparities in the extent and nature of deprivation. Territories such as the Andaman & Nicobar Islands, Jammu & Kashmir, Ladakh, and Chandigarh exhibit exceptionally high Headcount Ratios (HCRs) approaching the value of one, indicating that nearly the entire rural population in these areas experiences some form of multidimensional poverty. Other UTs, including Dadra & Nagar Haveli and Daman & Diu, Lakshadweep, Puducherry, and the National Capital Territory (NCT) of Delhi, also display high HCRs, though the overall intensity of poverty in these regions is comparatively lower. When examining the Average Intensity of Deprivation (AID), which measures the depth of

poverty among those identified as deprived, Chandigarh, Andaman & Nicobar Islands, and Delhi record the highest values, signifying that the extent of deprivation faced by poor households is particularly acute. In contrast, Puducherry and Ladakh register relatively lower AID levels, implying that although poverty remains widespread, the degree of deprivation experienced by everyone is less severe. In terms of welfare outcomes, the Multidimensional Welfare and Human Development Index (MWHDI) presents a contrasting scenario. Chandigarh, Andaman & Nicobar Islands, and Delhi secure the highest MWHDI scores, suggesting stronger performance in welfare and human development indicators such as access to education, healthcare, and infrastructure. On the other hand, Dadra & Nagar Haveli and Daman & Diu, Puducherry, and Lakshadweep rank among the lowest, indicating weaker rural development conditions and limited progress in improving living standards. Taken together, Chandigarh, Andaman & Nicobar Islands, and Delhi emerge as the best-performing UTs, characterized by relatively higher MWHDI values and lower deprivation intensity.

Conversely, Dadra & Nagar Haveli and Daman & Diu, Puducherry, and Lakshadweep stand out as the most deprived, combining low MWHDI scores with persistently high poverty levels. The situation in Jammu & Kashmir and Ladakh reflects a nuanced pattern: poverty is widespread but not particularly deep, suggesting that while many households face deprivation, their individual deficits are moderate. Notably, Puducherry represents a distinct case where poverty incidence is high, yet the severity of deprivation per person remains comparatively low. Overall, the analysis underscores the heterogeneous nature of rural poverty among Union Territories, shaped by diverse geographic, socio-economic, and administrative contexts. It highlights the need for region-specific policy interventions that address both the prevalence and depth of deprivation, ensuring that welfare strategies are adapted to the unique developmental realities of each UT.

Figure 3 Depicts age weighted multidimensional women’s health deprivation index(MWHDI), Headcount ratio (HCR) & average intensity (AVI) across States-Union territories of urban India.

