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A District-Level Analysis of Antenatal Care Utilization in Jharkhand using Sopher's Disparity Index during COVID-19

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Abstract

The coronavirus disease 2019 (COVID 19) pandemic was a litmus test for the health care across the world. In almost each and every corner the impact could be seen particularly in health sector and among vulnerable populations. Women are one of the highly vulnerable populations with poor health indicators and deprived of basic health care services in India. The impact of the COVID 19 would be much higher among them than any other sections of the society because of Lockdown and inadequate and poor health care services for them in India. Therefore, this study was conducted to know spatio-temporal aspects of Maternal Healthcare Services during COVID 19 in districts of Jharkhand through National Family Health Survey (NFHS)-4 and NFHS-5. Sopher's Disparity was used to study inter-district disparities in maternal health in Jharkhand. The analysis of Sopher's disparity index for antenatal care (ANC) indicators in Jharkhand before and after the COVID-19 pandemic highlights significant inter-district inequalities in maternal healthcare utilization. While districts such as Latehar, Simdega, and Paschimi Singhbhum demonstrated notable progress and equitable access to services, others like Koderma, Dhanbad, and Deoghar faced considerable challenges across multiple ANC indicators, including early registration, completion of four ANC visits, neonatal tetanus protection, and folic acid supplementation. The most important lesson we have learnt during the present pandemic as well as the past pandemics is that investing in preparedness can cost little and could save millions of lives.

Keywords: Maternal Healthcare Services, Sopher's disparity Index and Pandemic.

Introduction

Antenatal care (ANC) makes up one of the main components of reproductive health, where it includes observation and safeguarding the health of both mother and foetus. The first stage of pregnancy helps in the identification of early risk factors in pregnancies and complications before the emergence of severe complications, which can be treated with timely intervention (Girotra et al., 2023; A. Singh et al., 2023). Furthermore, ANC provides health awareness and vaccinations, which is essential for both mother and child. ANC includes a range of services such as informational sessions with highly qualified healthcare providers about maintaining optimal practices, monitoring for potential complications, psychological and emotional support, micronutrient supplementation, lowering hypertensive states to prevent eclampsia, tetanus vaccination, HIV testing, antiretroviral medication to prevent HIV transmission from mother to child, preventive treatment against malaria, and insecticide-treated mosquito nets. The World

Health Organization (WHO) has defined ANC as “services or cares a pregnant mother receives before birth at regular intervals to monitor maternal well-being, foetal well-being, and progress of foetal growth. During ANC, at least four visits are advised by the WHO (World Health Organization, 2003; Kumar et al., 2019; tkarino, 2023; UNICEF, 2024).

The WHO defines “health as a state of complete physical, mental, and social well-being, rather than merely the absence of disease or infirmity”. The Sustainable Development Goals (SDGs), which were established on 25th September 2015, by the United Nations General Assembly (UNGA) resolution "Transforming our world: the 2030 Agenda for Sustainable Development," went into effect on January 1, 2016 and will last until December 31, 2030. SDG 3 seeks “to promote healthy lives and well-being for people of all ages”. SDG 3.1 aims to bring the world's maternal mortality ratio down to 70 per 1000 livebirths or fewer; SDG 3.2, on the other hand, aims to eliminate infant and under-five deaths that can be prevented and decrease neonatal deaths to 12 per 1000 livebirths or less (Cresswell, 2023). Reducing maternal and neonatal morbidity and death is largely dependent on the availability and accessibility of maternal healthcare services throughout pregnancy. Women and babies may have negative short- and long-term effects if they do not have access to ANC.

According to UNICEF (2023), only 88% of pregnant women worldwide had at least one visit to a doctor for ANC during their pregnancy. Of those receiving treatment, a meager 69% make four or more antenatal care visits. With the highest rates of maternal death, a much smaller percentage of women got at least four prenatal care visits in Western and Central Africa (56 percent) and South Asia (55 percent). Pregnancy and delivery problems are the major causes of maternal mortality globally, with an estimated 830 women dying every day from avoidable pregnancy- and/or childbirth-related causes. More than 99 percent of these deaths from pregnancy take place in countries with middle to low incomes, involving India (Ogbo et al., 2019). In India, each year over 48.5 million pregnancies are reported out of which only 25 million live births are reported. In India, the under-5 mortality rate (U5MR) has decreased from 45 in 2014 to 32 in 2020 and the maternal mortality rate (MMR) has decreased from 113 in 2016–18 to 97 in 2018–20. India needs more efforts to achieve the targets set by SDG 3.1 and 3.2. A significant contributor to the improvements in MMR and U5MR is the increase in ANC visits across the country, which has contributed to the health improvements of mothers and their children. The percentage of women who had at least four ANC visits has increased from 51.2% in NFHS-4 (2015–16) to 58.1% in NFHS-5 (2019–20). In India, women can choose to get ANC at no cost through government-run healthcare facilities or for a fee by using private healthcare providers (Guha, 2021; Sharma, 2023; Thakkar et al., 2023). Nevertheless, despite this improvement, the gain in ANC coverage is still quite small. However, despite this improvement, ANC coverage has increased only a little, and further efforts are needed to dramatically enhance ANC access and usage across the country to ensure better mother and child health outcomes (Rai et al., 2022).