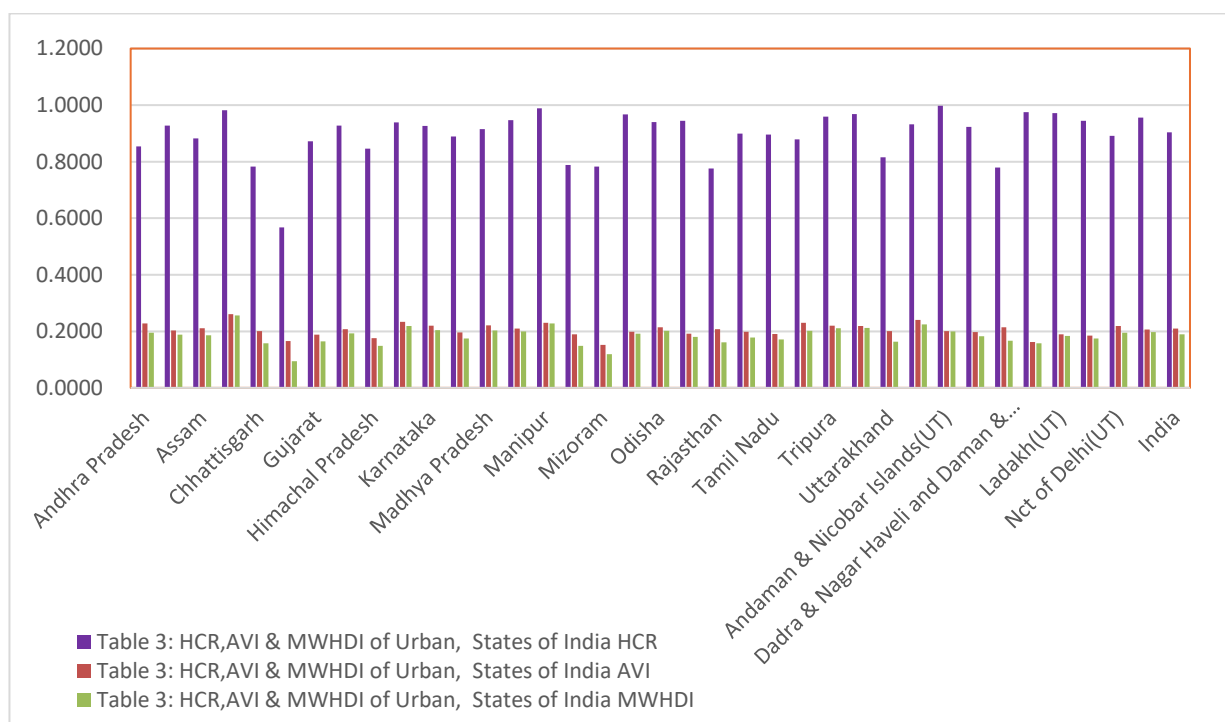


Figure 3. Age-weighted multidimensional women’s health deprivation index(MWHDI), average intensity(HCR) & average intensity (AVI) across States-Union Territories of Urban India.

The analysis of urban multidimensional deprivation in India reveals substantial regional variation across States and Union Territories, even though overall deprivation levels remain lower than those observed in rural areas. States such as Bihar, Manipur, West Bengal, Uttar Pradesh, Jharkhand, and Tripura exhibit the highest levels of urban deprivation, each recording Multidimensional Women’s Health Deprivation Index (MWHDI) scores exceeding 0.21. Among these, Bihar stands out as the most deprived state, with an MWHDI of 0.2560, reflecting not only the widespread prevalence of deprivation but also its intensity across multiple dimensions of women’s health and well-being. Structural barriers such as limited access to quality healthcare, poor sanitation, inadequate social protection, and gendered economic exclusion continue to perpetuate these high levels of deprivation. In contrast, Goa demonstrates the lowest level of urban deprivation (MWHDI 0.0942), followed closely by Mizoram, Himachal Pradesh, Meghalaya, Kerala, and Tamil Nadu.

These states exhibit relatively strong urban development performance, supported by robust public health systems, higher female literacy rates, and better access to essential infrastructure such as clean water, electricity, and healthcare facilities. Their lower deprivation scores reflect more inclusive urban governance and sustained investment in human development. A group of states, including Gujarat, Rajasthan, Uttarakhand, Odisha, Maharashtra, and Madhya Pradesh

fall within the moderate deprivation range, with MWHDI values between 0.16 and 0.20. These states show mixed outcomes, while urban areas benefit from industrial growth and expanding service sectors, inequality in access to healthcare, education, and social protection continues to constrain overall progress. The persistence of deprivation in these regions highlights the need for urban policies that go beyond economic growth to address social and gender disparities. Among the Union Territories (UTs), the pattern of deprivation is similarly uneven. Jammu & Kashmir, Ladakh, and Chandigarh report relatively low MWHDI values, reflecting better urban health and welfare outcomes, likely supported by stronger administrative focus and better service delivery mechanisms. Conversely, Andaman & Nicobar Islands, Puducherry, Delhi (NCT), and Dadra & Nagar Haveli and Daman & Diu register moderate levels of deprivation, where urban development coexists with deep-seated socio-economic inequalities. At the national level, India's average urban MWHDI of 0.1896 categorizes it within the moderately low deprivation bracket, signalling notable progress in urban well-being while still underscoring areas of concern. The data reveal a persistent east-central concentration of deprivation, contrasting sharply with the more advanced urban conditions in southern and western states. These spatial disparities highlight the necessity for region-specific policy interventions focused on improving access to healthcare, housing, and social services, particularly in underperforming urban centers. Addressing these gaps is essential to achieving equitable and sustainable urban development across India.

Figure 4 illustrates Headcount Ratio(HCR), Average Intensity (AVI) & Multidimensional Women's Health Deprivation Index(MWHDI) of Union Territory of Urban India.

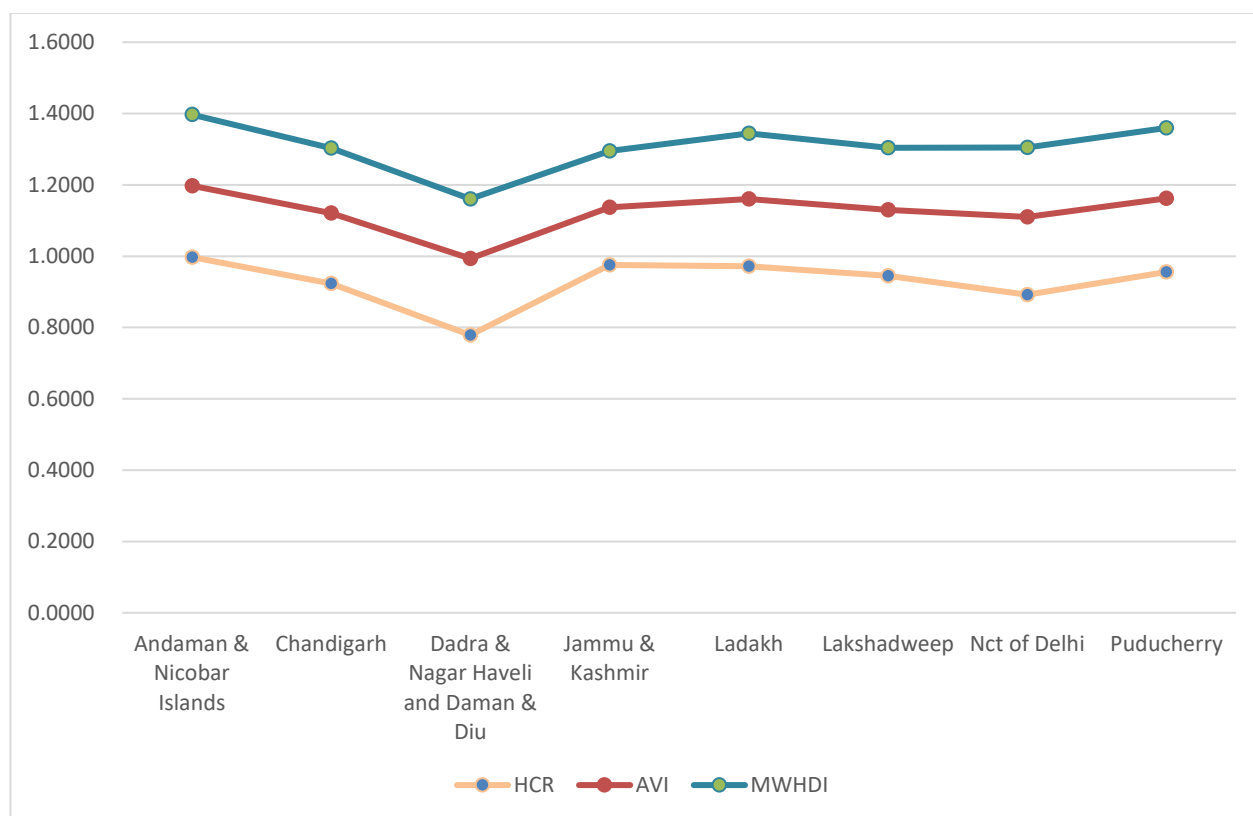


Figure 4. Headcount Ratio(HCR), Average Intensity (AVI) & Multidimensional Women's Health Deprivation Index(MWHDI), of Union Territory of Urban India.

Urban multidimensional deprivation across India's Union Territories (UTs) presents a mixed pattern of high to moderate levels, marked by distinct variations in both the extent and intensity of deprivation. Among the UTs, the Andaman & Nicobar Islands record the highest urban deprivation with an MWHDI of 0.1996, driven by an almost universal incidence of deprivation despite only moderate depth. This indicates that while the degree of deprivation per person is not extremely severe, it affects a vast majority of the population. Delhi (NCT) follows closely with an MWHDI of 0.1947, reflecting deep-rooted urban inequalities, including disparities in access to housing, healthcare, sanitation, and employment opportunities. Despite being a highly urbanized region, Delhi continues to face challenges linked to rapid urbanization, slum expansion, and uneven distribution of resources. Lakshadweep and Dadra & Nagar Haveli and Daman & Diu fall within the moderate deprivation range, with MWHDI values of 0.1743 and 0.1672, respectively. In these territories, deprivation is less widespread but tends to be more intense among affected groups, suggesting that while fewer individuals experience deprivation, those who do face multiple and interrelated disadvantages. On the other hand, Jammu & Kashmir emerges as the best-performing UT, recording the lowest MWHDI score (0.1580) and the least intensity of deprivation. Chandigarh and Ladakh also display moderate yet comparatively lower levels of urban deprivation, benefitting from stronger urban infrastructure and relatively better access to essential services. Overall, while the intensity of deprivation across most Union Territories remains moderate, the high headcount ratios reveal that multidimensional deprivation is still pervasive, affecting a large share of the urban

population. These findings underline the urgent need for targeted policy interventions to improve urban infrastructure, housing, healthcare, and basic service delivery. Strengthening governance mechanisms and ensuring equitable access to urban amenities will be crucial for reducing deprivation and fostering inclusive development across India's Union Territories.