Many factors influence the use of healthcare services for mothers. The factors impacting usage of services are socioeconomic status including education, household wealth, caste, and religion and health system-related factors like accessibility and availability of services (Girotra et al., 2023). Furthermore, regular mother and child health care services are delayed by emergency events including pandemics, tragedies, and disasters. Since there was a total stoppage of services during the first few months of the coronavirus disease 2019 (COVID 19) pandemic, disruptions in maternal healthcare services have been a major source of worry (Amare et al., 2022; Gamberini et al., 2023; Guarnizo-Herreño et al., 2023; Naqvi et al., 2022). The continuation of maternity and child health (MCH) services during COVID-19

has raised concerns around the world. As seen in Sierra Leone, previous epidemics like the Ebola crisis of 2014–15 severely hampered sexual and reproductive health and MCH services. Pregnant women had "three delays" because of these disruptions: delays in seeking care, traveling to medical institutions, and getting proper treatment. The increase in maternal mortality can be attributed to these difficulties (Shrivastava et al., 2021) .

Prior studies, the majority of which were carried out at the national level, have demonstrated a decrease in the use of healthcare services by mothers during the COVID-19 pandemic (Bankar & Ghosh, 2022; Mahajan et al., 2020; S. Sharma, Singh, et al., 2023). Although few studies studied at sub-national level patterns, none have particularly studied at Jharkhand (Dandona et al., 2024; Dhillon et al., 2023; S. Sharma, Aggarwal, et al., 2023; A. K. Singh et al., 2021; G. Singh, Gupta, et al., 2021; T. Singh et al., 2023; Sinha et al., 2022). This study examines the percentage of women visits ANC in Jharkhand before and during the pandemic using secondary data from NFHS-4 and NFHS-5.

Objectives

The objective of the study was to examine inter-district disparities and inequalities in ANC utilization before and after the pandemic, using Sopher's disparity index.

Study Area

Map-1, Jharkhand, in eastern India, is bordered on the north by Bihar, on the northwest by Uttar Pradesh, on the west by Chhattisgarh, on the south by Odisha, and on the east by West Bengal. According to the 2011 Census of India, the state's total population is 32,966,238 people, with a sex ratio of 947 females per 1000 males and a population density of 414 people per square kilometer. It is inhabited by people of varied ethnic, linguistic, and religious backgrounds. The literacy rate is 67.63 per cent, with male literacy at 78.45 percent and female literacy at 56.21 percent, respectively (Kumar 2018). With huge regional variations in health, Jharkhand requires special attention, since it has a MMR of 261 per 1 lakh live births, compared to the national average of 212. IMR (38) and under-five mortality (55) are also high in the state. Jharkhand is known for its rich minerals, resources, forest, and culture; however, 46.2 percent of the population is comprised of scheduled tribes (ST) and scheduled castes (SC) living below the poverty line (Gupta 2015). Jharkhand improved from 55 in 2019-20 to 70 in 2020-21 on the SDG 55 Good Health and Wellbeing Parameter. In 2019, Jharkhand ranks 34th out of 36 states/union territories on the Human Development Index.

Figure 1: Study area

Source: Prepared by author

Materials and Methods

Materials

The study is based on secondary data. This district fact sheet of the NFHS-4 (2014-15), and NFHS-5 (2019-2021) was taken for the study. The NFHS-4 shows the data for pre-covid and NFHS-5 shows data for post-covid period. District fact sheet of 24 districts of Jharkhand was taken. Development & Research Services Pvt. Ltd. conducted NFHS-4 fieldwork in Jharkhand from 9 April to 4 December 2016. The NFHS-5 fieldwork in phase 2 States/UTs was split into two sections due to the Covid-19 incident and the implementation of lockdown. The fieldwork for NFHS- 5 in Jharkhand began on the 20th of January to 21st March 2020 prior to the lockdown and from 5th December 2020 to 18th April 2021 posts lockdown. Each round of the NFHS has had as its main goal the provision of high-quality data on health and family welfare, as well as emerging challenges in this field. The NFHS-5 data will be valuable in establishing benchmarks and assessing the health sector's progress over time. The district fact sheet included a number of variables, including Maternal and Child Health, which was used for the study. The current study focused on ever married women between the ages of 15 and 49 who had at least one live birth prior to the survey (National Family and Health Survey., 2017; National Family and Health Survey, 2019-21).

Methods

The data included Mothers who had an antenatal check-up in the first trimester, Mothers who had at least 4 antenatal care visits, Mothers whose last birth was protected against neonatal tetanus, Mothers who consumed iron folic acid for 100 days or more when they were pregnant, Mothers who consumed iron folic acid for 180 days or more when they were pregnant and Registered pregnancies for which the

mother received a Mother and Child Protection (MCP) card. The present research work is an attempt to examine the spatio-temporal aspect of MCHS in districts of Jharkhand from NFHS-4 and 5 using Sopher's Disparity Index. The contents of NFHS-5 are similar to NFHS-4 to allow comparisons over time the Ministry of Health and Family Welfare, Government of India, designated the International Institute for Population Sciences, Mumbai, as the nodal agency to conduct NFHS-5. North Carolina 2010 Health Objectives had defined disparity of Health as difference in status of health among different segments of the population including differences that may occur by race, religion or ethnicity, education or income, disability and geographic location (Carter-Pokras & Baquet, 2002).