Table 3 shows Headcount Ratio (HCR), Average Intensity (AVI) & Multidimensional Women's Health Deprivation Index (MWHDI) of Urban States of India.

Table 3. HCR, AVI & MWHDI of Urban States of India.

| State | HCR | AVI | MWHDI |
|---|--------|--------|--------|
| Andhra Pradesh | 0.8542 | 0.2279 | 0.1946 |
| Arunachal Pradesh | 0.9271 | 0.203 | 0.1882 |
| Assam | 0.8819 | 0.2109 | 0.1860 |
| Bihar | 0.9818 | 0.2607 | 0.256 |
| Chhattisgarh | 0.7825 | 0.2009 | 0.1572 |
| Goa | 0.5679 | 0.1659 | 0.0942 |
| Gujarat | 0.8725 | 0.1879 | 0.1639 |
| Haryana | 0.9269 | 0.2075 | 0.1923 |
| Himachal Pradesh | 0.8456 | 0.1758 | 0.1486 |
| Jharkhand | 0.9385 | 0.2334 | 0.2191 |
| Karnataka | 0.9267 | 0.2203 | 0.2042 |
| Kerala | 0.8886 | 0.1959 | 0.1741 |
| Madhya Pradesh | 0.9145 | 0.2213 | 0.2024 |
| Maharashtra | 0.9467 | 0.2102 | 0.1990 |
| Manipur | 0.9887 | 0.23 | 0.2274 |
| Meghalaya | 0.788 | 0.1887 | 0.1487 |
| Mizoram | 0.7825 | 0.1516 | 0.1186 |
| Nagaland | 0.9668 | 0.1986 | 0.192 |
| Odisha | 0.9399 | 0.2141 | 0.2012 |
| Punjab | 0.9444 | 0.1913 | 0.1806 |
| Rajasthan | 0.7762 | 0.2076 | 0.1612 |
| Sikkim | 0.8986 | 0.1982 | 0.1781 |
| Tamil Nadu | 0.8962 | 0.1904 | 0.1706 |
| Telangana | 0.8791 | 0.2296 | 0.2019 |
| Tripura | 0.9587 | 0.2197 | 0.2106 |
| Uttar Pradesh | 0.9686 | 0.2182 | 0.2114 |
| Uttarakhand | 0.8157 | 0.2008 | 0.1638 |
| West Bengal | 0.9319 | 0.2408 | 0.2244 |
| Andaman & Nicobar Islands (UT) | 0.9973 | 0.2001 | 0.1996 |
| Chandigarh (UT) | 0.9232 | 0.1976 | 0.1824 |
| Dadra & Nagar Haveli and Daman & Diu (UT) | 0.7788 | 0.2147 | 0.1672 |
| Jammu & Kashmir (UT) | 0.9753 | 0.162 | 0.158 |
| Ladakh (UT) | 0.9716 | 0.1889 | 0.1835 |
| Lakshadweep (UT) | 0.9449 | 0.1845 | 0.1743 |
| Nct of Delhi (UT) | 0.8915 | 0.2183 | 0.1947 |
| Puducherry (UT) | 0.9554 | 0.2065 | 0.1973 |
| India | 0.9038 | 0.2098 | 0.1896 |

Source: NFHS (2019-21) individual record.

Table 4 illustrates Headcount Ratio(HCR), Average Intensity (AVI), Multidimensional Women's Health Deprivation Index (MWHDI) of Union Territory of Urban India.

Table 4. HCR, AVI & MWHDI of Urban, Union Territory of India.

| State | HCR | AVI | MWHDI |
|--------------------------------------|--------|--------|--------|
| Andaman & Nicobar Islands | 0.9973 | 0.2001 | 0.1996 |
| Chandigarh | 0.9232 | 0.1976 | 0.1824 |
| Dadra & Nagar Haveli and Daman & Diu | 0.7788 | 0.2147 | 0.1672 |
| Jammu & Kashmir | 0.9753 | 0.1620 | 0.1580 |
| Ladakh | 0.9716 | 0.1889 | 0.1835 |
| Lakshadweep | 0.9449 | 0.1845 | 0.1743 |
| Nct of Delhi | 0.8915 | 0.2183 | 0.1947 |
| Puducherry | 0.9554 | 0.2065 | 0.1973 |

Source: NFHS (2019-21) individual record.