The district is thought to be the most appropriate unit of study since data is readily available across time. Sopher's disparity index evaluates the gap between two groups in their possession of a particular property (Sopher, 1974; Bano, 2023).

DI = Log (X2 /X1) +Log (100 - X1) / (100 - X2)

Where, X2>X1 (that X2 should have higher value than X1) and Q=100.
In case of perfect equality i.e. no disparity, the value of DI will be 0. With the rising value of DI, the disparity rises.

Results

Table-1 shows values of Sopher's disparity Index of Mothers who had an antenatal check-up in the first trimester, Mothers who had at least 4 antenatal care visits, Mothers whose last birth was protected against neonatal tetanus, Mothers who consumed iron folic acid for 100 days or more when they were pregnant, Mothers who consumed iron folic acid for 180 days or more when they were pregnant and Registered pregnancies for which the mother received a Mother and Child Protection (MCP) card for the two time-periods from NFHS-4 and NFHS-5. The analysis of Sopher's disparity index for antenatal care (ANC) indicators before (NFHS-4) and after (NFHS-5) the COVID-19 pandemic reveals significant inter-district variations in Jharkhand, reflecting the pandemic's mixed impact on maternal healthcare services. For ANC registration in the first trimester, districts like Paschimi Singhbhum (0.555) and Latehar (0.496) exhibited the lowest disparities, indicating better early ANC utilization, whereas Deoghar (0.008) and Giridih (0.041) had the highest disparities. In terms of four ANC visits, Latehar (0.492), Simdega (0.459), and Paschimi Singhbhum (0.472) demonstrated better equity, while Khunti (-0.033) and Koderma (-0.050) showed declining trends. Neonatal tetanus protection was more equitably distributed in Gumla (0.309) and Latehar (0.300), but disparities remained high in Ranchi (0.022) and Paschimi Singhbhum (0.156).

Folic acid supplementation for 100 days showed better coverage in Latehar (0.728) and Garhwa (0.731), while Dhanbad (-0.017) and Deoghar (-0.023) recorded the highest disparities. Similarly, for 180 days of folic acid supplementation, Latehar (2.191) and Simdega (1.399) performed exceptionally well, whereas Koderma (-0.118) and Dhanbad (-0.037) lagged significantly. Regarding the distribution of Mother and Child Protection (MCP) cards, Latehar (0.673), Gumla (0.645), and Saraikela-Kharsawan (0.622) achieved widespread registration, whereas Garhwa (0.057) and Giridih (0.039) exhibited substantial gaps.

Overall, districts such as Latehar, Simdega, and Paschimi Singhbhum consistently demonstrated equitable access to maternal healthcare services, while Koderma, Deoghar, and Dhanbad faced significant challenges across multiple indicators. These disparities highlight the uneven healthcare impact of the pandemic, with some districts managing to maintain or improve performance while others

experienced disruptions, particularly in areas like folic acid supplementation and the completion of four ANC visits. Targeted policy interventions are required to address these inequalities and strengthen maternal healthcare services in high-disparity districts.

Table 1: Sopher's Disparity Index of ANC during pre (NFHS-4) and post (NFHS-5) Covid-19 in Districts of Jharkhand

Districts	ANC Trimister	ANC_4visits	Neonatal Tetatnus	Folic Acid_100 days	Folic Acid_180days	MPC
Bokaro	0.077	0.137	0.038	0.123	0.514	0.118
Chatra	0.348	0.467	0.098	0.639	0.577	0.275
Deoghar	0.008	0.108	0.065	-0.023	0.589	0.148
Dhanbad	0.118	0.077	0.073	-0.017	-0.037	0.073
Dumka	0.093	0.162	0.110	0.211	0.472	0.289
Garhwa	0.330	0.437	0.129	0.731	0.393	0.057
Giridih	0.041	0.100	0.018	0.334	0.984	0.039
Godda	0.096	0.164	0.193	0.302	0.678	0.171
Gumla	0.344	0.343	0.309	0.419	0.691	0.645
Hazaribagh	0.043	0.032	0.064	0.275	1.346	0.017
Jamtara	0.082	0.118	0.047	0.367	0.761	0.311
Khunti	0.166	-0.033	0.110	0.326	1.070	0.184
Koderma	0.122	-0.050	0.072	0.102	-0.118	0.116
Latehar	0.496	0.492	0.300	0.728	2.191	0.673
Lohardaga	0.296	0.384	0.240	0.280	0.412	0.177
Pakur	0.155	-0.023	0.069	0.277	0.284	0.101
Palamu	0.348	0.175	0.216	0.447	0.105	0.263
Paschimi Singhbhum	0.555	0.472	0.156	0.567	1.004	0.145
Purbi Singhbhum	0.189	-0.066	0.165	0.598	0.915	0.115
Ramgargh	0.138	0.110	0.105	0.243	0.310	0.092
Ranchi	0.114	-0.027	0.022	0.135	0.321	0.147
Sahibganj	0.336	0.288	0.028	0.324	1.186	0.179
Saraikela-Kharsawan	0.251	0.363	0.106	0.277	0.766	0.622
Simdega	0.302	0.459	0.005	0.846	1.399	0.484

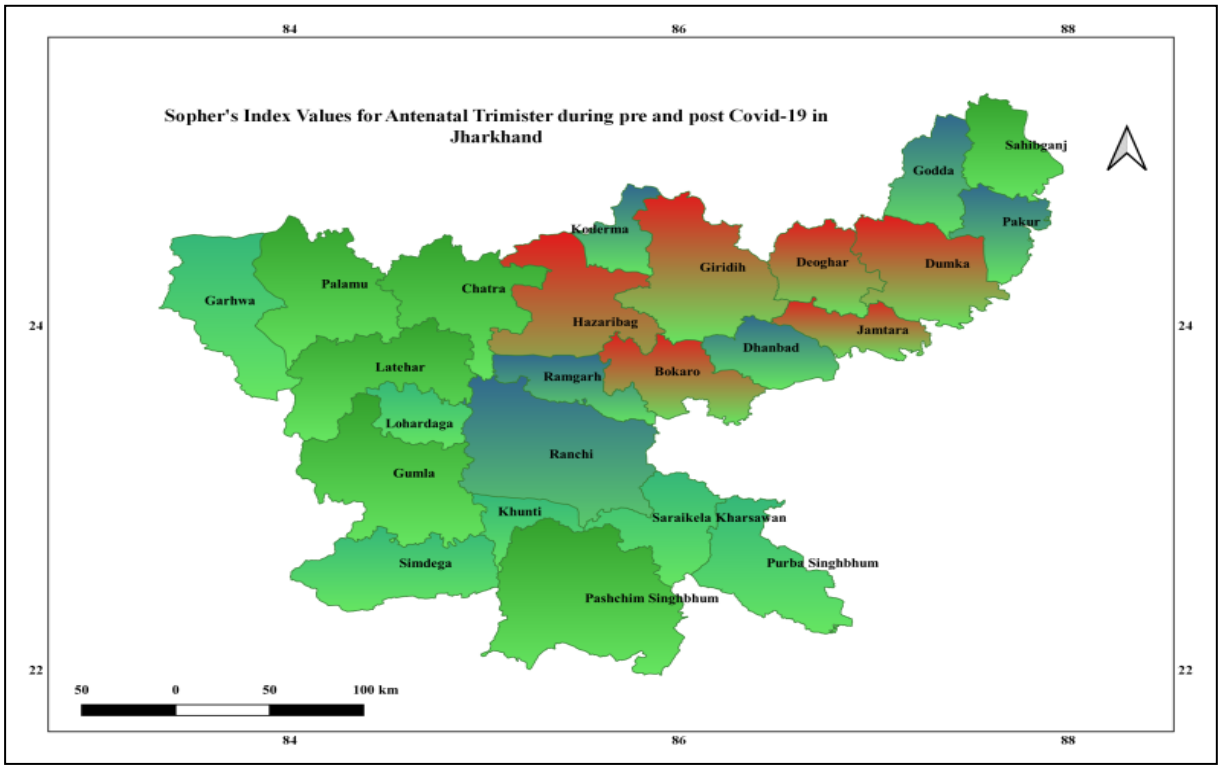
Sources: Calculated by author

Mothers who had Antenatal checkups in the first trimester

Figure 2 depicts the difference in antenatal check-ups in the first trimester across districts before (NFHS-4) and after (NFHS-5) Covid-19. Deoghar (NFHS-4, 58.1 and NFHS-5, 62.2) has the lowest difference

of 0.008 and Pashim Singhbhum (NFHS-4, 62.6 and NFHS-5, 19.6) has the highest difference of 0.555 for mothers who received an antenatal check-up in the first trimester. They are sorted in descending order, from worst to best. The worst districts are represented in red, including Bokaro, Hazaribagh, Giridih, Deoghar, and Jamtara. The districts with the best performance, such as Chatra, Palamu, Latehar, Gumla, and Paschim Singhbhum, are shown in blue.

Figure 2: Sopher's Disparity Index for mothers who antenatal check-ups in the first trimester in Jharkhand during Pre- and Post-COVID