Older women in India, particularly those aged 40 years and above, face heightened health challenges arising from chronic illnesses, physical dependency, and social neglect. However, an analysis of the Multidimensional Women's Health Deprivation Index (MWHDI) reveals that the index is predominantly influenced by the middle-aged female population (20-39 years) across most states. This is largely due to the age-weighting mechanism embedded within the index, where age groups are assigned weights based on their representation in the population. Consequently, because the middle-aged group constitutes the largest share of the female population, their characteristics exert a stronger statistical influence on the overall MWHDI scores. This demographic weighting makes the MWHDI more population-sensitive, reflecting the health realities of where the majority of women fall rather than risk-sensitive, which would prioritize groups facing the most severe vulnerabilities. As a result, the index tends to emphasize health issues common among women in their reproductive and economically active years, such as maternal health, reproductive autonomy, nutritional status, and occupational well-being. These are indeed critical concerns, yet this emphasis may inadvertently dilute the visibility of the health deprivations faced by older women, whose challenges are often distinct and underrepresented in aggregate measurements. Elderly women frequently experience chronic conditions such as cardiovascular disease, arthritis, osteoporosis, diabetes, and cognitive decline, compounded by limited healthcare access, economic dependency, and social isolation. However, because they represent a smaller proportion of the population, their severe but less prevalent health conditions have a lower statistical weight in shaping the index outcome. This methodological limitation underscores a key concern: while the MWHDI effectively captures the general landscape of women's health deprivation, it may underestimate the depth of vulnerability among older women, whose health risks are qualitatively different and often more enduring. In essence, the MWHDI provides valuable insights into the distribution of women's health deprivation across demographic and spatial contexts, but its population-driven weighting approach makes it more reflective of demographic dominance than of actual health risk severity. Therefore, to create a more risk-sensitive and age-inclusive index, future refinements could consider introducing adjusted vulnerability weights or separate sub-indices for distinct age cohorts. Such an approach would help balance statistical representation with the need to highlight the critical, yet often overlooked, health burdens of India's ageing female population.

4. CONCLUSION

An assessment of India's rural and urban Multidimensional Women's Health Deprivation Index (MWHDI) reveals significant variation across regions and settlement types. In rural India, the overall MWHDI value of 0.2322 indicates a moderate level of deprivation, accompanied by a high Headcount Ratio (HCR) that reflects widespread, though varying, access to basic health and social capabilities. Despite overall progress, several states, particularly Bihar, Jharkhand, Madhya Pradesh, West Bengal, and Manipur, continue to experience high levels of rural deprivation, largely due to persistent challenges in healthcare access, education, and living conditions. In contrast, Goa, Mizoram, and Dadra & Nagar Haveli and Daman & Diu register relatively lower MWHDI scores, suggesting better performance in women's health and well-being.

Among the Union Territories (UTs), Andaman & Nicobar Islands and Ladakh show stronger outcomes, whereas Puducherry and Lakshadweep lag, reflecting uneven policy impacts and resource distribution. In urban areas, the MWHDI stands at 0.1896 with a high HCR of 0.9038, signifying that although urban women generally have better access to infrastructure and services, multidimensional deprivation remains widespread. States such as Bihar, Manipur, West Bengal, Tripura, and Uttar Pradesh record higher urban MWHDI values, indicating persistent inequalities even in relatively developed city environments. Meanwhile, Goa, Mizoram, Chhattisgarh, and Rajasthan demonstrate lower levels of urban deprivation, reflecting better access to healthcare, education, and employment opportunities. Among the Union Territories, Andaman & Nicobar Islands and Puducherry perform comparatively well, whereas Jammu & Kashmir and Dadra & Nagar Haveli and Daman & Diu show weaker outcomes. Taken together, the rural-urban comparison suggests that while India has made measurable strides in reducing women's multidimensional health deprivation, regional and settlement-level disparities remain substantial. Interestingly, rural areas, though traditionally seen as more disadvantaged, show marginally better aggregate performance than urban areas, possibly due to improvements in basic services under targeted welfare schemes. Yet, both rural and urban regions display wide internal variations, with Bihar, Manipur, and West Bengal showing signs of steady improvement, while Goa, Mizoram, and Dadra & Nagar Haveli and Daman & Diu continue to struggle with structural inequalities. These findings underscore the need for context-specific and regionally nuanced policy measures aimed at improving women's health, education, and living standards across the country. A differentiated policy approach addressing both the depth and breadth of deprivation will be essential to achieving gender-equitable development outcomes nationwide.

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