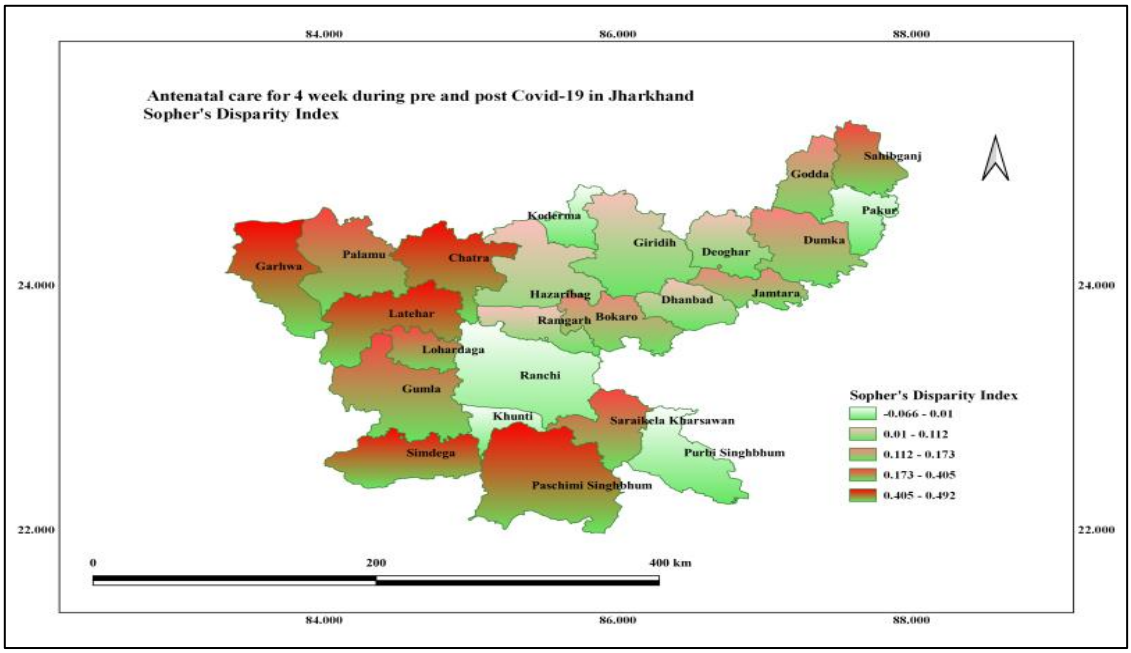


Source: Prepared by author

Mothers who had at least 4 ANC visits

For mothers who had at least 4 ANC visits, Purbi Singhbhum (NFHS-4, 40.7 and NFHS-5, 59.9) showed decrease in disparity with (-0.066) where as in Latehar (NFHS-4, 43.1 and NFHS-5, 28.4) the disparity has increased with 0.492. Figure 3 shows district wise disparity of mothers who had at least 4 ANC visits during pre and post Covid-19. They were sorted in descending order, from worst to best. The worst districts are represented in red shaded with green, including Chatra, Garhwa, Latehar, Bokaro, Paschim Singhbhum and Simdega. The districts with the best performance, such as Pakur, Koderma, Ranchi, Khunti and Purabi Singhbhum are shown in green.

Figure 3: Sopher's Disparity Index for mothers who had at least 4 ANC visits in Jharkhand during Pre- and Post-COVID

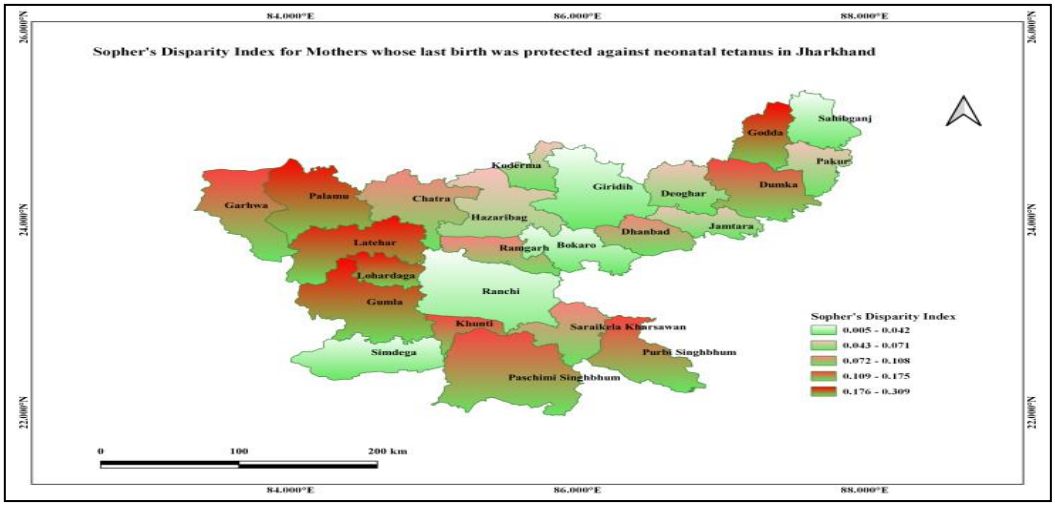


Source: Prepared by author

Mothers whose last birth was protected against neonatal tetanus

For mothers whose last birth was protected against neonatal tetanus, Purbi Singhbhum (NFHS-4, 40.7 and NFHS-5, 59.9) showed decrease in disparity with (-0.066) where as in Latehar (NFHS-4, 43.1 and NFHS-5, 28.4) the disparity has increased with 0.492. Figure 4 shows district wise disparity of mothers whose last birth was protected against neonatal tetanus during pre and post Covid-19. They were sorted in descending order, from worst to best. The worst districts are represented in red, including Palamu, Latehar, Lohardaga, Gumla and Godda.. The districts with the best performance, such as Sahibganj, Giridih, Ranchi, Bokaro and Simdega are shown in green.

Figure 4: Sopher's Disparity Index for mothers whose last birth was protected against neonatal tetanus in Jharkhand during Pre- and Post-COVID

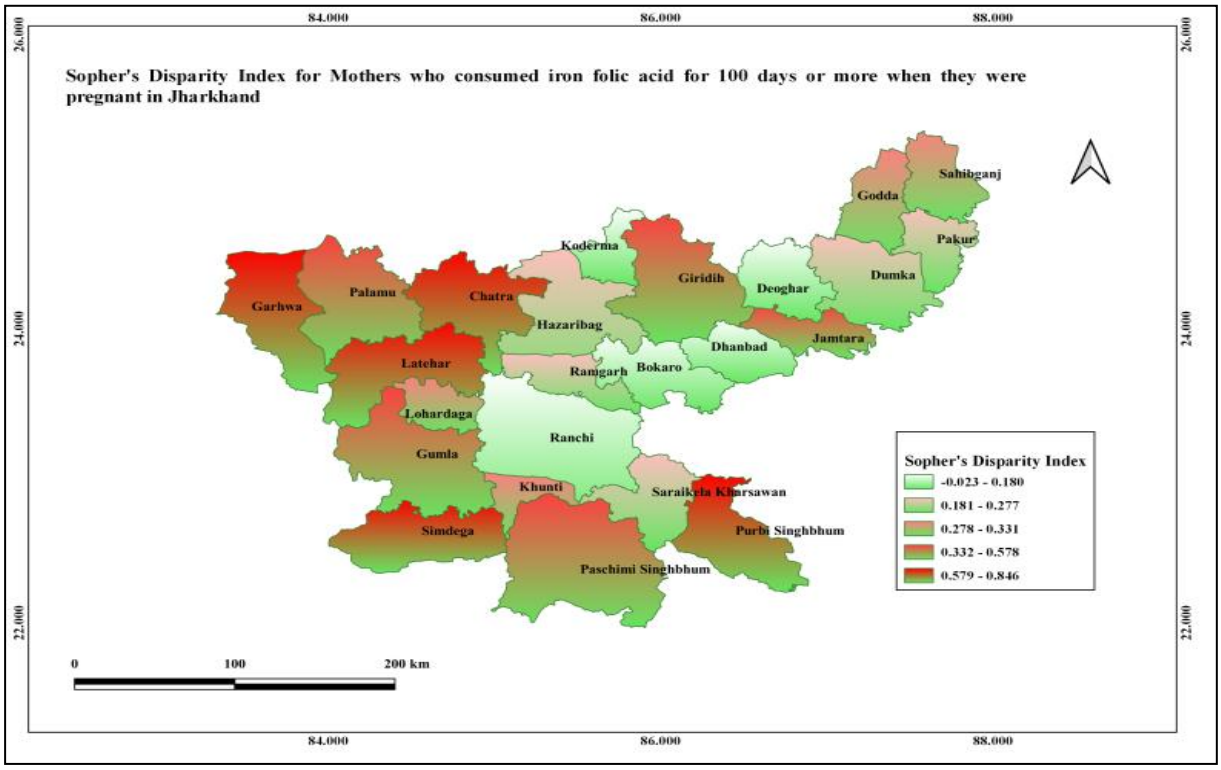


Source: Prepared by author

Mothers who consumed iron folic acid for 100 days

For mothers who consumed iron folic acid for 100 days or more when they were pregnant, Deoghar (NFHS-4, 18.5 and NFHS-5, 20.6) showed decrease in disparity with (-0.023) where as in Simdega (NFHS-4, 46.4 and NFHS-5, 7.2) the disparity has increased with 0.846. Figure 5 shows district wise disparity of mothers who consumed iron folic acid for 100 days or more when they were pregnant during pre and post Covid-19. They were sorted in descending order, from worst to best. The worst districts are represented in red, including Garhwa, Chatra, Latehar, Simdega and Purabi Singhbhum. The districts with the best performance, such as Dhanbad, Koderma, Bokaro and Deoghar are shown in green.

Figure 5: Sopher's Disparity Index for mothers who consumed iron folic acid for 100 days or more when they were pregnant in Jharkhand during Pre- and Post-COVID

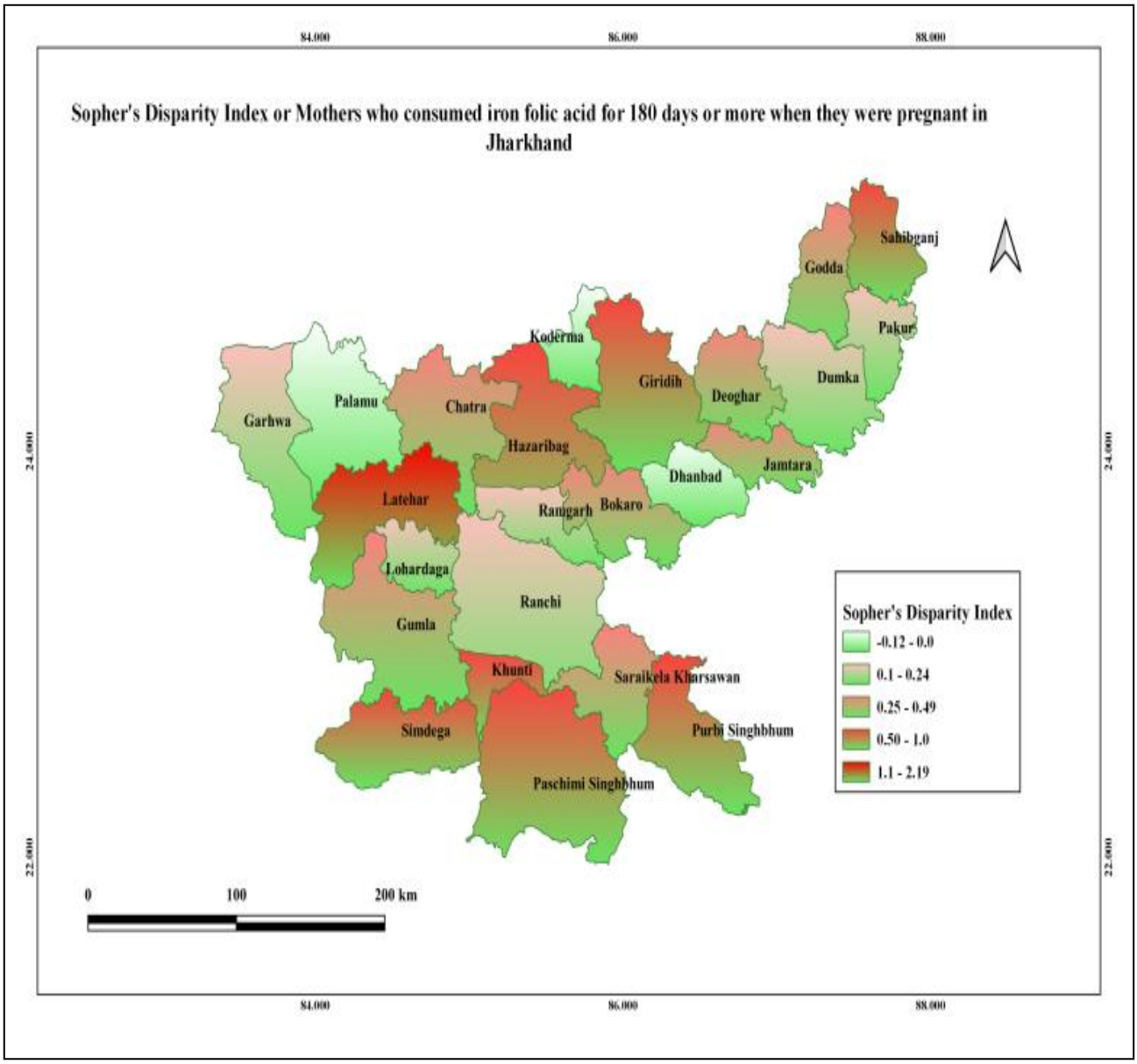


Source: Prepared by author

Mothers who consumed iron folic acid for 180 days

For mothers who consumed iron folic acid for 180 days or more when they were pregnant, Dhanbad (NFHS-4, 8.3 and NFHS-5, 9.5) showed least disparity with (-0.017) where as in Latehar (NFHS-4, 29.1 and NFHS-5, 0.2) showed highest disparity with 2.191. Figure 6 shows district wise disparity of mothers who consumed iron folic acid for 180 days or more when they were pregnant during pre and post Covid-19. They were sorted in descending order, from worst to best. The worst districts are represented in red, including Latehar, Simdega, Purabi Singhbhum and Sahibganj. The districts with the best performance, such as Dhanbad, Koderma, Palamu and Lohardaga are shown in green.

Figure 6: Sopher's Disparity Index for mothers who consumed iron folic acid for 180 days or more when they were pregnant in Jharkhand during Pre- and Post-COVID

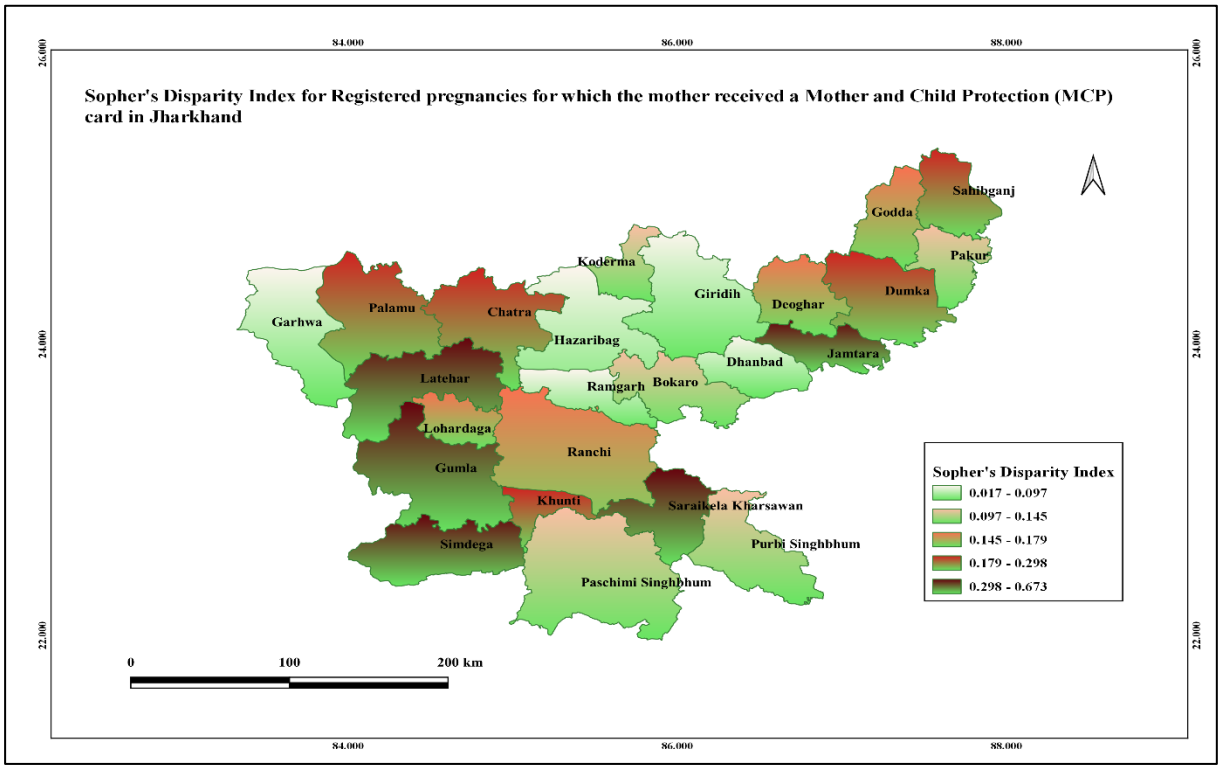


Source: Prepared by author

Mother received a Mother and Child Protection (MCP) card

For Registered pregnancies for which the mother received a Mother and Child Protection (MCP) card, Giridih (NFHS-4, 86.7 and NFHS-5, 92.3) showed least disparity with 0.039 where as in Latehar (NFHS-4, 98 and NFHS-5, 83.8) showed the highest disparity with 0.673. Figure 7 shows district wise disparity of registered pregnancies for which the mother received a Mother and Child Protection (MCP) card during pre and post Covid-19. They were sorted in descending order, from worst to best. The worst districts are represented in red, including Latehar, Simdega, Jamtara, Gumla and Saraikela Kharsawan. The districts with the best performance, such as Giridih, Ramgarh, Hazaribagh, Garhwa and Dhanbad are shown in green.

Figure 7: Sopher's Disparity Index for MCP Card Distribution Among Registered Pregnancies in Jharkhand during Pre- and Post-COVID



Source: Prepared by author

Discussion

The findings of this study show disparities in ANC utilization across the districts of Jharkhand, identifying regional inequalities in maternal healthcare services. Districts such as Latehar, Simdega, and Paschimi Singhbhum performed well than others in key indicators such as early ANC registration, completion of four or more ANC visits, and folic acid supplementation due to better healthcare infrastructure, stronger program implementation, and higher levels of community awareness. Conversely, districts like Koderma, Deoghar, and Dhanbad consistently underperformed, indicating systemic barriers, including inadequate health facilities, limited outreach of healthcare programs, and socio-economic challenges faced by women in these areas.

While Latehar and Simdega demonstrated high compliance for both 100-day and 180-day supplementation, many districts, such as Dhanbad and Koderma, reported negative or minimal values. This suggests gaps in nutritional counseling and supply chain management, as well as potential barriers such as cultural beliefs or a lack of awareness among pregnant women. Addressing these challenges is critical, as inadequate folic acid intake can lead to poor maternal and neonatal health outcomes, including anemia and birth defects.

Similarly, the distribution of MCP cards showed disparities. While districts such as Latehar and Gumla showed high levels of MCP card avalability, districts like Garhwa and Giridih lagged behind due to insufficient outreach by health workers, poor record-keeping, or lack of awareness among women about the importance of registration. The MCP card is crucial for monitoring maternal and child health, and its low coverage may further exacerbate disparities in accessing maternal healthcare services.

The differences in neonatal tetanus protection also highlight inequities in immunization outreach. While some districts achieved relatively high coverage, others, such as Ranchi and Paschimi Singhbhum, performed poorly. This suggests potential gaps in vaccination campaigns, logistical challenges, and issues related to healthcare access and delivery in these areas.

Overall, the findings reflect the uneven implementation of maternal healthcare services across districts in Jharkhand, which may be attributed to variations in healthcare infrastructure, socio-economic factors, and the effectiveness of government programs. Districts with better performance are likely benefiting from focused interventions, while underperforming districts require urgent attention. Targeted strategies, including strengthening healthcare infrastructure, improving the outreach of ANC and nutritional programs, enhancing awareness through community engagement, and addressing socio-economic barriers, are essential to bridge these gaps. Moreover, inter-district comparisons using tools like Sopher's Disparity Index can help policymakers identify priority areas and allocate resources more effectively to ensure equitable access to maternal healthcare services across Jharkhand.

Conclusion

The findings underscore the uneven impact of the pandemic on maternal health services, with some districts successfully mitigating disruptions while others experienced widening disparities. These results emphasize the urgent need for targeted, district-specific strategies to strengthen healthcare infrastructure and service delivery, especially in underperforming areas. Addressing these disparities is crucial for improving maternal health outcomes and ensuring equitable healthcare access across Jharkhand, particularly in the wake of the pandemic. The most important lesson we have learnt during the present pandemic as well as the past pandemics is that investing in preparedness can cost little and could save millions of lives.

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